# 2013-2017
# Energy Division & Program Administrator
# Energy Efficiency
# Evaluation, Measurement and Verification Plan
# Version 7 (Final)

*California Public Utilities Commission, Energy Division*

*San Francisco, California*

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# 1. Overview of Plan Development and Budget Summary

## 1.1. Introduction

This evaluation measurement and verification (EM&V) plan for the Investor Owned Utilities' (IOUs) and non-IOU program administrators' energy efficiency programs expands on Energy Division's past energy efficiency evaluation work both in its objectives and its administration. The most recent addition to this plan was authorized in D.14-10-046 to continue evaluation activities and D.15-10-028 established a rolling portfolio regulatory model for approving programs and continuing to conduct evaluation. Each year a budget filing is provided to the Commission to authorize funds for the upcoming year. This plan continues to implement the five core evaluation and research objectives set forth in September 2009 in D.09-09-047 and re-affirmed in D.12-11-015.

- Savings Measurement and Verification
- Program Evaluation
- Market Assessment
- Policy and planning support
- Financial and Management audit

This scope of the EM&V plan supports oversight of the program administrators' portfolio of energy efficiency programs. The energy efficiency portfolio is guided by the California Energy Efficiency Strategic Plan, and continues to emphasize market transformation and comprehensive approaches to energy savings. Business Plans, required as part of the rolling portfolio guidance, will be filed with the Commission in January 2017. Evaluation of these objectives helps the California Public Utilities Commission build a growing body of research and knowledge to support future program innovations and the work of other state agencies, including the California Energy Commission and the California Air Resources Board, while supporting the Energy Division's critical oversight role of the IOU ratepayer funded energy efficiency programs.

The core content of this Evaluation, Measurement & Verification Plan was developed and is maintained through a dis-aggregated approach that focused on research needs grouped at the sector level. Energy Division and program administrator evaluation staff collaborated at the sector level, via Project Coordination Groups, to assess status and outputs from current research to inform incremental evaluation needs for the next needed evaluation. The sectors and Program Coordination Groups align with the sector and program areas in the program administrator portfolios and the California Strategic Plan. Developing the needs at the sector level makes it easier to identify existing knowledge gaps and ultimately makes the research more useful and accessible for strategic planning and program implementation improvements. The sector level coordination groups encourage the ongoing participation of stakeholders and implementers in the EM&V process in reviewing plans and results.

In order to meet the CPUC's EM&V objectives, this plan, as reflected in the proposed sector or topic area research 'roadmaps' and overarching budget allocations:

- Balances the first three (impact, market, process) research objectives for each specific sector;
- Provides for a market studies, including addressing spillover and sector specific research to inform market transformation progress;
- Provides sufficient resources for continued in-depth research on the impacts of energy efficiency measures, programs, and portfolios;

- Enables portfolio-level analysis of costs and impacts, with the goal of assessing portfolio cost effectiveness and improving savings estimates in the future;
- Provides the necessary resources for Energy Division's oversight, reporting, savings potential and goals development, and strategic planning responsibilities related to energy efficiency EM&V.

This EM&V plan outlines the allocation of project funds to discrete activities that address Program Administrator and Energy Division information needs across over several sectors of intervention. The majority of the studies will be overseen and prioritized within the given sector Project Coordination Group, and will often address multiple needs in the same study. The sector level evaluation plans will be updated annually to keep stakeholders informed of evolutions in the master plan. Several sector-level plans address information needs across programs to maximize process and impact evaluations of the same programs or participants. In this way, the evaluation is more efficient, and eliminates duplication, overlap, and unnecessary disruption of program participants. Likewise, coordination across study types, impact and market studies in particular, will ensure consistency in methods and coordination of activities to improve efficiency and relevance of the results.

This EM&V Plan includes documentation of the planning process; descriptions of EM&V activity areas, enumeration of proposed EM&V studies, and budgets. By design, this plan is not a fixed document. Budget allocations and study descriptions will shift as the plan is executed and in response to observation of actual program activity, as well as evolving program and regulatory needs. The plan is a starting point and will be refreshed annually to reflect changes in budgets or proposed studies. Program Administrator and Commission staff will scope each of the EM&V studies more fully in the initial research planning stage of implementation and share publicly.

## 1.2. EM&V Goals, Directives, and Planning Principles

This section summarizes the goals and regulatory requirements for EM&V, as well as guidance and direction used to develop the sector-level research plans.

### 1.2.1. Goals and Regulatory Directives

The EM&V plan builds on the research and findings from past evaluations. The core objectives of EM&V were set out in Decision D.09-09-047. These objectives were slightly modified in D.10-10-033, D.10-04-092, and in R.09-11-014 and were recognized in D.12-11-015 to continue through 2015 activities per D.14-10-046. D.15-10-028 changes the structure and budget cycles of energy efficiency programs and evaluation by moving to "Rolling Portfolios" starting in 2017. D.16-08-019 described how the evaluation budgets for EM&V will shift after Business Plan submission and reinforced the need for continuing evaluation. Adjustments to the plan based on D.16-08-019 will be reflected in the next update to the plan. The Efficiency Savings and Performance Incentive (ESPI) mechanism was adopted by the Commission in D.12-12-032 for the program administrators. The five EM&V research objectives for the portfolios continue as below:

1. Savings Measurement and Verification – Measurement and verification of savings resulting from energy efficiency measures, programs, and portfolios serve the fundamental purpose of developing estimates of reliable load impacts delivered through ratepayer-funded efficiency efforts. Measurement and verification work should reflect a reasonable balance of accuracy and precision, cost, and certainty, and be designed for incorporation in procurement planning activities.
2. Program Evaluation – Evaluation of program-specific qualitative and quantitative measures, such as the program performance metrics and process evaluations, serves a key role in providing feedback

for the purposes of improving performance and supporting forward-looking corrections to utility programs and portfolios. In order to maximize return on ratepayer dollars, program evaluations must be completed on a timeline which informs mid-course corrections and/or program planning for the following cycle.

3. Market Assessment – In a constantly evolving environment, market assessments are an essential EM&V product needed to set the baseline for strategic design and improvement of programs and portfolios, identify and track appropriate metrics of market change, and measure progress toward achieving the goals of the California Long-Term Energy Efficiency Strategic Plan.
4. Policy and Planning Support - Consistent with prior program cycles, it is essential to reserve funding to support overarching studies and advisory roles which support Commission policy goals. Over the last program cycle this has been inclusive of potential and goals studies, maintenance of the Database for Energy Efficiency Resources, and other means which support the Commission's oversight role, but do not fall under the core EM&V categories described above.
5. Financial and Management Audit – Supporting the Commission's oversight function of ensuring the efficient and effective expenditures of ratepayer funds within the IOUs' energy efficiency portfolios is another objective of EM&V activities. Rigorous financial and management audits overseen by Commission staff will be critical in ensuring that the IOUs' general and administrative costs and other program expenditures are prudent and reasonable.

### 1.2.2. Planning and Organizing Principles

The EM&V planning exercise covers the five research objectives by combining them into three core activity areas: Program Portfolio and Market Analysis; Regulatory Planning and Policy Development; and Managing EM&V Compliance and Reporting. The sixth objective will be given a home upon the next re-design of the evaluation plan.

Program Portfolio and Market Analysis covers the majority of the research portfolio. This area includes the detailed research plans for impact, process and market studies for each sector or program area. It also includes the coordinating functions and overarching studies for specific study type (i.e. market and impact studies). Long term research roadmaps for each of these segments will guide the work going forward. In developing the EM&V Plan for this activity area, Energy Division and program administrator staff focused on the following approach:

- Identify incremental research needs based on past studies;
- Address a mix of needs across various study types (impact, process, market);
- Prioritize within limited budgets and Commission directed distribution of funds by agency;
- Consider external stakeholder study needs;
- Centralized planning and coordination for core functions (i.e. data) or research types (i.e. market studies).

Regulatory Planning and Policy Development includes the activities funded through EM&V that support ex ante value development and review, the potential analysis and goals development, support for the California Energy Efficiency Strategic Plan, and ad hoc policy research or improvements to evaluation methods. In developing and maintaining the EM&V Plan for this activity area, Energy Division focused on the following approach:

- Identify incremental research needs based on past studies and remaining funds;
- Focus on Commission directives for oversight, research; and
- Meet the needs for future planning and preparation for the next cycle.

Managing EM&V Compliance and Reporting covers the critical support activities of data management and reporting and the financial audits. These activities ensure compliance with Commission guidance on reporting energy savings and costs, and provides for a financial audit of the expenditures. These activities also ensure that evaluation findings and aggregate summaries of progress towards savings goals, cost effectiveness targets, and program performance are shared with policy makers, the public and other stakeholders. Developing user-friendly systems for accessing data and information (at appropriate levels of aggregation and in compliance with security provisions) is also a core function covered in this area of activity including:

- Identify incremental activities based on infrastructure already developed and remaining funds
- Focus on Commission directives for oversight, accessibility and transparency

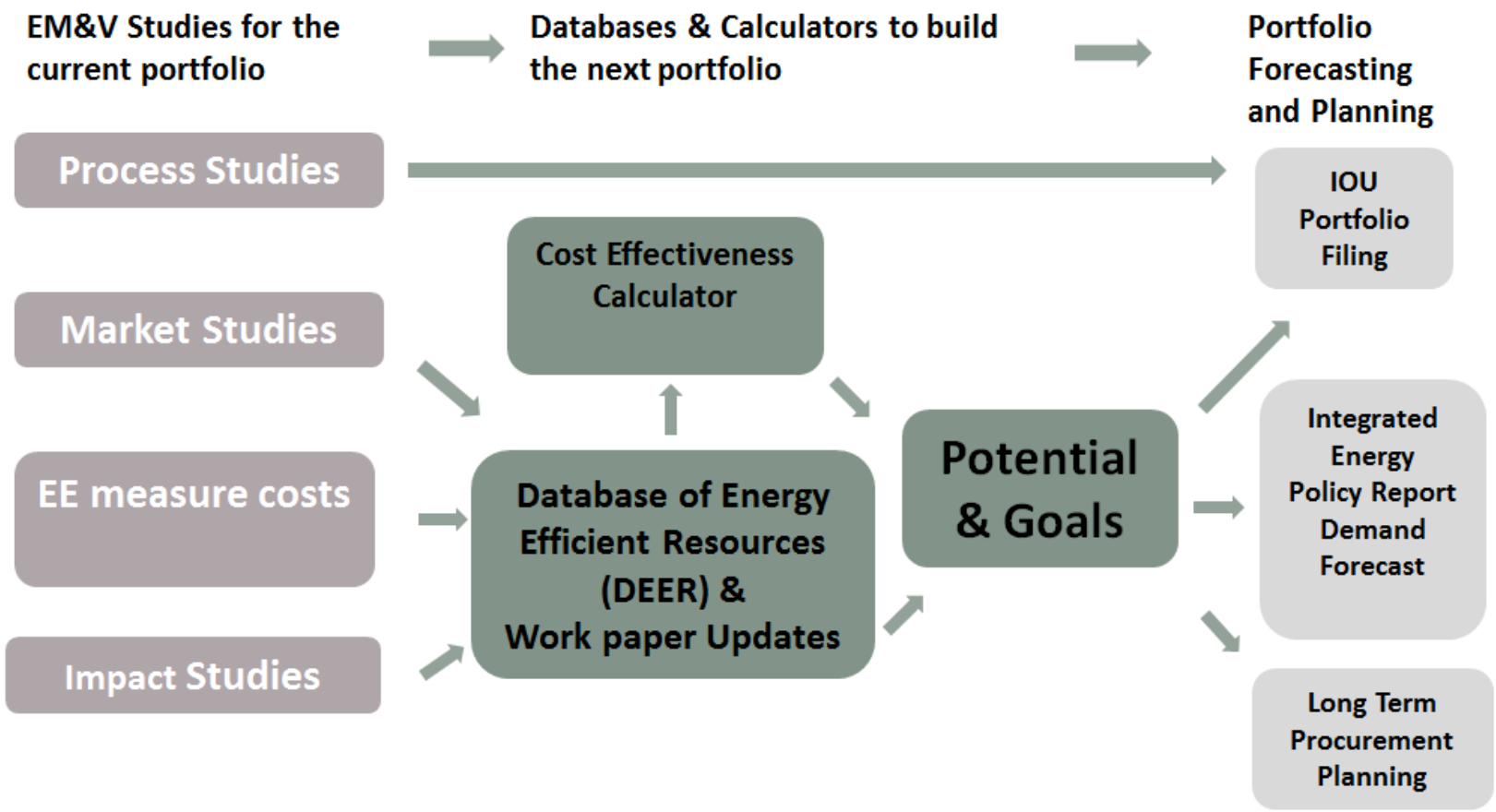
### 1.2.3. Timing and Feedback Loops

The timeliness and relevance of the research proposed in this portfolio is dependent on its availability to inform changes in measure savings estimates, program design, or policy directives. These activities operate in the context of both a regulatory proceeding and are interdependent with other analytical activities within Energy Division.

The Commission has adopted the 2013-2015 and similar 2016 & 2017 programmatic activities on which this evaluation plan is currently designed. Program planning for the next energy efficiency cycle will be guided by the Business Plans which will be filed in January 2017. The implementation of the portfolio, and evaluation, is intended to be on-going and the proposed changes to the portfolio would be developed, reviewed and adopted by the Commission in future years. The annual update to savings estimates and the Energy Savings Performance Incentive (ESPI) mechanism are key drivers for the timing of studies in this plan. The schedule for those activities is in D.15-10-028.

The goals and potential models, energy savings estimates (ex ante DEER and work papers), program design and policy adjustments are also drivers for timing of studies included in this plan. The flow of information is illustrated in Figure 1. Research roadmaps and individual studies will also have detailed timelines that consider this and future program cycle planning horizons to ensure timeliness and relevance of the planned research.

*Figure 1. Feedback Loop for Evaluation Measurement and Verification*



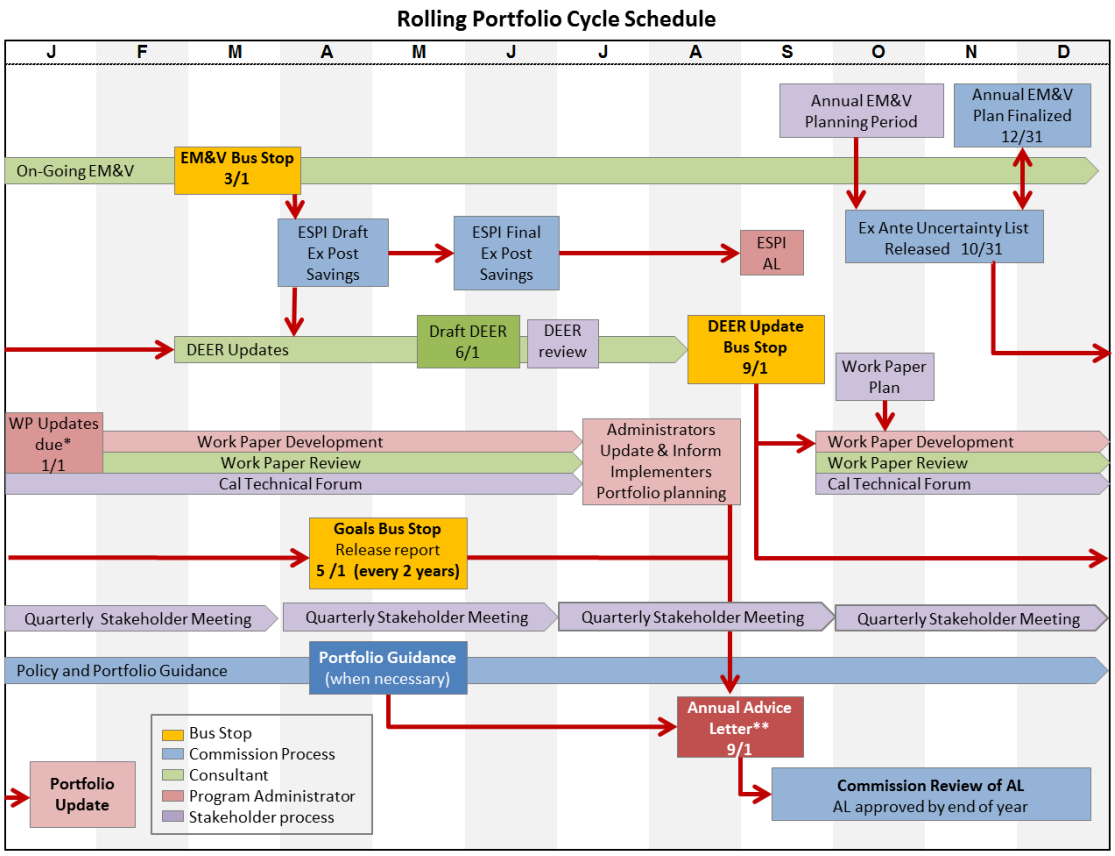
As noted in Figure 1, the information from impact evaluation is expected to provide feedback for updates to savings parameters, but realistically the time to get the utility tracking data, field an evaluation and do meaningful analysis necessitates a year (or more) delay. Energy Division is continuing to try to close this gap, but there are some limitations. Opportunities for on-going and embedded evaluation provide some hope for closing this gap. The Energy Savings Performance Incentive annual payment is a key driver in schedules for prioritizing and delivering impact studies for uncertain measures as noted earlier.

Process evaluations feed directly back to program performance and design changes, and can typically be completed within the program cycle time frame to provide actionable feedback for program implementers. These findings can also have implications for policy or portfolio mid-course changes.

Market studies have the dual purpose of feedback into baselines for savings estimates, and program design in understanding where opportunities lie in the market based on current trends. These studies typically have a long time horizon and hence are most helpful when their long term timelines can coincide with opportunities for new policy direction.

In D.15-10-028, the rolling portfolio cycle also acknowledged the need for predictable feedback and timing of deliverables. In that decision the following annual flow of work was adopted and was first utilized in 2016.

*Figure 2. Rolling Portfolio Cycle Schedule*

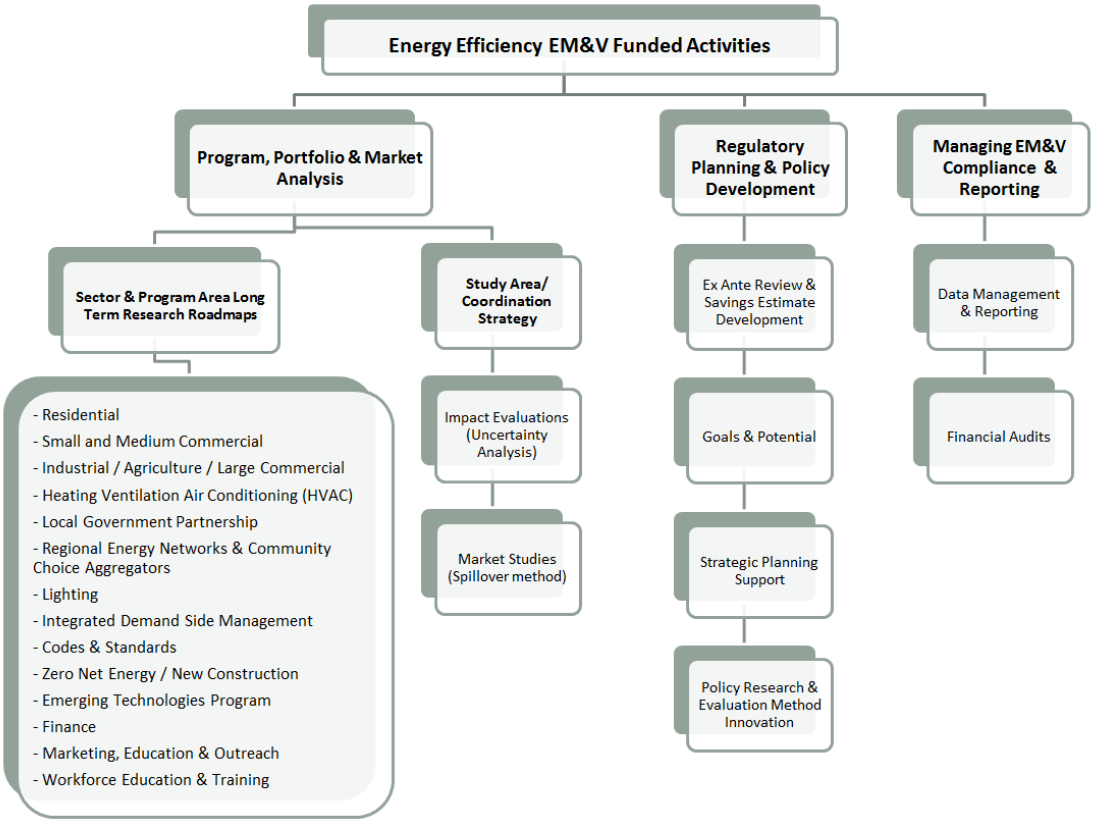



*Work papers for existing measures that are impacted by DEER updates shall be submitted by 1/1, to provide sufficient time for review
**In years that business plan is filed, advice letter filing should be filed concurrently for budget review. Portfolio guidance and business plans are not defined by a set schedule

Studies and work plans contained in this master evaluation plan will be developed in accordance with the expected timing of deliverables, specifically not all deliverables will be available every year. One of the key assets of the rolling portfolio cycle is an opportunity to prioritize and focus evaluation work on short and long term needs to inform the policy process and program improvement.

This evaluation plan is organized around three major categories, Program, Portfolio & Market Analysis; Regulatory Planning and Policy Development; and Managing EM&V Compliance and Reporting. These areas of evaluation activity are described in further detail in the following sections of the plan.

*Figure 3. Organization of the Joint Evaluation Measurement and Verification Plan*




## Program Portfolio and Market Analysis

### *Sector and Program Area Research Roadmap Development*

This planning effort was a collaborative process between CPUC Energy Division (ED), California IOUs, non-IOU program administrators, and CPUC advisory consultants. Multiple Project Coordination Groups have been formed to address the program activity areas in the energy efficiency portfolios and the California Energy Efficiency Strategic Plan. Each of these teams followed a similar basic process to develop their long term research roadmap plan, as described below.

1. Assess which studies have been recently completed and/or in-progress and prior program cycles to develop study and information gaps. This assessment included considerations for types of studies, and scope and depth of those studies.

2. Avoid duplication and strive to leverage resources to address prioritized information gaps and study needs by:
   a. Considering the status of past studies that are still underway but not yet completed
   b. Identifying areas of significant program changes
   c. Identify research areas that are under-developed
   d. Identify the high priority program team information needs and consider public stakeholder information needs (via public webinars)
   e. Investigate areas of potential overlap and duplication with research proposed in other coordination groups
3. Set priorities for available funding cycles (2013-2015, 2016 and 2017) study agenda given limited budget and resources by:
   a. Conducting multiple rounds of prioritization of project content as well as budget re-sizing by the Project Coordination Groups (PGCs).
   b. Consolidating, adding, and deleting projects as a result of key stakeholder review and comments received by the PCG

The current Long Term Research Roadmaps contained in this version of the plan are a result of the above collaborative process. The plans are living documents that evolve as funds are available and as priorities and needs are considered.

## Study Type Research Roadmap Development

Two study type research roadmaps are included in this EM&V plan. The purpose of these plans is to identify how Energy Division and the IOUs will track, coordinate and prioritize research activities across sector research but for a specific study type. These roadmaps serve a coordinating and strategies function, but also identify some specific research needs. The Market Studies research roadmap is focused on the coordination of market studies across the program administrators and Energy Division and the need for standing research activities to address long term tracking of market progress. Each roadmap is provided in this research plan. Commission staff will update the roadmaps throughout the evaluation cycle.

## Regulatory Planning and Policy Development

### *Goals and Potential, Ex Ante (DEER), Strategic Plan Roadmap Development*

Energy Division took sole responsibility for reviewing and preparing this segment of EM&V funded activities. Energy Division staff reviewed existing plans and remaining funding for research and have summarized the next steps to take in research or analysis in the upcoming years. These research roadmaps, specifying the research activity, are provided in the following section of this plan. The line item for Ad Hoc Policy Research and Evaluation Methods has not yet been scoped and is provided in this plan as a place holder to address up and coming evaluation or policy research needs.

## Managing EM&V, Compliance, and Reporting

### *Data Management and Reporting*

Energy Division took sole responsibility for preparing this segment of EM&V funded activities. The Data Management and Reporting section is based on past activity and future needs, similar to the research

roadmaps. The summary of the background, future activities and proposed budget are provided in the second chapter of this evaluation plan.

### 1.2.4. 2013-2017 EM&V Plan Budget Summary

In this section we present summaries of the current EM&V budgets by activity area and project. The summary tables in the following section include the budget by the EM&V activity categories, which are introduced in Section 3 of this plan. The list of active projects, budgets and status projects can be tracked on the Project Status Reporting web page: [http://psr.energydataweb.com/#/project-status/2013-2014] along with studies currently being completed. The funds that were authorized for 2016 and 2017 are included as draft distributions to various sector-level roadmaps, but have not yet been distributed to specific studies.

The EM&V projects are explained in more detail in the sector level research roadmaps in the following sections. In summary the distribution of funding across the general research objectives are illustrated in the following figures. These are dependent on the classification of each study, which is cited for each project in the project status reporting tool.

A contingency budget has also been set aside to address unexpected research needs. It is frequently used to leverage planned field work expansion, rather than new studies, to cover currently unknown needs. All contingency funded studies are still subject to public vetting rules.

The funding approved in 2016 and 2017 for EM&V for Energy Division has only been allocated by research roadmap area (not the categories shown in the pie chart) and are hence shown as "TBD"

***Figure 4 Distribution of 2013-2017 EM&V Funds***

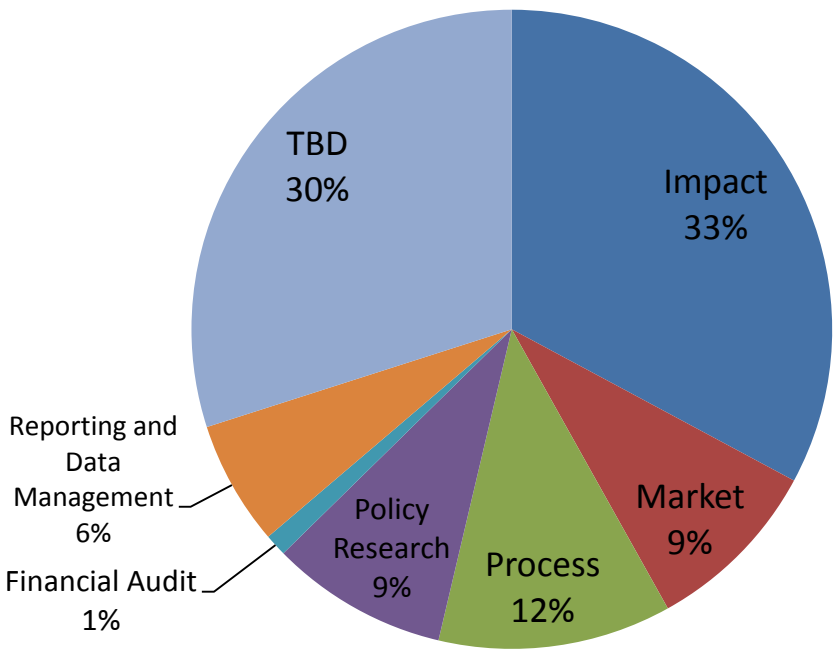


***Table 1. EM&V Plan Sector Budgets***[1]

| Sector | Study Manager | 2013-2015 Budget | 2016-2017 Budget | Sum of 2013-2017 Budget |
|---|---|---|---|---|
| **Residential** | | **$5,832,550** | **$7,968,324** | **$13,800,874** |
| | ED | $3,819,342 | $5,868,324 | $9,687,666 |
| | IOU | $2,013,208 | $2,100,000 | $4,113,208 |
| **Small & Medium Commercial** | | **$6,578,500** | **$3,628,328** | **$10,206,828** |
| | ED | $6,578,500 | $3,353,328 | $9,931,828 |
| | IOU | $0 | $275,000 | $275,000 |
| **Industrial and Agriculture, and Large Commercial** | | **$9,304,000** | **$9,102,200** | **$8,849,154** |
| | ED | $7,815,000 | $7,964,154 | $15,779,154 |
| | IOU | $1,287,200 | $885,000 | $2,172,200 |
| **Integrated Demand Side Management (IDSM)** | | **$1,263,000** | **$1,876,664** | **$2,989,664** |
| | ED | $1,083,000 | $1,676,664 | $2,609,664 |
| | IOU | $180,000 | $200,000 | $380,000 |
| **Workforce Education and Training (WE&T)** | | **$1,378,230** | **$409,584** | **$1,787,814** |
| | ED | $941,222 | $209,584 | $1,150,806 |
| | IOU | $437,008 | $200,000 | $637,008 |
| **Marketing, Education & Outreach (ME&O)** | | **$2,351,000** | **$2,760,000** | **$5,111,000** |
| | ED | $2,351,000 | $2,760,000 | $5,111,000 |
| **Emerging Technologies** | | **$776,222** | **$209,584** | **$985,806** |
| | ED | $391,222 | $209,584 | $600,806 |

[1] Source: "2013-2015 EMV Plan Study Inventory_v2.xls";

| Sector | Study Manager | 2013-2015 Budget | 2016-2017 Budget | Sum of 2013-2017 Budget |
|---|---|---|---|---|
| | IOU | $385,000 | $0 | $385,000 |
| **Local Government Partnership** | | **$1,195,000** | **$2,071,664** | **$3,266,664** |
| | ED | $480,000 | $1,676,664 | $2,156,664 |
| | IOU | $715,000 | $395,000 | $1,110,000 |
| **Lighting** | | **$10,333,914** | **$6,349,158** | **$16,683,072** |
| | ED | $8,945,000 | $5,449,158 | $14,394,158 |
| | IOU | $1,388,914 | $900,000 | $2,288,914 |
| **Finance** | | **$5,134,040** | **$838,332** | **$5,972,372** |
| | ED | $2,304,095 | $838,332 | $3,142,427 |
| | IOU | $2,829,945 | $0 | $2,829,945 |
| **Codes & Standards** | | **$5,854,635** | **$2,295,830** | **$8,150,465** |
| | ED | $4,864,635 | $2,095,830 | $6,960,465 |
| | IOU | $990,000 | $200,000 | $1,190,000 |
| **Zero Net Energy / New Construction** | | **$1,919,460** | **$2,207,498** | **$4,126,958** |
| | ED | $647,476 | $1,257,498 | $1,904,974 |
| | IOU | $1,271,984 | $950,000 | $2,221,984 |
| **Heating, Ventilation, and Air-Conditioning (HVAC)** | | **$9,290,497** | **$5,339,992** | **$14,630,489** |
| | ED | $8,290,497 | $5,029,992 | $13,320,489 |
| | IOU | $1,000,000 | $310,000 | $1,310,000 |
| **Regional Energy Networks/Community Choice Aggregators** | | **$575,000** | **$1,884,328** | **$2,459,328** |
| | ED | $1,676,664 | $2,251,664 | $2,911,664 |
| | BayREN | $189,487 | $189,487 | |
| | MCE | $18,177 | $18,177 | $392,788 |
| **Grand Total** | | **$61,934,248** | **$46,988,440** | **$108,772,688** |

***Table 2. Overall Budgets – Study Type Coordination Strategy and Regulatory Planning & Policy Development***

| Study Type / Coordination Strategy | Study Manager | 2013-15 | 2016-2017 | 2013-2017 |
|---|---|---|---|---|
| **Study Type Coordination** | | | | |
| Impact Analysis | ED | (funded via impact studies) | | (funded via impact studies |
| Market Studies | ED | $3,769,260 | $209,584 | $3,978,844 |
| **Regulatory Planning and Policy Development** | | | | |
| DEER / Ex Ante Review | ED | $7,100,000 | $0 | $7,100,000 |
| Policy Research/ Evaluation Methods | ED | $1,058,966 | $1,000,000 | $2,058,966 |
| | IOU | | $115,000 | $115,000 |
| Potential Goals and Targets | ED | $4,000,000 | $4,000,000 | $8,000,000 |
| Strategic Plan | ED | $250,000 | $1,000,000 | $1,250,000 |
| **Managing EM&V, Compliance, and Reporting** | | | | |
| Data Management and Reporting | ED | $3,385,000 | $4,191,660 | $7,576,660 |
| Financial Audit | ED | $500,000 | $1,081,184 | $1,581,184 |
| Report/Comments/Invoice tools | ED | $84,000 | $168,000 | $252,000 |
| Server Space | ED | 0 | $150,000 | $150,000 |
| | | **$20,147,226** | **$11,915,428** | **$32,062,654** |

***Table 3. Overall Budgets – Other Costs***

| Other Costs | Study Manager | 2013-15* | 2016-2017 | 2013-2017 |
|---|---|---|---|---|
| Utility EM&V Fixed Costs | IOU | $15,850,000 | $10,000,000 | $25,850,000 |
| Fixed Costs (EM&V Staff) | ED | $3,000,000 | $2,000,000 | $5,000,000 |
| Technical Advisors | ED | $2,480,000 | $880,000 | $3,360,000 |
| Evaluation Administration | ED | $6,164,866 | $3,353,328 | $9,518,194 |
| Contingency | ED | $858,299 | $339,688 | $1,197,987 |
| | IOU | $2,331,500 | $936,875 | $3,268,375 |
| | | | | |
| **Total Budgets across all Research and Management 2013-2017** | ED | $74,309,400 | $58,439,220 | $132,748,620 |
| | IOU | $16,476,500 | $17,766,875 | $34,243,375 |
| | | **$90,785,900** | **$76,206,095** | **$166,991,995** |

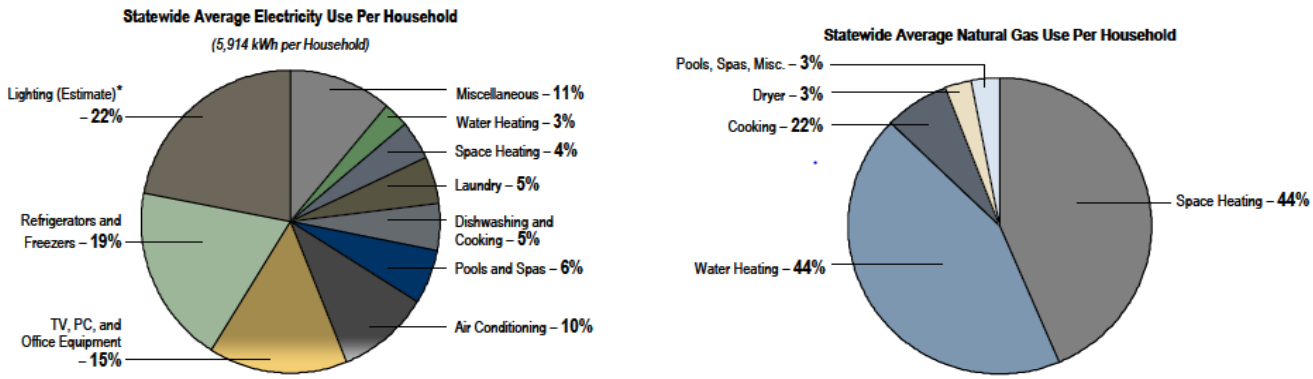
The budgets provided here are summarized in greater detail (by evaluation project) in the project status reporting tool. The detailed descriptions of the activities are found in the sector or study type roadmaps or chapter that describes the support activity.

# 2. Sector and Program Area Long Term Research Roadmaps

## 2.1. Residential

As indicated in the California Energy Efficiency Strategy Plan (January 2011 Update), energy demand for California's 12.6 million households represented 32% of total state electricity consumption and 36% of its total natural gas consumption in 2008. Approximately one-third of all households resided in multi-family structures and the other two-thirds of households lived in single family homes. The proportion of renters as compared to homeowners is about 42% and 58%, respectively. Shown below is a profile of the electricity and nature gas usage from the 2011 California Energy Efficiency Strategy Plan. Lighting (22%), refrigeration (19%) and electronic equipment (15%) are the highest electric end uses, while space heating (44%) and water heating (44%) are the highest gas end uses.

***Figure 5. Profile of Electricity and Nature Gas Usage***




The California Energy Efficiency Strategy Plan establishes the following goals:

1. New construction will reach "zero net energy" (ZNE) performance (including clean, onsite distributed generation) for all new single and multi-family homes by 2020.
2. Home buyers, owners and renovators will implement a whole house approach to energy consumption that will guide their purchase and use of existing and new homes, home equipment, household appliances, and lighting and plug load amenities.
3. Plug loads will be managed by developing consumer electronics and appliances that use less energy and provide tools to enable customers to understand and manage their energy demand.
4. The residential lighting industry will undergo substantial transformation through the deployment of high-efficiency and high-performance lighting technologies, supported by the state and national codes.

Achieving these goals is a key objective in the design of the IOUs portfolio of residential programs. In the last few years, the above goals are further augmented by California legislative goals set forth in SB350, AB802, AB793, AB758 and etc.

The following sections present the EM&V plans for the 2013-2014 and 2015- 2017 periods that will provide the necessary assessment and feedback towards helping to achieve the above strategic plan objectives.

### 2.1.1. Residential Portfolio of Programs

The residential portfolio of programs offer the following:

1. Whole Home Programs (a market transformation program)
    a. Whole House - Energy Upgrade California (EUC) – Basic/Advanced/Flex Path
    b. Multifamily - Energy Upgrade California (EUC)
    c. Moderate Income Direct Install (MIDI) (selected IOUs only))
2. Multifamily Programs
    a. Multifamily Energy Efficiency Rebate Program (MFEER)
    b. Comprehensive Manufactured Homes (CMHP, Third Party program, SCE Only)
    c. Direct Install for Manufactured and Mobile Homes Program (DIMMHP, 3P program, PG&E Only)
3. Home Energy Advisor Program
    a. Home Energy Advisor Survey (HEA) & Universal Audit Tool (UAT)
    b. Home Energy Report (HER) (i.e., Comparative Energy Usage Reports)
    c. Home Buyer Guide (aka On-line Buyer Guide)
4. Plug Load & Appliance Program (PLA) (a market transformation program)
    a. Home Energy Efficiency Rebate Program (HEER/downstream & midstream),
    b. -
5. Residential New Construction Program- a market transformation program
6. Residential HVAC Program (a market transformation program)
7. Residential Third Party (3P) Program

***Table 4. 2013-2014 Residential Portfolio Savings and Budget Summary***

| IOU | Program Name | Budget | kWh Savings | % of Residential Budget | % of Residential kWh |
|---|---|---|---|---|---|
| Statewide | Energy Advisor | $30,366,771 | 222,489,015 | 9% | 39% |
| Statewide | Res HVAC | $30,308,036 | 9,400,205 | 9% | 2% |
| Statewide | MFEER | $16,860,983 | 61,792,921 | 5% | 11% |
| Statewide | Res New Construction | $34,578,307 | 6,354,191 | 11% | 1% |
| Statewide | Plug Load & Appliances | $103,735,173 | 229,428,671 | 32% | 40% |
| Statewide | EUC – WH | $79,532,810 | 25,177,380 | 24% | 4% |
| Statewide | Res Third Party | $32,961,639 | 16,030429 | 10% | 3% |
| | **Total Statewide** | **$328,343,718** | **570,672,812** | | |
| | % of Statewide Portfolio | | | 17% | 15% |

***Table 2. 2015 Residential Portfolio Savings and Budget Summary***

| IOU | Program Name | Budget | kWh Savings | % of Residential | % of Residential |
|---|---|---|---|---|---|

| | | | | Budget | kWh |
|---|---|---|---|---|---|
| Statewide | Energy Advisor Program | $18,668,949 | 95,083,815 | 13% | 38% |
| Statewide | Plug Load & Appliances | $44,151,750 | 105,535,542 | 30% | 42% |
| Statewide | MFEER Program | $16,452,872 | 34,423,267 | 11% | 14% |
| Statewide | EUC - Home Upgrade | $38,644,594 | 9,385,363 | 26% | 4% |
| Statewide | Res-NC Program | $13,900,931 | 2,450,728 | 9% | 1% |
| Statewide | Res-HVAC Program | $17,050,771 | 3,054,045 | 11% | 1% |
| **Statewide** | **Total Residential Portfolio** | **$148,869,867** | **249,932,760** | **100%** | **100%** |

***Table 3. 2016 Residential Portfolio Savings and Budget Summary***

| IOU | Program Name | Budget | % of Total Budget |
|---|---|---|---|
| Statewide | Energy Advisor | $18,737,970 | 11% |
| Statewide | Res HVAC | $16,568,937 | 10% |
| Statewide | MFEER | $18,034,808 | 11% |
| Statewide | Res New Construction | $12,883,736 | 7% |
| Statewide | Plug Load & Appliances | $46,931,476 | 27% |
| Statewide | EUC – WH | $34,925,627 | 20% |
| Statewide | Res Third Party | $23,557,568 | 14% |
| | **Total Statewide** | **$171,640,122** | **100%** |

## Residential Retrofit Market and Program Background

The 2013-2016 Statewide Residential Program Portfolio is approximately 17% of the total IOUs' statewide EE program portfolio budget. Residential is the second largest program budget in aggregate (following the statewide Commercial Program Portfolio). Within the Residential Program Portfolio, each IOU has opted to implement different program strategies to meet their energy savings goals to date.

Each IOU is asked to provide a broad scope and array of programs to serve a multitude of customer wants and needs, including lower-income homeowners (i.e., those not meeting the low-income

qualification requirements). In addition, several residential retrofit programs are identified as market transformation programs (i.e., Energy Upgrade California and Plug Load and Appliance Programs).

These residential retrofit sector programs are generally designed to target two distinct groups of customer segments:

1. Homeowners & renters,
2. Apartment owners/managers.

The residential retrofit portfolio of programs also is designed to serve the needs of small business entities that behave like homeowners and/or renters in terms of their purchase behaviors and/or energy usage profiles.

The program theories often are expressed to overcome the following market barriers commonly faced across the residential energy efficiency sector:

- Lack of energy efficiency information available to and understood by consumers and contractors;
- Lack of awareness of specific measures, programs and/or practices available for consumers and contractors;
- Availability of energy efficiency products for retailers and contractors;
- Split incentive challenges in motivations for property owners versus renters;
- Lack of funds and/or financing options;
- Lack of quantity and quality of skilled contractors and installation workforce;
- Lack of Codes and Standards knowledge and compliance.

For these programs to be successful, it is important for all the participating and non-participating market actors to be aware and knowledgeable about the specific program, thereby motivating the desired purchase decisions and best quality installation efforts.

### 2.1.2. Programs included in the Research Scope

As indicated above, the residential retrofit program portfolio has changed substantially for 2013-2014. Several programs have been consolidated into this sector to simplify program design and administration and to allow for synergy savings and cost effectiveness.

1. Whole Home Programs
2. Multifamily Programs
3. Home Energy Advisor and Home Energy Report Programs
4. Plug Load & Appliance Program (PLA)

***Table 4. 2013-2014 Residential Retrofit Programs Savings and Budget Summary (Excluding HVAC, New Construction & Res. Third Party Programs)***

| 2013-2014 Program Years | kW | kWh | Therms | Budget | kW% | kWh% | Therms | Budget% |
|---|---|---|---|---|---|---|---|---|
| **SCE** | | | | | | | | |
| Energy Advisor Program | 5,730 | 12,667,350 | | $10,061,000 | 15% | 7% | 0% | 14% |
| Plug Load and Appliances Program | 19,574 | 98,197,140 | | $34,463,000 | 50% | 57% | 0% | 47% |
| Multi-family Energy Efficiency Rebate Program | 9,622 | 56,050,448 | | $8,487,000 | 24% | 32% | 0% | 12% |
| Energy Upgrade California - Whole Home Upgrade Program | 4,532 | 6,461,750 | | $19,786,000 | 11% | 4% | 0% | 27% |
| **SCE Total** | **39,458** | **173,376,688** | | **$72,797,000** | **100%** | **100%** | **0%** | **100%** |
| % of Statewide Program Total | 45% | 32% | 0% | 32% | | | | |
| **PG&E** | | | | | | | | |
| Energy Advisor Program | | 209,821,666 | 6,832,780 | $17,641,102 | 0% | 67% | 64% | 18% |
| Plug Load and Appliances Program | 14,771 | 88,962,058 | 1,659,601 | $39,947,273 | 42% | 28% | 16% | 42% |
| Multi-family Energy Efficiency Rebate Program | 588 | 279,897 | 451,067 | $2,059,866 | 2% | 0% | 4% | 2% |
| Energy Upgrade California - Whole Home Upgrade | 20,227 | 16,207,443 | 1,661,972 | $36,202,940 | 57% | 5% | 16% | 38% |

| 2013-2014 Program Years | kW | kWh | Therms | Budget | kW% | kWh% | Therms | Budget% |
|---|---|---|---|---|---|---|---|---|
| Program | | | | | | | | |
| **PG&E Total** | **35,586** | **315,271,064** | **10,605,420** | **$95,851,181** | **100%** | **100%** | **100%** | **100%** |
| % of Statewide Program | 40% | 59% | 64% | 42% | | | | |
| **SDG&E** | | | | | | | | |
| Energy Advisor Program | 0 | 0 | 0 | $820,112 | 0% | 0% | 0% | 3% |
| Plug Load and Appliances Program | 5,428 | 30,344,439 | 204,171 | $12,673,003 | 66% | 79% | 21% | 42% |
| Multi-family Energy Efficiency Rebate Program | 747 | 5,450,983 | 204,634 | $3,902,566 | 9% | 14% | 21% | 13% |
| Energy Upgrade California - Whole Home Upgrade Program | 2,007 | 2,508,188 | 573,873 | $12,847,890 | 25% | 7% | 58% | 42% |
| **SDG&E Total** | **8,182** | **38,303,610** | **982,678** | **$30,243,571** | **100%** | **100%** | **100%** | **100%** |
| % of Statewide Program Total | 9% | 7% | 6% | 13% | | | | |
| **SCG** | | | | | | | | |
| Energy Advisor Program | 0 | 0 | 0 | $1,710,997 | 0% | 0% | 0% | 5% |
| Plug Load and Appliances Program | 5,025 | 11,925,034 | 3,245,009 | $17,131,897 | 100% | 100% | 64% | 54% |
| Multi-family Energy Efficiency | 7 | 11,593 | 1,157,850 | $2,411,550 | 0% | 0% | 23% | 8% |

| 2013-2014 Program Years | kW | kWh | Therms | Budget | kW% | kWh% | Therms | Budget% |
|---|---|---|---|---|---|---|---|---|
| Rebate Program | | | | | | | | |
| Energy Upgrade California - Whole Home Upgrade Program | 0 | 0 | 684,288 | $10,696,979 | 0% | 0% | 13% | 33% |
| **SCG Total** | **5,032** | **11,936,627** | **5,087,147** | **$31,951,423** | **100%** | **100%** | **100%** | **100%** |
| % of Statewide Program Total | 6% | 2% | 31% | 14% | | | | |
| **Statewide Total** | **88,258** | **538,887,989** | **16,675,245** | **$230,843,175** | | | | |
| % of Statewide Program Total | 100% | 100% | 100% | 100% | | | | |

These residential programs serve residential single family and multi-family customer energy efficiency purchase needs, comprehensive retrofit needs, and behavior/information needs.

***Table 5. 2015 Residential Retrofit Programs Savings and Budget Summary (Excluding HVAC, New Construction & Res. Third Party Programs)***

| 2015 Program Year | kW | kWh | Therms | Budget | kW% | kWh% | Therms | Budget% |
|---|---|---|---|---|---|---|---|---|
| **SCE** | | | | | | | | |
| Energy Advisor Program | 2,428 | 5,083,803 | 0 | $4,090,800 | 13% | 6% | 0 | 10% |
| Plug Load and Appliances Program | 10,693 | 45,052,109 | 0 | $13,955,244 | 57% | 53% | 0 | 34% |
| Multi-family Energy Efficiency Rebate Program | 3,192 | 30,982,642 | 0 | $11,100,651 | 17% | 37% | 0 | 27% |

| 2015 Program Year | kW | kWh | Therms | Budget | kW% | kWh% | Therms | Budget% |
|---|---|---|---|---|---|---|---|---|
| Energy Upgrade California - Whole Home Upgrade Program | 2,544 | 3,694,178 | 0 | $11,995,785 | 13% | 4% | 0 | 29% |
| **SCE Total** | **18,857** | **84,812,732** | **0** | **$41,142,480** | **100%** | **100%** | **0** | **100%** |
| % of Statewide Program Total | 42% | 34% | 0 | 35% | | | | |
| **PG&E** | | | | | | | | |
| Energy Advisor Program | 7,804 | 90,000,012 | 3,210,800 | $13,531,293 | 42% | 71% | 80% | 28% |
| Plug Load and Appliances Program | 8,129 | 32,476,767 | 222,735 | $18,990,738 | 44% | 26% | 6% | 39% |
| Multi-family Energy Efficiency Rebate Program | 94 | 981,794 | 90,715 | $1,839,507 | 1% | 1% | 2% | 4% |
| Energy Upgrade California - Whole Home Upgrade Program | 2,523 | 3,159,402 | 492,482 | $13,998,809 | 14% | 2% | 12% | 29% |
| **PG&E Total** | **18,550** | **126,617,975** | **4,016,732** | **$48,360,347** | **100%** | **100%** | **100%** | **100%** |
| % of Statewide Program | 41% | 52% | 61% | 41% | | | | |
| **SDG&E** | | | | | | | | |

| 2015 Program Year | kW | kWh | Therms | Budget | kW% | kWh% | Therms | Budget% |
|---|---|---|---|---|---|---|---|---|
| Energy Advisor Program | 0 | 0 | 0 | $470,967 | 0 | 0 | 0 | 4% |
| Plug Load and Appliances Program | 4,150 | 23,860,686 | 369,033 | $4,725,614 | 73% | 82% | 70% | 35% |
| Multi-family Energy Efficiency Rebate Program | 187 | 2,456,343 | 33,502 | $2,183,742 | 3% | 9% | 6% | 17% |
| Energy Upgrade California - Whole Home Upgrade Program | 1,362 | 2,531,783 | 125,323 | $5,882,655 | 24% | 9% | 24% | 44% |
| **SDG&E Total** | **5,699** | **28,848,812** | **527,858** | **$13,199,978** | **100%** | **100%** | **100%** | **100%** |
| % of Statewide Program Total | 12% | 12% | 8% | 11% | | | | |
| **SCG** | | | | | | | | |
| Energy Advisor Program | 0 | 0 | 0 | $575,889 | 0 | 0 | 0 | 4% |
| Plug Load and Appliances Program | 2,087 | 4,145,980 | 1,433,909 | $6,480,154 | 100% | 99.9% | 70% | 43% |
| Multi-family Energy Efficiency Rebate Program | 1 | 2,488 | 481,771 | $1,328,972 | 0 | 0 | 24% | 9% |

| 2015 Program Year | kW | kWh | Therms | Budget | kW% | kWh% | Therms | Budget% |
|---|---|---|---|---|---|---|---|---|
| Energy Upgrade California - Whole Home Upgrade Program | 0 | 0 | 119,623 | $6,767,345 | 0 | 0.1% | 6% | 44% |
| **SCG Total** | **2087** | **4,148,468** | **2,035,303** | **$15,152,360** | **100%** | **100%** | **100%** | **100%** |
| % of Statewide Program Total | 5% | 2% | 31% | 13% | | | | |
| **Statewide Total** | **45,193** | **244,427,987** | **6,579,893** | **$117,855,165** | | | | |
| % of Statewide Program Total | 100% | 100% | 100% | 100% | | | | |

***Table 6. 2016 Residential Retrofit Programs Savings and Budget Summary (Excluding HVAC, New Construction & Res. Third Party Programs)***

| 2016 Program Years | kWh | kW | Therms | Budget |
|---|---|---|---|---|
| SCE | | | | |
| Energy Advisor Program | 11,319,519 | 4,216 | - | $4,090,800 |
| Plug Load and Appliances Program | 32,012,367 | 9,314 | - | $13,955,244 |
| Multi-family Energy Efficiency Rebate Program | 26,372,199 | 2,329 | - | $11,100,651 |
| Energy Upgrade California - Whole Home Upgrade Program | 1,798,825 | 1,779 | - | $11,785,955 |
| **SCE Total** | **71,502,910** | **17,638** | **0** | **$40,932,650** |
| % of Statewide Program Total | 33% | 37% | - | 35% |
| **PG&E** | | | | |

| 2016 Program Years | kWh | kW | Therms | Budget |
|---|---|---|---|---|
| Energy Advisor Program | 109,382,577 | 17,739 | 3,935,402 | $13,531,293 |
| Plug Load and Appliances Program | 13,098,874 | 2,321 | 465,466 | $18,990,738 |
| Multi-family Energy Efficiency Rebate Program | 678,061 | 25 | 511,372 | $1,839,507 |
| Energy Upgrade California - Whole Home Upgrade Program | 5,496,000 | 5,285 | 469,711 | $13,998,809 |
| **PG&E Total** | **128,655,512** | **25,370** | **5,381,951** | **$48,360,347** |
| % of Statewide Program Total | 59% | 54% | 65% | 41% |
| **SDG&E** | | | | |
| Energy Advisor Program | 11,253,334 | 0 | 0 | $357,988 |
| Plug Load and Appliances Program | 4,320,773 | 3,421 | 797,284 | $7,505,340 |
| Multi-family Energy Efficiency Rebate Program | 857,644 | 556 | (23,254) | $3,765,678 |
| Energy Upgrade California - Whole Home Upgrade Program | 883,316 | 314 | 28,049 | $2,373,158 |
| **SDG&E Total** | **17,315,067** | **4,291** | **802,079** | **$14,002,164** |
| % of Statewide Program Total | 8% | 9% | 10% | 12% |
| **SCG** | | | | |
| Energy Advisor Program | - | - | 0 | $757,889 |
| Plug Load and Appliances Program | - | - | 1,433,909 | $6,480,154 |
| Multi-family Energy Efficiency Rebate Program | - | - | 481,771 | $1,328,972 |
| Energy Upgrade California - Whole Home Upgrade Program | - | - | 119,623 | $6,767,345 |
| **SCG Total** | **-** | **-** | **2,035,303** | **$15,334,360** |
| % of Statewide Program Total | - | - | 25% | 12% |
| **Statewide Total** | **217,473,489** | **47,299** | **8,219,333** | **$118,629,521** |
| % of Statewide Program | 100% | 100% | 100% | 100% |

| 2016 Program Years | kWh | kW | Therms | Budget |
|---|---|---|---|---|
| Total | | | | |

### 2.1.3. Uncertainties and Challenges to Successful Implementation

In 2013-2014, two of the residential sub-programs were identified as "market transformation programs": Plug Load and Appliance and Whole House programs. To support this directive, the preliminary process for managing market transformation has been identified in the program implementation plan.

Below is a list of uncertainties facing the 2013-1014 residential programs (i.e., retrofit only):

1. Support for progress tracking and planning efforts for residential retrofits markets and deep energy reduction strategic planning goals,
2. Determining the effectiveness of new program designs and accuracy of associated energy impacts (i.e., EUC Whole House and EUC-MF/MIDI, Comparative Energy Usage, Online Audit Tools, etc.),
3. Supporting efforts to update work-papers to ensure accuracy of energy savings claims,
4. Collecting data to support innovation activities,
5. Support required for WE&T residential contractor data and sector strategy needs (i.e., EUC Whole House and MF)
6. Uncertainty about the possible double-counting of savings resulting from behavior program

Much like the lighting studies, a wide range of residential studies were also authorized by both ED and IOUs to cover Low-income/ESAP, Demand Reduction, Marketing Education and Outreach programs.

For 2015, Decision 12-11-015 directed the IOUs to hire a market transformation consultant to guide the EUC-HU market transformation process. As a result of this initiative with the Navigant Consulting team, the statewide EUC-HU program made significant process improvements to establish core and regional services as well as standardizing services for participating contractors. Much of these program process changes were implemented in 2015 and beyond.

As expected, EUC-MF participation and number of completed projects increased in 2015. This, along with improved data collection per recommendations from the 2014 evaluation, is facilitating a more thorough evaluation of the EUC-MF program.

The ESAP/LI proceeding was not finalized in 2015 as expected, but in 2016. In this latest ESAP/LI preceding, there is increasing linkage between the Multi-family Energy Efficiency Rebate Program (MFEER) and Moderate Income Direct Installed Program (MIDI), especially through the proposed single-point of contact engagement strategy.

For 2016 and beyond, program designs and implemented must adhere to the latest CPUC decisions and California legislative goals. These additional requirements and cost effectiveness program targets will push for additional program innovations and evolutions.

## Ex Ante Coordination

Ex ante processes (including DEER updates, Uncertain Measures List updates, work papers review, and custom projects review) incorporate data and results from the latest EM&V studies. The ex ante values that are relevant to this sector are highlighted in this section, they may also be included in other relevant chapters.

## Summary of DEER 2016 Updates:

- Clothes washers updated to reflect new rating systems
- Appliance (refrigerators and freezers) updated to reflect that a large fraction of the program collected units had little or no market value and thus have no gross savings. The result of this revision was a reduction in gross savings, but an increase in NTG compared to previous DEER versions.

## Summary of 2015 Uncertain Measure Updates:

To assess which measures to move off and/or to add onto the Uncertain Measures List requires looking ahead to future IOU portfolios and analysis by ex ante and ex post teams. The current 2015 Uncertain Measures List (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF, Attachment 3) contains the following items for this sector and shall be prioritized in the evaluation studies.

The 2015 Uncertain Measure list for residential measures (other than lighting) remains unchanged from 2014.

***Table 7. 2015 Uncertain Measures***

| Measure Description | Comments on Need | PGE | SCE | SDGE | SCG |
|---|---|---|---|---|---|
| Home Energy Reports (Residential Energy Advisor Program) | Behavioral program requires ex post evaluation of all claims. | X | X | X | |
| Energy Upgrade California | Change in program design and maturing program offering makes assumptions uncertain; normal replacements versus early retirement assumptions are uncertain. | X | X | X | |
| Home Energy Surveys (mail and phone) | Changing survey and audit methods and target population makes use of previous result inappropriate. | | X | | |
| Variable speed pool pump | Rapid reductions in equipment pricing and improved efficiency make gross and net savings | | | X | |

| Measure Description | Comments on Need | PGE | SCE | SDGE | SCG |
|---|---|---|---|---|---|
| | uncertain. | | | | |
| Water savings kits/items (shower and faucet) | Energy impacts of this measure not subject to previous evaluation and assumption are uncertain; uncertain install rate and level of free riders. | | | X | X |

Ex ante staff leads and ex post staff leads will coordinate processes, studies, and timelines to better align the flow of information between ex ante and ex post projects. Ex post evaluation studies provide data and results for ex ante updates. Planning for ex ante updates in the future will also require evaluation planning and input. Evaluation studies will need to budget time and schedule to provide input into ex-ante processes, such as DEER and the uncertain measure list. Currently, ex ante funding is budgeted under the overall ex ante contract. More information about the budget is provided in the Ex Ante Review section of this document.

For 2016, a primary focus of Energy Division evaluation activities will be addressing uncertain measure updates as identified by the Ex-Ante team. To assess what measures to move off and/or add onto the Uncertain Measures List requires looking ahead to IOU portfolios and analysis of ex ante and ex post teams. The current 2016 Uncertain Measures List 2016 includes the following measures for each IOU:

***Table 8. 2016 Uncertain Measures***

| Measure Description | Comments on Need | PGE | SCE | SDGE | SCG |
|---|---|---|---|---|---|
| Home Energy Reports (Residential Energy Advisor Program) | Behavioral program requires ex post evaluation of all claims. | X | X | X | X |
| Energy Upgrade California (Multi-family) | Change in program design and maturing program offering makes assumption uncertain; normal replacements versus early retirement assumptions are uncertain. | X | X | X | X |
| Home Energy Surveys (mail and phone) | Changing survey and audit methods and target population makes use of previous result inappropriate. | | X | | |
| High Efficiency Water Heating for Commercial and Residential use – tank-less/instant water heaters and 0.9 and higher EF storage water heaters | The main areas of uncertainty are overall system differential water and energy use considering tank and pipe losses as well as firing efficiency, standard practice vs. | X | | X | X |

| Measure Description | Comments on Need | PGE | SCE | SDGE | SCG |
|---|---|---|---|---|---|
| | code baseline and NTG. | | | | |
| Water savings kits/items (shower and faucet) | Energy impacts of this measure not subject to previous evaluation and assumption are uncertain; uncertain install rate and level of free riders. | X | X | X | X |

## Next planned DEER Update

The DEER team is currently in the planning stages for 2017 updates. The scope of these updates is still under development

## Program Administrators' Planned Work Paper Submissions

Program Administrators submit planned work papers for the upcoming portfolio cycle to Commission staff. These work papers often use DEER data and/or methodology to add technologies that are not in DEER to the energy efficiency portfolio.

***Table 9. Planned Work Paper Submissions***

| Program Administrator | Sector | Tech Type | Measure/Value/ Parameter | Reason for the Update/New Work paper |
|---|---|---|---|---|
| PG&E | RES | Appliances and Plug Loads | Energy Star Clothes Dryers | New data |
| PG&E | RES | Appliances and Plug Loads | Energy Star Clothes Washers | New data |
| PG&E | RES | Appliances and Plug Loads | Retail Plug Load | New data |
| PG&E | RES | Appliances and Plug Loads | Home Energy Reports | New data |
| PG&E | COMM | Food Service | Deck Ovens | New data |
| PG&E | COMM | HVAC | High Performance Evaporative Pre-Cooled Condenser | New data |
| PG&E | COMM | HVAC | Indirect Evaporative Dedicated Outdoor Air System (DOAS) | New data |
| PG&E | AG | Irrigation | Vertical Hollow and Solid Shaft Pump Motors | New data |

| Program Administrator | Sector | Tech Type | Measure/Value/ Parameter | Reason for the Update/New Work paper |
|---|---|---|---|---|
| PG&E | COMM | Refrigeration | Ultra-Low Temperature Freezer | New data |
| PG&E | COMM | Service and Domestic Hot Water | High Efficiency DHW Boiler (>75 mBTU/h) | New data |
| PG&E | COMM | HVAC | Economizer Control Commercial | New data |
| PG&E | COMM | HVAC | Condenser Coil Cleaning Commercial | New data |
| PG&E | COMM | HVAC | Unoccupied Supply Fan Control Commercial | New data |
| PG&E | COMM | HVAC | Evaporator Coil Cleaning Commercial | New data |
| PG&E | COMM | HVAC | Refrigerant Charge Commercial | New data |
| PG&E | COMM | HVAC | PTAC/PTHP Controller | DEER Updates |
| PG&E | COMM | HVAC | Economizer Repair | DEER Updates |
| PG&E | COMM | HVAC | Economizer Control | DEER Updates |
| PG&E | COMM | HVAC | Condenser Coil Cleaning | DEER Updates |
| PG&E | COMM | HVAC | Unoccupied Supply Fan Control | DEER Updates |
| PG&E | COMM | HVAC | Evaporator Coil Cleaning | DEER Updates |
| PG&E | COMM | HVAC | Refrigerant Charge | DEER Updates |
| PG&E | COMM | Refrigeration | Vending Machine Controller – Uncooled | DEER Updates |
| PG&E | COMM | Lighting | 4 Watt Int Screw-in CFL | DEER Updates |
| PG&E | RES | Appliances and Plug Loads | Home Energy Upgrade Program | DEER Updates |
| PG&E | RES | Appliances and Plug Loads | Unit 1 Refrigerator Recycling | DEER Updates |
| PG&E | RES | Appliances and Plug Loads | CLOTHES WASHER WATER AGENCIES MEF >= 2.4 WF <= 4.0 | DEER Updates |
| SDG&E | RES | Appliances and Plug Loads | Pool Response – This is an IDSM project for pool pumps using a low cost controller. If effective - could be a residential rebate. | Deer Updates |

| Program Administrator | Sector | Tech Type | Measure/Value/ Parameter | Reason for the Update/New Work paper |
|---|---|---|---|---|
| SCG | RES | Appliances and Plug Loads | Showerhead/Faucet Aerator | New Data and Title 24 requirements |
| SCG | RES | Appliances and Plug Loads | Boiler Reset Control | New Data from ET Field Trials |
| SCG | RES | Appliances and Plug Loads | Boiler on-demand pump | New Data from ET Field Trials |
| SCG | RES | Appliances and Plug Loads | residential tub spout & showerhead | New Measure |
| SCE | RES | Appliances and Plug Loads | Clothes Dryer | WP already drafted by PG&E. SCE deciding whether to adopt. |
| SCE | RES | Appliances and Plug Loads | Variable speed drive on pool motors | Proceeding through SCE's intake process. |

### 2.1.4. Key Research Questions for 2013-2015 EM&V Studies

In this section, we describe the 2013-15 studies for this roadmap as well as studies authorized elsewhere. Below, please find a list of the residential research studies that addressed specific residential retrofit information needs. In addition to this list of studies, the following residential studies were completed for 2015 in the Low-Income/ESAP proceedings:

- ESA Program Impact Evaluation Study
- Low-Income Multi-Family Segmentation Study, ECD
- ESA Program Energy Education Study
- Low Income Needs Assessment

The above studies are funded by a different CPUC proceeding and will be managed by the Low-Income ESAP study team. The need for critical synthesis of all residential information will be increasingly critical so a consistent set of overarching findings and recommendations will be possible.

***Table 10. 2013-2015 Residential Retrofit Programs EM&V Research Questions Summary***

| Study Name | Research Questions [2013-2015] |
|---|---|
| **2013-2015 Impact Studies** | |
| (Residential-1B) SDG&E Home Energy Center Trial & Impact Evaluation | Study canceled due to cancellation of program. |
| (Residential-3A) Impact Evaluation of Comparative Energy Usage Report Programs 2013, 2014, 2015 | What is the energy savings when comparing treatment versus control groups? Is the program experimental design by the IOUs acceptable?<br>What are the peak demand savings?<br>How is program targeting affecting the energy savings? |

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| | What is the realization rate between the impact evaluation and the IOUs energy savings claims? |
| (Residential 3C) SCE Home Energy Audits (HEA) Impact Evaluation | SCE has claimed energy savings associated with their mail audits and filed workpapers using results from the 2010-12 evaluation. However, this program is on the ESPI uncertainty list due to the how the 2010-12 evaluation results varied from the ex ante values for all but the mail-in surveys. However, the use of the alternative survey delivery mechanism varied widely for the utilities. Additionally, the degree of usage-based targeting (i.e., using past bills to target customers for participation) and uptake of difference measure categories varied between the utilities and may not reflect 2015 program year participants. Staff believes that additional years of ex post evaluation are required before the uncertainty associated with ex ante values can be reduced to an acceptable level. As such, researchable questions for this evaluation include: What if any, are the measureable savings attributable to the HEES program? Has the program influenced an uptake of other rebated/upstream measures? What is the joint savings adjustment required to prevent double counting? |
| (Residential 3D) HER Upstream Adjustment Study | Postponed: Does the Home Energy Reports treatment group purchase upstream lighting measures (CFLs; LEDs, High Efficient Incandescent) at a higher rate than the control group? If so, what is the fraction of upstream lighting savings that are attributable to the HER program that must be removed from the rebate program? |
| (Residential-6B) MF-EUC/MIDI & MFEER Focused Impact Evaluation Study; 2013-14, 2015<br><br>Target: Property owners/managers | Are the IOUs and RENs collecting and documenting sufficient data to assess program impacts for the EUC-MF programs?<br>Are the EnergyPro modeled savings estimates reasonable? (EUC-MF)<br>Are the engineering estimates for the ESPI hot water saving measures reasonable?<br>What should the baseline be for the EUC-MF and MFEER programs? Are the measures being replaced prior to the end of their useful life (early replacement), or replaced upon burnout (or failure)?<br>What is the level of free-ridership for EUC-MF and MFEER measures? |
| (Residential-8B) Focused Impact Evaluation for SF-WH Home Upgrade Basic/Flex Program; 2013-14 Advanced/Basic; 2015<br><br>Target: Homeowners | This study should build-upon results from the process evaluation study (i.e., Residential-8A)<br>Are the IOUs and RENs collecting and documenting sufficient data to assess program impacts for the EUC-SF programs?<br>How can data from 2010-2012 EUC-SF studies be combined with 8A and 8B and what advanced analytics can be used to inform the program?<br>What is the uncertainty around “billing analysis” estimates, |

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| | what are the savings drivers for Basic/Flex, and can the uncertainty be reduced?<br>What are the energy savings realization rates (kW, kWh, Therms) before attribution? (i.e. adjusted gross savings)<br>What number of full retrofit jobs commenced as "Fast Track – Emergency Replacements" for essential HVAC or other energy equipment?<br>Are there other market dynamics that we should account for in this impact evaluation?<br>Include survey questions on financing, spillover and "take back"<br>How can the program process be improved to improve energy savings outcome? |
| (Residential 16 A) 2013-2014 Residential VSD Pool Pumps Update for ESPI (SDG&E only) | Are the parameters used to calculate program impacts from work papers to program tracking database consistent for 2013 estimates?<br>Has the decrease cost differential between standard 2-speed pumps versus variable speed pumps is now around $200 versus $1200-$1600 back in 2011, moved the baseline?<br>What are the operating parameters (i.e., run time, hours of operation) and average unit size/load that impact gross savings?<br>Has the market changed and what is the potential impact on realization rates, net kWh, kW and Therm savings? |
| (Residential 16A ) SW SF Water Saver Kits Parameter Update | Canceled due to low priority for ED |
| (Residential 16B) Pool Covers Impact Assessment | Canceled due to lack of residential measure installations |
| (Residential 17) Economic Assessment of Water Heating Technologies for Residential and Multifamily Residences | Is there an opportunity to retrofit homes with new, electric water heat technologies to help reduce GHG emissions and reduce natural gas consumption in storage constrained areas? This assessment hopes to identify costs associated with retrofitting and operating electric heat pump technology for water heat. |
| (Residential 18) Appliance Recycling | Canceled due to discontinuation of the program |
| (Residential 19A) SW Online Audit Tools Impact Evaluation | Do the Tools encourage ongoing customer engagement? Is there measurable energy savings associated with using the Tool? Do the Online Tools increase participation in other IOU rebate or upstream programs? |
| (Residential 19B) SCE Online Tool Evaluability Assessment | Is SCE capturing data that could support an impact evaluation going forward? If not, what additional data should SCE track? |
| (Residential 20 C-D)Tech Support: 2016 Pilots<br>SCE East West Pilot | Provide technical support to ED regarding evaluation approach for residential program pilots using RCT experimental designs for behavior program pilots and market transformation |

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| SCE MF 10-10-10 Pilot<br>SCG CWDCW Pilot<br>SW Res Plug Load Pilot | strategies. |
| (Residential 21) Bill Payment Program (Auto-Pay) Study | Do residential customers enroll in utility automatic billing payment (ABP or "auto-pay") or budget/levelized billing use 4-6% more energy than their peers, per the Duke study? Is this due to the lack of price signals/usage reminders in the form of paper bills? Do customers who enrolled in auto-pay consume more than those who are not? Do auto-pay customers in the HERs treatment group consume less energy than auto-pay customers in the control group? How much, in terms of kWh, kW and Therms do either cohort consume versus those not on auto-pay? |
| **Process** | |
| (Residential-1A) SCE and PG&E Pilots/Trial Studies | What is the program theory for this intervention? Why should we implement this program?<br>What is the counterfactual for this program theory? (i.e., what would have happened without this program intervention?)<br>What is the market baseline condition?<br>What is the free-ridership?<br>What is the energy savings? Is the planned energy savings realized in the pilots/trials?<br>Should this intervention be adopted into the core program? |
| (Residential-3B) SCE UAT Work-paper Update<br>(Project not funded in 2013-2014) | Since SCE has transitioned from Home Energy Efficiency Survey to Home Energy Advisor on-line audit tool, using an ongoing engagement design, has the energy savings claims in the work-paper on file changed?<br>Has the energy savings increased or declined for on-line, mail-in, in-home and phone deliveries?<br>Has this new UAT tool changed customer "behavior"? If yes, how? |
| (Residential-4) Residential Solution Workbook<br><br>The goal is to develop an at-a-glance planning document for the residential sector to look at end-use specific and misc. plug load appliances and other home enveloped related measures. This study should leverage data available from prior CLASS/RASS and other general population studies. | This is a similar initiative to the Lighting Solution Workbook.<br>What are the key planning metrics for end-use specific and misc. plug load products and measures?<br>What data is available from prior research studies? (i.e., RASS/CLASS and other tracking and characterization studies)<br>How can the data be displayed so at-a-glance planning and prioritization could be possible? |
| (Residential-5) Market | What market data is needed to update existing work-papers to |

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| Characterization & Data Collection for Work-paper Update | ensure their relevance?<br>Has the customer usage profile changed?<br>Has the baseline efficiency level of the appliance changed?<br>Has the market dynamics changed thus affecting the level of free-riders? |
| (Residential-6A) MF-EUC/MIDI Pilots & MFEER Program Change Process Evaluation | What is the program design change?<br>Has this change altered the program theory?<br>Is the program evaluable? Are the program data tracking system sufficient to support both process and impact evaluation?<br>Can these key program processes improve program outputs and outcomes, including energy savings (kW/kWh & Therm)?<br>Is the program's interaction with REN and other entities productive?<br>The result of this study should be the input to Residential-6B study. |
| (Residential-8A) Focused Process Evaluations for SF WH Home Upgrade Program Change | What is the program design change?<br>Has this change altered the program theory?<br>Is the program evaluable? Are the program data tracking system sufficient to support both process and impact evaluation?<br>Can these key program processes improve program outputs and outcomes, including energy savings (kW/kWh & Therm)?<br>Is the program's interaction with REN and other entities productive?<br>What are the implications for program design and implementation as a result of Title-20 and Title-24 update in 2014?<br>The result of this study should be the input to Residential-8B study. REN's impact evaluation studies are accounted for separately. |
| **Market** | |
| (Residential-2A & -2B) Overarching Residential Study—(2A) Behavior, (2B) Market Transformation Indicators | Behavior:<br>Describe smart meter business case decisions and relevant conservation and DR cost and benefits assumptions anticipated from behavior strategies<br>Describe IOU progress to date implementing Smart Meter behavior strategies (per above decisions)<br>Characterize current residential EE and DR behavior program market; number and type of vendors and services provided, key trends<br>Categorize EE/DR behavior pilots within a behavior program framework. Apply this to IOU/EE programs<br>Summarize savings results from pilots that could be useful to project potential energy savings from behavior change in CA<br>Summarize any lessons learned from behavior potential studies in other states or alternate behavior potential estimation models for CA |

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## A Summary of 2013-2015 EM&V Studies, Budgets, and Timing

***Table 11. 2013-2015 Residential Retrofit Programs Budgets and Timing***

| 2013-2015 Study Area/Title | Study Manager (ED/IOU) | 2013-2015 Budget | Status | Completion Date |
|---|---|---|---|---|
| **Impact** | | | | |
| (Residential-1B) SDG&E Home Energy Center Trial and Impact Evaluation | ED | $0 | Cancelled | Cancelled |
| (Residential-3A) Impact Evaluation of Comparative Energy Usage Report Programs | ED | $584,342 | 2013 Complete; 2014 Complete | Q4 2015 |
| (Residential-6B) Focused Impact Evaluation of MF-EUC/MIDI & MFEER | ED | $200,000 | Complete | Q1 2016 |
| (Residential-8B) Focus Impact Evaluation of WH/EUC Program | ED | $300,000 | Complete | Q4 2015 |
| (Residential – 16A) 2013-2014 Residential VSD Pool Pumps Update for ESPI (SDG&E only) | ED | $160,000 | Complete | Q1 2016 |
| Residential-3A) Impact Evaluation of Comparative Energy Usage Report Programs | ED | $430,000 | Underway | Q1 2017 |
| (Residential 3C) SCE Home Energy Audits (HEA) Impact Evaluation | ED | $135,000 | Underway | Q1 2017 |
| (Residential 3D) HER Upstream Adjustment Online Survey | ED | $90,000 | Underway | Q1 2017 |
| (Residential-6B) Focused Impact Evaluation of MF-EUC/MIDI & MFEER | ED | $300,000 | Underway | Q1 2017 |
| (Residential-8B) Focus Impact Evaluation of WH/EUC Program (IOUs/RENs) | ED | $550,000 | Underway | Q1 2017 |

| 2013-2015 Study Area/Title | Study Manager (ED/IOU) | 2013-2015 Budget | Status | Completion Date |
|---|---|---|---|---|
| (Residential 16A ) SW SF Water Saver Kits Parameter Update | ED | | Study canceled after completing draft plan due to changing priorities | Canceled |
| (Residential 16B) Pool Covers Impact Assessment | ED | | Canceled due to lack of residential installations | Canceled |
| (Residential 17) Economic Assessment of Water Heating Technologies for Residential and Multifamily Residences | ED | $100,000 | Underway | Q1 2017 |
| (Residential 18) Appliance Recycling | ED | | Canceled due to discontinuation of the program | Cancelled |
| (Residential 19A) SW Online Audit Tools Impact Evaluation | ED | $375,000 | Underway | Q1 2017 |
| (Residential 19B) SCE Online Tool Evaluability Assessment | ED | $45,000 | Underway | Q1 2017 |
| (Residential 20 C-D)Tech Support: 2016 Pilots<br>SCE East West Pilot<br>SCE MF 10-10-10 Pilot<br>SCG CWDCW Pilot<br>SW Res Plug Load Pilot | ED | $120,000 | Ongoing | Q4 2017 |
| (Residential 21) Bill Payment Program (Auto-Pay) Study | ED | $200,000 | Underway | Q1 2017 |
| **Process** | | | | |

| 2013-2015 Study Area/Title | Study Manager (ED/IOU) | 2013-2015 Budget | Status | Completion Date |
|---|---|---|---|---|
| (Residential-1A)<br><br>(1) SCE Set-top Box Trial<br><br>(2) SCE/SoCalGas EUC-MF Pilot Program Evaluation<br><br>(3) PG&E RPP Trial | SCE<br><br>SCE/SoCalGas<br><br>PG&E | $80,000<br><br>$100,000<br><br>(funded by ETP) | | (1) Completed<br><br>(2) ECD: Q4/2016<br><br>(3) Tracked by ETP. |
| (Residential-3B) SCE UAT Work-paper Update (Not funded) | SCE | $0 | | Project not funded. |
| (Residential-4) Residential Solution Workbook Project, Part-I Market View & Part-II Measure View | IOUs | $200,000 | | Completed |
| (Residential-5) PLA Market Characterization & Data Collection for Work-paper Update<br><br>SCE CMHP HVAC QM Analysis<br><br>SW MF Pool Pump Study | PG&E<br><br>SCE<br><br>SCE | $150,000<br><br>$32,000<br><br>$150,000 | | Completed |
| (Residential-6A) SCE/SCG/SDG&E Multifamily Program Process Evaluation Phase-1<br><br>Please refer to 2015 Residential-14 for Phase-II | SCE | $ 262,108 | | ECD: Q4/2016 |
| (Residential-8A) Focus Process Evaluation for WH/EUC Program Changes | PG&E | $250,000 | | Completed |

| 2013-2015 Study Area/Title | Study Manager (ED/IOU) | 2013-2015 Budget | Status | Completion Date |
|---|---|---|---|---|
| (Residential-15) SCG & Municipality Joint Offerings: Lessons Learned & Opportunity Study | SoCalGas | $50,000 | | Completed |
| (Residential-9) Residential Portfolio Evaluation Whitepaper | SDG&E | $70,000 | | Completed |
| (Residential-10) 2015 Parameter Research to Support Home Energy Reports Program, Early M&V Research to Support Online Audits Program | PG&E | $195,000 | | Completed |
| (Residential-12) 2015 EUC-HU Process Evaluation Phase-2 | PG&E | 150,000 | | Completed |
| (Residential-13) Cold Water Default Clothes Washer Rapid Feedback Process Evaluation | SoCalGas | $70,000 | | Completed |
| (Residential-14) 2015 SCE/SCG/SDG&E Multifamily Program Process Evaluation Phase-II | SCE | $254,100 | | ECD: Q4/2016 |
| PG&E MF Study | PG&E | 210,000 | Underway | Q3/2017 |
| **Market** | | | | |
| (Residential 2A & 2B) Behavior Programs Characterization Study | ED | $230,000 | Complete | Q3 2015 |
| (Residential-11A) Market Characterization of Online Peer-to-Peer Market for Used Refrigerators & Freezers | PG&E | $0 | Cancelled | |
| (Residential-11B) Market Characterization of Used Refrigerator | PG&E | $0 | Cancelled | |

| 2013-2015 Study Area/Title | Study Manager (ED/IOU) | 2013-2015 Budget | Status | Completion Date |
|---|---|---|---|---|
| Sales: Retail & Auction Houses | | | | |

## 2.1.5. 2013-2015 Study Descriptions

Below, please find a brief description for each proposed residential retrofit study.

| | |
|---|---|
| **Study Title:** (Residential-1A) SCE & PG&E Pilots/Trials | **Budget**: $300,000 |
| **Expected Completion Date:** 2014 | **Study Manager:** IOUs |
| **Description:** Selected PLA trials/pilots to test product/measures, delivery mechanism, customer acceptance & energy savings estimates | |
| **Objective:** To support program innovation activities and data collection efforts to quantity benefits | |
| **Key Research Questions:**<br>• What is the program theory for this intervention? Why should we implement this program?<br>• What is the counterfactual for this program theory? (i.e., what would have happened without this program intervention?)<br>• What is the market baseline condition?<br>• What is the free-ridership?<br>• What is the energy savings? Is the planned energy savings realized in the pilots/trials?<br>• Should this intervention be adopted into the core PLA program?<br>Note:<br>1. SCE is working on two projects:<br>a. SCE Set-top Box Trial ($80,000),<br>b. SCE/SCG EUC-MF Pilot Process Evaluation ($75,000/SCE and $25,000/SCG).<br>2. PG&E is working on one project:<br>a. PG&E EUC-MF Pilot Process Evaluation ($100,000) | |
| **Potential EM&V Methods:** See next section for detailed project description | |

| | |
|---|---|
| **Study Title:** (Residential-1B) SDG&E Home Energy Center Trial & Impact Evaluation | Study canceled due to program cancellation. Budget reassigned to SF-EUC, MF-EUC/MFEER and HERs impact evaluations |
| Canceled | **Study Manager:** ED |
| **Description:** SDG&E Home Energy Center Trial Study and energy savings analysis | |
| **Objective:** To support program innovation activities and data collection efforts to quantity benefits | |
| **Potential EM&V Methods:** NA | |

| **Study Title:** (Residential-2A & 2B) Behavior Programs Characterization | **Budget:** $230,000 |
|---|---|
| **Expected Completion Date:** 2014 | **Study Manager:** ED |
| **Description:** A study to develop a framework for estimating behavior potential. , | |
| **Objective:** Identify sources for assumptions to populate potential models for energy savings using behavior change strategies. | |
| **Key Research Questions:**<br>Behavior:<br>• Describe smart meter business case decisions and relevant conservation and DR cost and benefits assumptions anticipated from behavior strategies<br>• Describe IOU progress to date implementing Smart Meter behavior strategies (per above decisions)<br>• Characterize current residential EE and DR behavior program market; number and type of vendors and services provided, key trends<br>• Categorize EE/DR behavior pilots within a behavior program framework. Apply this to IOU/EE programs<br>• Summarize savings results from pilots that could be useful to project potential energy savings from behavior change in CA<br>• Summarize any lessons learned from behavior potential studies in other states or alternate behavior potential estimation models for CA | |
| **Potential EM&V Methods: See next section for detailed project description** | |
| **Potential Ex Ante Uses:** | |

| Study Title: (Residential-3A) Impact Evaluation of Home Energy Report Initiatives | Budget: $584,342 |
|---|---|
| Expected Completion Date: 2014 and 2016 | Study Manager: ED |
| Description: Conduct impact evaluation of the Opower comparative energy usage program implemented by the IOUs (PG&E, SCE and SDG&E) for program years 2013 and 2014. . Also conduct impact evaluation of Marin Clean Energy's comparative feedback program implemented in Q4 2013 through 2014. | |
| Objective: (1) verify IOUs energy claims and other study considerations | |
| • Key Research Questions: | |
| What is the energy savings when comparing treatment versus control groups? Is the program experimental design by the IOUs acceptable? | |
| What are the peak demand impacts? | |

| **Study Title:** (Residential-3B) SCE UAT Work-paper Update | **Budget:** $0 (Project not funded) |
|---|---|
| **Expected Completion Date:** 2014 | **Study Manager:** SCE |
| **Description:** Update SCE's HEES work-paper, since the program is in transition to the new Home Energy Advisor Tool (aka UAT) using an ongoing engagement model for on-line delivery | |
| **Objective:** (1) update work-paper to improve the accuracy of energy savings reporting | |
| **Key Research Questions:**<br>• Since SCE has transitioned from Home Energy Efficiency Survey to Home Energy Advisor on-line | |

| **Study Title:** (Residential-3B) SCE UAT Work-paper Update | **Budget:** $0 (Project not funded) |
|---|---|
| audit tool, using an ongoing engagement design, has the energy savings claims in the work-paper on file changed?<br>• Has the energy savings increased or declined for on-line, mail-in, in-home and phone deliveries?<br>• Has this new UAT tool changed customer "behavior"? If yes, how? | |
| **Potential EM&V Methods:** See next section for detailed project description | |

| **Study Title:** (Residential-4) Residential Solution Workbook Project, Part-I and Part-II | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** 2013 | **Study Manager:** IOUs |
| **Description:** This project is inspired by the Lighting Solution Workbook. The Residential Solution Workbook has two parts: Part-1: Market View ($100,000) and Part-II Measure View ($100,000).<br><br>For Part-I Market View, this project will develop an at-a-glance planning document to capture key market metrics for end-use specific and misc. plug load products/measures (i.e., saturation, sales volume, efficiency level, etc.).<br><br>For Part-II, the Measure View project will take a deeper diver to investigate six different measures: (1) clothes dryers, (2) pool pumps, (3) advanced power strips, (4) space heaters, (5) audio/video devices, and (6) computing devices. For these six devices a dash board to highlight key device/measure parameters will be developed.<br><br>Note: SCE and PG&E have engaged RIA to develop both Part-I and Part-II of this project. | |
| **Objective:** to improve statewide residential planning and prioritization efforts | |
| **Key Research Questions:**<br>This is a similar initiative to the Lighting Solution Workbook.<br>• Part-I: Market View<br>  ○ What are the key planning metrics for end-use specific and misc. plug load products and measures?<br>  ○ What data is available from prior research studies? (i.e., RASS/CLASS and other tracking and characterization studies)<br>  ○ How can the data be displayed so at-a-glance planning and prioritization could be possible?<br>• Part-II: Measure View<br>  ○ For six high priority devices/measures, can a dash-board to track key device/measure parameters such as saturation and etc. be developed?<br>  ▪ Clothes dryers,<br>  ▪ Pool pumps,<br>  ▪ Advanced power strips,<br>  ▪ Space heaters (gas and electric),<br>  ▪ Audio/video (including speakers, audio systems, docking stations, blue-ray/DVD players, game consoles),<br>  ○ Computing (including desktops/laptops modems, routers, printers, servers and multi-function devices). | |
| **Potential EM&V Methods:** See next section for detailed project description. This project will utilize | |

| **Study Title:** (Residential-4) Residential Solution Workbook Project, Part-I and Part-II | **Budget:** $200,000 |
|---|---|
| existing and available study results. For part-II, the project may contact selected manufacturers to fill data gaps. | |

| **Study Title:** (Residential-5) Market Characterization & Data Collection for Work-paper Update | **Budget:** $365,000 |
|---|---|
| **Expected Completion Date:** 2014 | **Study Manager:** IOUs |
| **Description:** Develop updated market characterization and usage profile information to update existing work-papers | |
| **Objective:** to improve the accuracy and relevance of residential measures and energy savings claims | |
| **Key Research Questions:**<br>• What market data is needed to update existing work-papers to ensure their relevance?<br>• Has the customer usage profile changed?<br>• Has the baseline efficiency level of the appliance changed?<br>• Has the market dynamics changed - thus affecting the level of free-riders?<br><br>Note:<br>This project has the following statewide sub-projects:<br>1. (SCE lead, $32,000) CMHP HVAC-QM data analysis by ASW Engineering, project transferred to HVAC PCG.<br>2. (SCE lead, $150,000) MF pool pump study, this project will go through a RFP process for consultant selection by Q1/2014.<br>3. (PG&E lead, $150,000) Work paper Update for High Priority Measures and Most Efficient Update by RIA.<br>a. This project will focus on the following measures: (1) clothes washers, (2) water heaters, (3) refrigerators for SF/MF for mid/up-stream rebate considerations), (4) microwave and stove-top/oven (SF/MF), (5) dishwashers (with IOUs defined specification), (6) advanced (Smart) power strips. | |
| **Potential EM&V Methods:** See next section for detailed project description | |

| **Study Title:** (Residential-6A) SCE/SCG/SDG&E MF Program Process Evaluation (Phase-1) | **Budget:** $262,108 |
|---|---|
| **Expected Completion Date:** Q4/2016 | **Study Manager:** IOUs |
| **Description:** Conduct a process evaluation to look at the effectiveness of new program design and implementation as well as new interaction with REN entities | |
| **Objective:** to improve program design, implementation and marketing activities/outputs and outcomes | |
| **Key Research Questions:** (target: property owners/managers)<br>• What is the program design change?<br>• Has this change altered the program theory?<br>• Is the program evaluable? Are the program data tracking system sufficient to support both process and impact evaluation? | |

| **Study Title:** (Residential-6A) SCE/SCG/SDG&E MF Program Process Evaluation (Phase-1) | **Budget:** $262,108 |
|---|---|
| • Can these key program processes improve program outputs and outcomes, including energy savings (kW/kWh & Therm)?<br>• Is the program's interaction with new REN partners productive?<br><br>The results of this study should be the input to Residential-6B study.<br><br>Please refer to Residential Pilots/Trials Study (Residential-1A). PG&E and SCE/SCG EUC-MF Pilot Process Evaluations are discussed in that study effort. | |
| **Potential EM&V Methods:** See next section for detailed project description | |

| **Study Title:** (Residential-6B) Focused Impact Evaluation to investigate MF-EUC/MIDI and MFEER Program Changes | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** 2015 | **Study Manager:** ED |
| **Description:** Calculate savings for high uncertainty measures (water saving devices) identified for the Energy Savings Performance Incentive mechanism (ESPI) delivered through the MFEER program; assess appropriate measure baselines (early replacement vs. replace on burnout); evaluate program free ridership | |
| **Objective:** to improve program design, implementation and marketing activities/outputs and outcomes | |
| **Key Research Questions:** (target: property owners/managers)<br>Calculate energy savings from ESPI measures; multi-family water savers, specifically for MFEER program. Additionally,<br>• Are the IOUs and RENs collecting and documenting sufficient data to assess program impacts for the EUC-MF programs?<br>• Are the EnergyPro modeled savings estimates reasonable? (EUC-MF)<br>• Are the estimates for the ESPI water saving kits measures reasonable?<br>• What should the baseline be for the EUC-MF and MFEER programs? Are the measures being replaced prior to the end of their useful life (early replacement), or replaced upon burnout (or failure)?<br>• What is the level of free-ridership for EUC-MF and MFEER measures? | |
| **Potential EM&V Methods:** See next section for detailed project description | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Residential-16A)<br>2013-2014 Residential VSD Pool Pumps Update for ESPI (SDG&E only) | **Budget:** $160,000 |
|---|---|
| **Expected Completion Date:** Q4 2015 | **Study Manager:** CPUC, ED |
| **Description**: Field study with surveys for SDG&E's variable speed drive pool pump rebate program to provide updates to support the Efficiency Savings Performance Incentives process. | |
| **Objective:** To determine parameter inputs in order to validate gross and net savings inputs. | |
| **Key Research Questions:** | |

| **Study Title:** (Residential-16A)<br>2013-2014 Residential VSD Pool Pumps Update for ESPI (SDG&E only) | **Budget:** $160,000 |
|---|---|
| • Are the parameters used to calculate program impacts from work papers to program tracking database consistent for 2013 estimates?<br>• Has the decrease cost differential between standard 2-speed pumps versus variable speed pumps is now around $200 versus $1200-$1600 back in 2011, moved the baseline?<br>• What are the operating parameters (i.e., run time, hours of operation) and average unit size/load that impact gross savings?<br>• Has the market changed and what is the potential impact on realization rates, net kWh, kW and Therm savings? | |
| Potential EM&V Methods:<br>• Surveys via phone to:<br>  o Verify that the pool pump was installed.<br>  o Determine awareness of program<br>  o Determine what/who influenced decision to purchase VSD pump.<br>  o Determine likelihood of installing the pump without the program.<br>• Interview pool contractors to determine installation of VSD pool pumps versus 2 speed since 20ll<br>• Site-visits to homes with pools to:<br>  o Verify installation and install meters and collect nameplate data<br>  o Gather information on hours of operation<br>• Review Work paper methodology and assumptions, modify as necessary to calculate gross savings.<br>• Net savings will include realization rates and adjustment for free riders.<br><br>Other Considerations: | |

| **Study Title:** (Residential-8A) Focused Process Evaluation to investigate WH/EUC Program Changes | **Budget:** $250,000 |
|---|---|
| **Expected Completion Date:** 2014 | **Study Manager:** IOUs |
| **Description:** Conduct a process evaluation to look at the effectiveness of new program design and implementation as well as new interaction with REN entities | |
| **Objective:** to improve program design, implementation and marketing activities/outputs and outcomes | |
| **Key Research Questions:** (target: homeowners)<br>• What is the program design change?<br>• Has this change altered the program theory?<br>• Is the program evaluable? Are the program data tracking system sufficient to support both process and impact evaluation?<br>• Can these key program processes improve program outputs and outcomes, including energy savings (kW/kWh & Therm)?<br>• Is the "Fast Track" process for HVAC emergency replacement well designed in the perspective of contractors, and customers? | |

| **Study Title:** (Residential-8A) Focused Process Evaluation to investigate WH/EUC Program Changes | **Budget:** $250,000 |
|---|---|
| • Is the program's interaction with the REN entities productive?<br><br>The result of this study should be the input to Residential-8B study. | |
| **Potential EM&V Methods:** See next section for detailed project description | |

| **Study Title:** (Residential-8B) Focused Impact Evaluation to investigate EUC-SF Basic/Flex or Home Upgrade Program Changes | **Budget:** $300,000 |
|---|---|
| **Expected Completion Date:** 2015-16 | **Study Manager:** ED |
| Description: Conduct an impact evaluation to verify program energy savings claims from EUC-SF | |
| **Objective:** to improve program design, implementation and marketing activities/outputs and outcomes | |
| **Key Research Questions:** (target: Homeowners)<br>This study should build-upon results from the process evaluation study (i.e., Residential-8A)<br>• Can the program energy savings be verified?<br>• What are the energy savings realization rates (adjusted gross) in terms of kW, kWh, Therms?<br>• What is the uncertainty around "billing analysis" estimates, what are the savings drivers, and can this uncertainty be reduced?<br>• Are there other market dynamics that we should account for in this impact evaluation?<br>• How can data from 2010-2012 EUC-SF studies be combined with 8A and 8B and what advanced analytics can be used to inform the program?<br>• How can the program process be improved to improve energy savings outcome? | |
| **Potential EM&V Methods:** See next section for detailed project description | |

| **Study Title:** (Residential-9)<br>2015 Residential Portfolio Evaluation Whitepaper | **Budget:** $70,000 |
|---|---|
| **Expected Completion Date:** 9/30/2015 | **Study Manager:** IOUs, SDG&E |
| **Description**: The goal of this whitepaper project is to explore a methodology for developing a "savings impact load shape" for the entire EE and IDSM residential portfolio. | |
| **Objective:** Develop a more accurate, less expensive, timely savings impact results from the residential sector programs. | |
| **Key Research Questions:** (1) Is there a way to utilize "Smart Meters" to determine a net aggregate residential impact load shape? (2) Can it be accomplished in a more expedient, accurate, cost-effective manner? (3) Can the number of residential programs be significantly reduced? (4) Is there a cut-off point (consumption? X times poverty level) where this methodology doesn't make sense? | |
| Potential EM&V Methods:<br>• Use Behavior Program's ex-post billing/AMI analysis as the foundation to target market customers in the residential portfolio, | |

| **Study Title:** (Residential-9)<br>2015 Residential Portfolio Evaluation Whitepaper | **Budget:** $70,000 |
|---|---|

- Include a Randomize Control Trial (RCT) design using treatment and control groups for comparison. It may be difficult to set aside control group & then not directly offer this group services.
- Utilize vendor end use algorithms to target experimental customers with appropriate messaging (ARP, HVAC, lighting, refrigerator, etc.). The net effects of the measures and behavioral changes will be included in the overall portfolio billing analysis.

- The goal is to yield net savings estimates out of this analysis by discerning the difference in energy use between customers assigned to treatment versus control groups. With smart meters, this can be done hourly so get accurate delta load shape for electric, monthly savings for gas.

There are several advantages to this method: (1) Result = NET savings, at residential portfolio level, (2) it can eliminate the need for exact measure counts & savings parameters for both base case and high efficient cases; (3) it can eliminate NTG evaluation and endless debates. This approach is faster and inexpensive relative to the current methods. (4) It can eliminate need for multiple "program designs" and administrative requirements (or at least fewer of them), (5) If not implemented as evaluation methodology, at least this method can provide value to calibrate total net residential savings, (6) it can generate a reliable delta load shape for resource planning

There are disadvantages to this approach: (1) Program intervention attribution is at a residential portfolio level. This study approach will not provide guidance on where to best allocate budgets or sub-program cost effectiveness, (2) There will be a loss of direct EUL and IMC for TRC calculation (some weighted averages may be needed).

Other Considerations:

We don't have all the answers for this approach, but would like to use this whitepaper to explore options to see if this can work. For example: (1) What are the appropriate metrics to collect? (2) How do we get a "true" control group? (3) Does program influence on the control group needed to be counted? (4) What about the treatment of DR savings?

| **Study Title:** (Residential-10)<br>2015 Parameter Research to Support Home Energy Reports Program, Early M&V Research to Support Online Audits Program | **Budget:** $195,000 |
|---|---|
| **Expected Completion Date:** 6/30/2015 | **Study Manager:** IOUs, PG&E |

**Description:**

Behavior-based programs have become a central element of the IOU's residential energy efficiency portfolios. Removing incremental savings already counted in the Upstream Lighting Program is a central concern for the Home Energy Report Programs. In 2012, PG&E conducted a home inventory study to assess the extent to which program participants installed more light bulbs than the control group. There is a need to update a portion of this study to estimate the proportion of efficient lamps sold at retail in the state of California.

Residential online audit programs are an increasingly important part of the IOU's residential energy efficiency portfolios. In mid-2014 DNV GL published a white paper, funded by the CPUC entitled *Evaluation of Opt-In Behavior Programs* that recommends certain methodologies for estimating the savings resulting from these types of opt-in program designs, namely variance-in-adoption (VIA)

| **Study Title:** (Residential-10)<br>2015 Parameter Research to Support Home Energy Reports Program, Early M&V Research to Support Online Audits Program | **Budget:** $195,000 |
|---|---|
| model method and matched comparison group, depending on the specific characteristics of the programs. There is a need to the IOUs to employ these advocated methodologies to derive savings estimates for residential online audit programs. | |
| **Objective:**<br>The primary objective of the residential behavioral programs research is to provide improved parameter estimates for Home Energy Reports attribution analyses and to conduct early M&V for residential online audit programs. | |
| **Key Research Questions:**<br>• Do behavior program participant households install ULP participant light bulbs at the same levels as control households?<br>• How do the savings estimates resulting from VIA and matched comparison group methodologies compare to those resulting from the more traditional regression based analyses? | |
| EM&V Methods:<br>Triangulation approach of multiple sources of primary and secondary data for estimating total California lamp sales. Estimated cost: $65,000.<br><br>Early M&V of residential online audit program. Estimated cost: $130,000 | |

| **Study Title:** (Residential-11A)<br>Market Characterization of Online Peer-to-Peer Market for Used Refrigerators & Freezers | **Budget:** $45,000. (Project cancelled) |
|---|---|
| **Expected Completion Date:** 7/1/15 | **Study Manager:** IOUs, PG&E |
| **Description:** Response to Recommendation in "Appliance Recycling Program Impact Evaluation" Report Work Order 35, October 24, 2014: 6.2.5. The magnitude of the peer-to-peer market channel dwarfs other market forces in the second-hand market. Unfortunately, this market segment is very difficult to study. The original research plan for this evaluation did not include a peer-to-peer component, however as the magnitude of the sector became apparent, attempts were made to include and explore it. Analysis funds were not sufficient to fully study the data collected, and additional data could be easily gathered using the methodology develop in the course of this evaluation. | |
| **Objective:**<br>The objective of this study is to: 1.) define the size of market of used refrigerators and freezers that transfer ownership via the major online sales systems. 2.) Assess the nature of these online marketplace systems to determine what opportunities might exist for intervention or participation in these marketplaces by IOUs incentive programs. 3.) Define what those online peer-to-peer intervention programs would be like – what they would have to offer – how they would have to be structured – what challenges would they encounter and how could those barriers be overcome? 4.) Issue recommendations for next steps in terms of how might such new intervention programs be implemented, what would be the next steps? | |
| **Key Research Questions:** (list not exhaustive)<br>• What is the number of used refrigerators that are sold by on-line exchanges each year within the | |

| **Study Title:** (Residential-11A)<br>Market Characterization of Online Peer-to-Peer Market for Used Refrigerators & Freezers | **Budget:** $45,000. (Project cancelled) |
|---|---|
| IOU territories? What is the size of used refrigerators/freezers overall and by channel?<br>• What percentage of the total sales of used refrigerators does this represent?<br>• How many Online Peer-to-Peer market offering are there?<br>• How do they rank and compare to one another in terms of estimated sales and unit transfers achieved per year?<br>• What is the geographic focus of these online peer-to-peer services located across the IOU territories in California?<br>• Where does the growth of online peer-to-peer sales/transfers of used refrigerators and freezers come from – in terms of what the prior channel was for these transfers?<br>• What is the source of the used refrigerators that the online peer-to-peer sells and transfers? | |
| **Potential EM&V Methods:**<br>Secondary research, interviews and survey (i.e., market actors, market participants/purchasers), survey | |

| **Study Title:** (Residential-11B)<br>Market Characterization of Used Refrigerator Sales: Retail & Auction Houses | **Budget:** $45,000. (Project cancelled) |
|---|---|
| **Expected Completion Date:** 7/1/15 | **Study Manager:** IOUs, PG&E |
| **Description**: Response to Recommendation in "Appliance Recycling Program Impact Evaluation" Report Work Order 35, October 24, 2014: 6.2.4. Role of Auction Houses in the Secondary Market: Study the role of auction houses and liquidators more closely and determine whether there is an opportunity for the program to plan a role in removing these units from resale on the retail market. This evaluation found that nearly 40% of the units sold back onto the grid passed through auction houses. By targeting this market actor, groups of units could be efficiently removed from the grid. | |
| **Objective:** Confirm the magnitude of the "Auction House & Liquidator" sector in the sales of used refrigerators. In defining this sector, the Impact Study brought a new major market actor to the attention of the IOU program managers. This market characterization effort will create an overview of Auction Houses & Liquidators as a channel for the sale of used refrigerators and present information of statistics, trends and insights. The objective of this study is to provide the data and perspectives necessary to enable the program managers to assess if any intervention with this market actor would be viable as an additional program design. | |
| **Key Research Questions:** (list not exhaustive)<br>• What is the number of used refrigerators that are sold by Auction Houses and Liquidators each year within the IOU territories?<br>• What percentage of the total sales of used refrigerators does this represent and sales trend?<br>• How many Auction Houses are there? How many Liquidators are there?<br>• Where are these Auction Houses and Liquidators located across the IOU territories in California?<br>• What is the source of the used refrigerators that the Auction Houses and Liquidators sell? Who do they buy them from? Do they get any of them for free?<br>• What percentage of these used refrigerators actually diverted from programs whose intent was to recycle these appliances, and remove them from functioning as energy usage on the grid?<br>• Who are the customers of the Auction Houses and Liquidators, who actually purchase these used | |

| **Study Title:** (Residential-11B)<br>Market Characterization of Used Refrigerator Sales: Retail & Auction Houses | **Budget:** $45,000. (Project cancelled) |
|---|---|
| appliances?<br>• Where would these customers purchase the refrigerators they need to acquire, if they were not available for purchase from the Auction Houses and Liquidators?<br>• What is the range in prices paid by the Auction Houses and Liquidators when they acquire these used units? What is the range in prices paid for these units?<br>• Are they only bought in bulk?<br>• Can the research consultant discern any opportunities for the IOUs to enter into an intervention in these business models? If yes, what is the program theory and logic model? | |
| **Potential EM&V Methods:**<br>Secondary research, interviews and survey (i.e., market actors, participants/purchasers) | |

| **Study Title:** (Residential-12)<br>2015 EUC-HU Process Evaluation Phase-2 | **Budget:** $150,000. |
|---|---|
| **Expected Completion Date:** 7/1/16 | **Study Manager:** IOUs, PG&E |
| **Description**: Second Phase of Process Evaluation of EUC Home Upgrade – which will continue and expand upon work done in the First Phase which will be in-the-field from February thru April of 2015. This Second Phase EUC HU evaluation effort will offer a revisit of the key components of the process evaluation as completed in the first part of 2015, as necessary. This Phase 2 effort will also explore other new important components of the program design, program execution and also explore new potential program components for future program development and expansion. | |
| **Objective:** Continue to explore the following--<br>• Process Mapping<br>• Participant Trend Analysis<br>• Marketing Effectiveness<br>• QI/QM best practices<br>• Developmental Evaluation<br>• Expanded Usability Testing<br>• Additional Incentives | |
| **Key Research Questions:** Study will define all key aspects of the EUC HU program effort. Questions will be defined via which of the above study components will be selected by the IOUs for implementation. | |
| **Potential EM&V Methods:**<br>• Interviews with key market actors<br>• Survey interviews with key program partners – local governments, regulatory staff, contractors who service the home retrofit and renovation marketplace.<br>• Survey interviews with participants of the program.<br>• Survey interviews with interested program participants, who have not yet completed the work.<br>• Survey interviews with non-participants of the program, who completed the same type of work on their homes, but not thru the program.<br>• Focus groups with all of the above target audiences and customers.<br>• Literature review that defines and evaluates how other entities outside of the California State IOUs complete their home upgrade programs. | |

| **Study Title:** (Residential-13) Cold Water Default Clothes Washer Rapid Feedback Process Evaluation | **Budget:** $70,000 |
|---|---|
| **Expected Completion Date:** Q2 2016 | **Study Manager:** IOUs, SoCalGas |

**Description:**
SoCal Gas (SCG) is launching a new measure in the PLA program in April 2015, in which rebates will be provided to customers who purchase a cold water default clothes washer. The EM&V team can conduct a rapid feedback analysis in parallel with program implementation to provide program feedback. This information is used to fine-tune and streamline program design. Although this is a SCG pilot initially, this rapid feedback information will benefit all IOUs offering gas services.

**Objective:**
Provide rapid feedback to program implementers with specific focus on improving the critical early stages of deployment, program recruitment and delivery.

**Key Research Questions:**
- Are there any pilot implementation and program design concerns?
- Is the pilot program theory and logic acceptable to the participants and non-participants? Is this intervention effective?
- How does the launch of the new measure compare with current industry best practices?
- Is the rebate offered appropriate to achieve the program's goal?
- Are the customers satisfied with the product?
- What are the recommendations and corrective action, before scaling this pilot statewide?

**Potential EM&V Methods:** Interviews, surveys, data collection and analysis.
Potential problems that may occur with this study are:
- There may be a very small customer sample size to survey. The results of this rapid feedback may be more qualitative than quantitative.
- We may need feedback from customers who did not buy the product but were considering it. To gain this feedback it would take more time and funding to locate these customers.

| **Study Title:** (Residential-14) 2015 SCE/SCG/SDG&E Multifamily Program Process Evaluation Phase-II | **Budget:** $254,100 |
|---|---|
| **Expected Completion Date:** Q4/2016 | **Study Manager:** IOUs, SCE |

**Description:**
This study will investigate the strategic program concerns and characterize the market for the 2014-2015 portfolio of statewide multifamily programs in order to guide program design for 2016 and beyond. Programs covered include EUC-MF, MFEER, MIDI.

This is an approved scope of work from 2013-2014, but under-funded. The agreement is to seek phase-II funding of $250,000 in 2015 to support a total project budget of $500,000.

**Objective:**
The goal of this study is to assess the MF Program design and implementation strategies and characterize the diverse multi-family market segment. Objectives include: assess the single point of contact approach, evaluate marketing and outreach methods, determine the role of property rating and recognition schemes, examine potential multi-family market segmentation schemes, and scope

| **Study Title:** (Residential-14) 2015 SCE/SCG/SDG&E Multifamily Program Process Evaluation Phase-II | **Budget:** $254,100 |
|---|---|
| additional issues identified in the approved statement of work. | |
| **Key Research Questions:**<br>Phase-II<br>• Prioritize measures appropriate for early replacement in MF sector by major segments.<br>• Review Title 20/24 implementation requirements and identify implications.<br>• Map contractor qualifications and property owners/managers' wants/needs by property and tenant segments.<br>• What is the role and effectiveness of the Energy Star Portfolio Manager? What is the best way to enroll properties?<br>• Potential Addition: Scope out study requirements for (1) laundry room leasing operations, (2) fuel switching concerns, (3) MF BOC training. Once scoping work is done, these may become study requirements for 2016. | |
| **Potential EM&V Methods:**<br>• Multi-family program review (inside and outside of California) and literature review,<br>• Contractor phone surveys and in-depth interviews,<br>• Property owner/manager phone survey,<br>• Focus groups with property owners and managers,<br>• Conjoint analysis and engineering analyses,<br>• GIS analysis. | |

| **Study Title:** Multifamily 2014-2015 Program Process Evaluation | **Budget:** $210,000 (2013-2014 and 2015 M&E Budget) |
|---|---|
| **Expected Completion Date:** 2017 Q3 | **Study Manager:** PG&E |
| **Description:** This process evaluation project will study program design and performance, customer perspectives, and program coordination. | |
| **Objective:** To gain insight into drivers and barriers to program participation, to assess program design and implementation strategies, and to understand how the program could be improved. | |
| **Key Research Questions:**<br><br>***Program Design and Performance***<br><br>• What opportunities are there to increase program participation?<br>• What opportunities are there to increase the total savings and types of measures installed among participating buildings?<br>• How do the measures offered by the Multifamily Energy Efficiency Rebate (MFEER) program compare to the technical energy savings potential in multifamily buildings and to perceived needs by building owners and operators?<br>• What opportunities are there to increase the program's influence on energy efficient measure installations (e.g., reduce free ridership)?<br><br>***Customer Perspectives*** | |

| **Study Title:** Multifamily 2014-2015 Program Process Evaluation | **Budget:** $210,000 (2013-2014 and 2015 M&E Budget) |
|---|---|

- How satisfied are program participants with their program experiences?
- What are building owners' and operators' levels of awareness and perceptions of PG&E's multifamily programs?
- What effects do program measures and participation have on tenants? (Possible impacts include comfort, feelings of safety, aesthetics, changes in utility bills, and changes in rent.)

***Program Coordination***

- Does the current program model effectively cross-promote complementary offerings by PG&E and BayREN?
- Are there opportunities to communicate with customers and present available programs more comprehensively and holistically?
- What implications do lessons learned in the process evaluation for southern California's utilities have for PG&E?

**Potential EM&V Methods:** This project will utilize existing and available study results. EM&V methods to include background data gathering, interviews (with utility program staff, program implementer staff, implementation contractors, participating and non-participating building decision-makers, tenants of buildings served),and an investigation of opportunities to use analytics to target promising buildings.

| **Study Title:** (Residential-15)<br>SCG & Municipality Joint Offerings: Lessons Learned & Opportunity Study | **Budget:** $50,000<br>(Initially funded by SoCalGas Only, outside of the 2015 SW M&E allocation) |
|---|---|
| **Expected Completion Date:** Q2 2016 | **Study Manager:** SoCal Gas |

**Description:** SoCal Gas's territory overlaps with many municipal electric providers and there are advantages in offering joint gas, electric and water efficiency programs to customers. SoCal Gas would like to create a comprehensive list of municipal energy efficiency programs to gain an understanding of the various program offerings and attributes. This information will be the first step in providing insight on the various types of programs that exist, what programs are most successful and how can SoCal Gas work effectively with these municipalities.

SoCalGas welcomes the other IOUs to participate in this study.

**Objective:** Provide a source document with electric, gas and water program summaries for municipalities that provide electric service and overlap SoCal Gas territory

**Key Research Questions:**

- Identify key stakeholder contacts at muni/water partner candidates.
- What gas, electric and/or water energy efficiency programs (as well as low-income) do municipalities that overlap SoCal Gas's territory offer?
- What is the status/length of the municipality program (i.e. pilot, limited, etc.)?
- Who pays for the costs for these programs?
- What is the incentive structure for the programs (i.e. incentive amount, services, caps, etc.)?
- What is the process for marketing and implementing these programs?
- What is the participation rate in these programs?

| **Study Title:** (Residential-15)<br>SCG & Municipality Joint Offerings: Lessons Learned & Opportunity Study | **Budget:** $50,000<br>(Initially funded by SoCalGas Only, outside of the 2015 SW M&E allocation) |
|---|---|
| • Gauge the Municipalities' interest for joint-program partnership with SoCalGas (SCG being a third-party implementer) where we can share energy savings on the same measure (e.g. attic insulation (for heating and cooling)).<br>• Establish approximate budgets for potential muni/water partners<br>• Create loading order for potential partners (largest to smallest budget)<br>• Establish which existing SoCalGas programs are most desirable to potential partners (i.e. ESAP, Foodservice, etc.) | |
| **Potential EM&V Methods:** Literature review and municipality program manager interviews. | |

## 2.1.6. Key Research Questions for 2016 and Beyond

As indicated above, per Rule Making 13-11-005, the California program administrators are embracing a statewide business planning process, in addition to preparation of Program Implementation Plans (PIPs), to support the rolling Energy Efficiency portfolio. The anticipated filing date for the statewide residential business plans is January 2017. At this time, neither the Residential Business Plan and/or the associated Residential PIPs are finalized. As a result of these upcoming changes, this 2017 M&E Roadmap Update is considered to be interim. After the filing of the Business Plans and PIPs are completed, this Residential Roadmap will go through a significant update, scheduled for early 2017.

This 2017 interim residential roadmap update is working with the following program information and assumptions:

- The upcoming clarification and re-definition of lead statewide program administrator for certain residential programs will likely to change program implementation process for selected programs.
- The implementation of residential AB802 and High Opportunity Projects and Programs (HOPPs) are introducing new program designs and processes that would require evaluation and assessment.
- The implementation of residential AB793 Energy Management Technology Pilots by the IOUs are also introducing new and emerging technologies and applications that would warrant evaluation.
- The California REN programs will continue and subject to further assessment.
- The residential program portfolio should expect to see increasing significance of Third Party Programs for the next few years.
- Otherwise, the residential portfolio of programs will continue to pursue cost-effective program design using both deemed and calculated approaches to promote EE/DSM new construction and retrofit applications to support single-family, multi-family and behavior interventions.

After posting the Residential M&E Roadmap in October, this study team received the following stakeholder feedback:

- One stakeholder asked about the source of the data for the two pie charts (Figure-5. Profile of Electricity and Nature Gas Usage). The concern is about the validity of this information,
- The second question is about the availability of AMI data to provide miscellaneous plug load data,
- The third comment is about using tool such as Universal Audit Tool to monitor major appliances and miscellaneous plug load information,
- The IOUs should reconsider the gas boiler study since it may be under-budgeted given the planned scope,
- The ED/IOUs should initiate a study to look at Effective Useful Life (EUL) of residential measures.

We appreciated the above inputs and we have provided detailed replies on the public site. The above comments concerning residential usage profile, AMI data, disaggregate energy usage data, and the on-line tool prompted a discussion about the best way to obtain timely and accurate detailed residential usage information. A team member suggested to initiate a new round of disaggregated software assessment to follow-up on the recently completed PG&E test bed study, which demonstrated more work is required to improve accuracy of disaggregation software. We also agreed to verify the availability of the next RASS update. Another member suggested expanding the planned on-line tool (i.e., Universal Audit Tool) assessment study to include an assessment of accuracy of disaggregation results. SCG agreed to re-scope its gas boiler market characterization study into a multi-year and multi-phased study as a result of the recent feedback. Finally, the residential study team agreed to keep these concerns on the forefront of the residential M&E study planning efforts.

Below is a summary table illustration IOUs Statewide Residential Program Portfolio. The Plug Load and Appliance and Energy Upgrade California Programs continue to be a significant portion of overall program budget.

For AB802 HOPP and AB793 pilot implementations, we expect that 2017 will be a year of intense program implementation. These activities will be subject to evaluation and assessment in 2017 and 2018. The planned evaluation studies below are focused on 2016 and 2017 program activities. The table below lists planned IOU-led activities that will use 2017 M&E funds:

## A Summary of 2016-2017 EM&V Studies, Budgets, and Timing

**Proposed Energy Division Budget: 2016=$2,542,940 and 2017=$2,934,162**

The Residential research area will continue to cover the areas of deemed savings and other approaches for promoting high efficiency appliances as well as whole house and multifamily and behavioral interventions. The completion of current studies may reveal some new areas of interest. Evaluation adaptations emerging from the implementation of AB802 related to baseline changes and meter-based program designs may also need to be addressed in this evaluation plan for the future. Regardless, the impact and uncertain parameter updates are required. Specific studies, budgets and timing will be presented in the update to the EM&V plan in 2017.

Proposed Energy Division-led activities with 2016-2017 funds are described in the following tables.

***Table 5. 2016-2017 Energy Division EM&V Studies, Budgets, and Timing***

| 2016-2017 Study Title | Study Manager | Proposed Budget[2] |
|---|---|---|
| Home Energy Reports<br>PG&E<br>SCE<br>SDG&E<br>Marin Clean Energy | ED | $345,000 IOUs<br>$75,000 MCE |
| HER Upstream Adjustment Study | ED | $90,000 |
| EUC – MF/MFEER (includes water savers/kits for ESPI) | ED | $300,000 |
| SF – Home Upgrade<br>IOUs<br>RENs | ED | $350,000 IOUs $200,000 RENs |
| SW SF Water Saver Kits<br>**(Cancelled)** | ED | ($120,000) |
| MF Electric Space and Water Heat Technology Economic Assessment | ED | $100,000 |
| Appliance Recycling **(Cancelled)** | ED | ($200,000) |
| Online Audit Tools<br>SCE Evaluability Assessment | ED | $45,000 |
| SW Impact Evaluation | | $375,000 |
| Tech Support: 2016 Pilots<br>SCE East West Pilot | ED | $20,000 |
| SCE MF 10-10-10 Pilot | | $40,000 |
| SCG CWDCW Pilot | | $20,000 |
| SW Res Plug Load Pilot | | $40,000 |
| Bill Payment Program (Auto-Pay) Study | ED | $200,000 |
| SCE Home Energy Audits (HEA) Impact Evaluation | ED | $135,000 |
| Project and Data management and other Uncertainty Assessments as Needed | ED | $527,940 |
| **Total Budgeted** | | $2,542,940 |

## 2016 and Beyond Study Descriptions – Energy Division

Below, are brief descriptions for residential retrofit studies considered for the upcoming years. Energy Division-led evaluations for the residential sector will focus on work related to uncertain measures

[2] All budgets are subject to change pending additional review of program scope and thorough review of evaluation requirements.

identified by the Ex-Ante team. The ED-led work may also include evaluation efforts to address the following projects:

- IOU HOPPS programs (i.e. PG&E residential Pay-for-Performance and SCE Direct Install),
- Leveraging behavior program interventions – an examination of Home Energy Report recommendations and recipient/non-recipient action, as we know that only certain report recipients take action in response to report receipt. A greater understanding of what actions these participants take as a result of report recommendations, as well as, how recipients who do not take action interpret and react to report recommendations, are the focus of this proposed study. There may consequently be opportunities to improve report recommendations and generate greater participation and/or savings.
- Continued ED support for IOU pilots:
    - AB 793 pilots/programs,
    - PG&E's ongoing Residential Retail Products Platform Phase II pilot,
    - SCE's Multi-Family 10-10-10 and Energy Pledge pilots,
    - Any new proposed pilots.

As indicated previously, this portion of the residential M&E roadmap will be substantially updated with specific studies for 2017 immediately after the statewide business plans and PIPs are filed and accepted.

## Other Important Considerations

The residential study team is currently coordinating study activities with the following teams:

- EE Lighting study team,
- EE HVAC study team,
- EE WE&T study team,
- IDSM study team,
- And other important study and program areas such as Marketing Education and Outreach (MEO), Financing, and Low-income/ESAP programs.

These coordination activities are helpful to streamline study content to avoid duplication. However, these coordination activities are not meaningful substitutes for an overarching critical synthesis of research findings and recommendations.

This evaluation space also needs to continue to explore the improved use of automated data as a tool to improve program – embedded evaluation activities and quicker feedback on performance.

## 2016-2017 IOUs EM&V Studies

**Proposed Program Administrator Budgets: 2016=$ 900,000 and 2017=$1,200,000.**

IOU-led activities with 2016 and 2017 funds are described in the following tables.

***Table 6. 2016-2017 IOU EM&V Studies, Budgets, and Timing***

| 2016-2017 Study Area/Title | Study Manager (ED/IOU) | 2016-2017 Budget | Completion Date |
|---|---|---|---|

| 2016-2017 Study Area/Title | Study Manager (ED/IOU) | 2016-2017 Budget | Completion Date |
|---|---|---|---|
| **Process** | | | |
| Retail Product Portfolio (RPP) MT Evaluation and Market Characterization (Phase I) | PG&E | $200,000 | 2016 |
| Home Energy Report Study Fund for Ongoing Interval Data Research Support | PG&E | $200,000 | 2016 |
| Home Energy Advisor Work-paper Update & Process Evaluation Study | SCE | $175,000 | 2017 |
| Step Up – Power Down (PG&E only) | PG&E | $125,000 | 2016 |
| **Market Assessment** | | | |
| Market Assessment of gas boilers for MF and commercial | SCG | $200,000 | 2017 |
| **Total 2016** | | **$900,000** | |
| Process Evaluation of AB793 Programs | PG&E | $100,000 | Q1/2018 |
| Statewide Single Family Pool Pump Workpaper Update and Process Evaluation | SCE | $150,000 | Q1/2018 |
| Upstream Lighting Attribution Study | PG&E | $50,000 | 2017 |
| Statewide Residential Baselines for Business Plan Metrics | IOUs | $300,000 | 2017 |
| Statewide Retail Products Platform (RPP) National Market Share Characterization | PG&E | $100,000 | Q4/2017 |
| **Other Studies Under Consideration** | | | |
| • PG&E Step-Up-and-Power-Down Process Evaluation,<br>• PG&E Early M&V for PG&E Home Energy Reports,<br>• Statewide RPP Market Transformation Evaluation Framework,<br>• CALTRACK Energy Savings Tool Support for EUC-HU program,<br>• PG&E Single-Family and Multi-Family Population Characterization and Analysis. | IOUs | $500,000 | 2017 |

| 2016-2017 Study Area/Title | Study Manager (ED/IOU) | 2016-2017 Budget | Completion Date |
|---|---|---|---|
| • Statewide Exploration of HERs-Rating Post-Occupancy Outcomes | | | |
| **Total 2017** | IOUs | **$1,200,000** | |

## 2016 and Beyond IOU Study Descriptions

| **Study Title:** Retail Products Platform (RPP) Market Transformation (MT) Evaluation and Market Characterization | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** December, 2016 | **Study Manager:** IOU |
| **Description**: Piloted to address the problem of growth in residential electric consumption resulting from miscellaneous plug load plug load growth, Pacific Gas and Electric Company (PG&E) is conducting a phase two pilot of a retailer-focused (midstream) program design called the Retail Products Platform (RPP). The RPP Pilot uses a mid-stream design to influence retailers to demand, stock, and sell more energy efficient models of home appliances and consumer electronics in targeted product categories. Retailers are paid per-unit incentives for every program-qualified model that they sell during the program period. The RPP program uses a market transformation (MT) approach to bring about long-term, sustainable changes to the structure or functioning of a market to reduce barriers to the adoption of energy efficient measures. | |
| **Objective**: The purpose of this first of a two-phase study is to conduct the tasks related to the process evaluation section, and portions of the savings claim portion, of the evaluation plan entitled *Pacific Gas & Electric Company 2015 Retail Plug-Load Portfolio Program* that is available on the public documents area of the CPUC website (energydataweb.com) under the search term RPP. | |
| **Key Research Questions:** Are retailers executing the marketing plans required as a condition of participation in RPP? What are the product-specific market barriers to the adoption of energy efficient measures? Can the rebates paid to retailers be verified to be linked to the sale of qualified models? Is there a detectable change in the key metrics associated with program success (e.g., program-qualified share)? | |

| **Study Title**: Home Energy Report (HER) Study Fund for Ongoing Interval Data Research Support | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** December, 2016 | **Study Manager:** IOU |
| **Description**: Home Energy Reports (HER) represents a key portion of the savings of the statewide residential portfolio. Randomized control trials (RCTs) form the basis of the HER experiments being run by all of the IOUs, but in themselves do not distinguish the portion of savings that may have been claimed by the Upstream Lighting Program. | |
| **Objective**: This study would identify the time-of-day, and time-of-year, when the savings observed in | |

| **Study Title**: Home Energy Report (HER) Study Fund for Ongoing Interval Data Research Support | **Budget:** $200,000 |
|---|---|
| HER experiments occurs. It will also provide the opportunity to how the impact of HERs continues after cessation of report delivery (persistence). | |
| **Key Research Questions:**<br><br>How does savings by time-of-day and time-of-year change in households receiving the reports over a number of years? Do savings increase during times-of-day and times-of-year that are associated with increased lighting use? To what extent to energy savings persist in households that had received the reports for some time, after they stop receiving the reports? To what extent do savings observed within specific households endure after a particular customer moves away from the residence? | |

| **Study Title**: Home Energy Advisor Work-paper Update & Process Evaluation Study | **Budget:** $175,000 |
|---|---|
| **Expected Completion Date:** September 2017 | **Study Manager:** SCE |
| **Description**: Residential home energy advisor programs are an increasingly important part of the IOU's residential energy efficiency portfolios. In mid-2014 DNV GL published a white paper, funded by the CPUC entitled *Evaluation of Opt-In Behavior Programs* that recommends certain methodologies for estimating the savings resulting from these types of opt-in program designs, namely variance-in-adoption (VIA) model method and matched comparison group, depending on the specific characteristics of the programs. There is a need to the IOUs to employ these advocated methodologies to derive savings estimates for residential online audit programs.<br><br>In addition, changes in implementation of these online tools make a process evaluation necessary to understand how well the programs is achieving its goals of engaging customers and relaying actionable information about energy efficiency and conservation opportunities. | |
| **Objective**: The primary objective of the study is to conduct early EM&V for work paper updates and conduct a process evaluation of the HEA program. | |
| **Key Research Questions:**<br><br>What is the functionality of the energy analysis offered by the HEA tools?<br><br>How are customers using the HEA tool?<br><br>What could be done to enhance customer's usage of the HEA tool?<br><br>What data do the tools need to collect to enable evaluability?<br><br>What are appropriate metrics and values for WP updates? | |

| **Study Title**: Step Up Power Down – Commercial (PG&E Only) | **Budget:** $125,000 |
|---|---|

| **Study Title**: Step Up Power Down – Commercial (PG&E Only) | **Budget:** $125,000 |
|---|---|
| **Expected Completion Date:** December 31, 2017 | **Study Manager:** IOU |
| **Description**: Step Up Power Down – Commercial (SUPD-C) is a marketing campaign being conducted in partnership with the city governments of San Francisco and San Jose. SUPD-C is an 18-month, high intensity marketing and customer engagement campaign to promote PG&E's energy efficiency portfolio and employs strategies focused on new ways to engage people to change behaviors that affect and reduce energy use. PG&E launched this city-based energy savings challenge for large and small-and medium businesses (SMB) PG&E customers. | |
| **Objective**: This study would undertake of methodologies to estimate savings resulting from this initiative. Those methodologies include:<br>• Quasi-experimental approaches as recommended by exploratory research undertaken by E2E of the Haas School of Business at the University of California – Berkeley.<br>• Reviewing and augmenting the calibrated simulation models being developed by PG&E's SUPD-C implementation contractor CLEAResult (targeting the largest 20 participating buildings (IPMVP Option D).<br>• Reviewing and augmenting pre/post whole building energy use comparisons also tasked to CLEAResult (IPMVP Option C). | |
| **Key Research Questions:**<br>To what extent did SUPD-C achieve its objective of increasing adoption of PG&E's energy efficient measures within the targeted cities? To what extent did SUPD-C result in behavior change related to how people use energy? | |

| **Study Title**: MF Residential Boiler Market Characterization | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** December 31, 2017 | **Study Manager:** IOU |
| **Description**: For the 2016 EM&V research in the residential market, SoCalGas is proposing a statewide market assessment for boilers (water) for the residential MF market. This study is on the list of the ED's Short Term Market Studies Recommendation in the Market Studies Needs Assessment Report by ODC (see below). . | |
| **Objective**: This study would characterize the market for boilers and opportunities for energy efficiency intervention The study will collect current market data to run a cross tab on the 1) building/housing type, and 2) existing equipment condition (age, size, efficiency), and 3) energy usage. This information will help leverage the result from the To-Code study on boilers so that the IOUs can strategically develop both deemed and calculated programs for boilers. The study will also collect additional information to refute or agree with anecdotal information about owners/managers' decision process to repair (short-term or indefinitely) or to replace with to-code or above code boilers. | |
| **Key Research Questions:** | |

| **Study Title**: MF Residential Boiler Market Characterization | **Budget:** $200,000 |
|---|---|
| What is the market potential for boilers? What is the size of the indefinitely repair market? What are the barriers to replace existing boilers with high efficient models (local air quality restriction, production/service continuity, financing, capital, owner vs manager decision? | |

| **Study Title:** Process Evaluation of AB793 Programs | **Budget:** $100,000 (PG&E EM&V funds only) |
|---|---|
| **Expected Completion Date:** Q1/2018 | **Study Manager:** PG&E |
| **Description:**<br>By 1/1/2017, PG&E will be offering a smart thermostat rebate to promote the home energy management envisioned in AB 793. Because of the fast-moving nature of these "smart" and connected technologies, and the varied appeal of these technologies to different customer segments, research will be needed to fully understand program participation and customer experience, motivation, and satisfaction. A process evaluation of AB 793 offerings in their early stages should provide valuable insight to enable PAs to make program adjustments to maximize the effectiveness of these programs, both from a customer participation and experience perspective, and from a cost perspective.<br><br>This PG&E study effort may be expanded in early 2018 to include the other IOUs, since 2017 will be a year of AB793 program implementation to get results and impact. | |
| **Objective:**<br>Gain insight into drivers of, and barriers to, program participation, and into customer experience, motivation, and satisfaction with the program. Understand how the programs could be improved, and how future programs can be designed to maximize effectiveness. The study may also include process mapping, participant trend analysis, and assessment of marketing effectiveness. | |
| **Key Research Questions:**<br>Questions will be defined to complement the objectives that are prioritized in the scoping process. | |
| **Potential EM&V Methods:**<br>Combination of quantitative and qualitative methods; Customer surveys; Interviews with PA Program Staff; Interviews with key Program Delivery Partners. | |

| **Study Title:** Statewide Retail Products Platform (RPP) National Market Share Characterization | **Budget**: $100,000 (Statewide) |
|---|---|
| **Expected Completion Date:** December 2017 | **Study Manager:** PG&E |
| **Description:**<br>Piloted to address the problem of growth in residential electric consumption resulting from miscellaneous plug load plug load growth, the PG&E and IOUs are conducting a phase two pilot of a | |

| |
|---|
| retailer-focused (midstream) program design called the Retail Products Platform (RPP). The RPP Pilot uses a mid-stream design to influence retailers to demand, stock, and sell more energy efficient models of home appliances and consumer electronics in targeted product categories. Retailers are paid per-unit incentives for every program-qualified model that they sell during the program period. The RPP program uses a market transformation (MT) approach to bring about long-term, sustainable changes to the structure or functioning of a market to reduce barriers to the adoption of energy efficient measures.<br><br>There is additional study need to develop baseline metrics for this market transformation program. This project scope may be modified and/or expanded once the statewide business plans are submitted and approved. |
| **Objective:**<br>The purpose of this study is to develop, evaluate, and verify a method of estimating national market share of consumer goods in the RPP program. This study is needed to appropriately characterize the national market share of RPP products. |
| **Key Research Questions:**<br>Can a robust methodology be developed to reliably and accurately estimate national market share? |
| **Potential EM&V Methods:**<br>One potential method is to validate the use of internet page rank data for consumer goods-related pages as a basis to estimate national market share for RPP products. |

| | |
|---|---|
| **Study Title:** Statewide Single Family Pool Pump Workpaper Update and Process Evaluation | **Budget**: $150,000 (PG&E/SCE/SDG&E) |
| **Expected Completion Date:** Q1/2018 | Study Manager: SCE |
| **Description:**<br>This study will address decision frame influences by pool contractors ("stocking"), the effect of commissioning, and will update baseline data. | |
| **Objective:**<br>Update workpaper/s | |
| **Key Research Questions:**<br>What are the baseline technologies?<br>What savings are associated with commissioning of pool pumps, i.e., setting pool pumps to off-peak hours?<br>Are commissioning savings persistent?<br>What role do contractors play in setting decision frames for end-user uptake of variable speed pumps? | |
| **Potential EM&V Methods:**<br>Potential EM&V methods are contractor and end-user surveys, as well as on-site data collection to collect hours of use data, though NOT including metering. | |

| | |
|---|---|
| **Study Title:** Upstream Lighting Attribution Study | **Budget**: $50,000 (PG&E/SCE/SDG&E) |

| **Expected Completion Date:** Q1/2018 | **Study Manager:** PG&E |
|---|---|
| **Description:**<br>This research is proposed to provide the deductions to be taken from the 2016 Home Energy Reports (HER) savings claim to ensure that there are no savings claimed by Upstream Lighting Programs (ULPs) included in the HER savings claims. Cost estimate reflects $15K for a basic LightTracker report (a consumer purchase database from Apex Analytics) that estimates total efficient lamp sales by IOU for 2016 and $35K to produce a Lighting Savings Overlap Memo to inform the upstream deduction to be taken for 2016 HER savings claims (by TRC Solutions). An online study of HER treatment and control households by DNV GL will serve as the basis for the Lighting Savings Overlap Memo. | |
| **Objective:**<br>To quantify the energy savings resulting from HER programs that may have been claimed by the ULP programs so that any savings that are potentially double-counted can be removed from the HER savings calculated by the ex-post impact analysis. | |
| **Key Research Questions:**<br>As a result of upstream lighting program, what is the appropriate energy adjustment to the Home Energy Report program to eliminate the possibility of double counting savings? | |
| **Potential EM&V Methods:**<br>Lighting sales analysis, customer research on the purchase of replacement lamps, and possibly manufacturer interviews. | |

| **Study Title:** Statewide Residential Baselines for Business Plan Metrics | **Budget**: $300,000 (Statewide) |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** IOUs/TBD |
| **Description:**<br>Upon approval of the Business Plans in early 2017, it is anticipated that various metrics will be established. At this point it is unclear if baselines to support those metrics exist. This project may be further refined once the statewide business plans are submitted and approved. | |
| **Objective:**<br>To develop baselines for metrics in support of the approved Business Plans | |
| **Key Research Questions:**<br>• What are the approved metrics?<br>• What is the appropriate baseline to determine success for the metrics?<br>• Does the baseline exist?<br>• What is the level of granularity required to support the metrics/baselines? | |
| **Potential EM&V Methods:**<br>Depending on the metrics, the methodologies may vary. Literature review and secondary research | |

| **Study Title:** Statewide Residential Baselines for Business Plan Metrics | **Budget**: $300,000 (Statewide) |
|---|---|
| would be the preferred methods, but they may be insufficient for some baseline metric developments. In such cases, some primary research may be required. | |

| **Study Title**: MF Residential & Small Commercial Boiler Market Characterization | **Budget:** $275,000 ($200,000 approved in 2016 residential & $75,000 approved in 2017 commercial) |
|---|---|
| **Expected Completion Date:** December 31, 2017 | **Study Manager:** IOUs (SCG lead, SDG&E, PG&E) |

**Description**: SoCalGas is proposing a statewide (gas utilities) market assessment for boilers (water) for the residential MF market and small commercial market. This study is on the list of the ED's Short Term Market Studies Recommendation in the Market Studies Needs Assessment Report by ODC.

*Although the IOUs are adding this study brief for 2017, but the residential portion of the study plan is approved in 2016, thus not reflected in the summary project table for this 2017 update. The Small Commercial portion of the study plan will be funded in 2017 by the commercial study roadmap. SCG will continue to act as the overall study lead providing project coordination for both residential and non-residential portion of the study.*

**Objective**: This study would characterize the market for boilers and opportunities for energy efficiency intervention. The study will collect current market data to run a cross tab on the

1) building/housing type
2) existing equipment condition (age, size, efficiency)
3) energy usage

The study will also collect additional information to refute or agree with anecdotal information about owners/managers' decision process to repair (short-term or indefinitely) or to replace with to-code or above code boilers. This information will help leverage the result from the To-Code study on boilers so that the IOUs can strategically develop both deemed and calculated programs for boilers. This study information will also assist in the program design and marketing of HOPPs programs with a boiler component.

Given the stakeholders' comments in 2016, SoCalGas may take a multi-year and multi-phased research approach to address the list of key researchable questions below. The project phasing will be discussed in more detail in the statement of work.

**Key Research Questions:**

1. What is the current stock and vintage of boilers in multi-family and small commercial buildings?
2. What is the overall market potential for boilers in these buildings?
3. What is the size of the new purchase of a boiler versus the repair market?
4. What are the barriers to replace existing boilers with high efficient models?
5. Since MF property owners/managers are well known to utilize boilers beyond effective usage life, what does it take to motivate early replacement actions?

The above proposed studies will account for $700,000 out of the $1.200, 000 allocated statewide M&E budget for the Residential Sector. Below is a list of other 2017 study concepts under consideration. Additional details will be provided at the next major M&E roadmap update.

- PG&E Step-Up-and-Power-Down Process Evaluation,
- PG&E Early M&V for PG&E Home Energy Reports,
- Statewide RPP Market Transformation Evaluation Framework,
- CALTRACK Energy Savings Tool Support for EUC-HU program,
- PG&E Single-Family and Multi-Family Population Characterization and Analysis,
- PG&E Exploration of HERs-Rating Post-Occupancy Outcomes.

.

## 2.2. Commercial (Small/Medium, Institutional Partnerships)

### 2.2.1. Background

The Commercial Roadmap is focused on five general program types:

- Core Deemed
- Core Direct Install
- Third Party
- Energy Advisor (audits, benchmarking, continuous energy improvement, etc.)
- State and Institutional Partnerships

The tables below present all programs that correspond to these program types, along with the total 2013-15 ex ante kW, MWh and therm savings.

In 2004-2005, the CPUC approved the funding of local government and institutional partnerships across the four investor-owned utilities (PG&E, SCE, SCG and SDG&E). Prior to this, the IOUs had engaged in a few government partnerships individualized to meet the needs and interests of each jurisdiction.

Institutional Partnerships (IPs) are designed to create dynamic and symbiotic working relationships between Investor-Owned Utilities (IOU), state or local governments and agencies or educational institutions. The objective is to reduce energy usage through facility and equipment improvements, share best practices, and provide education and training to key personnel.

The Institutional Partnership Roadmap is focused on the process evaluations of the four statewide partnerships:

- California Community Colleges (CCC)
- University of California/California State University (UC/CSU)
- State of California Partnership
- California Dept. of Corrections and Rehabilitation (CDCR)

The impact evaluations of the Institutional Partnership programs were recently added to the oversight of the Commercial Roadmap. For program years 2013-15 there are no impact or process evaluations that are specifically targeted to these groups of programs, however, these programs will be included in the sample frame for some of the impact evaluations discussed below (specifically the studies being conducted to meet the needs of the Efficiency Savings and Performance Incentive (ESPI) decision[3]).

[3] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism.

**Table 1 Commercial Roadmap Savings by Program**

| PA | ProgramID | ProgramName | kW | MWh | Therms |
|---|---|---|---|---|---|
| PGE | PGE21002 | PLUG LOAD AND APPLIANCES | 22,877 | 118,166 | 1,287 |
| PGE | PGE210111 | LODGINGSAVERS | 9,549 | 32,801 | 140 |
| PGE | PGE210112 | SCHOOL ENERGY EFFICIENCY | 772 | 10,571 | 542 |
| PGE | PGE210113 | ENERGY FITNESS PROGRAM | 2,000 | 10,223 | (37) |
| PGE | PGE210114 | ENERGY SAVERS | 745 | 4,147 | (10) |
| PGE | PGE210115 | RIGHTLIGHTS | 2,339 | 16,797 | (44) |
| PGE | PGE210116 | SMALL BUSINESS COMMERCIAL COMPREHENSIVE | 323 | 2,703 | (6) |
| PGE | PGE210117 | ENERGY-EFFICIENT PARKING GARAGE | 65 | 617 | - |
| PGE | PGE210118 | FURNITURE STORE ENERGY EFFICIENCY | 3,801 | 18,537 | (108) |
| PGE | PGE210119 | LED ACCELERATOR | 3,936 | 17,931 | (7) |
| PGE | PGE21012 | COMMERCIAL DEEMED INCENTIVES | 22,862 | 128,231 | 6,211 |
| PGE | PGE210122 | CASINO GREEN | 822 | 8,471 | (13) |
| PGE | PGE210123 | HEALTHCARE ENERGY EFFICIENCY PROGRAM | 303 | 2,773 | 323 |
| PGE | PGE210126 | K-12 PRIVATE SCHOOLS AND COLLEGES AUDIT RETRO | 573 | 5,664 | (48) |
| PGE | PGE210128 | ENOVITY SMART | 250 | 3,774 | 444 |
| PGE | PGE210129 | NEXANT AERCX | 2 | 1,317 | 43 |
| PGE | PGE210131 | PECI AERCX | 29 | 1,313 | 48 |
| PGE | PGE210133 | STAPLES LOW PRESSURE IRRIGATION DI | 4,495 | 7,157 | - |
| PGE | PGE21014 | COMMERCIAL ENERGY ADVISOR | 16,319 | 27,728 | 3,676 |
| PGE | PGE210141 | LINCUS COMMERCIAL MID-MARKET PROGRAM | 5 | 190 | (1) |
| PGE | PGE21017 | BOILER ENERGY EFFICIENCY PROGRAM | 50 | 216 | 1,477 |
| PGE | PGE21018 | ENERGYSMART GROCER | 6,691 | 56,518 | 433 |
| PGE | PGE21022 | INDUSTRIAL DEEMED INCENTIVES | 1,736 | 8,738 | 874 |
| PGE | PGE21024 | INDUSTRIAL ENERGY ADVISOR | 1,223 | 2,075 | 271 |
| PGE | PGE21027 | HEAVY INDUSTRY ENERGY EFFICIENCY PROGRAM | 8,665 | 57,165 | 3,328 |
| PGE | PGE210310 | DAIRY INDUSTRY RESOURCE ADVANTAGE PGM | 2,003 | 9,546 | (4) |
| PGE | PGE21032 | AGRICULTURAL DEEMED INCENTIVES | 34,608 | 63,007 | 745 |
| PGE | PGE21034 | AGRICULTURAL ENERGY ADVISOR | 7,118 | 50,411 | 264 |
| PGE | PGE21035 | DAIRY ENERGY EFFICIENCY PROGRAM | 135 | 2,454 | - |
| PGE | PGE21036 | INDUSTRIAL REFRIGERATION PERFORMANCE PLUS | 1,213 | 10,858 | 4 |
| PGE | PGE21037 | LIGHT EXCHANGE PROGRAM | 147 | 959 | (3) |
| PGE | PGE21038 | WINE INDUSTRY EFFICIENCY SOLUTIONS | 1,435 | 9,291 | 420 |
| PGE | PGE21039 | COMPREHENSIVE FOOD PROCESS AUDIT & RESOURCE EFFICIENCY PGM | 1,304 | 9,520 | 3,990 |
| PGE | PGE2110011 | CALIFORNIA COMMUNITY COLLEGES | 1,955 | 14,511 | 990 |
| PGE | PGE2110012 | UNIVERSITY OF CALIFORNIA/CALIFORNIA STATE UNIVERSITY | 6,890 | 38,513 | 1,935 |
| PGE | PGE2110013 | STATE OF CALIFORNIA | 829 | 3,939 | 66 |
| PGE | PGE2110014 | DEPARTMENT OF CORRECTIONS AND REHABILITATION | 2,738 | 10,797 | 447 |

In 2010-2012, ED and the four IOUs collaborated on the process evaluation of the Institutional Partnerships (Navigant, 2013[4]). No process evaluations were planned for 2013-2015, due in part to the fact that these are legacy programs whose processes are relatively well-understood by the IOU IP program managers.

The impact evaluations of the Institutional Partnership programs were recently added to the oversight of the Commercial Roadmap. For program years 2013-15 there are no impact or process evaluations that are specifically targeted to these groups of programs, however, these programs will be included in

[4] Available at http://www.energydataweb.com/cpucFiles/pdaDocs/908/Statewide_Institutional_IOU_Energy_Efficiency_Partnership_Assessment%20Final%20Draft.pdf

the sample frame for some of the impact evaluations discussed below (specifically the studies being conducted to meet the needs of the Efficiency Savings and Performance Incentive (ESPI) decision[5]).

In 2010-2012, ED and the four IOUs collaborated on the process evaluation of the Institutional Partnerships (Navigant, 2013[6]). No process evaluations were planned for 2013-2015, due in part to the fact that these are legacy programs whose processes are relatively well-understood by the IOU IP program managers.

Similarly, although the evaluation of local government partnership, REN and CCA programs will be covered by the LGP and REN/CCA roadmaps, the ESPI impact evaluations conducted under this roadmap will also cover some component of these programs.

Furthermore, although there are separate roadmaps and PCGs for custom projects and for lighting, this roadmap will include impact evaluations for all nonresidential downstream lighting measures, both deemed and custom for 2013 and 2014. However, for 2015, the lighting impact evaluations have been moved to the Lighting roadmap. Therefore, for 2013 and 2014, the impact evaluations conducted under this roadmap included some component of the Core Custom and Lighting programs. However, all non-lighting custom measures, non-lighting nonresidential new construction measures and agricultural audit measures will be covered by the Industrial, Agricultural and Large Commercial (IACL) roadmap.

Finally, the evaluation of upstream HVAC rebates and HVAC Quality Maintenance (QM) HVAC Quality Installation (QI) will be covered by the HVAC roadmap. Therefore, evaluations performed under the HVAC roadmap will be conducted on the programs listed in the table above.

There are a number of primary evaluation needs that the studies in this roadmap are attempting to address which are:

1. Estimating ex post net and gross lifecycle savings values for all custom lighting measures and certain nonresidential downstream deemed measures with high uncertainty to meet the requirements of the Efficiency Savings and Performance Incentive (ESPI) decision[7]. The following studies address these needs:
    a. 2013-14 Nonresidential Downstream Deemed ESPI Impact Evaluation
    b. 2013-14 Nonresidential Downstream Custom Lighting ESPI Impact Evaluation
    c. 2015 Nonresidential Downstream Non-Lighting Deemed ESPI Impact Evaluation
2. Develop a better understanding of how the Direct Install, Third Party and Deemed programs operate, the value that these programs provide, what level of savings each of these programs have delivered, and how effective these programs have been in terms of cost effectiveness and depth of retrofit. The following study addresses these needs:
    a. 2013-14 Impact Evaluation of Deemed, Direct Installation and Third Party Programs

[5] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism.

[6] Available at http://www.energydataweb.com/cpucFiles/pdaDocs/908/Statewide_Institutional_IOU_Energy_Efficiency_Partnership_Assessment%20Final%20Draft.pdf

[7] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism.

b. 2015 Impact Evaluation of Deemed, Direct Installation and Third Party Programs
c. 2013-14 Direct Install Process Evaluation
d. 2015 Direct Install Process Evaluation
e. 2013-14 Third Party (3P) Programs Value and Effectiveness Study
f. Comprehensiveness Analysis Study

## Ex Ante Coordination

Ex ante processes (including DEER updates, Uncertain Measures List updates, work papers review, and custom projects review) incorporate data and results from the latest EM&V studies. The ex ante values that are relevant to this sector are highlighted in this section, they may also be included in other relevant chapters.

## Summary of DEER 2016 Updates:

- Several NTG values were updated including:
  - Agricultural water conserving sprinkler technologies
  - Non-HVAC pipe insulation
  - Custom new construction programs

## Next Planned DEER Update

The DEER team is currently in the planning stages for 2017 updates. The scope of these updates is still under development.

## Uncertain Measures List and Update

To assess what measures to move off and/or add onto the Uncertain Measures List requires looking ahead to IOU portfolios and analysis of ex ante and ex post teams. The current 2015 Uncertain Measures List (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF, Attachment 3) contains the following items for this sector and shall be prioritized in the evaluation studies.

***Table 7. 2015 Uncertain Measures Studied Under the Commercial Roadmap***

| Utilities | Measure | Areas of Uncertainty |
|---|---|---|
| PGE, SCE | Computer network and workstation power management software | Major concern that supply of this software is standard practice; this measure has not been previously studied and impact assumptions need verification. |
| PGE | Sprinklers - low pressure nozzles and micro conversions | Energy savings estimates uncertain due to unclear measure definition; this measure has not been previously studied and impact assumptions need verification. |
| SCG | Pipe insulation - steam and hot water | Uncertain typical pipe internal and surrounding temperatures, install rate (measure eligibility) and level of free riders. |

The draft 2016 Uncertain Measures List (http://www.cpuc.ca.gov/NR/rdonlyres/9F79154A-065B-4E80-B1AC-58A6E7223F91/0/Final_2015_ESPI_Uncertain_List.pdf), also includes a number of measures that are relevant for the Commercial Roadmap and are presented in the table below.

***Table 8. 2016 Uncertain Measures Relevant to the Commercial Roadmap***

| Utilities | Measure | Areas of Uncertainty |
|---|---|---|
| PG&E, SCE, SDG&E | Computer network and workstation power management software | Major concern that supply of this software is standard practice; this measure has not been previously studied and impact assumptions need verification. |
| PG&E, and other IOUs if claimed | Irrigation - low pressure nozzles and micro or drip conversions and/or VSD addition. | Energy savings estimates uncertain due to unclear measure definition; this measure has not been previously studied and impact assumptions need verification. |
| PG&E,SCG | Pipe and tank insulation - steam and hot water pipes and high temperature tanks | Uncertain typical pipe internal and surrounding temperatures, install rate (measure eligibility), EUL (length of time insulation remains in place in good functional condition) and level of free riders. |
| PG&E,SCE, SDG&E | Food-service equipment: fryers, steamers, ovens of all types, and holding cabinets. | There has been insufficient investigation into field performance (including hours of use and loading), EUL, and standard practice (for gross baseline and NTG). Direction was issued to PA's to perform this work in D.11-07-030, but from the recent work paper submissions it appears the appropriate work has not been undertaken. |
| PG&E,SCE, SDG&E | Refrigeration case LED lighting and controls | The main areas of uncertainty are operating hours, standard practice for baseline determination and NTG. Additionally, it is unclear if the measures include application to new and replacement case situations or just retrofits of existing cases. There are likely varying values required for facilities with large, medium and small refrigeration case amounts as well as retail stores with different standard operating hours. |
| PG&E,SCE, SDG&E | Refrigeration case Anti-Sweat Heater (ASH) controls | The main areas of uncertainty are operating hour reductions, standard practice and NTG. Additionally, it is unclear if the measure includes application to new and replacement case situations or just retrofits of existing cases. There are likely varying values required for facilities with large, medium and small refrigeration case amounts as well as retail stores with different standard operating hours. |
| PG&E, SDG&E, SCG | High Efficiency Water heating for commercial and residential use – tankless/instantaneous water heaters and 0.9 and | The main areas of uncertainty are overall system differential water and energy use considering tank and pipe losses as well as firing efficiency, standard practice versus code baseline and NTG. |

| Utilities | Measure | Areas of Uncertainty |
|---|---|---|
| | higher EF storage water heaters | |

## Program Administrators' Planned Work paper Submissions

Program Administrators submit planned work papers for the upcoming portfolio cycle to Commission staff. These work papers often use DEER data and/or methodology to add technologies that are not in DEER to the energy efficiency portfolio.

***Table 9. Program Administrators' Planned Work paper Submissions***

| Program Administrator | Measure/Value/Parameter | Reason for the Update/New Work paper |
|---|---|---|
| PG&E | Deck Ovens | New data |
| PG&E | Vertical Hollow and Solid Shaft Pump Motors | New data |
| PG&E | Ultra-Low Temperature Freezer | New data |
| PG&E | High Efficiency DHW Boiler (>75 mBTU/h) | New data |
| PG&E | Vending Machine Controller – Uncooled | DEER Updates |
| PG&E | Pipe Insulation | DEER Updates |
| PG&E | 20% Tuning | DEER Updates |
| SCE | Tier 2 Commercial Information Technology (IT) Advanced Power Strip (APS) | Same effort as described in SDG&E's list. |
| SCE | Commercial Quality Renovation: Reduce Overventilation | WP doesn't exist. Proceeding through SCE's intake process. Lab testing and building energy simulation may be performed. |
| SCE | Commercial Quality Renovation: Duct Insulation | WP doesn't exist. Proceeding through SCE's intake process. Lab testing and building energy simulation may be performed. |
| SCE | Commercial Quality Renovation: Duct Leakage | WP doesn't exist. Proceeding through SCE's intake process. Lab testing and building energy simulation may be performed. |
| SCE | Commercial Quality Renovation: Static Pressure Reduction and Flow Optimization | WP doesn't exist. Proceeding through SCE's intake process. Lab testing and building energy simulation may be performed. |
| SCE | Smart Thermostat | WP doesn't exist. Study in progress. |
| SCE | Indirect Evaporative DOAS | WP doesn't exist. ET study in progress. |
| SCE | Commercial Quality Maintenance: Economizer Repair | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial Quality Maintenance: Economizer Control | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial Quality Maintenance: | PG&E-led effort to update this work paper |

| Program Administrator | Measure/Value/Parameter | Reason for the Update/New Work paper |
|---|---|---|
| | Programmable Thermostat | based on WO032. |
| SCE | Commercial Quality Maintenance: Condenser Coil Cleaning | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial Quality Maintenance: Unoccupied Supply Fan Control | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial Quality Maintenance: Evaporator Coil Cleaning | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial Quality Maintenance: Refrigerant Charge | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial Quality Maintenance: VFDs on Agricultural Pumps | PG&E-led effort to update this work paper based on WO032. |
| SCE | Variable Refrigerant Flow Commercial Heat Pumps & Heat Recovery Systems >65kBtu/h | Existing work paper that was not approved by the ED. PG&E is leading the effort to revise the paper. |
| SCG | Pipe Insulation | New data from impact evaluation |
| SCG | Laminar Flow Restrictor for Health Care | New Measure |
| SDG&E | Water Nexus tool | Correlated saving associated with implementing water savings devices/equipment (ULF urinals, ULF toilets, faucets, etc.) |
| SDG&E | Tier 2 Commercial Information Technology (IT) Advanced Power Strip (APS) | Ongoing ET field trails as requested by CS EAR team |
| SDG&E | Slice Energy - Smart VAV controls for DDC and Pneumatic controls where supply fans have existing VFD's | Ongoing ET field trails to determine EE savings and code compliance |
| SDG&E | AirRite – small business (restaurants/fast food) whole facility HVAC approach (air balancing, tune ups, and controls for EE & DR) | Ongoing ET field trails to determine EE savings and code compliance |
| SDG&E | QM Power's Q-Sync Motors – fractional HP motors for refrigeration cases that claim higher savings than ECM's | Ongoing ET field trails to determine EE savings and code compliance |
| SDG&E | Pool Response – This is an IDSM project for pool pumps using a low cost controller. If effective - could be a residential rebate. | Ongoing ET field trails to determine EE savings and code compliance |

### 2.2.2. 2013-2015 EM&V Studies

The table below summarizes the 2013-15 EM&V Studies that have been budgeted, some of which are in the process of being implemented and one that is in the planning stage. The table provides the study manager, work order under which the study is being conducted, the corresponding budget, implementation status and expected completion date for each study.

***Table 10. 2013-2015 Commercial Programs EM&V Studies, Budgets, and Timing***

| Study Title | Study Manager | WO Number | Budget | Status | Completion Date |
|---|---|---|---|---|---|
| **Impact** | | | | | |
| 2013-2014 Nonresidential Downstream Deemed ESPI Impact Evaluation | ED | ED_I_COM_1 | $2,165,000 | Completed | Q1 2016 |
| 2013-2014 Nonresidential Downstream Custom Lighting ESPI Impact Evaluation | ED | ED_I_COM_1 | $1,215,000 | Completed | Q1 2016 |
| 2013-15 Impact and Process Evaluation of Commercial and Industrial Audit Programs* | ED | ED_I_COM_3 | $25,000 | Cancelled | |
| 2015 Nonresidential Downstream Non-lighting Deemed ESPI Impact Evaluation | ED | ED_I_COM_5-7 | $736,000 | Underway | Q1 2017 |
| 2013-2015 Impact Evaluation of Deemed, Direct Installation and Third Party Programs | ED | ED_I_COM_8 | $450,000 | Planning | Q2 2017 |
| Impact Evaluation of the High Uncertainty Refrigeration Measures | ED | ED_I_COM_9 | $250,000 | Planning | Q4 2017 |
| Experimental and Comparative Impact Evaluation | ED | ED_I_COM_10 | $310,000 | Planning | Q2 2017 |
| **Process** | | | | | |
| 2013-2014 Direct Install Process Evaluation | ED | ED_I_COM_2 | $270,000 | Underway | Q4 2016 |
| 2013-2014 3P Programs Value and Effectiveness Study | ED | ED_I_COM_2 | $622,500 | Completed | Q4 2015 |
| Comprehensiveness Analysis Study | ED | ED_I_COM_4 | $400,000 | Underway | Q4 2016 |
| 2015 Direct Install Process Evaluation | ED | ED_I_COM_2 | $135,000 | Underway | Q4 2016 |

*After an initial evaluation assessment, it was decided not to continue with the 2013-15 Impact and Process Evaluation of Commercial and Industrial Audit Programs.

### 2.2.3. 2013-2015 Study Descriptions

Below are descriptions for each of the 2013-15 studies, which include the key research questions that will be addressed, and the potential EM&V methods that will be utilized.

| | |
|---|---|
| **Study Title:** 2013-14 Nonresidential Downstream Deemed ESPI Impact Evaluation | **Budget:** $2,165,000 (Note that a portion of this budget was reallocated from the Lighting Roadmap, as this study is evaluating lighting measures). |
| **Expected Completion Date:** Completed | **Study Manager:** (ED) |
| **Description:** This study will develop ex post savings estimates of net and gross savings values for the nonresidential downstream deemed measures that were identified in the identified in the Efficiency Savings and Performance Incentive (ESPI) decision[8]. The evaluation will focus on high uncertainty measures or key measure-parameters (e.g., operating hours for LED lamps) and rely on a combination of new data collection, and existing data from relevant 2006-08 and 2010-12 impact evaluations. This study will develop separate reports for the 2013 and 2014 program years. | |
| **Objective:**<br>• Estimate ex post net and gross lifecycle savings values for nonresidential downstream deemed measures with high uncertainty as identified in Attachment 3 of the ESPI decision. | |
| **Key Research Questions:**<br>• What are ex post net and gross lifecycle savings values for nonresidential downstream deemed measures with high uncertainty as identified in Attachment 3 of the ESPI decision. | |
| **Potential EM&V Methods:** Phone surveys to develop NTGRs, onsites and monitoring to estimate key parameters for high uncertainty measures. | |

| | |
|---|---|
| **Study Title:** 2013-14 Nonresidential Downstream Custom Lighting ESPI Impact Evaluation | **Budget:** $1,215,000 (Note that this budget was reallocated from the IALC Roadmap, as this study is evaluating custom measures). |
| **Expected Completion Date:** Completed | **Study Manager:** (ED) |
| **Description:** This study will develop ex post savings estimates of net and gross savings values for the nonresidential downstream custom lighting measures to support the Efficiency Savings and Performance Incentive (ESPI) decision[9]. The evaluation will focus all nonresidential downstream custom lighting measures and rely on new monitoring and verification data collection. This study will develop separate reports for the 2013 and 2014 program years. | |
| **Objective:**<br>• Estimate ex post net and gross lifecycle savings values for nonresidential downstream custom lighting measures to support the ESPI decision. | |
| **Key Research Questions:** | |

[8] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF

[9] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF

| **Study Title:** 2013-14 Nonresidential Downstream Custom Lighting ESPI Impact Evaluation | **Budget:** $1,215,000 (Note that this budget was reallocated from the IALC Roadmap, as this study is evaluating custom measures). |
|---|---|
| • What are ex post net and gross lifecycle savings values for nonresidential downstream custom lighting measures. | |
| **Potential EM&V Methods:** Phone surveys to develop NTGRs, onsites and monitoring. | |

| **Study Title:** 2013-14 Process Evaluation of Direct Install Programs | **Budget:** $270,000 |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |
| **Description:** The direct install (DI) programs in California are diverse and touch residential, commercial and public agency customers. This study includes only those DI programs that reach commercial customers primarily those at or under 200kw of demand. SDG&E and SCE provide DI programs through their Core offerings. PG&E has third parties implement DI programs and in some instances, granting DI contractor oversight to certain advanced Local Government Partnerships (LGPs). The full scope of this study is yet to be determined, although the evaluation team expects the objectives and key research questions noted below to guide the study development. The next update to the EM&V Roadmap will update this study. The funds for study will be combined with 2015 funding for a single 2013-2015 DI study. | |
| **Objective:**<br>• Assess which IOU program models are successful at offering DI to commercial customers<br>• Determine which commercial DI programs are working effectively within the overall portfolio of commercial programs.<br>• Identify specific characteristics that drive performance, both at present and in the future. | |
| **Key Research Questions:**<br>• How do the various approaches to commercial DI program delivery compare?<br>• How do the programs interact within the portfolio of California commercial programs? What are areas of synergy or overlap? Are any programs that are duplicative or working at odds with each other?<br>• What characteristics of the DI program may contribute to positive program performance?<br>• Other questions yet to be determined. | |
| **Potential EM&V Methods:** Depth interviews of IOU staff and program implementation staff; secondary program material review; other methods TBD. | |

| **Study Title:** 2013-2014 3P Program Process Evaluation | **Budget:** $622,500 |
|---|---|
| **Expected Completion Date:** Completed | **Study Manager:** ED |
| **Description:** This study will characterize the unique value that each 3P Commercial resource program brings to the market as compared to what is offered through Core programs. This study will also explore how effectively the 3P Commercial programs are implemented, and how effectively they are being managed by the IOUs. This Study will be conducted under the Commercial Value and Effectiveness Evaluation Work Order. | |

| **Study Title:** 2013-2014 3P Program Process Evaluation | **Budget:** $622,500 |
|---|---|
| Objective: Determine the value and effectiveness of the 3P commercial programs. | |
| **Key Research Questions:**<br>1. What are the characteristics of the 3P Commercial programs and how do they provide value to the C&I market?<br>2. What need in the marketplace are these programs trying to fill?<br>3. How much and where do the 3P Commercial programs cross-market Core programs?<br>4. We include the following two research questions here for completeness and note that they will be addressed as part of their comprehensiveness evaluation effort with the results integrate into this study's report.<br>a. How much channeling actually occurs between the 3P Commercial and Core programs? That is, what customers participate in both 3P Commercial and Core/SW programs and to what degree?<br>b. Does the type of 3P Commercial program make a difference in terms of deeper savings (i.e. are customers installing more or fewer measures based on the implementer or sector? Are the program affecting more end-uses than others?)<br>5. What are the best methods to deal with program cycles and funding to develop a systematic approach to more flexible contracting?<br>6. How are the programs managed by the IOUs?<br>7. What is the nature of the 3P implementer and contractor relationship with the IOUs?<br>8. Why did PG&E drop some programs? Could this have been prevented?<br>9. How have the 3P Commercial programs responded to the best practice suggestions from the previous study?<br>10. How have the programs performed against savings goals (claimed) and the cost per kWh and Therm saved?<br>11. What is the delivery channel, measure mix and cost effectiveness of each program[10]?<br>12. What activities do the programs use to move from finding customers to completing energy saving projects? What is the project "close" rate?<br>13. How do the programs capture savings that would not have happened through the Core Programs or naturally in the market place? (From the perspective of the IOU's, 3P implementers and customers)<br>14. How do participants experience the program across multiple areas? | |
| **EM&V Methods:** IOU Program Staff interviews, 3P Implementation staff interviews; Case studies of 10 3P programs that will include customer surveys; secondary review | |

| **Study Title:** 2013-14 Comprehensiveness Analysis Study | **Budget:** $400,000. |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** (ED) |

[10] There have been concerns that many 3Ps are less cost-effective than core programs because they are direct install programs that incorporate the full measure cost. The only way to make these sorts of efforts cost effective is to install marginal short-payback equipment such as lighting that is just above code and harvest the early replacement credit.

| **Study Title:** 2013-14 Comprehensiveness Analysis Study | **Budget:** $400,000. |
|---|---|
| **Description:** This study will look across all nonresidential programs in 2010-2014 and provide insight on correlations between program structure and program success as indicated by the depth of retrofit achieved and other effectiveness metrics. Using a combination of program tracking data, CIS data, and phone interviews, the evaluation will provide quantitative and qualitative analysis on patterns of success, reasons why certain programs are most successful, and ways in which success can be extended and replicated. The evaluation will use multiple metrics to define and shed light on depth of retrofit achieved, including: savings beyond lighting measures, savings per incentive dollar spent, proportion of overall consumption saved, proportion of eligible buildings enrolled in a given program, effectiveness at promoting distributed generation and demand response, and program cost effectiveness. Findings will be broken out in multiple ways, including: measure type, program type (DI, 3P, LGP), urban/rural, size, building type, lease/own, and primary language spoken. | |
| **Objective:**<br>• Identify meaningful metrics of success that are most relevant to overall nonresidential program and portfolio objectives looking forward<br>• Identify nonresidential programs that are most successful based on multiple metrics of success looked at individually and together<br>• Figure out why certain programs are being most successful<br>• Inform how success can be extended and replicated | |
| **Key Research Questions:**<br>• What effects are derived from looking at measure performance against metrics that indicate depth of retrofit?<br>• What are the program drivers of high participation rates? Which jurisdictions have the highest participation when controlling for socio-economic and other variables?<br>• Which programs are most successful in bundling deep packages of measures and why? Are they getting results?<br>• How do the various approaches to program delivery, contracting, program design, outreach, measure mix and uptake compare across DI programs, and how do these track with program success in terms of depth of retrofit?<br>• How beneficial is the hybrid practice of measure documentation that is used by 3P programs mixing deemed and custom process evaluation for bundling measures and providing deeper savings per strategic plan goals?<br>• What is the size of the opportunity lost when custom projects ignore simple deemed measures? | |
| **Potential EM&V Methods:** Analysis of existing tracking data and program cost information. | |

Below are descriptions for each of the 2015 studies, which include the key research questions that will be addressed, and the potential EM&V methods that will be utilized.

| **Study Title:** 2015 Nonresidential Downstream Non-lighting Deemed ESPI Impact Evaluation | **Budget:** $736,000 |
|---|---|
| **Expected Completion Date:** Q1 2017 | **Study Manager:** (ED) |
| **Description:** This study will develop ex post savings estimates of net and gross savings values for the nonresidential downstream non-lighting deemed measures that were identified in the 2015 EPSI | |

| **Study Title:** 2015 Nonresidential Downstream Non-lighting Deemed ESPI Impact Evaluation | **Budget:** $736,000 |
|---|---|
| uncertain list[11]. The evaluation will focus on high uncertainty measures or key measure-parameters and rely on a combination of new data collection, and possibly existing data from relevant 2013-14 impact evaluations. | |
| **Objective:**<br>• Estimate ex post net and gross lifecycle savings values for nonresidential downstream non-lighting deemed measures with high uncertainty as identified in the 2015 EPSI uncertain list. | |
| **Key Research Questions:**<br>• What are ex post net and gross lifecycle savings values for nonresidential downstream non-lighting deemed measures with high uncertainty as identified in the 2015 EPSI uncertain list. | |
| **Potential EM&V Methods:** Phone surveys to develop NTGRs, onsites and monitoring to estimate key parameters for high uncertainty measures. | |

| **Study Title:** 2013-2015 Impact Evaluation of Deemed, Direct Installation and Third Party Programs | **Budget:** $450,000 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** (ED) |
| **Description:** This study will develop ex post savings estimates of net and gross savings values for the Deemed, Direct Installation and Third Party programs, and rely on a combination of new data collection, and existing ex post gross results from relevant 2013-2015 impact evaluations. | |
| **Objective:**<br>• Estimate NTGRs for key grouping of the Deemed, Direct Installation and Third Party programs (such as by program administrator and program type) using new and existing data.<br>• Utilize existing gross ex post savings results from relevant 2013-2015 impact evaluations, and NTGRs developed in this study to estimate various cost-effectiveness and program effectiveness metrics, such as the TRC (total resource cost). | |
| **Key Research Questions:**<br>• What are the NTGRs for Deemed, Direct Installation and Third Party programs<br>• What are the TRC, PAC and other program effectiveness metrics for Deemed, Direct Installation and Third Party programs | |
| **Potential EM&V Methods:** Phone surveys to develop NTGRs, existing ex post gross savings values. | |

| **Study Title:** Impact Evaluation of the High Uncertainty Refrigeration Measures | **Budget:** $250,000 |
|---|---|
| **Expected Completion Date:** Q4 2017 | **Study Manager:** (ED) |
| **Description:** This study will collect phone and on-site data to support future development of ex post savings estimates of net and gross savings values for the nonresidential downstream refrigeration | |

[11] http://www.cpuc.ca.gov/NR/rdonlyres/9F79154A-065B-4E80-B1AC-58A6E7223F91/0/Final_2015_ESPI_Uncertain_List.pdf

| **Study Title:** Impact Evaluation of the High Uncertainty Refrigeration Measures | **Budget:** $250,000 |
|---|---|
| deemed measures that are considered to have a high level of uncertainty and/or were identified in the 2016 EPSI uncertain list[12]. | |
| **Objective:**<br>• The evaluation will develop preliminary estimates of NTGRs, but the primary objective is to collect data to support future impact evaluations. | |
| **Key Research Questions:**<br>• What are ex post NTGRs for nonresidential downstream refrigeration deemed measures with high uncertainty. | |
| **Potential EM&V Methods:** Phone surveys to develop NTGRs, onsites data to support future estimates of key parameters for high uncertainty measures. | |

| **Study Title:** Experimental and Comparative Impact Evaluation | **Budget:** $310,000 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** (ED) |
| **Description:** This study will develop ex post savings estimates for individual projects using insitu baselines. The study will use savings developed from previous field verification and other data collection completed under the 2013-2014 impact evaluation and compare these savings to savings developed using site specific statistical modeling using AMI data. The study will compare the savings estimates developed using traditional analysis techniques with savings developed using multiple specifications of customer specific models using AMI and site level data. | |
| **Objective:**<br>• To compare savings estimates developed using traditional analysis techniques with savings developed using multiple specifications of customer specific models using AMI and site level data. | |
| **Key Research Questions:**<br>• How different are savings estimates for nonresidential energy efficiency projects when developed using traditional analysis techniques compared to those using various specifications of customer specific models based on AMI and site level data. | |
| **Potential EM&V Methods:** Utilization of existing ex post study data and results, engineering analysis to adjust existing ex post results, and analysis of AMI and site level data to estimate savings. | |

| **Study Title:** 2015 Process Evaluation of Direct Install Programs | **Budget:** $135,000 |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |
| **Description:** This is the same study as described in the 2013-2014 study. Funds for both 2013-2014 and 2015 will be combined for a single 2013-2015 DI process evaluation with a total budget of $660,000. | |
| **Objective:** See the objectives under the 2013-2014 study. | |

[12] http://www.cpuc.ca.gov/NR/rdonlyres/9F79154A-065B-4E80-B1AC-58A6E7223F91/0/Final_2015_ESPI_Uncertain_List.pdf

| **Study Title:** 2015 Process Evaluation of Direct Install Programs | **Budget:** $135,000 |
|---|---|
| **Key Research Questions:** See the research questions under the 2013-2014 study. | |
| **Potential EM&V Methods:** See the methods in the 2013-2014 study. | |

### 2.2.4. Scope of Programs for 2016 and beyond

The tables below present all the 2016 programs that correspond to this Commercial Roadmap, along with the total ex ante kW, MWh and therm savings for the first half of 2016. The scope of the 2017 approved programs may look slightly different.

***Table 22. 2016 Commercial Roadmap Savings by Program – Q1-Q2 2016***

| PA | ProgramID | Program Name | kWh | kW | Therms | 2016 Budget |
|---|---|---|---|---|---|---|
| PGE | PGE21002 | Plug Load and Appliances | 13,098,874 | 2,321 | 465,466 | $18,990,738 |
| PGE | PGE21012 | Commercial Deemed Incentives | 41,304,382 | 7,691 | 2,379,779 | $18,922,890 |
| PGE | PGE21014 | Commercial Energy Advisor | - | - | - | $5,979,427 |
| PGE | PGE21022 | Industrial Deemed Incentives | 5,592,500 | 2,681 | 105,700 | $794,316 |
| PGE | PGE21024 | Industrial Energy Advisor | - | - | - | $2,205,773 |
| PGE | PGE21032 | Agricultural Deemed Incentives | 11,460,975 | 6,624 | 108,325 | $3,815,997 |
| PGE | PGE21034 | Agricultural Energy Advisor | 20,500,000 | 2,050 | - | $4,259,648 |
| PGE | PGE2110011 | California Community Colleges | 3,355,038 | 542 | 148,207 | $3,495,392 |
| PGE | PGE2110012 | University of California/California State University | 8,279,591 | 1,748 | 225,574 | $11,801,373 |
| PGE | PGE2110013 | State of California | 347,427 | 347 | 27,079 | $1,423,968 |
| PGE | PGE2110014 | Department of Corrections and Rehabilitation | 828,073 | 111 | 165,229 | $3,199,909 |
| PGE | PGE210112 | School Energy Efficiency | 2,943,048 | 108 | 25,528 | $3,421,431 |
| PGE | PGE210113 | Energy Fitness Program | - | - | - | $2,940,737 |
| PGE | PGE210114 | Energy Savers | - | - | - | $1,329,057 |
| PGE | PGE210115 | RightLights | - | - | - | $5,211,807 |
| PGE | PGE210119 | LED Accelerator | 4,500,000 | 1,224 | - | $2,458,594 |
| PGE | PGE210123 | Healthcare Energy Efficiency Program | 2,817,774 | 448 | 116,737 | $1,189,849 |
| PGE | PGE210126 | K-12 Private Schools and Colleges Audit Retro | 2,870,400 | 337 | -690 | $1,844,726 |
| PGE | PGE21017 | Boiler Energy Efficiency Program [1] | - | - | 259,687 | $2,086,213 |
| PGE | PGE21018 | EnergySmart Grocer | 19,800,000 | 1,939 | 237,824 | $7,456,460 |
| PGE | PGE210128 | Enovity SMART [2] | - | - | - | $ - |
| PGE | PGE210129 | Nexant AERCx | - | - | - | $ - |
| PGE | PGE210131 | PECI AERCx | - | - | - | $ - |
| PGE | PGE210141 | Lincus Commercial Mid-Market Program | 794,632 | 72 | - | $ - |

| PA | ProgramID | Program Name | kWh | kW | Therms | 2016 Budget |
|---|---|---|---|---|---|---|
| PGE | PGE210143 | Hospitality Program [3] | 12,600,000 | 2,700 | 90,000 | $6,609,426 |
| PGE | PGE210133 | Staples Low Pressure Irrigation DI | - | - | - | $ - |
| PGE | PGE21035 | Dairy Energy Efficiency Program | - | - | - | $472,638 |
| PGE | PGE21036 | Industrial Refrigeration Performance Plus | 2,240,800 | 322 | - | $1,419,916 |
| PGE | PGE21037 | Light Exchange Program | - | - | - | $1,046,700 |
| PGE | PGE21039 | Comprehensive Food Process Audit & Resource Efficiency Pgm | 9,564,983 | 754 | 1,100,040 | $1,064,504 |
| PGE | PGE210312 | Dairy and Winery Industry Efficiency Solutions | 5,774,966 | 955 | 61,262 | $3,157,975 |
| PGE | PGE21027 | Heavy Industry Energy Efficiency Program | 18,000,000 | 2,813 | 900,000 | $11,067,518 |
| PGE | PGE210116 | Small Business Commercial Comprehensive | - | - | | $ - |
| PGE | PGE210117 | Energy-Efficient Parking Garage | - | - | - | $ - |
| PGE | PGE210118 | Furniture Store Energy Efficiency [4] | | | | $1,414,293 |
| PGE | PGE210310 | Dairy Industry Resource Advantage Program | - | - | - | $ - |
| PGE | PGE21038 | Wine Industry Efficiency Solutions | | | | |
| SCE | SCE-16-SW-002C | Commercial Deemed Incentives Program | 40,699,222 | 4,576 | - | $11,583,112 |
| SCE | SCE-16-SW-002D | Commercial Direct Install Program | 41,466,195 | 10,239 | - | $25,149,589 |
| SCE | SCE-16-SW-003C | Industrial Deemed Energy Efficiency Program | 2,137,150 | 372 | - | $1,555,273 |
| SCE | SCE-16-SW-004C | Agriculture Deemed Energy Efficiency Program | 311,019 | 88 | - | $836,138 |
| SCE | SCE-16-SW-005B | Lighting Innovation Program | 29,355,055 | 5,973 | - | $6,812,979 |
| SCE | SCE-16-L-003A | California Community Colleges Energy Efficiency Partnership | 3,493,205 | 763 | - | $3,075,165 |
| SCE | SCE-16-L-003B | California Dept. of Corrections and Rehabilitation EE Partnership | 1,485,540 | 80 | - | $644,167 |
| SCE | SCE-16-L-003F | State of California Energy Efficiency Partnership | 744,732 | 230 | - | $744,787 |
| SCE | SCE-16-L-003G | UC/CSU Energy Efficiency Partnership | 3,049,295 | 351 | - | $4,383,388 |
| SCE | SCE-16-TP-003 | Healthcare EE Program | 3,444,963 | 369 | - | $1,767,331 |
| SCE | SCE-16-TP-004 | Data Center Energy Efficiency | 4,174,463 | 462 | - | $2,340,661 |
| SCE | SCE-16-TP-005 | Lodging EE Program | 5,536,420 | 623 | - | $2,235,450 |
| SCE | SCE-16-TP-006 | Food & Kindred Products | 22,163,713 | 5,331 | - | $3,989,783 |
| SCE | SCE-16-TP-007 | Primary and Fabricated Metals | 21,277,509 | 2,848 | - | $4,104,991 |
| SCE | SCE-16-TP-008 | Nonmetallic Minerals and Products [5] | 18,085,946 | 2,615 | - | $4,627,969 |

| PA | ProgramID | Program Name | kWh | kW | Therms | 2016 Budget |
|---|---|---|---|---|---|---|
| SCE | SCE-16-TP-009 | Comprehensive Chemical Products | 6,110,372 | 933 | - | $3,171,077 |
| SCE | SCE-16-TP-012 | Refinery Energy Efficiency Program | - | | - | $ - |
| SCE | SCE-16-TP-013 | Cool Schools | 478,108 | 122 | - | $2,834,054 |
| SCE | SCE-16-TP-014 | Commercial Utility Building Efficiency | 1,808,271 | 672 | - | $2,687,097 |
| SCE | SCE-16-TP-017 | Energy Efficiency for Entertainment Centers | - | | - | $ - |
| SCE | SCE-16-TP-018 | School Energy Efficiency Program | 5,323,463 | 1,830 | - | $1,004,898 |
| SCE | SCE-16-TP-020 | IDEEA365 Program | 5,229,213 | 783 | - | $4,194,654 |
| SCG | SCG3711 | SW-COM-Deemed Incentives | - | - | 936,799 | $4,497,331 |
| SCG | SCG3716 | SW-IND-Deemed Incentives | - | - | 646,582 | $1,048,590 |
| SCG | SCG3720 | SW-AG-Deemed Incentives | - | - | 214,744 | $502,829 |
| SCG | SCG3757 | 3P-Small Industrial Facility Upgrades | - | - | 339,381 | $745,183 |
| SCG | SCG3758 | 3P-PREPS | - | - | 483,852 | $1,226,515 |
| SCG | SCG3759 | 3P-On Demand Efficiency | - | - | 423,166 | $2,545,075 |
| SCG | SCG3766 | 3P-SaveGas [6] | - | - | - | $ - |
| SCG | SCG3793 | 3P-IDEEA365-Instant Rebates! Point-of-Sale Foodservice Rebate Program | - | - | 154,351 | $547,078 |
| SDGE | SDGE3223 | SW-COM-Deemed Incentives-Commercial Rebates | 27,905,624 | 5,126 | 2,565 | $11,468,888 |
| SDGE | SDGE3233 | SW-IND-Deemed Incentives | 728,205 | 149 | 24,160 | $801,168 |
| SDGE | SDGE3239 | SW-AG-Deemed Incentives | 258,808 | 62 | 151,181 | $386,231 |
| SDGE | SDGE3226 | SW-COM Direct Install | 15,021,706 | 4,001 | -18,232 | $10,341,287 |

*Notes:*
*Source: http://eestats.cpuc.ca.gov/Views/Documents.aspx?quarterly (unless otherwise noted)*
*Note [1]: Boiler Energy Efficiency Program was closed as per 9/1/16 Advice Letter 3753-G/4901-E*
*Note [2]: Enovity SMART program was closed as per 9/1/16 Advice Letter 3753-G/4901-E*
*Note [3]: The Hospitality Program combines Casino Green and LodgingSavers as per Advice Letter 3753-G/4901-E*
*Note [4]: PGE 210118 Furniture Store Energy Efficiency was renamed PGE 210118 Retail Energy Efficiency in 9/22/16 Advice Letter 3753-G-A/4901-E-A*
*Note [5] Increase to commitment $ in the month of March is largely due to a project in Nonmetallic Minerals and Products(500189909) and a project in Comprehensive Petroleum Refining (500175916) having increased savings after final M&V*
*Note [6]: Program closed as of 12/31/2014 per Advice Letter 4725.*

### 2.2.1. Key Research Questions for 2016 and beyond

**Energy Division Proposed 2016 and 2017 EM&V Budgets: $3,353,328**

Small/medium (SMB) commercial studies will not be restricted to impact studies to inform the Energy Savings Performance Incentive (ESPI). A sub-set of funds will be targeted to identifying small and medium programs for future impact evaluations. We believe that programs that are developed in the future periods (post Business Plans) will likely change significantly.

One approach to understand small/medium sector's story is to conduct a gap analysis and literature review to identify historically non-evaluated areas. Another focus will be measure-related studies and turn-over studies for certain measures and the extent to which energy efficiency has been effectively acquired from the small business sector as compared to its energy usage/potential. Hopefully this information can be used for creating new approaches to attract micro-commercial consumers, target hard-to-reach sectors, and tenants and looking at financing options for these customers.

Water-energy nexus issues and code compliance in the small commercial sector may also be studied. Cross-cutting studies with C&S, ETP and other sectors may offer IOUs and ED staff a new perspective on how to reach SMB customers.

This portion of the small/medium roadmap will change after the statewide business plans are file and accepted. This evaluation space also needs to continue to explore the improved use of automated data as a tool to improve program – embedded evaluation activities and quicker feedback on performance.

**Program Administrator Proposed 2016 and 2017 EM&V Budgets: $275,000**

One study targeting the small commercial sector is being proposed by the Program Administrators. It is described below.

| **Study Title**: MF Residential & Small Commercial Boiler Market Characterization | **Budget:** $275,000 ($200,000 approved in 2016 residential & $75,000 approved in 2017 commercial) |
|---|---|
| **Expected Completion Date:** Q3 2017 | **Study Manager:** IOUs (SCG lead, SDG&E, PG&E) |
| **Description**: SoCalGas is proposing a statewide (gas utilities) market assessment for boilers (water) for the residential MF market and small commercial market. This study is on the list of the ED's Short Term Market Studies Recommendation in the Market Studies Needs Assessment Report by ODC. | |
| **Objective**: This study would characterize the market for boilers and opportunities for energy efficiency intervention. The study will collect current market data to run a cross tab on the<br><br>1) building/housing type<br>2) existing equipment condition (age, size, efficiency)<br>3) energy usage<br><br>The study will also collect additional information to refute or agree with anecdotal information about owners/managers' decision process to repair (short-term or indefinitely) or to replace with to-code or above code boilers. This information will help leverage the result from the To-Code study on boilers so that the IOUs can strategically develop both deemed and calculated programs for boilers. This study information will also assist in the program design and marketing of HOPPs programs with a boiler component. | |
| **Key Research Questions:**<br>6. What is the current stock and vintage of boilers in the multi-family and small commercial buildings?<br>7. What is the overall market potential for boilers in these buildings? | |

| **Study Title**: MF Residential & Small Commercial Boiler Market Characterization | **Budget:** $275,000 ($200,000 approved in 2016 residential & $75,000 approved in 2017 commercial) |
|---|---|
| 8. What is the size of the new purchase of a boiler versus the repair market?<br>9. What are the barriers to replace existing boilers with high efficient models?<br>10. Since MF property owners/managers are well known to utilize boilers beyond effective usage life, what does it take to motivate early replacement actions? | |

.

## 2.3. Industrial /Agriculture/Large Commercial, Non-residential New Construction

### 2.3.1. Background

#### Industrial, Agriculture, and Large Commercial Programs

Because the industrial, agriculture and large commercial (IALC) programs deliver the majority of portfolio therm savings and a large percentage of electric savings, we are dedicating significant effort to impact, process, and market characterization work in these segments. The results from the impact studies are of primary importance in supporting savings potential and goals estimates, calculating greenhouse gas reductions, and for procurement purposes. The IOUs, third party implementers and stakeholders are also interested in the answers from impact, process and market studies as these will enable us to achieve all possible cost-effective savings, fully engage the relevant markets, ensure that ratepayer funds are spent wisely and achieve greenhouse gas emissions reduction goals.

The industrial, agriculture and large commercial (IALC) sectors are diverse in terms of customer type and savings opportunities. Energy efficiency in these sectors is largely served by statewide IOU programs as well as third-party programs targeted to specific markets or measures. The primary focus of the industrial and agricultural programs has historically been the realization of direct energy savings through projects that offer incentives based on calculated savings. Accordingly, the primary evaluation focus has been on ex post measurement and verification of program and measure impacts to produce estimates of both gross and net savings (kWh, kW and therms) as well as a better understanding of the market conditions faced by customers.

#### Programs Included in Research Scope

The utilities individually field statewide industrial, agricultural and large commercial calculated incentive programs. In addition, there are certain statewide non-resource programs common among the IOUs, as well as numerous third party programs that serve specified markets or technology users. Calculated incentive projects that fall within the scope of this research may also be implemented by local government partnerships, institutional partnerships, and Regional Energy Networks (RENs). Rather than list each program individually, the table below shows budgets and estimated savings for the statewide programs, and rolled up estimates for the IOUs' third party programs. Any calculated incentive projects that may be implemented by the RENs fall under other types of programs, and therefore budget and savings are not included below.

The programs offered in 2015 are generally a carryover from the 2013-2014 portfolio period, which were generally similar to those offered in prior cycles. As in the 2013-2014 portfolios, in addition to energy savings the 2015 statewide programs are also directed toward meeting the energy management goals of the Strategic Plan through focused demand side management offerings and laying the groundwork for adoption of continuous energy improvement (CEI) by large, medium and small customers.

Since these sectors include customers that use large amounts of water in their activities, they provide program opportunities for combined water conservation and energy savings projects as well as opportunities for meeting the needs of agencies seeking greenhouse gas reduction through water conservation efforts. For these reasons, the IOUs were directed to include expanded efforts to address

the water/energy nexus in their agricultural and industrial programs beginning in 2013. In 2014, a separate proceeding was initiated to address water-energy nexus issues.[13] A decision issued in 2015 adopted an avoided embedded energy water-energy cost effectiveness calculator that can be used in developing programs that benefit both utility ratepayers and water customers.[14]

This roadmap has now been updated with studies the PAs are conducting or proposing to conduct in 2016. Due to various issues, the CPUC has not yet been able to issue RFPs to secure contractors to carry out evaluations for 2016 and beyond. The CPUC's proposed studies for 2016 and 2017 therefore are provided at a high level.

*Table 3. 2013-2014 IALC Programs Savings and Budget Summary*

| IOU | Program Name | Estimated KWh | Estimated KW | Estimated Therms | Budget |
|---|---|---|---|---|---|
| SCE | Industrial Energy Advisor | 0 | 0 | 0 | $3,671,003 |
| SCE | Industrial Calculated Incentives | 120,509,751 | 14,798 | 0 | $18,173,825 |
| SCE | Industrial Deemed Incentives | 68,568,511 | 19,873 | 0 | $9,416,633 |
| SCE | Industrial Continuous Energy Improvement | 0 | 0 | 0 | $1,538,537 |
| SCE | Industrial Third Party | 192,948,162 | 27788 | | $43,509,480 |
| SCE | Agriculture Energy Advisor | 18,000,000 | 0 | 0 | $5,921,087 |
| SCE | Agriculture Calculated | 12,421,810 | 3,174 | 0 | $3,231,235 |
| SCE | Agriculture Deemed | 4,535,772 | 1,437 | | $936,322 |
| SCE | Commercial Calculated | 150,257,234 | 25,441 | 0 | $16,087,060 |
| SCE | Commercial CEI | 0 | 0 | 0 | $2,609,300 |
| SCE | Commercial SBD | 85,050,000 | 15,120 | 0 | $17,823,294 |
| PG&E | Industrial Energy Advisor | 1,004,736 | 608 | 235,036 | $6,063,079 |
| PG&E | Industrial Calculated Incentives | 71,279,214 | 9,600 | 12,733,111 | $25,398,702 |
| PG&E | Industrial Deemed Incentives | 6,344,844 | 1,341 | 413,704 | $2,019,954 |
| PG&E | Industrial Continuous Energy Improvement | 0 | 0 | 0 | $1,022,797 |
| PG&E | Third Party Industrial | 78,628,794 | 11,549 | 13,381,851.92 | $50,690,708 |
| PG&E | Agricultural Calculated Incentives | 59,437,524 | 9,610 | 3,709,826 | $16,463,577 |
| PG&E | AG Deemed Incentives | 61,560,923 | 40,567 | 1,696,087 | $7,245,687 |
| PG&E | AG Third parties | 159,586,467 | 55,264 | 5,633,060 | $20,333,052 |
| PG&E | SW Commercial Calculated Incentives | 117,724,326 | 15,148 | 2,309,106 | $36,364,706 |
| PG&E | Commercial SBD | | | | $19,473,462 |
| PG&E | SW COM CEI | 0 | 0 | 0 | $840,083 |
| SDG&E | SW-IND- Benchmarking | 0 | 0 | 0 | $81,895 |
| SDG&E | SW IND – Audits NonRes | 0 | 0 | 0 | $200,079 |
| SDG&E | SW IND – Audits CIEEP | 0 | 0 | 0 | $795,346 |
| SDG&E | SW IND – Audits (TA) | 0 | 0 | 0 | $823,388 |
| SDG&E | SW IND – CEI | 0 | 0 | 0 | $900,998 |
| SDG&E | SW IND -- Pump Test Services | 0 | 0 | 0 | $30,463 |

[13] R. 13-12-011; link available at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Current+Proceeding+Activity.htm.

[14] See http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Current+Proceeding+Activity.htm, Rulemaking R. 13-12-011.

| IOU | Program Name | Estimated KWh | Estimated KW | Estimated Therms | Budget |
|---|---|---|---|---|---|
| SDG&E | SW IND – Calculated Incentives | 11,039,522 | 1,318 | 312,192 | $3,338,913 |
| SDG&E | SW-IND-Deemed Incentives | 6,834,105 | 1027 | 36,428 | $1,420,649 |
| SDG&E | SW-AG- Benchmarking | 0 | 0 | 0 | $35,134 |
| SDG&E | SW-AG Pump Test Services | 0 | 0 | 0 | $362,856 |
| SDG&E | SW AG – Audits | 0 | 0 | 0 | $74,174 |
| SDG&E | SW-Ag Audits (TA) | 0 | 0 | 0 | $589,343 |
| SDG&E | SW-AG Calculated Incentives | 5,519,760 | 659 | 156,096 | $1,685,189 |
| SDG&E | SW-AG Deemed Incentives | 3,424,140 | 515 | 16,599 | $719,800 |
| SDG&E | SW COM – CEI | 0 | 0 | 0 | $1,270,010 |
| SDG&E | SW—COM Pump Test Services | 0 | 0 | 0 | $70,664 |
| SDG&E | SW COM Calculated Incentives | 93,835,934 | 11,202 | 3,109,836 | $26,009,238 |
| SDG&E | SW-COM-Calculated Incentives-RCx | 9,754,445 | 276 | 106,254 | $2,359,543 |
| SDG&E | SW-COM-Calculated Incentives-Savings by Design | 20,851,070 | 8442 | 751,496 | $10,732,410 |
| SCG | SW-IND-Energy Advisor | 0 | 0 | 0 | $1,216,007 |
| SCG | SW-IND CEI | 0 | 0 | 0 | $645,999 |
| SCG | SW-IND-Calculated Incentives | 0 | 0 | 21,902,488 | $25,258,193 |
| SCG | SW-IND-Deemed Incentives | 0 | 0 | 2,947,836 | $2,083,532 |
| SCG | SW-AG-Energy Advisor | 0 | 0 | 0 | $78,013 |
| SCG | SW-AG-CEI | 0 | 0 | 0 | $64,221 |
| SCG | SW-AG-Calculated Incentives | 0 | 0 | 1,496,799 | $3,545,233 |
| SCG | SW-AG-Deemed Incentives | 0 | 0 | 924,465 | $1,067,167 |
| SCG | SW-COM CEI | 0 | 0 | 0 | $399,999 |
| SCG | SW-COM-Calculated Incentives | 0 | 0 | 5,844,240 | $9,239,849 |
| | **Total Statewide IALC** | **1,359,117,044** | **274,761** | **77,716,514** | **$403,931,888** |

*Table 2. 2015 IALC Programs Savings and Budget Summary*

| IOU | Program Name | Estimated KWh | Estimated KW | Estimated Therms | Budget |
|---|---|---|---|---|---|
| SCE | Industrial Energy Advisor | 120,509,751 | 0 | 0 | $1,794,545 |
| SCE | Industrial Calculated Incentives | 68,568,511 | 1,495 | 0 | $4,212,157 |
| SCE | Industrial Deemed Incentives | 0 | 792 | 0 | $1,555,273 |
| SCE | Industrial Continuous Energy Improvement | 192,948,162 | 0 | 0 | $887,112 |
| SCE | Industrial Third Party | 18,000,000 | 21,135 | 0 | $42,823,805 |
| SCE | Agriculture Energy Advisor | 12,421,810 | 2,076 | 0 | $3,172,896 |
| SCE | Agriculture Calculated | 4,535,772 | 361 | 0 | $1,136,820 |
| SCE | Agriculture Deemed | 31,016,699 | 419 | 0 | $836,138 |
| SCE | Commercial Calculated | 0 | 4,545 | 0 | $6,297,012 |
| SCE | Commercial CEI | 38,669,945 | 0 | 0 | $1,269,525 |
| SCE | Commercial SBD | 120,509,751 | 6,905 | 0 | $8,739,228 |
| PG&E | Industrial Energy Advisor | 358,002 | 213 | 49,167 | $3,132,289 |
| PG&E | Industrial Calculated Incentives | 27,978,459 | 3,734 | 3,337,558 | $13,763,312 |
| PG&E | Industrial Deemed Incentives | 3,153,346 | 691 | 174,086 | $1,204,021 |
| PG&E | Industrial Continuous Energy Improvement | 0 | 0 | 0 | $589,159 |
| PG&E | Third Party Industrial | 56,200,225 | 6,535 | 2,050,215 | $20,899,617 |

| IOU | Program Name | Estimated KWh | Estimated KW | Estimated Therms | Budget |
|---|---|---|---|---|---|
| PG&E | Agricultural Calculated Incentives | 24,661,234 | 5,242 | 1,501,966 | $10,240,375 |
| PG&E | AG Deemed Incentives | 12,281,345 | 5,762 | 155,874 | $3,815,997 |
| PG&E | AG Third parties | 14,902,779 | 2,123 | 227,964 | $8,227,091 |
| PG&E | AG Energy Advisor | 23,899,261 | 3,369 | 35,604 | $4,259,648 |
| PG&E | AG CEI | 0 | 0 | 0 | $506,988 |
| PG&E | SW Commercial Calculated Incentives | 68,844,271 | 7,084 | 2,395,580 | $25,132,514 |
| PG&E | Commercial SBD | 24,025,984 | 6,742 | 116,869 | $10,237,119 |
| PG&E | Commercial Deemed | 54,697,637 | 9,466 | 909,969 | $18,922,890 |
| PG&E | Commercial Energy Advisor | 7,960,408 | 3,104 | 1,217,783 | $5,979,427 |
| PG&E | Commercial HVAC | 6,805,062 | 2,122 | 209,214 | $18,277,223 |
| PG&E | Commercial 3P | 67,325,613 | 9,133 | 1,197,117 | $51,591,182 |
| PG&E | SW COM CEI | 0 | 0 | 0 | $491,754 |
| SDG&E | SW-IND- Benchmarking | 0 | 0 | 0 | $14,754 |
| SDG&E | SW IND – Audits NonRes | 0 | 0 | 0 | $240,589 |
| SDG&E | SW IND – Audits CIEEP | 0 | 0 | 0 | $440,859 |
| SDG&E | SW IND – CEI | 0 | 0 | 0 | $254,062 |
| SDG&E | SW IND -- Pump Test Services | 0 | 0 | 74,882 | $160,473 |
| SDG&E | SW IND -- Calculated Incentives | 3,802,070 | 222 | 14,686 | $1,444,593 |
| SDG&E | SW-IND-Deemed Incentives | 1,379,032 | 225 | 0 | $564,594 |
| SDG&E | SW-AG- Benchmarking | 0 | 0 | 0 | $6,533 |
| SDG&E | SW-AG Pump Test Services | 0 | 0 | 0 | $138,307 |
| SDG&E | SW AG – Audits | 0 | 0 | 0 | $106,599 |
| SDG&E | SW-AG Calculated Incentives | 1,901,035 | 111 | 37,441 | $623,270 |
| SDG&E | SW-AG Deemed Incentives | 689,416 | 112 | 7,960 | $257,877 |
| SDG&E | SW COM – CEI | 0 | 0 | 0 | $382,462 |
| SDG&E | SW—COM Pump Test Services | 0 | 0 | 0 | $159,392 |
| SDG&E | SW COM Calculated Incentives | 42,488,109 | 1,778 | 880,197 | $11,082,732 |
| SDG&E | SW-COM-Calculated Incentives-RCx | 5,853,670 | 160 | 820,940 | $3,231,960 |
| SDG&E | SW-COM-Calculated Incentives-Savings by Design | 12,139,049 | 3,405 | 38,898 | $5,240,036 |
| SCG | SW-IND-Energy Advisor | 0 | 0 | 0 | $615,730 |
| SCG | SW-IND CE 109,061 I | 0 | 0 | 0 | $324,017 |
| SCG | SW-IND-Calculated Incentives | 0 | 0 | 9,900,000 | $9,184,880 |
| SCG | SW-IND-Deemed Incentives | 0 | 0 | 646,582 | $1,048,590 |
| SCG | SW-AG-Energy Advisor | 0 | 0 | 0 | $39,703 |
| SCG | SW-AG-CEI | 0 | 0 | 0 | $32,200 |
| SCG | SW-AG-Calculated Incentives | 0 | 0 | 3,327,300 | $3,663,775 |
| SCG | SW-AG-Deemed Incentives | 0 | 0 | 214,744 | $502,829 |
| SCG | SW-COM CEI | 0 | 0 | 0 | $200,329 |
| SCG | SW-COM-Calculated Incentives | 0 | 0 | 3,836,700 | $5,195,394 |
| | **Total Statewide IALC** | **1,068,526,408** | **109,061** | **33,379,296** | **$315,151,656** |

*Table 11. 2016 IALC Programs Savings and Budget Summary*

| IOU | Program Name | Estimated KWh | Estimated KW | Estimated Therms | Budget |
|---|---|---|---|---|---|
| SCE | Commercial Deemed Incentives | 40,699,222 | 4,576 | 11,583,112 | $11,583,112 |

| IOU | Program Name | Estimated KWh | Estimated KW | Estimated Therms | Budget |
|---|---|---|---|---|---|
| | Program | | | | |
| SCE | Commercial Direct Install Program | 41,466,195 | 10,239 | 25,149,589 | $25,149,589 |
| SCE | Industrial Deemed Energy Efficiency Program | 2,137,150 | 372 | 1,555,273 | $1,555,273 |
| SCE | Agriculture Deemed Energy Efficiency Program | 311,019 | 88 | 836,138 | $836,138 |
| SCE | Lighting Innovation Program | 29,355,055 | 5,973 | 6,812,979 | $6,812,979 |
| SCE | California Community Colleges Energy Efficiency Partnership | 3,493,205 | 763 | 3,075,165 | $3,075,165 |
| SCE | California Dept. of Corrections and Rehabilitation EE Partnership | 1,485,540 | 80 | 644,167 | $644,167 |
| SCE | State of California Energy Efficiency Partnership | 744,732 | 230 | 744,787 | $744,787 |
| SCE | UC/CSU Energy Efficiency Partnership | 3,049,295 | 351 | 4,383,388 | $4,383,388 |
| SCE | Healthcare EE Program | 3,444,963 | 369 | 1,767,331 | $1,767,331 |
| SCE | Data Center Energy Efficiency | 4,174,463 | 462 | 2,340,661 | $2,340,661 |
| SCE | Lodging EE Program | 5,536,420 | 623 | 2,235,450 | $2,235,450 |
| SCE | Food & Kindred Products | 22,163,713 | 5,331 | 3,989,783 | $3,989,783 |
| SCE | Primary and Fabricated Metals | 21,277,509 | 2,848 | 4,104,991 | $4,104,991 |
| SCE | Nonmetallic Minerals and Products [7] | 18,085,946 | 2,615 | 4,627,969 | $4,627,969 |
| SCE | Comprehensive Chemical Products | 6,110,372 | 933 | 3,171,077 | $3,171,077 |
| SCE | Refinery Energy Efficiency Program | 0 | 0 | 0 | - |
| SCE | Cool Schools | 478,108 | 122 | 2,834,054 | $2,834,054 |
| SCE | Commercial Utility Building Efficiency | 1,808,271 | 672 | 2,687,097 | $2,687,097 |
| SCE | Energy Efficiency for Entertainment Centers | 0 | 0 | 0 | - |
| SCE | School Energy Efficiency Program | 5,323,463 | 1,830 | 1,004,898 | $1,004,898 |
| SCE | IDEEA365 Program | 5,229,213 | 783 | 4,194,654 | $4,194,654 |
| SCE | Enhanced Retrocommissioning | 3,611,093 | 200 | 986,116 | $986,116 |
| PGE | Commercial Calculated Incentives | 48,961,714 | 5,906 | 1,143,750 | $25,132,514 |
| PGE | Savings by Design (SBD) | 15,893,018 | 2,491 | 537,229 | $10,237,119 |
| PGE | Commercial Deemed Incentives | 41,304,382 | 7,691 | 2,379,779 | $18,922,890 |
| PGE | Commercial Continuous Energy Improvement | 0 | 0 | 0 | $491,754 |
| PGE | Commercial Energy Advisor | 0 | 0 | 0 | $5,979,427 |
| PGE | Commercial HVAC | 22,433,756 | 4,568 | 588,546 | $18,277,223 |
| PGE | Industrial Calculated Incentives | 18,339,418 | 1,794 | 3,742,441 | $8,712,285 |
| PGE | Industrial Deemed Incentives | 5,592,500 | 2,681 | 105,700 | $794,316 |
| PGE | Industrial Continuous Energy Improvement | 0 | 0 | 0 | $226,407 |
| PGE | Industrial Energy Advisor | 0 | 0 | 0 | $2,205,773 |
| PGE | Agricultural Calculated Incentives | 14,587,867 | 2,457 | 289,640 | $10,240,375 |

| IOU | Program Name | Estimated KWh | Estimated KW | Estimated Therms | Budget |
|---|---|---|---|---|---|
| PGE | Agricultural Deemed Incentives | 11,460,975 | 6,624 | 108,325 | $3,815,997 |
| PGE | Agricultural Continuous Energy Improvement | 0 | 0 | 0 | $506,988 |
| PGE | Agricultural Energy Advisor | 20,500,000 | 2,050 | 0 | $4,259,648 |
| PGE | Commercial Third Party Programs | 46,325,854 | 6,828 | 729,086 | $6,609,426 |
| PGE | Agricultural Third Party Programs | 19,155,749 | 2,281 | 1,161,302 | $8,227,091 |
| PGE | Industrial Third Party Programs | 50,129,793 | 6,509 | 2,994,481 | $20,899,617 |
| SDGE | SW-COM-Continuous Energy Improvement | 0 | 0 | 0 | $255,616 |
| SDGE | SW-COM-Calculated Incentives-Calculated | 11,630,694 | 1,796 | 364,800 | $4,031,116 |
| SDGE | SW-COM-Calculated Incentives-Savings by Design | 15,986,191 | 3,210 | 1,708 | $4,574,293 |
| SDGE | SW-IND-Continuous Energy Improvement | 0 | 0 | 0 | $255,965 |
| SDGE | SW-IND-Customer Services-Benchmarking | 0 | 0 | 0 | $27,224 |
| SDGE | SW-IND-Calculated Incentives-Calculated | 4,503,410 | 709 | 61,974 | $1,673,221 |
| SDGE | SW-IND-Deemed Incentives | 728,205 | 149 | 24,160 | $801,168 |
| SDGE | SW-AG-Customer Services-Audits | 0 | 0 | 0 | $106,104 |
| SDGE | SW-AG-Calculated Incentives-Calculated | 440,261 | 88 | 8,397 | $180,255 |
| SDGE | SW-AG-Deemed Incentives | 258,808 | 62 | 151,181 | $386,231 |
| SDGE | SW-COM-Calculated Incentives-RCx | 0 | 0 | 0 | $171,337 |
| SDGE | SW-IND-Customer Services-Audits CIEEP | 0 | 0 | 0 | $302,337 |
| SDGE | SW-AG-Customer Services-Pump Test Services | 0 | 0 | 0 | $211,623 |
| SDGE | SW-Ind-Customer Services-Pump Test Services | 0 | 0 | 0 | $231,189 |
| SDGE | SW-Com-Customer Services-Pump Test Services | 0 | 0 | 0 | $191,068 |
| SCG | SW-COM-CEI | 0 | 0 | 0 | $200,329 |
| SCG | SW-COM-Calculated Incentives | 0 | 0 | 3,836,700 | $5,195,394 |
| SCG | SW-IND-Energy Advisor | 0 | 0 | 0 | $615,730 |
| SCG | SW-IND-CEI | 0 | 0 | 0 | $324,017 |
| SCG | SW-IND-Calculated Incentives | 0 | 0 | 9,900,000 | $9,184,880 |
| SCG | SW-IND-Deemed Incentives | 0 | 0 | 646,582 | $1,048,590 |
| SCG | SW-AG-Energy Advisor | 0 | 0 | - | $39,703 |
| SCG | SW-AG-CEI | 0 | 0 | - | $32,200 |
| SCG | SW-AG-Calculated Incentives | 0 | 0 | 3,327,300 | $3,663,775 |
| SCG | SW-AG-Deemed Incentives | 0 | 0 | 214,744 | $502,829 |
| | TOTALS | 568,217,541 | 97,352 | 121,046,503 | $268,473,723 |

## Evaluation Role in Addressing Program Challenges and Uncertainty

Custom impact evaluations continue to find that the largest uncertainties in ex ante gross impact estimation are establishing baselines, screening for measure eligibility and accurately representing true operating conditions for individual projects. Related to the baseline issue is the tendency to mischaracterize the type of projects – for example, treating projects as early retirement opportunities or add-on projects, even when preponderance of evidence might suggest natural replacement of customer systems.

Other areas for focused ex ante gross impact improvement include key metrics and factors such as a current and comprehensive assessment of the following: market characterization, measure saturation, industry standard practice, effective useful measure life, and savings persistence. The evaluation also reviews whether programs are following best practices in modeling. The ex post evaluations and companion ex ante review activities focus on improvement in these areas for calculated (i.e., non-deemed or custom) offerings.

In addition, understanding the complexities of program influence on the customer decision-making process (net to gross), remains a very salient and crucial research challenge. To address this, field research is needed to arrive at ex post savings estimates that reliably account for and attribute all program influence, yielding net impact results that clearly inform program design, goals and supply forecasting, among other areas.

Beginning in the 2010-2012 portfolio period, CPUC staff implemented an ex ante parallel review process for calculated incentive projects. The intent of this process is to conduct collaborative review with the IOUs of savings calculations and program influence before an application is approved. This is intended to improve program effectiveness through changes in implementation processes and procedures. The ultimate goal, through these activities, is to bring the program realization rate as close to 1.0 as possible, thereby reducing uncertainty with respect to realized savings.

As in prior evaluations, the 2015 ex post evaluation of savings impacts is coordinated with the custom project ex ante review activity to optimize evaluation efforts. The impact review and results will provide useful and timely project review and program design and implementation feedback to the utilities and third party program implementers.

With respect to program implementation in these sectors, major challenges revolve around the requirements of program control, design and evaluation, given the constraints of business operations in the rapidly evolving economic and regulatory frameworks that characterize California's contemporary business climate. Overlaid on this foundational challenge are other constraints including the complexity, cost and time requirements of nonresidential calculated projects, as well as the customers' frequent requirement for relatively short payback periods. Targeted market evaluations will seek to address these challenges and conditions.

Installation of energy efficiency measures must also coincide with a window of opportunity on the customer side and be in sync with the portfolio period and associated program control and design features of the portfolio. Some of these challenges may be addressed going forward with the proposed

rolling portfolio approach, [15] and through opportunities identified via process evaluations/results or other means.

## Recent Evaluation Activities

### 2.3.2. 2013-2015 EM&V Studies, Budgets, and Timing

*Table 12. 2013-2015 IALC EM&V Studies, Budgets, and Timing*

| IALC Impact Studies | Study Manager | Budget | Completion Date |
|---|---|---|---|
| Nonresidential New Construction Whole Building Impact Evaluation (2013 projects) | CPUC Staff | $660,000 | Q3 2015 |
| NRNC Whole-Building Energy Use Profile Evaluation | CPUC | $100,000 | Q1 2017 |
| Custom Measures including New Construction | CPUC Staff | $7,055,000 | Q1 2017 |
| IALC Process Studies | | | |
| Non Residential Audits Process Evaluation –Large Integrated Audit Component and Energy Advisor Component (Small Medium Business/Mid-Market, Energy Advisor) | IOU | (Reallocated to other studies) ~~$120,000~~ | On hold pending new audit intervention |
| Energy Management and Information Systems (EMIS)/Whole Building Process Evaluation (On Hold) | PG&E | $100,000 | 2017 |
| IALC Market Studies | | | |
| Markets, Applications, Systems, Industries (MASI) – (Integrated Design for New Construction (ZNE), Motors: Baseline Motors, Ind/Food/Ag, and Refineries, Wastewater Treatment, Chain Operations, Food Processing Opportunities, Oil & Gas: New Opportunities and Produced Water, Agriculture: Greenhouse and Irrigated Agriculture) | IOU | $750,000 | Completed March 2015 |
| Savings by Design Hospital Baseline Study | PG&E | $17,000 | Completed Q1 2016 |

[15] Adoption of a rolling portfolio process in 2015 and beyond is being addressed in R. 13-11-005. A link to the proceeding is available at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Current+Proceeding+Activity.htm.

| IALC Impact Studies | Study Manager | Budget | Completion Date |
|---|---|---|---|
| Data Center Baseline Study | PG&E | $30,000 | Completed Q1 2016 |
| Industry Standard Practice Studies | PG&E | $37,000 | Completed Q4 2015 |
| Data Center Market Characterization Study: Phase 2 | PG&E | $131,000 | Completed Q3 2015 |
| Data Center Market Characterization: Phase 3 | PG&E | $100,000 | Q2 2016 |
| Industry Standard Practice (ISP) | IOUs | TBD | As needed |
| 2015 Savings by Design Healthcare Baseline Study | PG&E | $22,200 | Q4 2015 |
| Incremental Measure Cost | IOU | On Hold | On Hold |
| Market-based Incentives for Non-residential Programs | SCE | $200,000 | On Hold |

### 2.3.3. Study Descriptions for 2013-2015

| | |
|---|---|
| **Study Title:** Impact Study – Non-Residential New Construction (2013 program year) | **Budget:** $660,000 |
| **Completion Date:** Q3 2015 | **Study Manager:** CPUC staff |
| **Description:** Evaluation activities for estimating the gross and net energy impacts from Whole Building projects carried out under the statewide Savings by Design program in 2013. (For 2014, these projects are rolled into the Custom Measures Impact sample population). | |
| **Objective:** Examine program performance and opportunities for improvement, and provide recommendations accordingly; review current evaluation guidelines. | |
| **Key Research Questions:** What are the realized energy savings, load reductions and factors in driving the decision to install energy efficient equipment | |
| **Potential EM&V Methods:** site visits, metering, building energy simulation models, and decision maker and design-team surveys. | |

| | |
|---|---|
| **Study Title:** Impact Study -- Custom Measures – 2013-2014 | **Budget:** $4,655,000 |
| **Expected Completion Date:** 2016 | **Study Manager:** CPUC |
| **Description:** Ex post measurement and verification of program and measure impacts | |
| Objective:<br>• To produce ex post gross and net savings estimates (kWh, kW and therms) for custom measure Claims | |

| | |
|---|---|
| **Study Title:** Impact Study -- Custom Measures – 2013-2014 | **Budget:** $4,655,000 |
| **Key Research Questions:**<br>• What are the realized energy savings, load reductions and factors in driving the decision to install energy efficient equipment | |
| **Potential EM&V Methods:** Field measurement, desk review, modeling, decision maker surveys | |

| | |
|---|---|
| **Study Title: Impact Study -- Custom Measures** | **Budget: $2,400,000** |
| **Completion Date:** Q1 2017 | **Study Manager:** CPUC staff |
| **Description:** Ex post measurement and verification of program and measure impacts | |
| **Objective:**<br>• Produce ex post gross and net savings estimates (kWh, kW and therms) for custom measure Claims | |
| **Key Research Questions:**<br>• What are the realized energy savings, load reductions and factors in driving the decision to install energy efficient equipment | |
| **EM&V Methods:** Field measurement, desk review, impact modeling, decision maker surveys | |

| | |
|---|---|
| **Study Title: Energy Use Profile Study – NRNC Whole-Buildings** | **Budget: $100,000** |
| **Completion Date:** Q1 2017 | **Study Manager:** CPUC staff |
| **Description:** Billing data-based assessment of typical building energy use profiles following completion of construction | |
| **Objective:**<br>Inform ex ante and ex post modeling efforts and assumptions regarding stable energy use levels and implications for M&V and associated program design features | |
| **Key Research Questions:**<br>• Propose impact modeling solutions and program design features that address building usage profiles following construction and expected longer-term energy savings | |
| **EM&V Methods:** Billing data-based load profile development for whole-building new construction, assess implications for modeling and program design | |

| | |
|---|---|
| **Study Title:** Non Residential Audits Process Evaluation – Large Integrated Audit Component and Energy Advisor Component | **Budget:** TBD |
| **Expected Completion Date:** On Hold | **Study Manager:** PG&E |

| | |
|---|---|
| **Study Title:** Non Residential Audits Process Evaluation – Large Integrated Audit Component and Energy Advisor Component | **Budget:** TBD |
| **Description:** Build on 2006-2008 nonresidential audit evaluations and add components addressing Integrated Audits and the new Statewide Energy Advisor Program that feature audit offerings. | |
| **Objective:**<br>• Conduct process evaluation of new programs and examine the audit process as a delivery vehicle into incentive programs. | |
| **Key Research Questions:**<br>• Confirm and refine program theory and determine the effectiveness of program implementation for this new audit approach across both the small and large CIA market. | |
| **Potential EM&V Methods:** A mixture of qualitative and quantitative methods usually associated with process evaluations. | |

| | |
|---|---|
| **Study Title:** Market Characterization and Assessment – ( Integrated Design for New Construction (ZNE), Motors: Baseline Motors, Ind/Food/Ag, and Refineries, Wastewater Treatment, Chain Operations, Food Processing Opportunities, Oil & Gas: New Opportunities and Produced Water, Agriculture: Greenhouse and Irrigated Agriculture) | **Budget:** $750,000 |
| **Expected Completion Date:** Q3 2014 (Completed) | **Study Manager:** SCE |
| **Description:** Combine market characterization and wants and needs research to further define the C/I/A efficiency environment. | |
| **Objective:** Results will inform future portfolio efforts in the CIA segment via understanding opportunity, barriers, wants and needs. | |
| **Key Research Questions:** Identify growth areas and market sizing by NAICs or other criteria in combination with wants and needs research in order to enhance program delivery and measure penetration. Gather information to enhance the success of programs addressing these and related markets. Provide market data that describes new opportunities as well as constraints, and frames existing efforts within identified segments. | |
| **Potential EM&V Methods:** Interviews, surveys, secondary research | |

| | |
|---|---|
| **Study Title:** Savings by Design Healthcare Study | **Budget:** $17,000 |
| **Expected Completion Date:** Q4 2015 | **Study Manager:** PG&E |
| Description: This is part of a regular update of the Savings by Design Healthcare Baseline Study which provides specifications on healthcare facilities and medical office buildings design. | |

| **Study Title:** Savings by Design Healthcare Study | **Budget:** $17,000 |
|---|---|
| **Objective:** The Savings by Design Healthcare Baseline Study provides specifications of how healthcare facilities are currently being built in the state of California as it pertains to the envelope, lighting, mechanical equipment, domestic or service hot water systems as well as process loads and occupancy assumptions. | |
| **Key Research Questions:**<br>• What are the typical occupancy designations?<br>• What are the minimum fenestration requirements?<br>• Are there any issues with implementation?<br>• How has Title 24 changed the requirements? | |
| **Potential EM&V Methods:** A mixture of qualitative and quantitative methods usually associated with process evaluations. | |

| **Study Title:** Data Center Market Characterization Study: Phase 2 | **Budget:** $131,000 |
|---|---|
| **Expected Completion Date:** Q4 2015 | **Study Manager:** PG&E |
| **Description:** The Data Center Market Characterization Study is designed to understand the hard-to-reach market of embedded data center that are 5,000 sq-ft or less and located in office and industrial complexes. The research is built on a collaborative of Silicon Valley Power, Northwest Energy Efficiency Alliance, City of Palo Alto, Lawrence Berkeley National Laboratory and PG&E. The study will compile data on potential EE measures, savings estimates and information on the interaction between building owners, tenants and facility managers. | |
| **Objective:** Develop an enhanced understanding of the small-to-medium data center market, including current practices, barriers to energy efficiency adoption and best practices as obtained through focus groups with data center owners and managers, equipment manufacturers and vendors. | |
| **Key Research Questions:**<br>• What are the most likely adoptable EE measures for embedded data centers?<br>• What is the set of field protocols for measuring their EE savings potential?<br>• How can we test these protocols in the field? | |
| **Potential EM&V Methods:** A mixture of qualitative and quantitative methods usually associated with market characterizations. | |

| **Study Title: Data Center Market Characterization: Phase 3** | **Budget: $131,000** |
|---|---|
| **Expected Completion Date:** Completed Q1 2016 | **Study Manager:** PG&E |
| **Description:** Market characterization of the embedded data center space of telecom closets and rooms 5,000 sq-ft or less. | |

| Study Title: Data Center Market Characterization: Phase 3 | Budget: $131,000 |
|---|---|
| Objective:<br>• Estimate the savings potential of the embedded data center space by examining the end-user needs and energy savings potential of various measures. | |
| Key Research Questions:<br>• How can Dynamic Power Management (DPM) Setup and Implementation be performed in specific customer sectors such as engineering laboratories, biotech, municipalities and universities?<br>• What are Server Reference Measurements for deploying DPM?<br>• What is the calculation methodology for estimating energy savings in the EDC space? | |
| Potential EM&V Methods: Field testing. | |

| Study Title: Data Center Baseline | Budget: $37,000 |
|---|---|
| Expected Completion Date: Q1 2016 | Study Manager: PG&E |
| Description: This is part of a regular update of the Data Center Baseline Study. This document assists architects and engineers utilizing the New Construction and Retrofit Incentive Program with guidance on specifications that are consistent with Title 24-2013 and industry practice for data center construction. | |
| Objective:<br>• Ensure consistency in the documentation of building new construction and performing retrofits for Data Centers under the revised Title 24 rules. | |
| Key Research Questions:<br>• Are there any issues with implementation?<br>• How has Title 24 changed the requirements for new construction and retrofits? | |
| Potential EM&V Methods: Primary research with customers and industry experts as well as supplemental secondary research. | |

| Study Title: Industry Standard | Budget: $37,000 |
|---|---|
| Expected Completion Date: Ongoing | Study Manager: IOUs |

| **Study Title:** Industry Standard | **Budget:** $37,000 |
|---|---|
| **Description:** Continuation of ongoing measure eligibility studies. The studies to date that are suggested include: (To be determined); These will include high impact measures from IALC programs.<br><br>The Industry Standard Practice research completed as of November 2015 include:<br><br>• Pump Off Controller/Upstream: Oil Field Artificial Lift System/Rod Beam Pump<br>• Variable Frequency Drive/Upstream: Oil Field Artificial Lift System/Electric Submersible Pump<br>• Variable Frequency Drive/Upstream: Oil Field Artificial Lift System/Progressive Cavity Pump<br>• Variable Frequency Drive/Upstream: Oil Field Steam Generator/Feedwater Pump<br>• Variable Frequency Drive/Upstream: Oil Field Steam Generator/Air Blower<br>• Split Pass/Upstream: Oil Field Steam Generator/Split Pass<br>• Variable Frequency Drive/Upstream: Oil Field Steam Generator/Waste Water Injection Pumps<br>• Variable Frequency Drive/Midstream Oil: Motor 1,000-3,000/HP Oil Pipeline Pump<br>• Wine Tank Insulation<br>• Juice Tank Insulation | |
| **Objective:** Identify measures that have become industry standard practice. | |
| **Key Research Questions:** To help in the determination of appropriate baselines with market data primarily by determining if the measures/projects have become standard practice. | |
| **Potential EM&V Methods:** Primary research with customers and industry experts as well as supplemental secondary research. | |

| **Study Title: Industry Standard Practice** | **Budget: $37,000** |
|---|---|
| **Expected Completion Date:** Completed Q4 2015 | **Study Manager:** IOUs |
| **Description:** Continuation of 2013-2014 Cycle of Industry Standard Practice | |
| **Objective:**<br><br>• To review and understand what is Industry Standard Practice in specific situations, providing guidance to EE program implementers. | |
| **Key Research Questions:**<br><br>• What is considered industry standard practice in various sectors? | |
| **Potential EM&V Methods:** Interviews and secondary research. | |

| Study Title: Market Based Incentives for Nonresidential Programs | Budget: $200,000 |
|---|---|
| Expected Completion Date: ON HOLD | Study Manager: SCE |
| Description: The CPUC approached the IOUs to explore varying incentive rates. One example is by using locational DSM efforts which are based on varying avoided cost mechanisms. An examination of varying incentives to match varying avoided costs is therefore required. | |
| Objective:<br>• Examine various scenarios for varying incentive rates. | |
| Key Research Questions:<br>• How would using a locational Demand Side Management (DSM) method affect incentive | |
| Potential EM&V Methods: Data tracking and interviews. | |

| Study Title: Incremental Measure Cost Study | Budget: TBD |
|---|---|
| Expected Completion Date: TBD | Study Manager: IOU/CPUC TBD |
| Description: Recent IMC studies have answered some questions needed to support defensible and timely reporting of IMCs for nonresidential projects but a large gap still exists between what is required for reporting and what can be cost effectively determined from the status quo. | |
| Objective:<br>• Eliminate the need for collecting project specific Incremental Measure Costs (IMCs). | |
| Key Research Questions:<br>• What are the average new construction IMC values by project size, climate zone (CZ) and type? | |
| Potential EM&V Methods: TBD | |

| Study Title: 2015 Savings by Design Healthcare Baseline Study | Budget: $22,000 |
|---|---|
| Expected Completion Date: Q4 2015 (Completed) | Study Manager: PG&E |
| Description: Perform additional tweaks to the EnergyPro model for Savings by Design Healthcare as per CPUC consultant recommendations. | |
| Objective:<br>• Complete the Title 24 updates to the Savings by Design Healthcare Baseline with the requested changes based on Commission Staff consultant's recommendations. | |

| Study Title: 2015 Savings by Design Healthcare Baseline Study | Budget: $22,000 |
|---|---|
| Key Research Questions:<br>• What are the current practices and parameters for designing hospitals and medical office | |
| **Potential EM&V Methods:** Interviews and secondary research. | |

| Study Title: Energy Management and Information Systems (EMIS)/Whole Building Demonstration Process Evaluation (On Hold) | Budget: $100,000 |
|---|---|
| **Expected Completion Date:** ON HOLD | **Study Manager:** PG&E |
| **Description:** Process evaluation of proposed energy management system program efforts. | |
| Objective:<br>• Assess whether current whole building demonstration efforts are successful. | |
| **Key Research Questions:** N/A | |
| Potential EM&V Methods: N/A | |

### 2.3.4. Key Research Questions for 2016 and Beyond

**Proposed Energy Division 2016-2017 Budget: $7,964,154**
**Proposed Program Administrators 2016-2017 Budget: $750,000**

CPUC studies related to industrial, agriculture and large commercial programs and projects, as well as water programs and projects, will most likely be focused on impact evaluations as impact evaluation generally takes up a large part of the budget in this sector. In addition, some portion of the CPUC evaluation budget will be devoted to ex ante review activities. Additional study proposals for 2016 and beyond will be developed and presented for stakeholder review once the CPUC gets evaluation contractors on board.

*Table 6. 2016 and Beyond IALC EM&V Studies, Budgets, and Timing*

| IALC Impact Studies | Study Manager | Budget | Completion Date |
|---|---|---|---|
| Custom project impact evaluation including whole building nonresidential new construction | CPUC | $3,982,077 per year total | 2018 |
| Program Evaluation – Water Energy | CPUC | $TBD | 2018 |
| 2017 Studies | CPUC | $TBD | 2019 |
| **IOU Studies** | **Study Manager** | **Budget** | **Completion Date** |
| Market Based Incentive Study | SCE | $100,000 | 2016 |
| IALC Pilot Programs Process Evaluation | IOUs | $250,000 | 2018 |
| EE Potential in IALC- Phase 1: Identifying the Untapped Potential | IOUs | $125,000 | Q3 2017 |

| IALC Impact Studies | Study Manager | Budget | Completion Date |
|---|---|---|---|
| EE Potential in IALC- Phase 2: Market Characterization of Key EE Opportunity Markets | IOUs | $250,000 | Q4 2018 |
| SBD Tech Assist. | IOUs | 30,000 | Q2 2017 |
| Implementing Net Savings in IALC Custom Portfolio: A Whitepaper | IOUs | 30,000 | Q2 2017 |
| Evaluability Study for Commercial Whole Building and HOPPs | PG&E | 50,000 | TBD |
| Ongoing EM&V Microstudies | IOUs | <50,000 | Ongoing |
| 2017 Studies | IOUs | $500,000 | TBD |

### 2.3.1. 2016 and Beyond Study Descriptions

CPUC impact studies and IOU 2016 studies are listed below. This roadmap will be updated with 2017 studies when they are developed.

| Study Title: Impact Study -- Custom Measures | Budget: TBD |
|---|---|
| **Completion Date:** Q1 2018 and annually thereafter | **Study Manager:** CPUC staff |
| **Description:** Ex post measurement and verification of program and measure impacts | |
| **Objective:**<br>• Produce ex post gross and net savings estimates (kWh, kW and therms) for custom measure Claims | |
| **Key Research Questions:**<br>• What are the realized energy savings, load reductions and factors in driving the decision to install energy efficient equipment | |
| **EM&V Methods:** Field measurement, desk review, impact modeling, decision maker surveys | |

| Study Title: Program Evaluation – Water/Energy | Budget: TBD |
|---|---|
| **Completion Date:** Q1 2018 | **Study Manager:** CPUC staff |
| **Description:** Evaluation of water/energy programs | |
| **Objective:**<br>• Produce embedded energy and direct energy savings results for water/energy programs | |
| **Key Research Questions:**<br>• What are the embedded and direct energy savings from projects that save energy through cold water conservation | |
| **EM&V Methods:** Field measurement, desk review, impact modeling, decision maker surveys | |

| Study Title: Market Based Incentives (MBI) For Nonresidential Programs Study | Budget: $100,000 |
|---|---|
| **Completion Date:** TBD | **Study Manager:** SCE |

| Study Title: Market Based Incentives (MBI) For Nonresidential Programs Study | Budget: $100,000 |
|---|---|
| **Description:** Policymakers and leadership of the ED and IOUs have asked various questions about how we take Demand Side Management (DSM) to the market. On the one hand, Energy Division has approached the IOUs to explore varying nonresidential incentive rates for custom EE projects as a mechanism to improve custom portfolio resource value. On the other hand, the integration of locational programs into current EE DSM portfolios has led procurement leaders on the IOU side to ask how and if market locations should influence the determination of incentive rates. The SONGS mitigation efforts is one case where generation reductions/constraints in a particular physical market may require varying incentive rates or alternative incentive structures. | |
| **Objective:** Understand and estimate the locational impact or requirements of variable incentives on customer program participation. | |
| • **Key Research Questions:** How do the IOUs and the CPUC-ED take Demand-Side Management (DSM) to the market?<br>• Do market locations influence the determination of incentive rates? If so, how?<br>• How should incentive regimes respond to market or measure conditions? | |
| **EM&V Methods:** Interviews, market studies | |

| Study Title: IALC Pilot Programs Process Evaluation | Budget: $250,000 |
|---|---|
| **Expected Completion Date:** Q1 2018 | **Study Manager:** Statewide IOU |
| **Description**: Primary process evaluation to provide feedback on new and emerging IALC pilot programs. | |
| **Objectives:**<br>1. Document existing operations for new and emerging IALC pilot and demonstration programs<br>2. Identify and recommend improvements to programs to increase the programs' effectiveness as measured by advanced technology adoption, customer participation, depth of retrofit, and cost effectiveness | |
| **Key Research Questions:**<br>1. What are the hard-to-reach water savings opportunities in water and wastewater beyond pumps and how must the Water-Energy calculator be adjusted to accommodate these potential savings opportunities?<br>2. Evaluate the Savings by Operations (SBO) demonstration project. Identify "control group buildings" and compare them to the Savings By Operations projects to evaluate the impact of the SBO Program. | |
| **Potential EM&V Methods:** Focus groups, data mining and analytics | |

| Study Title: EE Potential in IALC- Phase 1: Identifying the Untapped Potential | Budget: $125,000 |
|---|---|
| **Expected Completion Date:** Q3 2017 | **Study Manager:** Statewide IOU |

| Study Title: EE Potential in IALC- Phase 1: Identifying the Untapped Potential | Budget: $125,000 |
|---|---|
| **Description:** The Untapped EE Potential in IALC study is based secondary research to mine existing data for untapped potential in Industrial, Agricultural and Large Commercial (IALC) including behavioral measures. Based on the past audits and the results of the 2015 Measure, Application, Segments and Industry (MASI) which identified IALC market potential at a high level and other research, this study aims to provide more in-depth quantification of the E savings opportunities (kWh, kW, therms, potential customers reached by NAICS code, service IDs, etc.). | |
| **Objective:** Develop an enhanced understanding of untapped opportunities, for example the small-to-medium data center market, including current practices, barriers to energy efficiency adoption and best practices as obtained through focus groups with data center owners and managers, equipment manufacturers and vendors. | |
| **Key Research Questions:**<br>1. What are key NAIC market segments and EEMs where large untapped EE opportunities exist in IALC?<br>2. How large and where are the new EE opportunities that the Internet of Things (IoT) and smart meter data offer in IALC and how can this data be used to identify and/or evaluate gross savings?<br>3. If Cannabis is legalized, what are key technologies and markets that offer the highest opportunity for E savings? How must EE programs change to accommodate this new industry?<br>4. What are the energy efficiency savings opportunities with existing conditions as the baseline (by NAICS and Measure Group)?<br>5. Others TBD | |
| **Potential EM&V Methods:** Data mining and analytics, secondary research review | |

| Study Title: EE Potential in IALC- Phase 2: Market Characterization of Key EE Opportunity Markets | Budget: $250,000 |
|---|---|
| **Expected Completion Date:** Q4 2018 | **Study Manager:** Statewide IOUs |
| **Description:** This study will build upon Phase 1 of the EE Potential in IALC study to do an in-depth analysis of how to best address the barriers that inhibit current programs ability to capture the untapped savings opportunities identified. | |
| **Objective:** Get a deep market understanding of key IALC customer segments that provides information useful in the design of targeted EE interventions to these markets. For example: develop an enhanced understanding of the small-to-medium data center market, including current practices, barriers to energy efficiency adoption and best practices as obtained through focus groups with data center owners and managers, equipment manufacturers and vendors. | |

| Study Title: EE Potential in IALC- Phase 2: Market Characterization of Key EE Opportunity Markets | Budget: $250,000 |
|---|---|
| Key Research Questions:<br>1. What are the key barriers and gaps with current program offerings that inhibit capturing the large untapped EE opportunities exist in IALC?<br>2. What are programmatic approaches that have succeeded?<br>3. What are customers and vendors wants & needs? | |
| Potential EM&V Methods: Secondary research, qualitative interviews of industry experts, vendors, customers | |

| Study Title: Technical Assistance Study - Program Design Exploration for a New Building Design Document Plus Training Program | Budget: $30,000 |
|---|---|
| Desired Completion Date: Q2 2017 | Study Manager: Statewide IOUs |
| Description: This study would explore what program design elements are needed to launch a successful technical assistance program focused on claiming savings through a customer's use of a building design standard template coupled with training for the project delivery team. | |
| Objective: The objective would be to outline a strawman program design for a new program (desired launch in mid-2017) that gets customers to design and build their existing facility retrofit projects to the most advanced technical specification possible. | |
| Key Research Questions:<br>1. What does the customer project journey look like from start to finish?<br>2. What would be the roles and responsibilities of internal and external stakeholders involved?<br>3. What ECMs and building types are ideal candidates for participation in such a program?<br>4. What would the M&V plan need to be for such a technical assistance program that claims savings?<br>5. What would a strawman program budget (e.g. $0 incentive dollars, $X training, etc.) and expected energy savings look like for 10, 25, 50 buildings? | |
| Potential EM&V Methods: A mixture of qualitative and quantitative methods usually associated with evaluability study | |

| Study Title: Implementing Net Savings in IALC Custom Portfolio: A Whitepaper | Budget: $30,000 |
|---|---|
| Desired Completion Date: Q2 2017 | Study Manager: Statewide |
| Description: Implementing Net Savings in IALC Phase 1: A Whitepaper would explore various issues in implementing net savings in the custom project portfolio. Based on the outcome of this whitepaper, a follow-up whitepaper - Strategies to Increase Net Savings in IALC Custom Portfolio: A Whitepaper -similar in scope and budget would be proposed addressing how to increase net savings. | |

| Study Title: Implementing Net Savings in IALC Custom Portfolio: A Whitepaper | Budget: $30,000 |
|---|---|
| **Objective:** This study would be designed to work in close collaboration with the CPUC-ED and other interested stakeholders. The objectives of this whitepaper would be multifold:<br>1. Document what "net" means and determine common definitions<br>2. Document how net savings are estimated in CA versus other jurisdictions<br>3. Document how AMI/smart meter data can be used<br>4. Identify best practices to propose to California. | |
| **Key Research Questions:**<br>1. How should net savings be measured in the custom world?<br>2. What is the definition of "net"? | |
| **Potential EM&V Methods:** Interviews with key subject-matter experts on net methods and EE EM&V 2.0 | |

| Study Title: Evaluability Study for Commercial Whole Building and HOPPs | Budget: $50,000 |
|---|---|
| **Expected Completion Date:** TBD | **Study Manager:** PG&E |
| **Description**: Based upon results from The Commercial Whole Building Demonstration Project, an early EM&V study is necessary to provide program guidance on tangible next steps for a successful program rollout. This methodology could also be used to provide early EM&V for High Opportunity Projects and Programs (HOPPS) projects. | |
| **Objective:**<br>The objective of this study is to provide early feedback using pre-defined key metrics on the progress of the Commercial Whole Building Program and HOPPs. | |
| **Key Research Questions:**<br>1. What changes need to be made to existing program design?<br>2. What incentive level changes need to be made, if any?<br>3. Do customers have significant barriers to participation and if so, what are they and how can they be overcome? | |
| **Potential EM&V Methods:** Customer interviews, focus groups or surveys, baseline studies, key metrics and literature reviews. | |

| Study Title: Ongoing EM&V Microstudies | Budget: TBD – Overall cumulative <$50,000 |
|---|---|
| **Expected Completion Date:** Ongoing | **Study Manager:** IOUs |
| **Description**: Ongoing EM&V Microstudies are a conglomeration of ideas in the form of targeted questions designed to increase energy efficiency uptake throughout the IALC sector and that do not warrant a full EM&V study. The funding for these comes from the EM&V primary and contingency budget and may be conducted leveraging internal PG&E resources (data analytics team, EM&V lead, engineering services or others). | |

| Study Title: Ongoing EM&V Microstudies | Budget: TBD – Overall cumulative <$50,000 |
|---|---|
| Objective:<br>These microstudies have tailored questions designed to be completed within a shorter timeframe than typical EM&V studies and with a smaller budget. | |
| Key Research Questions:<br><br>PG&E Led:<br>1. Is there precedent for a segment-based approach with multichannel delivery (i.e. DI, Deemed, Custom) delivered by a single implementer? If so, who are the market actors?<br>2. What non-monetary incentives have proven effective in EE programs across the country?<br>3. How can IALC Programs evaluate the depth of savings and cost effectiveness as efficiencies levels increases for common measures such as AHUs, chillers, boilers, lighting, and lighting controls? How can this information be used to create cost effectiveness/ROI curves that justify which efficiency levels to provide incentives and for how much?<br>4. What is the impact of measuring Commercial New Construction (Savings by Design) savings claims on the % better than T-24 vs. an Energy Use Intensity Calculation?<br>5. What is the difference between current savings calculations and future savings calculations?<br><br>Other IOU Led: TBD | |
| Potential EM&V Methods: Data mining and analytics, qualitative research | |

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## 2.4. Heating, Ventilation, Air Conditioning (HVAC)

### 2.4.1. Background

#### Sector Description

The HVAC sector PCG covers the portions of the residential and non-residential Investor Owned Utilities (IOU)-run HVAC programs that achieve energy and peak demand savings and market transformation through providing incentives for customers to install high efficiency HVAC equipment and providing installation and maintenance services designed to improve the efficiency of HVAC systems. These programs include the commercial and residential upstream incentive programs that provide rebates for highly efficient HVAC equipment, and programs that support high-quality residential and commercial maintenance and installation of HVAC equipment. Other HVAC activities outside of the HVAC upstream incentives and "quality" installation and maintenance programs that are in the IOU portfolios include downstream deemed HVAC measures provided by IOU Core, third party and local government programs. HVAC replacements in Energy Upgrade California, controls and retrofit work in custom non-residential programs, and HVAC measures associated with low-income energy efficiency direct install programs are outside the scope of this HVAC research roadmap.

#### Programs included in the Research Scope (PY 2013-2015)

The HVAC Roadmap will research activities in four broad topic areas: Upstream HVAC, Quality Maintenance (QM), Quality Installation (QI) and Deemed HVAC. Program activities studied under this Roadmap are identified below, along with the ex-ante estimated savings and budgets. Since HVAC measures are generally offered as a component of a larger program, budget estimates were obtained from the reported incentive payments and estimated program administration and marketing costs. For the 2013-14 cycle, savings and incentive data were obtained from the 2013-14 tracking data. For the 2015 program cycle, forecasted savings and incentive data were obtained from 2015 Program Compliance Filings.

**Upstream HVAC**

Upstream HVAC programs addressed only the non-residential sector during the 2013–14 program cycle. Each IOU has a single non-residential program where the upstream measures are administered. All of PG&E's 2013–14 upstream measures are administered through Program 21015- Commercial HVAC. SCE's 2013–14 upstream measures were administered through Program SCE-13-SW-002F, Non-Residential HVAC. SDG&E's 2013–14 upstream measures were administered through Program 3224, SW-COM-Deemed Incentives-HVAC Commercial. The 2013-14 program cycle savings and estimated budget for the Upstream HVAC component of each program are listed below:

***Table 7. 2013-2014 HVAC Programs, Savings and Budgets***

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| PGE21015 | COMMERCIAL HVAC | 35,077,015 | 5,730 | 104,154 | $16,895,140 |
| SCE-13-SW-002F | NONRESIDENTIAL HVAC PROGRAM | 77,901,683 | 16,751 | 11,848 | $26,978,799 |

| | | | | | |
|---|---|---|---|---|---|
| SDGE3224 | SW-COM-DEEMED INCENTIVES-HVAC COMMERCIAL | 186,629 | 86 | (1,111) | $103,346 |

Upstream rebates for residential HVAC systems were included in the 2015 Compliance Filing. The 2015 program cycle savings and estimated budget for the Upstream HVAC component of each program are listed below:

***Table 7. 2015 Upstream HVAC Programs, Savings and Budgets***

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| PGE21006 | Residential HVAC | 565,074 | 192 | (3,314) | $1,698,754 |
| PGE21015 | COMMERCIAL HVAC | 4,719,727 | 1,701 | 90,878 | $7,772,863 |
| SCE-13-SW-001E | Residential HVAC | 201,276 | 206 | - | $749,715 |
| SCE-13-SW-002F | NONRESIDENTIAL HVAC PROGRAM | 30,982,017 | 6,957 | 113,185 | $12,414,130 |
| SDGE3224 | SW-COM-DEEMED INCENTIVES-HVAC COMMERCIAL | 100,752 | 34 | (709) | $47,941 |

**Quality Maintenance**

PG&E is offering QM for the residential and non-residential sectors through its core HVAC offerings. 21006 – Residential HVAC and 21015 – Commercial HVAC. Additionally, 21016 Air Care Plus, a third-party AC tune-up program administered by PECI (now ClearResult), is available to commercial PG&E customers. SCE administers all of its commercial HVAC maintenance activities through SCE-13-SW-002F Commercial Quality Maintenance SDG&E is implementing HVAC maintenance measures in the residential and commercial sectors via three different programs - SDGE3212 Residential HVAC-QI/QM, SDGE3224 SW-COM-Deemed Incentives - Commercial HVAC and SDGE3226 SW-COM-Direct Install. The 2013-14 program cycle savings and estimated budget for the Quality Maintenance component of each program are listed below:

***Table 7. 2013-2014 Quality Maintenance HVAC Programs, Savings and Budgets***

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| PGE21006 | PG&E Residential QM | 2,192,733 | 2,236 | 29,447 | $5,015,268 |
| PGE21015 | PG&E Commercial QM | 10,085,877 | 970 | 621,897 | $4,391,088 |
| PGE21016 | PG&E Air Care Plus | 6,453,916 | 802 | 484,577 | $2,046,649 |
| SCE-13-SW-002F | SCE Commercial QM | 4,463,004 | 1,698 | 19,219 | $8,179,188 |
| SDGE3212 | SW-CALS - RESIDENTIAL HVAC-QI/QM | 432,735 | 210 | 17,814 | $168,387 |

| | | | | | |
|---|---|---|---|---|---|
| SDGE3224 | SDG&E Non Residential Deemed Incentive | 17,948,699 | 7,862 | -566 | $3,602,933 |
| SDGE3226 | SDG&E Non Residential Direct Install | 7,814,166 | 2,584 | -6,559 | $3,068,727 |

For 2015, a small amount of residential QM activity was forecasted for SCE. The 2015 program cycle savings and estimated budget for the Quality Maintenance component of each program are listed below:

***Table 7. 2015 Quality Maintenance HVAC Programs, Savings and Budgets***

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| PGE21006 | PG&E Residential QM | 625,100 | 583 | 18,002 | $3,456,237 |
| PGE21015 | PG&E Commercial QM | 965,614 | 7 | 61,578 | $6,041,865 |
| PGE21016 | PG&E Air Care Plus | 9,024,156 | 902 | 371 | $1,242,027 |
| SCE-13-SW-001E | Residential HVAC | 2,837 | 4 | 94 | $17,846 |
| SCE-13-SW-002F | SCE Commercial QM | 7,111,304 | 4,326 | 28,325 | $7,586,076 |
| SDGE3212 | SW-CALS - RESIDENTIAL HVAC-QI/QM | 5,828 | 8 | (4) | $76,069 |
| SDGE3224 | SDG&E Non Residential Deemed Incentive | 4,704,125 | 2,018 | (95) | $1,977,214 |
| SDGE3226 | SDG&E Non Residential Direct Install | 8,627,939 | 2,698 | (287) | $2,544,133 |

**Quality Installation**

In the 2013-14 program cycle, QI activities were limited to residential programs. SCE administers all of its residential HVAC QI activities through the SCE-13-SW-002E Residential HVAC program. SDG&E is implementing QI measure through the SDGE 3212 SW-CALS- Residential HVAC-QI/QM program. The 2013-14 program cycle savings and estimated budget for the Quality Installation component of each program are listed below:

***Table 7. 2013-2014 Quality Installation HVAC Programs, Savings and Budgets***

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| SCE-13-SW-001E | RESIDENTIAL HVAC PROGRAM | 2,564,453 | 1,747 | 27,170 | $487,151 |
| SDGE3212 | SW-CALS - RESIDENTIAL HVAC-QI/QM | 21,073 | 11 | 1,676 | $369,969 |

For 2015, a small amount of residential QI activity was forecasted for SCG. The 2015 program cycle savings and estimated budget for the Quality Installation component of each program are listed below:

***Table 7. 2015 Quality Installation HVAC Programs, Savings and Budgets***

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| SCE-13-SW-001E | RESIDENTIAL HVAC PROGRAM | 1,385,181 | 1,664 | 21,766 | $2,640,966 |

| | | | | | |
|---|---|---|---|---|---|
| SCG3706 | SW-CALS-Residential HVAC | 24,930 | 42 | 3,758 | $130,034 |
| SDGE3212 | SW-CALS - RESIDENTIAL HVAC-QI/QM | 39,879 | 23 | 1,854 | $295,684 |

**Deemed HVAC**

Other deemed HVAC measures are offered throughout the portfolios, through a combination of the Statewide Core programs, Third Party Programs, Institutional Partnership Programs and Local Government Partnership programs. The list of Statewide Core and Third Party programs in the 2013-14 program cycle offering deemed HVAC measures are listed below. These are not covered in the studies outlined above

***Table 7. 2013-14 Deemed HVAC Programs, Savings and Budgets***

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| PGE21002 | PLUG LOAD AND APPLIANCES | 123,446 | -10 | 1,288,386 | $849,635 |
| PGE21003 | MULTIFAMILY ENERGY EFFICIENCY REBATES PROGRAM | - | - | 6,713 | $72,751 |
| PGE21008 | ENHANCE TIME DELAY RELAY | 1,891,053 | 2,710 | -5,116 | $1,010,725 |
| PGE21009 | DIRECT INSTALL FOR MANUFACTURED AND MOBILE HOMES | 7,534,111 | 4,912 | -41,018 | $3,565,132 |
| PGE210111 | LODGINGSAVERS | 10,359,713 | 4,495 | | $3,009,347 |
| PGE210112 | SCHOOL ENERGY EFFICIENCY | -5,340 | - | 14,619 | $20,540 |
| PGE21012 | COMMERCIAL DEEMED INCENTIVES | 6,548,994 | 1,765 | 414,313 | $1,254,665 |
| PGE210122 | CASINO GREEN | 64,974 | 27 | - | $13,417 |
| PGE21017 | BOILER ENERGY EFFICIENCY PROGRAM | -11,016 | - | 363,757 | $313,480 |
| PGE21018 | ENERGYSMART GROCER | 105,178 | 183 | | $90,993 |
| PGE21022 | INDUSTRIAL DEEMED INCENTIVES | 25,565 | 7 | 17,604 | $9,088 |
| PGE210310 | DAIRY INDUSTRY RESOURCE ADVANTAGE PGM | 813,150 | 374 | - | $259,495 |
| PGE21032 | AGRICULTURAL DEEMED INCENTIVES | 108,389 | 39 | 808 | $30,852 |
| PGE21035 | DAIRY ENERGY EFFICIENCY PROGRAM | 45,780 | 21 | - | $15,594 |
| SCE-13-SW-001B | PLUG LOAD AND APPLIANCES PROGRAM | 1,760,106 | 2,132 | -304 | $534,466 |
| SCE-13-SW-001C | MULTIFAMILY ENERGY EFFICIENCY REBATE PROGRAM | 12,043 | 5 | -6 | $6,151 |
| SCE-13-SW-002C | COMMERCIAL DEEMED INCENTIVES PROGRAM | 15,294,881 | 2,644 | -17,895 | $1,814,469 |
| SCE-13-SW-002D | COMMERCIAL DIRECT INSTALL PROGRAM | 3,264 | 0 | 497 | $853 |
| SCE-13-SW-003C | INDUSTRIAL DEEMED ENERGY EFFICIENCY PROGRAM | 1,135,988 | 221 | -9,392 | $159,435 |
| SCE-13-TP-001 | COMPREHENSIVE MANUFACTURED HOMES | 5,130,738 | 2,609 | -23,177 | $4,410,180 |
| SCE-13-TP-003 | HEALTHCARE EE PROGRAM | 1,113,600 | 181 | -1,305 | $85,246 |
| SCE-13-TP-005 | LODGING EE PROGRAM | 331,000 | 51 | -88 | $14,335 |

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| SCE-13-TP-017 | ENERGY EFFICIENCY FOR ENTERTAINMENT CENTERS | 363,847 | 336 | 55,622 | $1,080,236 |
| SCE-13-TP-018 | SCHOOL ENERGY EFFICIENCY PROGRAM | 14,700 | 29 | - | $12,728 |
| SDGE3203 | SW-CALS-PLUG LOAD AND APPLIANCES-HEER | 23,640 | 14 | - | $37,147 |
| SDGE3204 | SW-CALS-PLUG LOAD AND APPLIANCES-POS REBATES | 35,388 | 32 | | $40,593 |
| SDGE3212 | SW-CALS - RESIDENTIAL HVAC-QI/QM | 423,426 | 194 | 17,773 | $101,074 |
| SDGE3223 | SW-COM-DEEMED INCENTIVES-COMMERCIAL REBATES | 3,741,477 | 531 | 177,602 | $367,978 |
| SDGE3224 | SW-COM-DEEMED INCENTIVES-HVAC COMMERCIAL | 429,363 | 175 | | $154,897 |
| SDGE3226 | SW-COM DIRECT INSTALL | 211,974 | -46 | 22,287 | $31,918 |
| SDGE3233 | SW-IND-DEEMED INCENTIVES | 29,750 | 5 | -54 | $3,112 |
| SDGE3279 | 3P-RES-COMPREHENSIVE MANUFACTURED-MOBILE HOME | 1,865,676 | 847 | 78,790 | $554,622 |

The list of Statewide Core and Third Party programs in the 2015 program cycle offering deemed HVAC measures not otherwise covered in the studies outlined above is shown below:

***Table 7. 2015 Deemed HVAC Programs, Savings and Budgets***

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| PGE21002 | Plug Load and Appliances | 2,429,738 | 885 | 171,230 | $869,098 |
| PGE21003 | Multifamily Energy Efficiency Rebates Program | - | - | 5,816 | $45,217 |
| PGE21006 | Residential HVAC | 61,329 | 99 | 33,049 | $302,658 |
| PGE21008 | Enhance Time Delay Relay | 918,766 | 1,485 | -23 | $657,650 |
| PGE21009 | Direct Install for Manufactured and Mobile Homes | 5,411,970 | 3,111 | -32,148 | $1,830,750 |
| PGE210111 | LodgingSavers | 2,340,669 | 1,113 | - | $800,508 |
| PGE21012 | Commercial Deemed Incentives | 2,267,242 | 462 | 42,656 | $388,018 |
| PGE210126 | K-12 Private Schools and Colleges Audit Retro | 5,338 | - | 871 | $1,178 |
| PGE21015 | Commercial HVAC | 1,098,990 | 416 | 56,821 | $422,886 |
| PGE21017 | Boiler Energy Efficiency Program | -90,769 | 0 | 153,213 | $149,278 |
| PGE21018 | EnergySmart Grocer | 1,188,000 | 191 | - | $106,232 |
| PGE21022 | Industrial Deemed Incentives | -28,681 | -4 | 93,636 | $5,602 |
| PGE210310 | Dairy Industry Resource Advantage Pgm | 490,500 | 225 | - | $293,919 |
| PGE21032 | Agricultural Deemed Incentives | - | - | - | $15,809 |
| SCE-13-SW-001B | Plug Load and Appliances Program | 789,841 | 849 | -22 | $578,233 |

| ID | Program | kWh Savings | kW Savings | therm Savings | Est Budget |
|---|---|---|---|---|---|
| SCE-13-SW-001C | Multifamily Energy Efficiency Program | 56,359 | 169 | -11,267 | $461,552 |
| SCE-13-SW-002C | Commercial Deemed Incentives Program | 5,375,443 | 781 | -712 | $657,908 |
| SCE-13-SW-002D | Commercial Direct Install Program | 258,826 | -54 | 32,127 | $40,132 |
| SCE-13-SW-002F | Nonresidential HVAC Program | 3,622,277 | 1,289 | 26,683 | $2,069,187 |
| SCE-13-SW-003C | Industrial Deemed Energy Efficiency Program | 683,078 | 112 | -97 | $97,959 |
| SCE-13-TP-001 | Comprehensive Manufactured Homes Program | 2,137,952 | 1,001 | -1,009 | $1,703,941 |
| SCE-13-TP-014 | Commercial Utility Building Efficiency | 3,271,167 | 2,137 | - | $1,153,237 |
| SCE-13-TP-018 | School Energy Efficiency Program | 12,052 | - | - | $1,925 |
| SCG3702 | SCG3702-SW-CALS-Plug Load and Appliances | - | - | 59,100 | $483,536 |
| SCG3703 | SW-CALS-Plug Load and Appliances - POS | - | - | 16,400 | $100,649 |
| SCG3704 | SW-CALS-MFEER | - | - | 4,000 | $16,479 |
| SCG3706 | SW-CALS-Residential HVAC | - | - | 67,900 | $1,040,273 |
| SCG3711 | SW-COM-Deemed Incentives | - | - | 50,210 | $85,741 |
| SCG3716 | SW-IND-Deemed Incentives | - | - | 960 | $1,020 |
| SCG3758 | 3P-PREPS | - | - | 5,693 | $2,509 |
| SCG3765 | 3P-Manufactured Mobile Home | 1,504,926 | 1,333 | 131,386 | $2,182,388 |
| SDGE3203 | SW-CALS-Plug Load and Appliances-HEER | 27,679 | 3 | 5,740 | $86,154 |
| SDGE3204 | SW-CALS-Plug Load and Appliances-POS Rebates | 86,496 | 132 | - | $83,182 |
| SDGE3211 | Local-CALS - Middle Income Direct Install (MIDI) | 5,116 | 6 | 1,945 | $154,425 |
| SDGE3212 | SW-CALS – Residential HVAC-QI/QM | 287,047 | 141 | 12,294 | $86,462 |
| SDGE3214 | SW-CALS - CAHP/ESMH-E Star Manufactured Homes | 66,920 | 19 | 870 | $18,688 |
| SDGE3223 | SW-COM-Deemed Incentives-Commercial Rebates | 634,506 | 108 | 120 | $52,832 |
| SDGE3224 | SW-COM-Deemed Incentives-HVAC Commercial | 679,919 | 280 | - | $330,066 |
| SDGE3226 | SW-COM Direct Install | 2,381 | 1 | -15 | $24,584 |
| SDGE3233 | SW-IND-Deemed Incentives | 79,096 | 14 | 13 | $6,643 |
| SDGE3239 | SW-AG-Deemed Incentives | 36,710 | 6 | 8 | $3,157 |
| SDGE3279 | 3P-Res-Comprehensive Manufactured-Mobile Home | 1,870,843 | 1,324 | 137,435 | $2,960,420 |

## Uncertainty and Challenges to Successful Implementation

The major goal of the IOU HVAC programs continues to be to transform the HVAC sector to increase the efficiency of equipment, improve customer practices and promote the proper installation and maintenance of HVAC units. However, the California HVAC market is currently facing challenges with poor installation quality and low compliance with HVAC related building codes and standards. Low customer awareness of the importance of optimally maintaining the systems throughout their lifecycle, causes the systems to not operate efficiently, resulting in lost energy savings. The California Energy Commission estimates that less than 10 percent of HVAC work is performed under proper building permits and that poor installation and maintenance results in HVAC system over-use by 20 to 30 percent regardless of rated efficiency.[16] Transforming the market, behavior and practices in the HVAC sector is also of critical importance because HVAC is one of the largest energy end-uses across California and is the primary driver of resource constraint during hot summer peak demand events. This has led to special emphasis on HVAC as an end-use with respect to energy savings. HVAC has a chapter of the California Long-Term Energy Efficiency Strategic Plan dedicated to it, and is the focus of one of the four "Big Bold Energy Efficiency Strategies" developed by the CPUC in 2007. HVAC is the only end-use highlighted in that way: "Heating, Ventilation and Air Conditioning (HVAC) will be transformed to ensure that its energy performance is optimal for California's climate." In 2010 as a follow-up to the HVAC chapter in the Strategic Plan the CPUC published a more detailed "HVAC Action Plan" which identified specific activities designed to achieve the goals. The Western HVAC Performance Alliance (WHPA) maintains the HVAC Action Plan, tracks progress, and sets annual goals to address activities identified in the HVAC Action Plan. The WHPA's joint effort by the IOUs and the HVAC industry comprised of an executive committee and several technical subcommittees. Additional information on the WHPA is available at http://www.performancealliance.org/.

## Emerging Evaluation and Information Needs

Despite evaluation efforts to better understand the aforementioned gaps through the 2010-12 evaluation period, we do not yet have sufficient data about HVAC market behavior to make well-informed decisions for long-term market transformation efforts. In particular, from a Quality Maintenance perspective, the PCG is interested in knowing how current and future HVAC research can best guide programs to target and remediate the worst performing existing HVAC systems.

The utilities' proposed ex ante savings estimates have been challenged and reduced through ex ante review of IOU workpapers. Issues identified in the workpaper dispositions include establishing an appropriated baseline for HVAC efficiency and the appropriateness of assumptions used to develop energy savings estimates for the QI and QM programs.

The question of baseline covers multiple topics. First, what is the true as-found state of HVAC systems in California with respect both to their design and installation? How have the systems changed since

[16] California Energy Commission, Strategic Plan to Reduce the Energy Impact of Air Conditioners (Jun 2008), http://energy.ca.gov/2008publications/CEC-00-2008-010/CEC-400-2008-10.pdf.

installation, including introduction of non-condensables during service, state of charge level and other characteristics? What are the baseline practices with respect to maintenance, installation, sales, and distribution? What is the baseline level of technician skill and diligence? Finally, what is the role of codes, as not all HVAC activity involves a code-triggering event?[17] These are all important outstanding issues. While HVAC has been held up as an area of high importance, research into these pressing questions has not been sufficient in previous program cycles.

### 2.4.2. Ex Ante Coordination

Ex ante processes (including DEER updates, Uncertain Measures List updates, work paper reviews, and custom project reviews) incorporate data and results from the latest EM&V studies. The ex ante values that are relevant to this sector are highlighted in this section; they may also be included in other relevant chapters.

**Summary of DEER 2016 Updates:**

- All commercial space heating boiler measures are updated with new standard case and HVAC system type applicability
- All IEER-rated HVAC measures from DEER2015 are updated with expanded IEER rating values
- General revisions to building prototypes based on laboratory and field data.

**Summary of 2015 Uncertain Measure Updates:**

To assess what measures to move off and/or add onto the Uncertain Measures List requires looking ahead to IOU portfolios and analysis of ex ante and ex post teams. The current 2015 Uncertain Measures List (http://www.cpuc.ca.gov/NR/rdonlyres/9F79154A-065B-4E80-B1AC-58A6E7223F91/0/Final_2015_ESPI_Uncertain_List.pdf) contains the following items for this sector and shall be prioritized in the evaluation studies. The list of 2016 uncertain measures will be released in October 2016 for consideration and listed in the final evaluation plan.

**2015 Uncertain Measures**

| Measure Description | Comments on Need | PGE | SCE | SDGE | SCG |
|---|---|---|---|---|---|
| HVAC Quality Maintenance activities | Change in program design and maturing program offering with many new measures makes assumption for impact highly uncertain. The lack of coordination between electric and gas utility offerings further makes | X | X | X | X |

[17] Related to QI a building permit is required where activities related to air flow, refrigerant charge and duct sealing on a new construction or equipment replacement.

| | | | | | |
|---|---|---|---|---|---|
| | the assumption uncertain | | | | |
| HVAC mini-split system | This new technology is now widely available yet expensive with limited applicability. Performance has not been studied and free ridership is uncertain. | | X | | |

**Coordinated Efforts**

Ex ante staff leads and ex post staff leads will coordinate processes, studies, and timelines to better align the flow of information between ex ante and ex post projects. Ex post evaluation studies provide data and results for ex ante updates. Planning for ex ante updates in the future will also require evaluation planning and input. Evaluation studies will need to budget time and schedule to provide input into ex ante processes, such as the DEER and the uncertain measures list. Currently, ex ante funding is budgeted under the overall ex ante contract. More information about the budget is provided in the Ex Ante Review section of this document.

**Next planned DEER Update**

The DEER updates related to HVAC measures in 2017 and 2018 are as follows:.

| Measure Category | Content |
|---|---|
| Non-Residential Packaged HVAC Measures | All IEER-rated HVAC measures have updated IEER rating values due to code requirements that specify both EER **and** IEER minimum |
| Non-Residential Water Chiller Measures | Chiller measures have been updated to conform with current Title 24 requirements and to allow scaling to non-DEER defined tiers |
| Residential Insulation Measures | A correction has been made to the method used to size residential HVAC systems in DEER2015 |
| Residential HVAC Sizing Correction | A correction has been made to the specification of some existing ceiling and wall insulation measures |
| Refrigerant Charge Adjustment | Measure parameters are updated based on recent EM&V data |

**Program Administrators' Planned Work Paper Submissions**

Program Administrators submit planned work papers for the upcoming portfolio cycle to Commission staff. These work papers often use DEER data and/or methodology to add technologies that are not in DEER to the energy efficiency portfolio.

| PA | Sector | Tech Type | Measure/Value /Parameter | Reason for the Update/New Workpaper |
|---|---|---|---|---|

| PA | Sector | Tech Type | Measure/Value /Parameter | Reason for the Update/New Workpaper |
|---|---|---|---|---|
| SCG | Commercial | HVAC | Rooftop Unit Heat Recovery, NonRes (Fast food restaurant) | New Measure |
| SCG | Residential | HVAC | Boiler Reset Control, Res MF | New/update measure |
| SCE | Commercial | HVAC | Commercial Quality Renovation: Reduce Overventilation | WP doesn't exist. Proceeding through SCE's intake process. Lab testing and building energy simulation may be performed. |
| SCE | Commercial | HVAC | Commercial Quality Renovation: Duct Insulation | WP doesn't exist. Proceeding through SCE's intake process. Lab testing and building energy simulation may be performed. |
| SCE | Commercial | HVAC | Commercial Quality Renovation: Duct Leakage | WP doesn't exist. Proceeding through SCE's intake process. Lab testing and building energy simulation may be performed. |
| SCE | Commercial | HVAC | Commercial Quality Renovation: Static Pressure Reduction and Flow Optimization | WP doesn't exist. Proceeding through SCE's intake process. Lab testing and building energy simulation may be performed. |
| SCE | Commercial | HVAC | Smart Thermostat | WP doesn't exist. Study in progress. |
| SCE | Commercial | HVAC | Indirect Evaporative DOAS | WP doesn't exist. ET study in progress. |
| SCE | Commercial | HVAC | Commercial Quality Maintenance: Economizer Repair | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial | HVAC | Commercial Quality Maintenance: Economizer Control | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial | HVAC | Commercial Quality Maintenance: Programmable Thermostat | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial | HVAC | Commercial Quality Maintenance: Condenser Coil Cleaning | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial | HVAC | Commercial Quality | PG&E-led effort to update this work |

| PA | Sector | Tech Type | Measure/Value /Parameter | Reason for the Update/New Workpaper |
|---|---|---|---|---|
| | | | Maintenance: Unoccupied Supply Fan Control | paper based on WO032. |
| SCE | Commercial | HVAC | Commercial Quality Maintenance: Evaporator Coil Cleaning | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial | HVAC | Commercial Quality Maintenance: Refrigerant Charge | PG&E-led effort to update this work paper based on WO032. |
| SCE | Commercial | HVAC | Variable Refrigerant Flow Commercial Heat Pumps & Heat Recovery Systems >65kBtu/h | Existing work paper that was not approved by the ED. PG&E is leading the effort to revise the paper. |
| SCE | Residential | HVAC | Quality Installation For Residential Split Systems & Packaged Units | Communicating with ED on workpaper update process |
| PG&E | Residential | HVAC | Residential HVAC Quality Maintenance (QM) | DEER2017/2018 update |
| PG&E | Residential | HVAC | 95 AFUE Furnace Res | DEER2017/2018 update |
| PG&E | Residential | HVAC | 97 AFUE Furnace Res | DEER2017/2018 update |
| PG&E | Residential | HVAC | Duct Test & Seal: Residential | DEER2017/2018 update |
| PG&E | Commercial | HVAC | Air-Cooled Packaged Chillers | DEER2017/2018 update |
| PG&E | Residential | HVAC | Residential Upstream HVAC | DEER2017/2018 update |
| PG&E | Residential | HVAC | Energy Upgrade California Home Upgrade | DEER2017/2018 update |
| PG&E | Commercial | HVAC | Unitary Air-Cooled Com AC and HP >65kBtuh | DEER2017/2018 update |

### 2.4.3. Key Research Questions to be addressed in 2013-2015 EM&V

***Table 13. 2013-2014 HVAC EM&V Research Questions Summary with 2015 Add-on***

| Study Name | Research Questions [2013-2015] |
|---|---|
| **Impact** | |
| Impact Evaluation of Commercial and proposed Residential Upstream HVAC Programs | • What are the first year and lifecycle gross and net kWh, kW and therm impacts? |

| Study Name | Research Questions [2013-2015] |
|---|---|
| Impact Evaluation of Residential and Commercial Quality Installation Programs and proposed incentives for "to code" installations in the Residential sector | • What are the first year and lifecycle gross and net kWh, kW and therm impacts? |
| Impact Evaluation of Residential and Commercial Quality Maintenance Programs | • What are the first year and lifecycle gross and net kWh, kW and therm impacts? |
| Impact Evaluation of Deemed HVAC Measures | • What field data can inform DEER updates and work paper review/revisions?<br>• What measures and parameters should be studied in future impact evaluations? |
| HVAC Laboratory Testing | • What are the efficiency and capacity impacts of common HVAC system faults?<br>• Can efficiency impact data on QM service actions provide data to improve diagnostic protocols and field test procedures? |
| **Market** | |
| Market Assessment to Identify Baselines and Barriers for Existing HVAC Conditions, Building Permit and Title 24 Compliance | • What are the baselines for CA HVAC industry standard practice in obtaining building permits and achieving 2008 Title 24 compliance for Residential and Commercial HVAC equipment replacements? |
| Market Assessment of Residential and Commercial Customer Decision-making on High Efficiency HVAC Systems, Quality Maintenance and Quality Installation | • What are the drivers behind QI/QM/high efficiency customer purchasing decision-making across various market sectors? |
| Comparison of AMI Billing Analysis Methods for Estimating Energy Savings from Residential and Commercial Quality Maintenance | • What are effective methods for disaggregating HVAC loads from site loads?<br>• What are effective methods for using whole building interval data for measuring the impacts of maintenance programs?<br>• What opportunities exist for marrying load cycling with HVAC programs to optimize site energy consumption? |
| HVAC Contractor & Technician Behavior Phase II | • What opportunities and challenges surrounding HVAC contractor and technician behavior remain after the completion of the Phase I project? |
| Commercial Market Tracking Gap Analysis | • What are the gaps in our understanding of the current commercial HVAC maintenance market and practices?<br>• How can filling in those gaps lead to better program design and influence?<br>• Is there a neighboring HVAC market that provides a good barometer for the influence of California HVAC |

| Study Name | Research Questions [2013-2015] |
|---|---|
| | programs? |

### 2.4.4. Study Description and Objectives for 2013-2015

***Table 14. 2013-2015 HVAC EM&V Studies, Budgets, and Timing***

| Study | Estimated Budget | Study Lead | Final Completion Date |
|---|---|---|---|
| Impact Evaluation of Commercial Upstream HVAC Programs (HVAC1) | $2,185,497 | ED | Q1 2017 |
| Impact Evaluation of Residential Quality Installation Programs and pilot "to code" installation programs in the Residential sector (HVAC2) | $300,000 | ED | Q2 2017 |
| Impact Evaluation of Commercial Quality Maintenance Programs (HVAC3) | $2,363,030 | ED | Q1 2017 |
| Impact Evaluation of Deemed HVAC Measures (HVAC4) | $513,970 | ED | Q1 2017 |
| HVAC Laboratory Testing (HVAC5) | $1,250,000 | ED | Q4 2016 |
| Market Assessment to Identify Baselines and Barriers for Existing HVAC Conditions, Building Permit and Title 24 Compliance (HVAC6) | $1,678,000 | ED | Q2 2017 |
| Market Assessment of Residential and Commercial Customer Decision-making on High Efficiency HVAC Systems, Quality Maintenance and Quality Installation | $300,000 | IOU | Apr-15 |
| Comparison of AMI Billing Analysis Methods for Estimating Energy Savings from Residential and Commercial Quality Maintenance | $275,000 | IOU | Mar-16 |
| HVAC Contractor & Technician Behavior Phase II | $250,000 | IOU | Apr-15 |
| HVAC System Evaluation versus Measure Evaluation – White Paper | Cancelled | IOU | Cancelled |
| Customer Targeting Pilot Evaluation | $175,000 | IOU | TBD |
| HVAC Permitting Characterization | Cancelled | IOU | Cancelled |
| HVAC Billing Analysis with AMI Data: Phase II | $350,000 | IOU | Q1 2017 |
| **Total IOU HVAC EM&V Budget** | | | **$1,350,000** |

| Study | Estimated Budget | Study Lead | Final Completion Date |
|---|---|---|---|
| **Total ED HVAC EM&V Budget** | | | **$8,290,497** |
| **Total HVAC EM&V Budget** | | | **$9,640,497** |

### 2.4.5. 2013 -2015 Study Descriptions for HVAC Programs

| | |
|---|---|
| **Study Title:** Impact Evaluation of Commercial and Residential Upstream HVAC Programs | **Budget:** $1,950,000<br>2015 Add-on: $285,497 |
| **2013-14 Completion Date:** April 1, 2016<br>**Expected 2015 Completion Date:** Q1 2017 | **Study Manager:** ED |
| **Description:** Objectives for this study are to quantify first year and lifecycle gross and net kWh, kW and therm impacts. | |
| **Objective:**<br>• Commercial Upstream HVAC is a major component of the HVAC portfolio and the IOUs have included upstream incentive programs for residential sector in their portfolio for 2015.<br>• Impact evaluation of these types of programs were included in the 2010-2012 HVAC evaluations, but critical questions still need to be addressed.<br>• New commercial HVAC equipment efficiency standards will make it more difficult to claim savings from upstream HVAC programs.<br>• The efficiency of HVAC equipment that is incentivized through the upstream program as installed is not well known and represents an important area of uncertainty.<br>• Installation quality and distribution system efficiency are not well known in the general HVAC upgrade market. | |
| **Key Research Questions:**<br>What are the first year and lifecycle gross and net kWh, kW and therm impacts? | |
| **EM&V Methods:**<br>• Research Plan - http://www.energydataweb.com/cpucFiles/pdaDocs/1325/HVAC_1 Upstream research plan DRAFT final Public.pdf<br>• 2013-14 Gross Impacts: http://www.energydataweb.com/cpucFiles/pdaDocs/1498/HVAC1%20Impact%20Report%20Final.pdf<br>• Cover commercial HVAC equipment promoted by upstream program. Residential HVAC equipment may be included in 2015 based on program accomplishments.<br>• Prioritize based on participation of HVAC units that are being incentivized in the upstream program.<br>• Will cover split systems, packaged rooftop units, PTACs, and chillers.<br>• Field measurement of key parameters of participant HVAC equipment across a variety of commercial building types and climate zones. May also include data collection of participants and non-participant residential HVAC equipment as the program becomes more mature.<br>• 2015 Add-on will provide additional funding for activities to reduce parameter uncertainty of uncertain measures and potentially end use metering of those measures. A 2015 plan addendum | |

| **Study Title:** Impact Evaluation of Commercial and Residential Upstream HVAC Programs | **Budget:** $1,950,000<br>2015 Add-on: $285,497 |
|---|---|
| will be developed to define the 2015 activity. | |

| **Study Title:** Impact Evaluation of Residential Quality Installation Programs | **Budget:** $300,000 |
|---|---|
| **Expected 2013-14 Completion Date:** Q2 2017 | **Study Manager:** ED |
| **Description:** Objectives for this study are to review Quality Installation programs and assess permitting pilot programs. | |
| **Objective:**<br>• Quality Installation programs are a key component of the overall goals for HVAC savings and for achieving the energy efficiency goals outlined in the CPUC Strategic Plan.<br>• Residential QI was a component of the 2010-2012 evaluation, but the commercial programs have been slow to roll out or haven't been launched. The CPUC EE Decision on 2013-2014 IOU Applications directed the IOUs to create a pilot program for to code installations.<br>• Savings are highly uncertain, causing relatively low projected budgets and savings goals for 2013-2015.<br>• Benefits beyond Title 24 requirements for HVAC installations for new construction or time of replacement are not well known.<br>• With growing interest in "whole building" design, especially because of AB 758 and Energy Upgrade California, there is a need to better understand how well HVAC contractors participating in IOU programs are ensuring maximized savings to their customers though ensuring the tightness of the building envelope and other "whole building" design aspects.<br>• Rigorous study and quantification of QI savings is needed to assess the true potential for energy savings of these programs | |
| **Key Research Questions:**<br>What are the first year and lifecycle gross and net kWh, kW and therm impacts? | |
| **EM&V Methods:**<br>• Research Plan - http://www.energydataweb.com/cpucFiles/pdaDocs/1374/HVAC_2 QI and Code Compliance Research Plan Year 2 QI and CCIPP - Public Version.pdf<br>• Process evaluations of QI and Code Compliance Incentive Pilot Programs.<br>• Desk review of QI program participants and to-code installations.<br>• Objectives are to gain a better understanding of first year and lifecycle gross and net kWh, kW and therm impacts of QI and code compliance efforts. | |

| **Study Title:** Impact Evaluation of Residential and Commercial Quality Maintenance Programs | **Budget:** $1,530,000<br>2015 Add-on: 850,000 |
|---|---|
| **2013-14 Completion Date:** April 1, 2016<br>**Expected 2015 Completion Date:** Q1 2017 | **Study Manager:** ED |
| **Description:** Objectives for this study are to quantify first year and lifecycle gross and net kWh, kW and therm impacts. | |
| **Objective:** | |

| **Study Title:** Impact Evaluation of Residential and Commercial Quality Maintenance Programs | **Budget:** $1,530,000<br>2015 Add-on: 850,000 |
|---|---|
| • Quality Maintenance programs are a key component of the overall goals for HVAC savings and for achieving the energy efficiency goals outlined in the CPUC Strategic Plan.<br>• Commercial QM programs were a component of the 2010-2012 evaluation, but results were inconclusive. The program participation for residential QM has been slow to ramp up, but the IOUs are projecting in most cases increased participation in these programs going forward.<br>• New program designs for 2013-2014 introduced multiple service actions for which impact data are sparse.<br>• Program designs continued to evolve as 2010-2012 impact data became available; impact evaluations will likely need to be updated in 2013-2015 cycle as program designs change. | |
| **Key Research Questions:** What are the first year and lifecycle gross and net kWh, kW and therm impacts? | |
| **EM&V Methods:**<br>• Research Plan - http://www.energydataweb.com/cpucFiles/pdaDocs/1373/HVAC3 Quality Maintenance Research Plan FINAL 2013-14.pdf<br>• 2013-14 Gross Impacts: http://www.energydataweb.com/cpucFiles/pdaDocs/1504/HVAC3%20Commercial%20Quality%20Maintenance%20Programs-%20Impact%20Evaluation%20Report.pdf<br>• Net-to-gross (DRAFT): http://www.energydataweb.com/cpucFiles/pdaDocs/1623/HVAC3%20NTG%20Final%20Report.pdf<br>• Impact evaluation covers commercial QM programs, with a focus on measures and treatments that are considered to have the highest impact in projected energy savings, such as a focus on RCA, coil cleaning, economizer maintenance and repair, thermostat replacement, and supply fan control in the Commercial sector.<br>• Calibrated simulation modeling will be used to project annual savings from monitored data and estimate savings by individual service action.<br>• 2015 Add-on includes billing analysis of residential participating units. 2015 Add-on provided funding for additional commercial site visits. A 2015 plan addendum will be developed to define the 2015 activity. | |

| **Study Title:** Impact Evaluation of Deemed HVAC Measures | **Budget:** $300,000<br>2015 Add-on: $150,000 –Pending Review] |
|---|---|
| **2013-14 Completion Date:** October 2016<br>**Expected 2015 Completion Date:** Q2 2017 | **Study Manager:** ED |
| **Description:** Objective is to provide field data for DEER updates and work paper review/revisions; and identify measures and parameters for future impact studies. | |
| **Objective:**<br>• 2010-2012 HVAC evaluations have focused on a subset of deemed HVAC measures.<br>• Custom HVAC measures are covered under custom program evaluation.<br>• Gap exists for deemed HVAC measures that are not addressed in QI, QM or upstream rebate activities. Examples include ductless mini-split air conditioners and heat pumps, HVAC controls, VFDs for HVAC applications, boilers and furnaces. | |
| **Key Research Questions:** | |

| **Study Title:** Impact Evaluation of Deemed HVAC Measures | **Budget:** $300,000<br>2015 Add-on: $150,000 –Pending Review] |
|---|---|
| • What field data can inform DEER updates and work paper review/revisions?<br>• What measures and parameters should be included in future EM&V studies? | |
| **EM&V Methods:**<br>• Year 1 Report: http://www.energydataweb.com/cpucFiles/pdaDocs/1284/DeemedHVACMeasures.pdf<br>• Year 2 Report (DRAFT): http://www.energydataweb.com/cpucFiles/pdaDocs/1617/HVAC-4%20Year%202%20DRAFT%20Report%202016-07-26.docx<br>• Scope identified evaluation gaps based on a combination of the magnitude of the savings and the uncertainty in the DEER or work paper estimates.<br>• Uncertainty analysis of selected measures<br>• Information to inform other studies to conduct field data collection focusing on obtaining parameter level data as required to reducing savings uncertainty.<br>• 2015 Add-on will provide additional funding to focus on the uncertainty of simulation based measures, especially those studied in the Upstream and QM evaluations. | |

| **Study Title:** Laboratory Testing of HVAC QM procedures | **Budget:** $1,000,000<br>2015 Add-on: $) |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |
| **Description:** Objectives are to obtain efficiency impact data on QM service actions and provide data to improve diagnostic protocols and field test procedures. | |
| **Objective:**<br>• HVAC QM laboratory testing is an ongoing activity spanning multiple program cycles.<br>• Laboratory testing provides impact data and insights into HVAC system response to service actions that are not possible in a field study.<br>• Laboratory testing is seen as an integral part of the overall QM impact evaluation procedure. | |
| **Key Research Questions:**<br>• What are the efficiency and capacity impacts of common HVAC system faults?<br>• Can efficiency impact data on QM service actions and provide data to improve diagnostic protocols and field test procedures? | |
| **EM&V Methods:**<br>• Research Plan - http://www.energydataweb.com/cpucFiles/pdaDocs/1205/LabTesting_Research_Plan_12-4-14_HVAC5.pdf<br>• Additional tests identified in the 2013-2014 plans but not completed will be addressed during the 2015 cycle. Results from 2013-2014 testing may also suggest additional tests for the 2015 cycle.<br>• Tests will be conducted in qualified laboratories following AHRI, ASHRAE and/or ANSI standards as applicable.<br>• 2015 Add-on will continue the testing as done in previous cycles. A 2015 plan addendum will be developed to define the 2015 activity. | |

| **Study Title:** Market Assessment to Identify Baselines and Barriers for Existing HVAC Conditions, Building Permit and Title 24 Compliance | **Budget:** $1,450,000<br>2015 Add-on: $325,000 |
|---|---|
| **Expected Completion Date:** Q3 2016<br>**Expected 2015 Completion Date:** Q1 2017 | **Study Manager:** ED |

**Description:** Objectives are to identify baselines for CA HVAC industry standard practice in obtaining building permits and achieving 2008 Title 24 compliance for Residential and Commercial HVAC equipment replacements.

**Objective:**

- As stated in SB 454, the State of California is interested in investigating the failure of contractors to comply with building energy efficiency standards (Title 24, Part 6) and to obtain required building permits[18]. To improve utility energy efficiency program effectiveness, as well as to inform state policy making, this study intends to identify baselines for CA HVAC industry standard practice in obtaining building permits and achieving 2008 Title 24 compliance for Residential and Commercial HVAC equipment replacements. Both baselines are hypothesized to be low and will be estimated in this study along with the impact of permits on costs and system performance. This study will attempt to produce a rigorous estimate (both a top down and bottom up perspective) of the current permitting in the state for HVAC installation in alterations to existing buildings (change-outs); the degree of variance across jurisdictions; reasons for variance; and if there are any lessons to be learned from the differences. This study will estimate the percent of projects that obtained required building permits and comply with building energy efficiency standards (Title 24, Part 6).
- Investigate permitting and compliance separately to determine whether non-permitted projects are compliant and if permitted projects are compliant.
- Evaluate efficacy of HERS raters and if inspected jobs meet Title 24 requirements.
- Examine barriers and awareness of HERS raters on the code requirements and inspection processes. Identify knowledge gaps where training could help HERS raters to better impact compliance with Title 24 HVAC requirements.

**Key Research Questions:** What are the baselines for CA HVAC industry standard practice in obtaining building permits and achieving 2008 Title 24 compliance for Residential and Commercial HVAC equipment replacements?

**EM&V Methods:**

- Research Plan – http://www.energydataweb.com/cpucFiles/pdaDocs/1239/HVAC WO6 Final MAPC Research Plan_25Feb2015.pdf
- Interim Memo #1 - http://www.energydataweb.com/cpucFiles/pdaDocs/1598/HVAC6%20Market%20Assessment%20of%20Residential%20HVAC%20Installations%20Results%20Phase%20One_FINAL.pdf
- The research focuses on the residential sector; however, it also includes a limited sample of nonresidential HVAC change-outs to investigate the presence of a permit and compliance requirements. The research will leverage data from previous studies were known change-outs occurred or where HVAC equipment is aging and has a higher probability of being replaced. The CA

[18] http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0451-0500/sb_454_cfa_20110516_105446_sen_comm.html

| **Study Title:** Market Assessment to Identify Baselines and Barriers for Existing HVAC Conditions, Building Permit and Title 24 Compliance | **Budget:** $1,450,000<br>2015 Add-on: $325,000 |
|---|---|

2009 Residential Appliance Saturation Study (RASS) will be basis of the residential sample. The Commercial Market Share Tracking (CMST) YR 2012 will be the basis for the non-residential sample.

- For residential permit and compliance the research team will identify eligible sample and recruit for onsite inspections (regardless of the status of the permit).
- The team will on-site survey sample of RASS program participants (permitted/unpermitted) to obtain T24 compliance baseline estimates and collect data related to Title 24 2008 compliance requirements.
- The team will phone or site survey CA building departments to obtain permits from the site survey sample.
- Once an onsite has been completed the team will overlay the permit data collected at building departments and bin the results into categories of permitted and non-permitted. A statistician will extrapolate the compliance and permit results back to the population level.
- For commercial, the project will leverage data collected from CMST, analyze the field data for compliance analysis, and research the permit status. Borrowing methods from the residential approach, the team will report by category of permit and non-permit. A statistician will extrapolate the compliance and permit results back to the population level.
- To estimate the permit rate, the above methods will inform the "bottom-up" method. A second "top-down" method will be researched. For this method the team will collect permit data (multi-mode survey) from a sample of permit departments and reported sources to obtain total permit counts. To estimate total sales the team will leverage reports and public data such as AHRI.
- The project will conduct a thorough review and analysis of the documentation available in the HERS registry.
- This analysis will request a large volume of QA/QC test (i.e., two years' worth) to measure the frequency of errors found. The frequency of errors will then be extrapolated to the population of unaudited units to estimate the overall percent of projects that may be non-compliant.
- To examine barriers and awareness of HERS raters, the team will phone a sample of raters to inform the survey guide and conduct a multi-mode (most likely online survey) with experienced HVAC HERS raters.
- 2015 Add-on will provide additional budget to existing tasks (estimating top down permit rate, project and contractor management and final reporting).
- 2015 Add-on will add additional market actor surveys or interviews as needed. A 2015 plan addendum will be developed to define the 2015 activity.
- 2015 Add-on may verify permit status for HVAC programs and identify customers' barriers to permitting and compliance.

| **Study Title:** Market Assessment of Residential and Commercial Customer Decision-making on High Efficiency HVAC Systems, Quality Maintenance and Quality Installation Purchases | **Budget:** $300,000 |
|---|---|
| **Completed:** April 2015 | **Study Manager:** IOU |

| **Study Title:** Market Assessment of Residential and Commercial Customer Decision-making on High Efficiency HVAC Systems, Quality Maintenance and Quality Installation Purchases | **Budget:** $300,000 |
|---|---|
| **Description:** Objective is to identify the drivers behind QI/QM/high efficiency customer purchasing decision-making across various market sectors. | |
| **Objective:**<br>• Identify how the benefits of HVAC industry standards-based quality maintenance and installation and equipment efficiency are perceived by market actors.<br>• In the context of leveraging consensus HVAC industry standards to define minimum service quality levels, identify market intervention strategies for increasing customer understanding of the QM/QI value proposition to increase their receptiveness to contractor QM/QI offerings and eventually proactively demand QM/QI in manner that contractors understand and can meet with the appropriate QM/QI services (seek to align perspectives between demand and supply sides similar).<br>• Address research priorities or data needs identified in the U.C. Davis Western Cooling Efficiency Center (WCEC) HVAC customer study [results pending]. | |
| **Key Research Questions:** What are the drivers behind QI/QM/high efficiency customer purchasing decision-making across various market sectors? | |
| **EM&V Methods:**<br>• Final Report - http://www.energydataweb.com/cpucFiles/pdaDocs/1269/CDM_Report_2015-04-15_FINAL.pdf<br>• Coordinate sample design and data collection with site surveys during "Market Assessment: Identifying Baselines and Barriers for Existing HVAC Conditions, Building Permit and Title 24 Compliance" to survey QI/QM program participants and nonparticipants. | |

| **Study Title:** Comparison of AMI Billing Analysis Methods for Estimating Energy Savings from Residential Quality Installation and Quality Maintenance | **Budget:** $275,000 |
|---|---|
| **Completed:** March 2016 | **Study Manager:** IOU |
| **Description:** Objectives are to explore methods for disaggregating HVAC loads from site loads, estimating savings from whole building interval data, and exploring opportunities for marrying load cycling with HVAC programs to optimize site energy consumption. | |
| **Objective:**<br>• Use billing regression models and AMI data to estimate HVAC program impacts when both whole-house AMI data and HVAC end-use metered data are available, and;<br>• Use billing regression models and AMI data to estimate HVAC program impacts when only whole-house AMI data are available (i.e., no HVAC metered data are available). | |
| **Key Research Questions:**<br>• What are effective methods for disaggregating HVAC loads from site loads?<br>• How can these methods be adapted to measuring energy savings resulting from QI and QM activities? | |
| **EM&V Methods:**<br>• Final Report: | |

| **Study Title:** Comparison of AMI Billing Analysis Methods for Estimating Energy Savings from Residential Quality Installation and Quality Maintenance | **Budget:** $275,000 |
|---|---|
| http://www.energydataweb.com/cpucFiles/pdaDocs/1479/AMI%20Report%20Volume%201%20FINAL.pdf<br>• End-use and whole building metering of residential buildings<br>• Regression analysis of whole building data with comparison to end-use metering<br>• Pre/post regression analysis of whole building interval data to estimate savings from RQI and RQM program participants | |

| **Study Title:** HVAC Contractor & Technician Behavior Phase II | **Budget:** $250,000 |
|---|---|
| **Completed:** April 2015 | **Study Manager:** IOU |
| **Description:** Objectives are to further understanding of the opportunities and challenges surrounding HVAC contractor and technician behavior. | |
| **Objective:**<br>• The objectives of this study are to better understand HVAC:<br>  ○ Training Needs – training and testing criteria necessary for certifications to meet/exceed HVAC service quality levels as defined by HVAC industry standards.<br>  ○ Quality Installation Skills Standards – estimate impacts of program requirements for skill standards that promote technician certifications on program participation rates as well as potential incremental costs and benefits for customers.<br>  ○ Technician Implementation Challenges – technological, communication, business model, etc. issues that technicians encounter in the field.<br>  ○ Business Models – approaches to aligning business model priorities with best practices from training to deliver QI/QM to meet/exceed HVAC service quality levels as defined by HVAC industry standards.<br>  ○ MTIs - Operationalize five HVAC Market Transformation Indicators for future data collection.<br>• Determine technicians' awareness and use of industry standards.<br>• Determine the roll and efficacy of various types of technician training and certification. | |
| **Key Research Questions:** What opportunities and challenges surrounding HVAC contractor and technician behavior remain after the completion of the Phase I project? | |
| **Potential EM&V Methods:**<br>• Final Report - http://www.energydataweb.com/cpucFiles/pdaDocs/1292/HVAC C&T Behavior Phase2 FINAL REPORT.pdf<br>• Interviews with HVAC Contractors<br>• Interviews with HVAC technicians<br>• Interviews with market actors<br>• Interviews with program implementers<br>• Secondary research review to inform operationalization of MTIs | |

| **Study Title:** Customer Targeting Pilot Evaluation | **Budget:** $175,000 |
|---|---|
| **Expected Completion Date:** TBD – Pending AMI | **Study Manager:** IOU (Statewide HVAC, PG&E Lead) |

| **Study Title:** Customer Targeting Pilot Evaluation | **Budget:** $175,000 |
|---|---|
| Phase II Results | |
| **Description:** California is home to a diverse customer base, spread across highly varied climates. With limited program resources, more savings may be possible by targeting customers with new data analytics capabilities made possible with the advent of AMI data. | |
| **Objective:**<br>• Provide EM&V support to determine both process improvements and challenges in implementing customer targeting schemes. Set the stage for better marketing efforts and program planning. | |
| **Key Research Questions:**<br>• Can customer targeting be an effective program strategy to achieve greater savings and cost effectiveness?<br>• Can new billing analysis methods be used to provide quality metrics of program success? | |
| **Potential EM&V Methods:**<br>• Surveys and interviews with important market actors<br>• Billing analysis methods including random coefficients modeling | |

| **Study Title:** HVAC Billing Analysis with AMI Data: Phase II | **Budget:** $350,000 |
|---|---|
| **Expected Completion Date:** Q1 2017 | **Study Manager:** IOU (Statewide HVAC, PG&E Lead) |
| **Description:** Initial efforts to demonstrate the feasibility of using billing analysis techniques, especially the random coefficients modeling approach, have proven promising in the residential sector. This follow-on study will shore up any open methodological questions and determine if similar strategies can be used successfully in evaluation of commercial HVAC programs. | |
| **Objective:**<br>• Address any outstanding issues remaining from Phase I of the billing analysis research on residential programs<br>• Determine if similar methods can be used effectively to evaluate commercial HVAC program savings. | |
| **Key Research Questions:**<br>• What new evaluation methodologies can best take advantage of interval data?<br>• Are these methodologies appropriate for impact evaluation?<br>• Is the Random Coefficients Modeling approach useful for evaluation of savings from commercial HVAC programs? | |
| **EM&V Methods:**<br>• Research Plan: http://www.energydataweb.com/cpucFiles/pdaDocs/1568/AMI_PhaseII_ResearchPlanDRAFT.pdf<br>• Billing analysis methods including random coefficients modeling | |

## Other Important Considerations

It will be critical to leverage Codes & Standards/Zero Net Energy, Emerging Technologies, and Workforce Education & Training (WE&T) PCGs, as well as HVAC Action Plan and Codes & Standards Action Plan, efforts to optimize information sharing for research.

### 2.4.6. Research Questions for 2016 and Beyond

**Proposed 2016-2017 Energy Division Budget: $5,029,992 (2016-2017)**

The upcoming years for the HVAC evaluation activities will continue to explore challenges with implementing and quantifying maintenance and installation programs. It is anticipated that the completion of current studies may reveal new areas of interest, resolve outstanding issues, and reveal market study needs for the HVAC sector. Impact and uncertain parameter updates will continue to be an important focus for this research area. Evaluation adaptations emerging from the implementation of AB802 related to baseline changes and meter-based program designs may also need to be addressed in this evaluation plan for the future. The need to update past net-to-gross studies for consistency with the revised baselines is one of several areas affected by the legislation. Net to gross studies have renewed importance due to the change from gross to net savings goals.

Given the span of HVAC evaluations, it may be time to take a retrospective look at how programs have evolved since initiation to understand future potential. Studies could examine program participation over time, and percentage of residential or commercial customers that have participated in HVAC program activity. Additional analysis of the location or demographics of participants may also provide valuable information on identifying future opportunity.

Energy Division will consider implementing the following list of studies in 2016 and beyond to address these issues; but all concepts and budgets will be revisited and prioritized once contractors are brought on board.

| Study Title | Description | Estimated Budget |
|---|---|---|
| Industry standard practices for maintenance | Evaluations of CQM programs have been difficult due to the lack of pre-service data. Programs have recruited quality contractors to improve the quality of the maintenance services, but NTG ratios have suffered as a result. A study of general maintenance practices in the industry will help establish baseline equipment condition and the prevalence of CQM activities in the general HVAC marketplace. | $880k |
| NTG updates consistent with Existing equipment baseline | Deemed net to gross ratios in DEER and recently evaluated net to gross ratios assume a code baseline for certain measure types. Measures now subject to an existing conditions baseline will need to have the net to gross ratios re-evaluated so that the gross and net savings are consistent. The measure by measure baseline assignments are being updated in a working group led by ED with assistance from ERS. Once the assignments are know, the NTGRs will need to be updated consistent with the assigned baseline. | $590k |
| Commercial distribution system study | Upstream HVAC replacement programs provide incentives to place new and efficient equipment on existing buildings. However, little is known about the remaining system components. In particular, distribution systems that are located in unconditioned spaces may leak excessively, greatly reducing the installed system efficiency. This study will provide baseline information for establishing realistic distribution efficiencies for upstream program participants. | $295k |
| Field performance | Variable refrigerant flow (VRF) and mini-split systems are a growing | $295k |

| Study Title | Description | Estimated Budget |
|---|---|---|
| of VRF and mini-split HVAC systems | part of the HVAC portfolio. Literature reviews and baseline system type surveys have been conducted, but little field data on the installed operation of these systems has been collected | |
| Other deemed measures | Deemed measures comprising a growing portion of the HVAC portfolio that have not been evaluated include smart thermostats, high efficiency furnaces, electronically commutated (EC) motor replacements in furnaces and air handlers, HVAC boilers, VFD and advanced digital economizer controller (ADEC) add-ons to existing HVAC units, and packaged terminal air conditioner (PTAC) controls. | $590k |
| Continuation of HVAC -1 and HVAC – 3 based on field results. | Depending on the results of the 2015 evaluations of Upstream HVAC, Commercial Quality Maintenance (CQM), and residential quality maintenance (RQM) programs, additional sample may be needed to improve the relative precision of the estimates. | $590k |
| Lab testing | Lab testing has been an important foundation of the HVAC evaluation effort for several years. Continuing work in the lab is needed to answer remaining research questions, evaluate additional FDD protocols and address maintenance impacts for new generation R-410a equipment. | $590k |
| WB billing approach validation study | Validation of normalized metered consumption analysis techniques for HVAC programs has been hampered by a lack of monitored HVAC performance data to validate HVAC end-use disaggregation and energy savings algorithms. This study will provide a robust sample of commercial HVAC end-use metered buildings to validate the ability of whole building approaches to detect and quantify HVAC loads within the whole-building data and validate savings estimates for HVAC interventions | $590k |
| HVAC program retrospective | Examine program percentage of residential and commercial customers that have participated over time. Conduct additional analysis of the location and demographics of participants to inform the direction of future HVAC programs | $295k |

**Proposed 2016-2017 Program Administrator Budget: $610,000**

Program Administrator budget allocations to specific studies have not been fully allocated due to uncertainty around Business Plan approval. The IOUs have earmarked these remaining funds to be allocated to 2017 study needs once Business Plan approval is in place.

| | |
|---|---|
| **Study Title:** Develop and Test Residential HVAC Customer Targeting Parameters | **Budget**: $20,000 |
| **Expected Completion Date:** Q1 2017 | **Study Manager:** IOUs (PG&E Lead) |
| **Description:** Recent research indicates that a relatively small percentage of customers in residential HVAC programs are responsible for a majority of the total program savings when observed at the | |

| **Study Title:** Develop and Test Residential HVAC Customer Targeting Parameters | **Budget**: $20,000 |
|---|---|
| meter. This study will explore customer targeting techniques for use in residential downstream HVAC energy efficiency programs. | |
| **Objective:** Identify and optimize targeting techniques that identify subsets of the general population that are most likely to save the most energy through residential downstream HVAC energy efficiency programs. | |
| **Key Research Questions:**<br>• What customer targeting techniques are most useful for maximizing energy savings? | |
| **Potential EM&V Methods:** this project will analyze existing AMI data for recent PG&E residential downstream HVAC maintenance programs; to test targeting techniques; it will apply them to past participants. The project builds off of a project completed in summer 2016 at PG&E. | |

| **Study Title:** Granularity of AMI data for Estimating HVAC Savings | **Budget**: $170,000 |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** IOUs |
| **Description:** AB 802 requires that AMI metering data to be used as a basis for determining energy savings. For commercial and residential HVAC energy efficiency programs, energy savings from either quality installation or quality maintenance programs are currently based on filed workpapers or DEER savings estimates using broad assumptions and "rules of thumb." Energy savings from these two methods are difficult to apply to HVAC configurations, system types, control schemes, building types/ orientations, occupancy types, and other variables that are unique to nearly every installed system encountered by contractors and technician.<br><br>The IOUs have completed Phase I of a study of AMI metering data can be used to estimate energy savings from HVAC system performance improves achieved through regular standards-based maintenance programs or unit/system replacements. This study resulted in the development of a mathematical model can be for examining metering data to accurately predict expected energy savings.<br><br>Phase II of this research (approved for 2016) would further develop and refine the model.<br><br>Phase III, proposed here, would be used to finalize the model for various building types, load shapes, control schemes, and other factors in order to more effectively distinguish HVAC energy usage from other end uses and "noise" so that sufficient data granularity for estimating energy usage and savings can be gleaned from the AMI metering data. | |
| **Objective:** Further **r**efine the AMI metering data HVAC modeling algorithm to fit a variety of different building, system, and climate zones so that it is better able to measure changes in HVAC energy performance resulting from maintenance or unit/system replacement. | |

| **Study Title:** Granularity of AMI data for Estimating HVAC Savings | **Budget**: $170,000 |
|---|---|
| **Key Research Questions:**<br>• How can the current AMI energy modeling algorithm be modified and applied to:<br>  • Different building types/configurations/orientations?<br>  • Different building usages?<br>  • Different unit types and system configurations?<br>  • Different control schemes?<br>  • Different climate zones.<br>• What adjustments to the model are necessary to distinguish HVAC system usage from other building loads and "noise" that would mask changes in system performance?<br>• What is the feasibility of using AMI metering data for "proving" savings and using these savings as a basis for program incentives to boost participation in maintenance and early replacement programs?<br>• What is the feasibility of using AMI data as a means of identifying potential customers who might benefit from either a regular maintenance program or early replacement of their HVAC unit/system? | |
| **Potential EM&V Methods:** Continuation of the development of the Random Coefficient Modeling technique | |

# 2.5. Local Government Partnerships

## Recent Changes

In 2015, this chapter was reformatted to become a LGP (local government partnerships) – only document.[19]

In 2014, the Energy Division (ED) introduced a new forum, the Stakeholder Advisory Group (StAG), to provide local governments and their partnership implementers a greater voice in matters pertaining to the local government sector's Evaluation, Measurement, and Verification (EM&V) programming and project management decisions. In addition to local governments and partnership implementers, the StAG also includes the seven State energy efficiency (EE) program administrators, and thus also serves as the advisory body to the REN-CCA roadmap and its project activities. Together with other experts and advocates, the StAG engages in consensus-building discussions of local government-related EM&V projects via conference calls six times per year.

The StAG represents an addition to and evolution of the PCG for IOU LGPs. The PCG is an approximately every-eight-weeks forum for the investor-owned utilities (IOUs) – who oversee administration of the State's more than 50 local government partnerships – to engage with ED and its advisor staff on EM&V planning and programming decisions.

## 2.5.1. Background

The origins of local government partnerships date to 2002. In 2002-2003, the CPUC approved local government programs for IOU contract, and some local governments (LGs) operated building retrofit programs using other public funds. In 2003-2005, the CPUC expanded funding of local government EE efforts across the four IOUs (Pacific Gas & Electric (PG&E), Southern California Edison (SCE), Southern California Gas (SoCalGas), and San Diego Gas & Electric (SDG&E). The 2008-2009 cycle represented an increase in CPUC-approved resources going to this sector and this period saw adoption of the EE Long-term Strategic Plan. In the year 2010-2012 cycle, the CPUC made available significant funding resources for PG&E and SCE to promote Strategic Plan activities and strategies with PG&E's Innovator Pilots in the amount of $17m, and SCE LGP pilots at $32m.[20] The same CPUC budget decision also introduced SEEC (the Statewide Energy Efficiency Collaborative (SEEC) as a ratepayer-funded resource for local governments. Strategic Plan support projects and SEEC best practices support continue to be integral program features to the LGPs. The 2010-2012 cycle represented a major expansion in the number of LGPs and resources directed to LG-derived EE solutions.

LGPs are structured variously within the energy efficiency portfolio as city, county, and regional government-led partnerships. It is also not uncommon to have a private or non-profit implementer arrangement. Implementers are expected to handle IOU contracting issues, drive and be accountable for goal setting and achievement, disburse funds to their member LGs, and serve as the face of the partnership to the CPUC and other entities.

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[19] The Institutional (State agency) Partnerships are tracked within the Commercial chapter and a companion chapter provides treatment for REN (Regional Energy Networks) – CCA (Community Choice Aggregators) evaluation plans.

[20] D.09-09-047

*Sector and Program Area Long Term Research Roadmaps* - Local Government Partnerships

The 2013-2015 program cycle also marked a period of IOU expansion of the sector and growth in local agency capacity to deliver EE. In PG&E's territory, increased emphasis on energy savings potential through small-medium-business (SMB) direct install (DI) projects unlocked and informed by its LGPs. PG&E's ramp up of its DI-LGP integration had the IOU rethink its third-party delivery approach, enfolding it under its EE partnerships and reinforcing their regional (county-wide or multi-county) approach. SDG&E's five partnerships, serving five partners within a single county, have collaborated closely to put forward a Regional Energy Partnership approach that promotes knowledge transfer among the local government partners and agencies without formal partnerships. SCE and SoCalGas[21] have both signaled they are prepared to introduce to their LGPs new DI programs The two IOUs have nearly identical rosters of LGPs and the two coordinate to provide both gas and electric savings opportunities to achieve deep EE savings.

Variation in the IOU approaches to their LGPs evident today came about in part from the 15-year evolution of the LGPs within separate IOU territories and a "light touch" approach to overseeing the local government EE sector that Energy Division applied until 2012. Four distinct IOU LGP models may allow for increased ability to respond to local conditions, strengths and weakness, but such variation complicates regulatory oversight and makes the task of program evaluation difficult. Additionally, recent EM&V studies and stakeholder feedback have raised questions and concerns surrounding uneven eligibility opportunities and interpretation of rules from county to county across the State.

In response, CPUC Decision 16-08-019[22] clearly signaled a call for change in the way the IOUs administer their LGPs, directing that "all business plans should also include strategies for improving the consistency of LGP administration statewide."

In the interim, the four IOUs operate their LGPs on a spectrum of resource to non-resource weighting. In this continuum PG&E has the most resource-based programs while SoCalGas and SDG&E offer entirely non-resource programs.[23] In the middle is SCE, which treats efforts to address public buildings as resource programs. All four IOUs have some non-resource programs that address State Strategic Plan goals.

The IOU LGPs are expected to perform the following activities and deliver the following services:

1. Generate energy and demand savings through retrofits of municipal facilities;
2. Generate leads and opportunities for their IOU partners and be a source of on-the-ground information for the CPUC and other State agencies;
3. Support local agency actions that advance the California Long Term Energy Efficiency Strategic Plan's goals;
4. Exchange best practices and peer-to-peer knowledge transfer to allow for statewide expedited replication of successful approaches and to avoid projects whose approaches have not found success elsewhere;
5. Initiate discussions with community decision makers and local agency gatekeepers to advance the State's climate and energy goals; and
6. Initiate discussions with their community constituents to advance the State's climate and energy goals.

[21] As of the date of finalization of this Plan, SCG had not yet begun DI service to its LGPs (i.e. SoCalGas's core program approved a DI program in 2016, however it has not been launched.
[22] Findings of Law, No. 53, p. 104, August 18, 2016, http://docs.cpuc.ca.gov/SearchRes.aspx?docformat=ALL&DocID=166232537
[23] SDG&E partnerships support resource programs and have energy savings goals reported through their core programs.

These six broad goals set an expectation for the LGPs to deliver energy savings, allow the IOUs and State agencies a better understanding of and improved access to these communities, and emphasize implicit expectations for code compliance efforts, capacity building, knowledge transfer, and peer-to-peer engagement. Expectations to promote communication and dialogue among LGPs are intended to more efficiently spread promising new approaches while avoiding those found to be unworkable. Additionally, the IOUs' recently completed RIA-conducted LGP study suggests that high-levels of LGP engagement are a low-cost and reliable predictor of LGP effectiveness and success. LGP capacity building by way of peer-to-peer sharing and increased participation has been something of a challenge and lesser priority by some IOUs in recent cycles. Thus, Energy Division is supportive of elevating implicit LGP networking expectations so that this activity is identified as a clear and explicit LGP function.

LGP program changes and expansion in the 2015 and 2016 program years include the introduction of three new LGPs in the southern part of the State. Two are joint SCE-SoCalGas LGPs, North Orange County and San Bernardino Regional Energy Partnership; and the SCE-only High Desert LGP serves communities including and around Barstow and Victorville. In addition, three County partnerships with SCE, formerly within the State Partnerships grouping, were moved to LGPs: County of Los Angeles, County of Riverside, and County of San Bernardino. As a result, these three counties are now expected to be counted and treated consistently as LGPs by SCE, something SoCalGas has always done. Additionally, SCE and SCG have been moving their LGPs to a more regional-solutions model and have several consolidation efforts underway to more closely tie together proximate partner communities. These IOUs' former joint LGP, City of Beaumont, folded in 2016, citing municipal budget challenges. In 2016, PG&E graduated to full LGP partnership status a number of provisional partnerships out of its LGEAR incubator program.[24]

Table 15, below, presents the 2013-2015 *ex ante* first-year savings and expenditures for the local government partnerships and for overarching programs in support of the partnerships.

[24] Local Government Energy Action Resources (LGEAR) 2016 graduates consist of six LGPs serving the counties of Butte, Colusa, Glenn, Kings, Merced, San Joaquin, Shasta, Stanislaus, Sutter, Tehama, Tulare, Yolo, and Yuba. In 2013-2014 SoCalGas joined or added eight LGPs to bring their roster into closer alignment with SCE's offerings. These LGPs included Western Riverside Energy Partnership, City of Redlands, City of Beaumont City of Simi Valley, Westside Cities, Gateway Cities Partnership, San Gabriel Valley COG Partnership and Santa Ana.

***Table 15. 2013-2015 Local Government Partnerships and Overarching Programs in Support of Partnerships Savings and Expenditures***

| IOU | Program ID | Program Name | 2013-2014 Program Cycle | | | | 2015 Program Cycle | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures |
| **Local Government Partnerships** | | | | | | | | | | |
| PGE | PGE211009 | East Bay | 33,275,881 | 2,087 | 78,715 | 18,533,923 | 11,611,123 | 2,027 | -21,952 | 6,719,111 |
| PGE | PGE211024 | San Francisco | 17,095,271 | 3,419 | 68,537 | 12,939,113 | 8,067,907 | 1,428 | -36,579 | 6,611,788 |
| PGE | PGE211023 | Silicon Valley | 10,990,217 | 1,205 | 60,821 | 7,588,513 | 13,253,706 | 939 | -22,213 | 4,609,175 |
| PGE | PGE211010 | Fresno | 7,767,630 | 1,167 | 9,315 | 3,872,751 | 7,551,318 | 1,426 | -55,910 | 3,130,833 |
| PGE | PGE211007 | Association of Monterey Bay Area Governments (AMBAG) | 11,487,200 | 1,744 | 16,323 | 7,915,038 | 9,648,466 | 1,080 | -26,487 | 4,213,849 |
| PGE | PGE211011 | Kern | 12,140,256 | 2,108 | -61,048 | 5,102,079 | 6,251,049 | 952 | -41,842 | 2,811,185 |
| PGE | PGE211021 | Sierra Nevada | 7,707,383 | 1,006 | -19,858 | 5,268,446 | 3,454,852 | 540 | -12,484 | 1,954,601 |
| PGE | PGE211019 | San Mateo County | 7,597,881 | 782 | -11,575 | 4,641,507 | 5,619,083 | 656 | -6,747 | 2,625,108 |
| PGE | PGE211022 | Sonoma County | 4,841,733 | 660 | 10,768 | 2,877,636 | 5,603,896 | 805 | -4,233 | 2,226,417 |
| PGE | PGE211016 | Redwood Coast | 2,843,992 | 489 | -12,952 | 3,208,554 | 2,585,340 | 516 | -19,727 | 1,474,416 |
| PGE | PGE211013 | Marin County | 2,402,056 | 275 | -5,588 | 2,664,877 | 3,251,093 | 396 | 199,693 | 1,179,302 |
| PGE | PGE211020 | Santa Barbara | 5,148,092 | 610 | -22,289 | 2,280,433 | 1,512,118 | 261 | -14,021 | 966,840 |
| PGE | PGE211018 | San Luis Obispo Co. | 4,954,875 | 728 | -25,379 | 2,802,162 | 1,061,729 | 189 | -7,770 | 878,220 |
| PGE | PGE211015 | Napa County | 2,331,780 | 299 | -1,277 | 1,327,911 | 576,830 | 128 | -265 | 519,326 |
| PGE | PGE211012 | Madera | 919,490 | 148 | -2,899 | 481,361 | 901,601 | 144 | -4,146 | 436,007 |
| PGE | PGE211014 | Mendocino County | 937,747 | 128 | 552 | 748,926 | 1,149,922 | 156 | -2,062 | 626,591 |
| SCE | SCE-13-L-002G | Community Energy Leader Partnership | 5,680,339 | 856 | -3,432 | 2,935,326 | 1,760,320 | 154 | 7,381 | 1,610,971 |
| SCE | SCE-13-L-002L | Orange County Cities | 3,229,388 | 630 | 2,261 | 1,302,767 | 356,445 | 27 | 0 | 626,572 |

| IOU | Program ID | Program Name | 2013-2014 Program Cycle | | | | 2015 Program Cycle | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures |
| | | Energy Leader Partnership | | | | | | | | |
| SCE | SCE-13-L-003C | County of Los Angeles Energy Efficiency Partnership | 5,961,644 | 767 | 86,431 | 2,050,213 | 3,389,868 | 333 | -594 | 1,805,796 |
| SCE | SCE-13-L-002N | San Joaquin Valley Energy Leader Partnership | 2,196,733 | 372 | -3,314 | 1,468,943 | 175,510 | 25 | -158 | 629,974 |
| SCE | SCE-13-L-002O | South Bay Energy Leader Partnership | 1,781,504 | 288 | -3,474 | 2,350,869 | 521,190 | 42 | -245 | 1,125,351 |
| SCE | SCE-13-L-002Q | Ventura County Energy Leader Partnership | 4,002,476 | 561 | -3,553 | 1,739,493 | 327,750 | 11 | 0 | 726,815 |
| SCE | SCE-13-L-002F | Gateway Cities Energy Leader Partnership | 947,749 | 90 | -815 | 751,051 | 283,703 | 3 | -44 | 339,031 |
| SCE | SCE-13-L-002M | San Gabriel Valley Energy Leader Partnership | 2,872,891 | 367 | -1,483 | 1,545,826 | 1,087,771 | 60 | -543 | 707,493 |
| SCE | SCE-13-L-003E | County of San Bernardino Energy Efficiency Partnership | 1,020,650 | 181 | 199 | 706,226 | 444,692 | 153 | 101 | 650,202 |
| SCE | SCE-13-L-003D | County of Riverside Energy Efficiency Partnership | 845,988 | 117 | 629 | 504,081 | 102,453 | 22 | 0 | 191,456 |
| SCE | SCE-13-L-002J | Desert Cities Energy Leader Partnership | 2,517,897 | 421 | -1,652 | 856,843 | 1,118,472 | 164 | -580 | 953,948 |
| SCE | SCE-13-L-002R | Western Riverside Energy Leader Partnership | 770,444 | 100 | -1,020 | 708,784 | 236,661 | 53 | -16 | 313,006 |

| IOU | Program ID | Program Name | 2013-2014 Program Cycle | | | | 2015 Program Cycle | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures |
| SCE | SCE-13-L-002P | South Santa Barbara County Energy Leader Partnership | 905,070 | 208 | -2,440 | 976,832 | 396,051 | 17 | 0 | 335,175 |
| SCE | SCE-13-L-002D | City of Santa Ana Energy Leader Partnership | 1,251,546 | 120 | -417 | 629,900 | 573,297 | 3 | 0 | 387,827 |
| SCE | SCE-13-L-002B | City of Long Beach Energy Leader Partnership | 711,637 | 125 | -489 | 416,260 | 161,679 | 49 | -80 | 228,600 |
| SCE | SCE-13-L-002C | City of Redlands Energy Leader Partnership | 759,070 | 140 | -990 | 462,088 | 65,687 | 6 | 0 | 99,558 |
| SCE | SCE-13-L-002T | West Side Energy Leader Partnership | 653,082 | 142 | -1,620 | 549,926 | 23,179 | 0 | 0 | 163,476 |
| SCE | SCE-13-L-002K | Kern County Energy Leader Partnership | 550,234 | 130 | -3,194 | 802,453 | 8,328 | 1 | -51 | 87,084 |
| SCE | SCE-13-L-002H | Eastern Sierra Energy Leader Partnership | 108,658 | 28 | -1,123 | 365,223 | 21,379 | 10 | -23 | 176,237 |
| SCE | SCE-13-L-002S | City of Adelanto Energy Leader Partnership | 2,294,258 | 271 | -714 | 541,385 | 166,892 | 46 | -1,388 | 286,465 |
| SCE | SCE-13-L-002A | City of Beaumont Energy Leader Partnership | 37,850 | 9 | -85 | 138,717 | 0 | 0 | 0 | 51,969 |
| SCE | SCE-13-L-002E | City of Simi Valley Energy Leader Partnership | 82,151 | 6 | -5 | 154,730 | 11,545 | 2 | 0 | 77,406 |
| SCE | SCE-13-L-002V | San Bernardino Association of Governments | N/A | N/A | 0 | 0 | 0 | 0 | 0 | 52,704 |

| IOU | Program ID | Program Name | 2013-2014 Program Cycle | | | | 2015 Program Cycle | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures |
| SCE | SCE-13-L-002W | North Orange County Cities | N/A | N/A | 0 | 0 | 0 | 0 | 0 | 11,943 |
| SCG | SCG3777 | LGP-San Gabriel Valley COG Partnership | N/A | N/A | 0 | 133,024 | 0 | 0 | 0 | 116,053 |
| SCG | SCG3742 | LGP-LA Co Partnership | N/A | N/A | 0 | 185,575 | 0 | 0 | 0 | 138,376 |
| SCG | SCG3783 | LGP-Western Riverside Energy Partnership | N/A | N/A | 0 | 131,668 | 0 | 0 | 0 | 126,310 |
| SCG | SCG3754 | LGP-Ventura County Partnership | N/A | N/A | 0 | 182,956 | 0 | 0 | 0 | 92,825 |
| SCG | SCG3776 | LGP-Gateway Cities Partnership | N/A | N/A | 0 | 93,421 | 0 | 0 | 0 | 63,584 |
| SCG | SCG3747 | LGP-South Bay Cities Partnership | N/A | N/A | 0 | 274,840 | 0 | 0 | 0 | 252,363 |
| SCG | SCG3744 | LGP-Riverside Co Partnership | N/A | N/A | 0 | 132,516 | 0 | 0 | 0 | 58,199 |
| SCG | SCG3745 | LGP-San Bernardino Co Partnership | N/A | N/A | 0 | 150,041 | 0 | 0 | 0 | 53,912 |
| SCG | SCG3750 | LGP-Orange Co Partnership | N/A | N/A | 0 | 135,404 | 0 | 0 | 0 | 63,531 |
| SCG | SCG3752 | LGP-Community Energy Partnership | N/A | N/A | 0 | 232,981 | 0 | 0 | 0 | 143,856 |
| SCG | SCG3746 | LGP-Santa Barbara Co Partnership | N/A | N/A | 0 | 164,005 | 0 | 0 | 0 | 83,261 |
| SCG | SCG3748 | LGP-San Luis Obispo Co Partnership | N/A | N/A | 0 | 207,641 | 0 | 0 | 0 | 109,753 |
| SCG | SCG3743 | LGP-Kern Co Partnership | N/A | N/A | 0 | 198,990 | 0 | 0 | 0 | 72,650 |
| SCG | SCG3749 | LGP-San Joaquin | N/A | N/A | 0 | 129,458 | 0 | 0 | 0 | 89,649 |

| IOU | Program ID | Program Name | 2013-2014 Program Cycle | | | | 2015 Program Cycle | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures |
| | | Valley Partnership | | | | | | | | |
| SCG | SCG3778 | LGP-City of Santa Ana Partnership | N/A | N/A | 0 | 59,065 | 0 | 0 | 0 | 58,407 |
| SCG | SCG3781 | LGP-City of Redlands Pilots | N/A | N/A | 0 | 63,198 | 0 | 0 | 0 | 32,131 |
| SCG | SCG3782 | LGP-City of Beaumont Programs | N/A | N/A | 0 | 73,385 | 0 | 0 | 0 | 31,398 |
| SCG | SCG3780 | LGP-City of Simi Valley Partnership | N/A | N/A | 0 | 42,025 | 0 | 0 | 0 | 22,205 |
| SCG | SCG3779 | LGP-West Side Cities Partnership | N/A | N/A | 0 | 17,711 | 0 | 0 | 0 | 35,340 |
| SCG | SCG3753 | LGP-Desert Cities Partnership | N/A | N/A | 0 | 26,384 | 0 | 0 | 0 | 10,645 |
| SCG | SCG3801 | LGP-NOCC | N/A | N/A | 0 | 0 | 0 | 0 | 0 | 60,994 |
| SCG | SCG3802 | LGP-SANBAG | N/A | N/A | 0 | 0 | 0 | 0 | 0 | 58 |
| SDGE | SDGE3272 | LGP- City of Chula Vista Partnership | N/A | N/A | 0 | 2,829,767 | 0 | 0 | 0 | 832,044 |
| SDGE | SDGE3273 | LGP- City of San Diego Partnership | N/A | N/A | 0 | 2,816,067 | 0 | 0 | 0 | 1,238,464 |
| SDGE | SDGE3274 | LGP- County of San Diego Partnership | N/A | N/A | 0 | 1,821,924 | 0 | 0 | 0 | 993,870 |
| SDGE | SDGE3275 | LGP- Port of San Diego Partnership | N/A | N/A | 0 | 1,648,462 | 0 | 0 | 0 | 830,008 |
| SDGE | SDGE3276 | LGP- SANDAG Partnership | N/A | N/A | 0 | 1,420,521 | 0 | 0 | 0 | 721,814 |
| **Local Government Partnership Subtotal** | | | **171,622,743** | **22,781** | **141,863** | **117,382,195** | **93,332,902** | **12,824** | **-72,984** | **58,953,530** |

| IOU | Program ID | Program Name | 2013-2014 Program Cycle | | | | 2015 Program Cycle | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures | Energy Savings (kWh) | Demand Reduction (kW) | Gas Savings (Therm) | Program Expenditures |
| **Programs Supporting Partnerships** | | | | | | | | | | |
| PGE | PGE2110051 | Local Government Energy Action Resources (LGEAR) | 21,854,898 | 2,073 | -62,795 | 16,586,232 | 20,369,565 | 3,145 | -118,971 | 10,810,840 |
| PGE | PGE2110052 | Strategic Energy Resources | 0 | 0 | 0 | 4,080,843 | 0 | 0 | 0 | 7,508,767 |
| SCE | SCE-13-L-002U | Local Government Strategic Planning Pilot Program | 0 | 0 | 0 | 7,222,334 | 0 | 0 | 0 | 3,221,345 |
| SCE | SCE-13-L-002Rollup | Energy Leader Partnership Program | 0 | 0 | 0 | 249,327 | 0 | 0 | 0 | -26,209 |
| SCE | SCE-13-L-002I | Energy Leader Partnership Strategic Support | 0 | 0 | 0 | 4,318,945 | 0 | 0 | 0 | 566,156 |
| SCG | SCG3774 | LGP-LG Regional Resource Placeholder | 0 | 0 | 0 | 523,307 | 0 | 0 | 0 | 337,172 |
| SCG | SCG3773 | LGP-New Partnership Programs | 0 | 0 | 0 | 98,748 | 0 | 0 | 0 | -523 |
| SCG | SCG3755 | LGP-Local Government Energy Efficiency Pilots | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,926 |
| SCG | SCG3751 | LGP-SEEC Partnership | 0 | 0 | 0 | 205,761 | 0 | 0 | 0 | 167,230 |
| SDGE | SDGE3278 | LGP- Emerging Cities Partnership | 0 | 0 | 0 | 397,305 | 0 | 0 | 0 | 412,408 |
| SDGE | SDGE3277 | LGP- SEEC Partnership | 0 | 0 | 0 | 609,147 | 0 | 0 | 0 | -2,496 |
| **Programs Supporting Partnerships Subtotal** | | | **21,854,898** | **2,073** | **-62,795** | **34,291,949** | **20,369,565** | **3,145** | **-118,971** | **22,996,616** |
| **Total Local Government Partnerships ('000s)** | | | **193,478** | **25** | **79** | **151,674** | **113,702** | **16** | **-192** | **81,950** |
| **Total EE Portfolio ('000s)** | | | **6,829,335** | **1,110** | **100,790** | **1,636,984** | **5,904,569** | **1,336** | **45,742** | **1,203,733** |
| **Percentage of Total EE Portfolio** | | | **3%** | **2%** | **0.08%** | **9%** | **2%** | **1%** | **-0.42%** | **7%** |

### 2.5.2. Conditions Affecting Local Government Partnerships

With the U.S. economy continuing to gain transaction in its long recovery from the Great Recession, local agencies have begun to rebound from the staff layoffs that began in late 2008 and persisted until about mid-2013. The upshot of the improved economic outlook is that local agencies may be in a better position to elevate energy efficiency efforts as a priority and to put resources toward the State's climate goals. Still, some local governments in California continue to struggle financially and their ability to deliver beyond core public health and safety services remains constrained.

Challenges in evaluating this sector include a large variation among city and county governments with difference in how these agencies view energy efficiency and carbon reduction as a priority depending on their economic, political, and geographic situations. Each local government is motivated to participate in an EE partnership for individual reasons; reasons which may shift with a change in political or economic conditions.

Additional difficulties include obtaining quality and affordable program evaluations within the IOU LGP sector. The absence of statewide program uniformity and four IOU LGP models presents an additional barrier to experts gaining mastery of the sector. PG&E and SCE operate their LGPs as resource programs and SDG&E and SCG offering their LGPs as non-resource programs. This leads to inconsistent accounting of energy savings and reporting for a vast and diverse sector composed of approximately 50 LGPs representing nearly all California counties except those without energy service by the four IOUs. Thus, a starting point for effective evaluation of this sector would be to recognize and comprehend each IOU's approach to how it administers its LGP programs.

In late 2012, the CPUC approved two new non-IOU delivery models (See REN-CCA roadmap chapter below at **Section 2.6.**).

Energy Division anticipates that an important future CPUC need may be useful research to address remaining unresolved questions regarding the appropriateness of some division of the EE market among the three PA types. As a response, Energy Division is proposing a new process evaluation within the LGP roadmap (detailed below in **Section 2.5.5.**) to conduct a *gap analysis* that would, among other things, examine IOU cooperation with the other PAs through the LGP lens. The LGP lens approach to appraising the existing condition of multiple PAs simultaneously operating in the local government space would seek to determine whether the LGPs -- as a mature program – should serve as the "marquee" or flagship ratepayer-supported EE offering in the local government space. Additionally, because the LGPs have some unique and exclusive features, the study effort would serve to learn if the LGPs warrant program revisions to ensure commensurate local agency commitment and performance expectations. Also, Energy Division is interested to learn whether the time is ripe for establishing parameters for the various PAs operating in the local government EE space. In other words, is a closer look at the benefits-to-commitment ratio assigned to LGPs warranted? And would more a precise definition of the LGP programs at this stage in their maturity be useful to fully capture opportunities and preserve the LGPs' position as model leaders for innovation in the EE space?

### 2.5.3. 2013-2015 Local Government Partnerships EM&V Studies

Table 16 presents the ongoing EM&V studies and budgets funded through the 2013-2015 cycle. It includes funding for projects that have not yet started, but for which budgets were set aside from the 2013-2015 allocation.

***Table 16. 2013-2015 Local Government Partnerships EM&V Studies, Budgets, and Expected Dates of Completion***

| 2013-2015 Study Area/Title | Study Type | Study Manager | Budget | Completion Date |
|---|---|---|---|---|
| **Studies In Progress** | | | | |
| PY 2013-2015 LGP Impact Evaluation | Impact | Energy Division | $230,000 | Q2 2017 |
| Local Government Partnerships Process Study: Assessing the LGP – DI Nexus | Process | | $418,000 | Q4 2017 |
| Targeted Process Evaluation of IOU Local Government Partnerships | Process | IOU(SCE) | $490,000 | Q4 2016 |
| Process and Effectiveness Evaluation of SCE Energy Leader Model | | IOU (SCE) | $225,000 | Q4 2016 |
| Local Government Partnerships Process Study: Assessing Implementer Autonomy, Communication, and Decision-making in the Context of IOU and Local Agency Officials | Process | Energy Division | $250,000 | Q4 2018 |

## 2.5.4. 2013-2015 Local Government Partnerships EM&V Study Descriptions

This section provides short descriptions, objectives, and key research questions of each of the 2013-2015 studies.

| **Study Title:** PY 2013-2015 Impact Evaluation of LGPs | **Budget:** $230,000 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** Energy Division<br>**Consultant Preparer:** ITRON |
| **Description:** This study would develop *ex post* savings estimates of net and gross savings values for the SCE and PG&E LGP programs for the 2013-2015 period. The evaluation would focus on high uncertainty measures or key measure-parameters (e.g., operating hours for LED lamps) and rely on a combination of new data collection, and existing data from relevant 2010-12 and 2013-14 impact evaluations. The study team would combine a 2013-2014 impact evaluation with the 2015 impact evaluation of LGPs; however, interim results would be developed prior to the completion of this study to focus on 2013-14 participation. This study would be conducted under the LGP/REN Nonresidential Downstream Impact Evaluation Work Order. Note: the SCG and SDG&E LGPs were eliminated from scope of this evaluation because their non-resource treatment does not easily lend itself to an impact evaluation. | |
| **Objectives:**<br>▪ Estimate LGP program group-specific gross impact parameters for measures with high uncertainty that are significant contributors to the LGP programs;<br>▪ Estimate net-to-gross ratios (NTGRs) for the LGP programs as a whole and for key grouping of LGP programs (such as by program administrator, and/or by delivery mechanism [e.g., direct install versus non-direct install]); and<br>▪ To increase the reliability of results, this evaluation combined funding of the 2013-2014 impact assessment with the 2015 evaluation so the study would span 2013-2015 participants. | |
| **Key Research Questions:**<br>▪ What are the ex post gross savings values for LGP programs?<br>▪ What are the NTGRs for LGP programs? | |
| **Potential EM&V Methods:** Telephone surveys to develop NTGRs, on-site verification, and monitoring to estimate key parameters for high uncertainty measures. These data would include a combination of new data collection, and existing data from relevant 2010-12 and 2013-14 CPUC impact evaluations. | |

| **Study Title:** Local Government Partnerships Process Study: Assessing the LGP-DI Nexus | **Budget:** $418,000 |
|---|---|
| **Expected Completion Date:** Q4 2017 | **Study Manager:** Energy Division<br>**Consultant Preparer:** Research Into Action |

**Description:** An examination of how the PAs can more fully capture the potential of Direct Install (DI) and the appropriate level of involvement and control by their local government partnerships. This study would build on the multi-year ED-led process study now reaching completion on the small commercial DI market.

**Background:** CPUC Decision 16-08-019 signaled that the Commission seeks greater IOU consistency among the IOU LGP programs. Energy Division has considered PG&E's model and believes it is a good example of thorough energy savings attribution with all LGP-budgeted programs receiving full credit for savings generated. PG&E believes it has found a way to balance its LGP budget and bring its TRC to 1.0 by having the LGPs capture the valuable SMB market. Energy Division believes this is a second example of PG&E having a methodology in place that could potentially be replicated statewide.

Therefore, this study would conduct a comparative analysis of PG&E's partners' experience with DI vis-a-vis those LGPs administered by SCE, and SDG&E, to better understand how local agency and implementer roles and ability to inform DI projects may be desirable and achievable; authority, decision making, and data sharing power dynamics; and equitability of opportunities, eligible measures, and qualifying EE sectors/targets.

The study would examine what may be working well among SCE and SDG&E DI programs and whether those attributes should be preserved and/or replicated within any statewide LGP DI approach.

PG&E has tested a select number of LGPs to serve as turnkey implementers covering DI administration functions typically done by the IOUs. ED is interested to learn if this approach should be expanded within PG&E's territory and beyond. And if so, what are appropriate determinants of qualifications. To enable this line of study, it's anticipated that one study element would be to conduct a focused analysis on PG&E partners' experience with DI to better understand how certain designated LGPs serve as lead shot-caller to implement, direct, and hire-and-fire DI implementers and how this arrangement may result in synergies, cost considerations, ability to capture deeper EE and fair share, as well as non-EE benefits such as local work force and economic development.

Also, the study would examine whether certain PG&E partner calls for a right of first refusal (ROFR) to allow LGPs priority to conduct DI projects over third-party vendors is warranted; and what the implications within the territory and statewide would be of a rule change.

Additionally, the study may include treatment of a handful of DI programs that interface with LGPs is small including Moderate Income Direct Install (MIDI), manufactured homes, lodging, casinos, tribal lands, vintners, and others. The study would allow for a deeper understanding of the direct install program component of the LGPs to specifically inform on:

- The level of influence of the DI component on customers to completing additional and more comprehensive follow-on installations of energy efficiency measures; and
- The importance of the DI component in encouraging customers to participate in other LGP or utility programs.

The study would examine various DI models in place at each IOU, the result of IOU trials and innovations such as required co-pays, and IOU-local government co-branding marketing efforts, all of which would provide the CPUC a better understanding of the ties and co-dependencies between DI and LGPs, and whether small commercial savings is an appropriate LGP requirement.

If time and study budget resources allow, the study would include an inventory and classification of programs serving the SMB markets and would create a logic model for how SMB customers are served to promote understanding of distinctions between the program types.

| **Study Title:** Local Government Partnerships Process Study: Assessing the LGP-DI Nexus | **Budget:** $418,000 |
|---|---|

**Objectives:**
Improve CPUC understanding of DI and LGP coordination, potential, and opportunity.

**Research Questions:**

- How can the comprehensiveness of DI programs be improved and what, if any, contribution can the LGPs make toward this goal?
- What are potential solutions to a shortage of qualified energy auditors who can perform comprehensive energy audits beyond lighting or single measures?
- What can be done to improve matters for small businesses which may have difficulty finding contractors to complete comprehensive energy audits?
- What risk is associated with the LGPs' existing over-reliance on lighting-only programs to achieve savings? What might be a good divestment and diversification strategy and what costs might be associated with any change of approach?
- What are solutions to reported failure of DI vendors to uniformly make use of provided energy audit checklists, and what role might LGPs have in being part of the solution?
- What are consequences of the status quo (the lack of uniform adoption of the checklist)? and
- Are the reported lack of uniform energy audits and savings. across program vendors significant?
- Can common non-lighting measures such as refrigeration and VFDs serve as adequate diversification of SMB DI programs or are more and more varied measures installed warranted?
- What are the repercussions of installing only measure offered through a given DI program (as opposed to a comprehensive and/or independent facility energy audit to identify all opportunities?
- What strategies and solutions can be identified and implemented to counter SMB perceptions and barriers surrounding more complex measures, (higher cost, longer paybacks)?
- What barriers exist and what accommodation or relief might be appropriate, warranted, or available with regard to barriers to bundling, Title 24 updates, and existing conditions as baseline conditions? How might AB 802's directives affect support or conflict with existing rules and offer relief, if any? Are DI projects typically adequately informed by and capturing the full benefit of the LGPs in whose region they service?
- Are DI projects contributing to stranded energy savings that go unrealized and/or cream skimming? And if so, what could be done to correct this condition?
- Would there be benefit to consistent PAs attribution of DI program savings and budgets to their LGPs?
- Should LGP implementers be the gatekeepers for existing no-cost municipal DI offerings made available directly to LGs to allow for decision-making ability to put forward a regional vision?
- Should LGPs have some say in the goals or hiring and firing of the 3P program DI providers given their budget and savings ties?
- Should there be an on-ramp period for advanced LGPs with DI implementation experience to have some first right of refusal?
- Should DI implementers have the authority to specify measures and incentive structures for those measures and adjust incentives as applicable to regional market conditions?
- What are existing barriers to LGPs coordinating Utility DI programs?
- What is the track record of DI 3P implementers with accommodating LGPs in terms of responsiveness to LGP requests, sharing data, and program coordination?
- How do the LGPs serve as the marketing arm of the DI, 3P, and IOU core programs?
- What would be the effect if LGP marketing of these programs were eliminated?
- What types of marketing and outreach activities are presently undertaken by LGPs and to what degree do the program designs originate with the IOUs?
- To what degree is an LGP's marketing approach shaped by its level of control of the DI programs in its region?
- What has been the overall community engagement and uptake rates, referrals to DI/3P/core programs, and reported savings?

| **Study Title:** Local Government Partnerships Process Study: Assessing the LGP-DI Nexus | **Budget:** $418,000 |
|---|---|
| **Potential EM&V Methods:** Investigate through field visits, interviews, financial and data analysis, cause and effect. Interviews with all parties within the LGP-DI community. Data requests and review of public filings. | |

| **Study Title:** Targeted Process Evaluation of IOU Local Government Partnerships | **Budget:** $490,000 |
|---|---|
| **Expected Completion Date:** Q4 2016: | **Study Manager:** SCE<br>**Consultant Preparer:** Research Into Action |
| **Description:** PY 2013-2014 phase of ongoing process assessments of LGP activities, performance, and savings targets achievements. Budget includes both 2013-2014 funds ($365,000) and funds for a market assessment to aid post-2014 program design ($125,000). | |
| **Objectives: Objectives:** The PAs have proposed within this study to identify a set of high-priority LGPs activities that would undergo a process evaluation. This approach would identify LGPs to examine every year or two within a process study. It is expected that the process assessment scope would include municipal retrofits and Strategic Plan support activities, which have not yet been evaluated and which are non-duplicative with existing study efforts.<br>In order to better facilitate this endeavor, the IOUs propose that determining common criteria by which LGPs can be categorized is a necessary precursor. This study would attempt to derive such LGP categorizations. | |
| ▪ **Key Research Questions:**<br>▪ How can LGPs be categorized to facilitate appropriate comparisons ("apples-to-apples")? Would PA program management benefit from a customization of these statewide standard categories? If so, in what way?<br>▪ At a high level, what have been LGPs' primary achievements and challenges? How do achievements and challenges differ by LGP category?<br>▪ What are common LGP program processes? How do these practices differ by LGP category?<br>▪ What processes appear most effective? How do these practices differ by LGP category?<br>. What are opportunities for the PAs to improve program outcomes? Do the individual PAs need customized metrics and milestones?<br>.<br>. For each Strategic Plan menu item, why have the PAs struggled with assessing program performance and<br>▪ reporting results? Would each PA benefit from having a customized Strategic Plan menu?<br>▪ How can PAs improve project performance reporting such as building type, building vintage, and building square footage to better inform the how the LGPs are contributing to State goals?<br>▪ How many local governments have some type of Energy Management System (EMS)? How have they been using them? What achievements have the use of an EMS enabled? How many local governments link EMS data to other databases?<br>▪ How have the LGs shared resources across areas and regions? Are significant LGP-to-LGP knowledge transfer lines of communication established?<br>▪ To what extent do ratepayer dollars fund local government staff positions? Are staff positions within joint powers authorities or councils of governments? | |

| **Study Title:** Process and Effectiveness Evaluation of SCE's Energy Leader Model (SCE) | **Budget:** $225,000 |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** SCE<br>**Consultant Preparer:** Research Into Action |
| **Description:** Process Evaluation | |
| **Objective:** Study would be the first broad evaluation of the SCE Energy Leader Program (ELP) model since it was introduced in 2008. SCE seeks to demonstrate that the ELP is well received by the partners and results in its intended effect of building capacity via gradually paying greater incentive levels based on certain LG accomplishments. The CPUC seeks to learn whether the ELP effectively administers opportunities as LGP success is demonstrated. CPUC seeks to understand whether some Statewide graduated LGP model is warranted. | |
| **Key Research Questions:**<br>▪ What are the value, merit, and effectiveness of SCE's ELP model in motivating achievements of, and building capacity within LGs?<br>▪ What are the factors driving success? How can SCE build on its success to improve the program? What elements, if any, might be appropriate to extend statewide or, conversely, to discontinue?<br>▪ How do SCE-provided technical experts facilitate capacity and savings in LGs?<br>▪ What is current LG capacity? What is the likelihood that the ELP model offers a viable strategy for increasing that capacity? Are some LGs or types of LGs more likely to benefit from the ELP program model?[25] | |
| **EM&V Methods:**<br>▪ Review of program documents and records<br>▪ In-depth interviews with three to four key SCE and SCG program staff<br>▪ In-depth interviews with up to 20 program staff and contractors from SCE and SCG[26]<br>▪ Interviews with contacts for up to 18 sampled LGs | |

[25] Excerpted from the RIA Research Plan, September 10, 2015, pp. 2-3.

[26] A review of SCE and SCG program documents indicates that nine IOU staff are involved in managing SCE's non-institutional partnerships, and eight IOU staff involved in managing SCG's partnerships.

| **Study Title:** Local Government Partnerships Process Study: Assessing Implementer Autonomy, Communication, and Decision-Making Authority in the Context of IOU and Local Agency Officials | **Budget:** $250,000 |
|---|---|
| **Expected Completion Date:** Q4 2018 | **Study Manager:** Energy Division |
| **Description:** This study would combine two deferred process studies that treated the decision-making role and authority of LGP implementers, and the effect of outside communication flows and relationships between IOUs and local agency officials on the LGPs and their ability to fulfill their mission and function effectively and efficiently.[27] | |
| **Objective:** Improve Energy Division's understanding of LGP implementer importance and value in serving as a conduit for IOU communication and directives to partner local governments.<br>▪ Learn if IOU program rule changes are duly noticed and adequately made known to their partners<br>▪ Learn how partner understanding of new CPUC or IOU rules could be improved and how failure to fully understand may negatively impact program implementation<br>▪ Improve Energy Division's understanding of IOU communication with local government officials and and potential effects on LGP programs<br>▪ Improve Energy Division's understanding of the effects of IOU staff seeking higher office within the local government agencies they serve, and whether some restrictions are warranted.<br>▪ Review current communications and disclosures practices and recommend changes as appropriate for PA communication with local government elected leaders and high-level public agency staff. | |
| **Key Research Questions:** TBD | |
| **EM&V Data Collection Methods:** TBD | |
| **Objectives:** Improve Energy Division understanding of the role of the LGP implementer and LGP opportunities to contribute to their program assignments. Gauge LGPs well as satisfaction levels with existing contract arrangements, resource levels, and assigned markets and measures. | |

### 2.5.5. 2016 and Beyond Local Government Partnerships EM&V Studies

Table 17 summarizes the revised and proposed budgets for the LGPs for 2016 and 2017.

***Table 17: Revised and Proposed Budgets for 2016-2017 for LGPs***

| IOU | Program ID | Program Name | 2016 Revised Budgets | 2017 Proposed Budgets |
|---|---|---|---|---|
| **Local Government Partnerships** | | | | |
| PGE | PGE211009 | East Bay | 9,262,008 | 6,172,527 |
| PGE | PGE211024 | San Francisco | 7,832,558 | 6,245,398 |

[27] To clarify, outside communication flow would be instances where the LGP implementer was not privy to a conversation or decision, but rather the IOU engaged with the LG energy staff or LG decision makers directly and without implementer involvement.

| IOU | Program ID | Program Name | 2016 Revised Budgets | 2017 Proposed Budgets |
|---|---|---|---|---|
| **Local Government Partnerships** | | | | |
| PGE | PGE211023 | Silicon Valley | 4,074,436 | 3,824,195 |
| PGE | PGE211010 | Fresno | 3,846,492 | 2,628,577 |
| PGE | PGE211007 | Association of Monterey Bay Area Governments (AMBAG) | 3,581,301 | 3,769,231 |
| PGE | PGE211011 | Kern | 3,194,412 | 2,704,501 |
| PGE | PGE211021 | Sierra Nevada | 2,560,460 | 2,419,468 |
| PGE | PGE211019 | San Mateo County | 1,744,567 | 2,289,762 |
| PGE | PGE211022 | Sonoma County | 1,709,718 | 1,781,808 |
| PGE | PGE211016 | Redwood Coast | 1,556,910 | 1,630,095 |
| PGE | PGE211013 | Marin County | 1,334,743 | 1,299,861 |
| PGE | PGE211020 | Santa Barbara | 1,184,837 | 983,073 |
| PGE | PGE211018 | San Luis Obispo Co. | 936,840 | 1,066,609 |
| PGE | PGE211015 | Napa County | 549,632 | 539,200 |
| PGE | PGE211012 | Madera | 445,314 | 331,018 |
| PGE | PGE211014 | Mendocino County | 322,506 | 639,489 |
| PGE | PGE211026 | North Valley | 0 | 1,909,316 |
| PGE | PGE211027 | Sutter Buttes | 0 | 446,448 |
| PGE | PGE211028 | Yolo | 0 | 358,125 |
| PGE | PGE211029 | Solano | 0 | 1,472,951 |
| PGE | PGE211030 | Northern San Joaquin Valley | 0 | 1,443,753 |
| PGE | PGE211031 | Valley Innovative Energy Watch (VIEW) | 0 | 691,177 |
| SCE | SCE-16-L-002A | City of Beaumont Energy Leader Partnership | 91,747 | - |
| SCE | SCE-16-L-002B | City of Long Beach Energy Leader Partnership | 589,712 | 1,403,757 |
| SCE | SCE-16-L-002C | City of Redlands Energy Leader Partnership | -68,409 | 223,443 |
| SCE | SCE-16-L-002D | City of Santa Ana Energy Leader Partnership | 695,077 | 163,860 |
| SCE | SCE-16-L-002E | City of Simi Valley Energy Leader Partnership | 123,345 | - |
| SCE | SCE-16-L-002F | Gateway Cities Energy Leader Partnership | 627,599 | 1,260,800 |
| SCE | SCE-16-L-002G | Community Energy Leader Partnership | 1,938,328 | 889,349 |
| SCE | SCE-16-L-002H | Eastern Sierra Energy Leader Partnership | 143,100 | 87,039 |
| SCE | SCE-16-L-002J | Desert Cities Energy Leader Partnership | 375,038 | 202,115 |
| SCE | SCE-16-L-002K | Kern County Energy Leader Partnership | 146,379 | 124,490 |
| SCE | SCE-16-L-002L | Orange County Cities Energy Leader | 1,100,336 | 2,175,008 |

| IOU | Program ID | Program Name | 2016 Revised Budgets | 2017 Proposed Budgets |
|---|---|---|---|---|
| **Local Government Partnerships** | | | | |
| | | Partnership | | |
| SCE | SCE-16-L-002M | San Gabriel Valley Energy Leader Partnership | 364,562 | 802,063 |
| SCE | SCE-16-L-002N | San Joaquin Valley Energy Leader Partnership | 916,772 | 424,150 |
| SCE | SCE-16-L-002O | South Bay Energy Leader Partnership | 1,042,607 | 724,948 |
| SCE | SCE-16-L-002P | South Santa Barbara County Energy Leader Partnership | 228,359 | 246,603 |
| SCE | SCE-16-L-002Q | Ventura County Energy Leader Partnership | 775,647 | 433,607 |
| SCE | SCE-16-L-002R | Western Riverside Energy Leader Partnership | 442,155 | 206,119 |
| SCE | SCE-16-L-002S | City of Adelanto Energy Leader Partnership | 163,213 | 97,628 |
| SCE | SCE-16-L-002T | West Side Energy Leader Partnership | 223,189 | 172,191 |
| SCE | SCE-16-L-003C | County of Los Angeles Energy Efficiency Partnership | 994,509 | 653,643 |
| SCE | SCE-16-L-003D | County of Riverside Energy Efficiency Partnership | 675,874 | 146,345 |
| SCE | SCE-16-L-003E | County of San Bernardino Energy Efficiency Partnership | 548,531 | 351,586 |
| SCE | SCE-16-L-002W | San Bernardino Association of Governments | -73,979 | 123,916 |
| SCE | SCE-16-L-002V | North Orange County Cities | 3,250 | 158,121 |
| SCG | SCG3742 | LGP-LA Co Partnership | 564,976 | 227,492 |
| SCG | SCG3743 | LGP-Kern Co Partnership | 146,400 | 104,789 |
| SCG | SCG3744 | LGP-Riverside Co Partnership | 386,754 | 141,676 |
| SCG | SCG3745 | LGP-San Bernardino Co Partnership | 371,735 | 142,985 |
| SCG | SCG3746 | LGP-Santa Barbara Co Partnership | 229,565 | 123,769 |
| SCG | SCG3747 | LGP-South Bay Cities Partnership | 263,561 | 156,042 |
| SCG | SCG3748 | LGP-San Luis Obispo Co Partnership | 130,418 | 102,309 |
| SCG | SCG3749 | LGP-San Joaquin Valley Partnership | 205,751 | 115,285 |
| SCG | SCG3750 | LGP-Orange Co Partnership | 380,408 | 153,703 |
| SCG | SCG3752 | LGP-Community Energy Partnership | 155,179 | 139,684 |
| SCG | SCG3753 | LGP-Desert Cities Partnership | 49,639 | 18,034 |
| SCG | SCG3754 | LGP-Ventura County Partnership | 374,838 | 171,544 |
| SCG | SCG3776 | LGP-Gateway Cities Partnership | 518,648 | 174,765 |
| SCG | SCG3777 | LGP-San Gabriel Valley COG Partnership | 729,460 | 249,015 |
| SCG | SCG3778 | LGP-City of Santa Ana Partnership | 185,191 | 79,437 |

| IOU | Program ID | Program Name | 2016 Revised Budgets | 2017 Proposed Budgets |
|---|---|---|---|---|
| **Local Government Partnerships** | | | | |
| SCG | SCG3779 | LGP-West Side Cities Partnership | 140,726 | 47,822 |
| SCG | SCG3780 | LGP-City of Simi Valley Partnership | 130,703 | 24,107 |
| SCG | SCG3781 | LGP-City of Redlands Pilots | 148,670 | 61,966 |
| SCG | SCG3782 | LGP-City of Beaumont Programs | 105,403 | 26,885 |
| SCG | SCG3783 | LGP-Western Riverside Energy Partnership | 524,133 | 195,427 |
| SCG | SCG3801 | LGP-NOCC | 243,496 | 152,245 |
| SCG | SCG3802 | LGP-SANBAG | 299,142 | 149,600 |
| SDGE | SDGE3272 | LGP- City of Chula Vista Partnership | 1,708,121 | 1,769,590 |
| SDGE | SDGE3273 | LGP- City of San Diego Partnership | 1,714,404 | 1,683,813 |
| SDGE | SDGE3274 | LGP- County of San Diego Partnership | 1,119,760 | 1,135,170 |
| SDGE | SDGE3275 | LGP- Port of San Diego Partnership | 827,931 | 822,753 |
| SDGE | SDGE3276 | LGP- SANDAG Partnership | 1,084,429 | 1,088,848 |
| **Local Government Partnership Subtotal** | | | 68,943,114 | 64,976,115 |
| **Programs Supporting Partnerships** | | | | |
| PGE | PGE2110051 | Local Government Energy Action Resources (LGEAR) | 5,500,535 | 8,748,114 |
| PGE | PGE2110052 | Strategic Energy Resources | 2,764,003 | 9,907,347 |
| SCE | SCE-16-L-002U | Local Government Strategic Planning Pilot Program | 375,350 | 1,087,635 |
| SCE | SCE-16-L-002Rollup | Energy Leader Partnership Program | 10,444 | 1,065,771 |
| SCE | SCE-16-L-002I | Energy Leader Partnership Strategic Support | 395,232 | 473,652 |
| SCG | SCG3774 | LGP-LG Regional Resource Placeholder | 436,297 | 325,955 |
| SCG | SCG3773 | LGP-New Partnership Programs | 493,843 | 48,590 |
| SCG | SCG3755 | LGP-Local Government Energy Efficiency Pilots | 687,324 | 215,000 |
| SCG | SCG3751 | LGP-SEEC Partnership | 217,798 | 147,698 |
| SDGE | SDGE3278 | LGP- Emerging Cities Partnership | 280,868 | 279,168 |
| SDGE | SDGE3277 | LGP- SEEC Partnership | 293,433 | 252,705 |
| **Programs Supporting Partnerships Subtotal** | | | 11,455,126 | 22,551,635 |
| **Total Local Government Partnerships ('000s)** | | | **80,398** | **87,528** |
| **Total EE Portfolio ('000s)*** | | | **1,301,346** | **928,136** |
| **Percentage of Total EE Portfolio** | | | **6%** | **9%** |

*NOTE: The 2016 and 2017 budgets include Codes and Standards program budgets but not Low Income Energy Efficiency program budgets with the exception of PG&E, which includes both

**Proposed 2016-2017 Energy Division Budget:** $1,676,664 (2016-2017)

The Local Government Partnerships roadmap (this EM&V Plan chapter) has received new two-year (2016 and 2017) funding in the amount of $1.6 million for Energy Division-led studies pending adoption of their business plan. This funding is made available to conduct impact, process and market studies and evaluations to improve understanding and implementation of LGP programs and activities.

Besides noting the challenges in evaluating LGPs described above, the proposed studies described within this roadmap document call for careful consideration of the differences in size, available resources, and level of experience among local governments as well as their geographic, socioeconomic, and political variations. In addition, ED is interested in developing new studies that would explore savings and TRC issues in future impact studies and further investigation of the LGP efforts and potential in underserved and geographically-isolated regions.

**Remaining Unresolved LGP Questions and Study Areas Not Programmed in this Roadmap Update**

The LGP PY 2013-2014 Value and Effectiveness Study Report (completed in 2015) left some core study questions unanswered but which may be addressed in future studies yet to be programmed.

Additionally, the LGP PY 2013-2014 Value and Effectiveness Study Report identified new research questions that could be future topics for investigation within future program evaluations. These potential new future study questions include:

- What are appropriate consequences or penalties for Strategic Plan project failure by the LGPs?
- How are the IOUs encouraging LGPs to follow through on their completed Climate Action Plans to ensure they are adopted and implemented? What has been the effect of this IOU practice of monitoring, follow up, and encouragement (if they exist) on the LGPs?
- What local agency contribution might be appropriate to fund Strategic Plan projects?
- Are non-resource program efforts, which include the LG Strategic Plan projects (addressing GHG reduction, climate change, reach codes, and data management, among others) as important as or subordinate to the goal of achieving direct energy savings?

The Energy Division has an interest in better understanding how LGP Marketing, Education & Outreach (ME&O) efforts function both as Strategic Plan efforts and as outreach activities to promote IOU DI and core resource programs. ED counts two categories of ME&O here, which are in addition to statewide ME&O efforts. How are these efforts coordinated to ensure a consistent, non-duplicative message? Does any double counting of benefit occur? Another theme for possible exploration within future LGP studies would be to assess the overall effectiveness of the IOU marketing and outreach strategies that leverage LGP community networks to promote energy efficiency to their constituents. Research to date has not fully explained how these activities are being deployed, and what if any duplication exists with statewide ME&O efforts. Research questions that could potentially frame a future LGP study are:

- How do these marketing and outreach activities vary by IOU or LGP implementer?
- What types of marketing methods and strategies have been the most and least effective? Do these results vary by sector or program model?

- How are marketing and outreach activities tracked within this sector? What additional ME&O data should be tracked, in order to inform future evaluations and decision-making?
- What are the awareness levels of these activities?
- What are the engagement points, and is there effective follow-up to encourage project completion?

**Proposed Program Administrator Budget:** $395,000 (2016 and 2017]

The IOUs plan to focus their evaluation efforts on the systematic review of the local government partnership portfolio with a second wave of process evaluations. They have started this with a two-part "rolling" process evaluation described below.

Table 18 below details the proposed studies that rely on 2016 and 2017 program year funding.

***Table 18. 2016 and Beyond Proposed Local Government Partnerships EM&V Studies, Budgets, and Dates of Completion (PY 2016 program funds)***

| 2016-2017 Study Area/Title | Study Type | Study Manager | Budget | Completion Date |
|---|---|---|---|---|
| **Studies Proposed, but not yet Scoped** | | | | |
| Local Government Partnerships Process Study: Comparative Analysis of Select Large Regional LGPs | Process | Energy Division | $350,000 | Q4 2018 |
| Local Government Partnerships Process Study: Gap Analysis | Process | Energy Division | $285,000 | Q4 2018 |
| Applied Impact Analysis of the Sempra LGPs – Gauging Cost-effectiveness of the Non-resource LGPs; | Impact | Energy Division | $125,000 | Q4 2018 |
| Other Impact Evaluation Needs (TBD) | Impact | Energy Division | $590,000 | TBD |
| Local Government Partnerships Rolling Process Evaluations: First Wave | Process | IOU (SCG) | $295,000 | Q2 2017 |
| Local Government Partnerships Rolling Process Evaluations: Second Wave | Process | IOU | $100,000 | Q1 2018 |

### 2.5.6. 2016 and Beyond Local Government Partnerships EM&V Study Descriptions

This section provides short descriptions, objectives, and key research questions of each of the Local Government Partnership EM&V studies which would be funded with 2016 and 2017 EM&V budgets planned for this sector.

| **Study Title:** Local Government Partnerships Process Study: Comparative Analysis of Select Large Regional LGPs | **Budget: $350,000** |
|---|---|
| **Expected Completion Date:** Q4 2018 | **Study Manager:** Energy Division |
| **Description:** This process study would probe practices, performance, and organization of a handful of large multijurisdictional regional LGPs and compare methods, resources, and decision-maker commitment to better understand how a LGP implementer can put forward and effective regional vision and lead member LGs effectively. It's expected that this study would build upon findings that come out of the LGP-DI Nexus process study. | |
| **Objectives:** Improve Energy Division understanding of Select Large Regional LGPs | |
| ▪ **Key Research Questions:**<br>▪ How do LGP implementers teach, develop capacity in, and lead a course for EE achievement among their member agencies?<br>▪ How do LGPs intervene and respond differently to member agencies of different ability, resource availability, and local leader commitment to create a consistent member roster and put forward a coordinated regional vision?<br>▪ Is there a correlation between population served and ability to make a contribution to the State's EE efforts?<br>▪ Is there a correlation between population served and ability to deliver EE, innovate, serve as effective regional leader, and contribute to the statewide EE conversation?<br>▪ What attributes and predictors are linked to high-performing regional LGPs?<br>▪ Examine how multi-jurisdictional partnerships are organized, how decisions are made, how authority is delegated who is accountable for performance.<br>▪ How do local staff and decision-makers share information and best practices in a regional partnership? How is this different in regions without such an organization?<br>▪ Have cities changed how responsibility and authority for energy efficiency is assigned within local governments as a result of LGP activity? | |
| **EM&V Data Collection Methods:** TBD | |

| **Study Title:** Applied Impact Analysis of the Sempra LGPs – Gauging Cost-effectiveness of the Non-resource LGPs | **Budget:** $125,000 |
|---|---|
| **Expected Completion Date:** Q4 2018 | **Study Manager:** Energy Division |
| **Description:** This study would serve as a remedial evaluation to the CPUC address the Sempra LGPs which were eliminated from the scope of the 2016 LGP impact due to the inability to evaluate these non-resource programs in a conventional manner. The study would provide evaluated impact results for Sempra local government programs which were not included in the prior impact evaluation<br><br>**Background:** When ITRON initiated LGP impact study in 2016, the evaluator had no practical way to assess the Sempra IOUs' LGPs owing to their non-resource treatment of their programs. The evaluator of this study would devise a special methodology in order to understand precisely how much energy savings per ratepayer dollar the Sempra LGPs presently deliver. | |
| **Objective:** Ensure the State fully captures the potential of the local government sector to deliver energy savings from non-resource activities. | |

| **Study Title:** Applied Impact Analysis of the Sempra LGPs – Gauging Cost-effectiveness of the Non-resource LGPs | **Budget:** $125,000 |
|---|---|
| ▪ **Key Research Questions:** What are the measurable effects of Sempra's LCPs in terms of:<br>▪ Conversion rates from initial interest to program participation<br>▪ The extent of cross-program participation or spillover due to LGP's introduction/outreach activities<br>▪ Assess the effectiveness, thoroughness and usefulness of the LGP's database tracking to measure these non-resource program effects<br>▪ Identify and track other key performance benchmarks or indicators that can help administrators determine if the programs are on track to meet overall program goals. | |
| **EM&V Data Collection Methods:** Review of database tracking, database analysis and assessment, frequency analysis of key activities, literature review to identify appropriate non-resource program performance benchmarks, in-depth staff interviews, customer surveys to determine cross participation/spillover effects; | |

| **Study Title:** Local Government Partnerships Process Study: Gap Analysis – Assessing Limiting Factors and Barriers and Appropriate Response to New LG-led PAs | **Budget:** $285,000 |
|---|---|
| **Expected Completion Date:** Q4 2018 | **Study Manager:** Energy Division |
| **Description:** This study would address several areas within and related to the LGP programs that have emerged but that have not yet been treated within an evaluation study including gaps, potential gaps, and advisable mid-course corrections to aid and close achievement gaps and disparities in fair share allocation of EE resources, and revisiting what if any changes or CPUC or IOU affirmations may be warranted with regard to the existing privileges and commitments linked to the LGPs, in light of new and emerging REN and CCA EE programs. | |
| **Objective:** Two-part (could be segmented as two future studies). 1. Analysis of underserved or marginalized markets: Understand how existing or future programs capture potential of the local government's sector to deliver energy savings. Understand distribution of energy efficiency resources for different regions of the State and explore any relevant equity issues. Assess local agency access to tools and resources necessary to effectively compete for state funding. Review LGP relevance and consider future for continuation given changes to the California EE sector. And, 2. Analysis of how LGP program changes may be warranted given progression of this mature sector and introduction of new PA actors: Allow the CPUC to assess on how the local government sector has evolved and its condition with three PA types operating in some markets. Assess how changes may be justified should CCAs proliferate and RENs become permanent or more common. Assess whether LGPs should be assigned an exclusive market segment and how other PA types would operate to avoid redundancy. Assess whether LGPs warrants some minimum threshold for commitment, performance, and competency and whether they merit continuing as the highest-investment category and marquee local government EE program. | |
| **Key Research Questions:**<br>▪ Should LGPs be required to have a higher level of commitment and performance compared to non-IOU PAs' program structures?<br>▪ Do LGPs as "partners" come with a higher level of commitment and expectations linked to higher levels of investment?<br>▪ The LGPs at present have exclusive use of plan writing monies and incentives paid to local agencies for savings achieved. Is this exclusive arrangement warranted?<br>▪ Which local government program type would best be suited to ensuring that some essential EE resources (i.e. a "safety net" are made available at the local level statewide?<br>▪ The LGP evaluation conducted by RIA under IOU direction made findings and recommendations for mature-to-novice LGP knowledge transfer and mentoring. Is Energy Division intervention necessary and justified to | |

| **Study Title:** Local Government Partnerships Process Study: Gap Analysis – Assessing Limiting Factors and Barriers and Appropriate Response to New LG-led PAs | **Budget:** $285,000 |
|---|---|
| put these recommendations into action? If so, how should Energy Division respond?<br>▪ What would be a valid definition of Hard to Reach for use for in the EE sector in California, and are multiple definitions warranted so as to recognize barriers due to geography, language, income, education level, and other factors?<br>▪ How important is consideration of geography in defining "Hard to Reach"?<br>▪ How should geographic criteria be weighed against other qualifying HTR criteria such as income and language barriers to attain an appropriate definition of "Hard to Reach"?<br>▪ How effectively are funds being used across LGPs in different territories? a. How long does it take to train a LG in benchmarking or other capacities for those LGPs that identify as HTR vs. urban LGPs? b. Are savings for a HTR LGP proportionate to those of other LGPs?<br>▪ How are LGPs addressing the goals set forth in SB350?<br>▪ How well equipped are LGPs to address the goals set forth in SB350?<br>▪ What barriers exist that to LGP contributing to SB350 goals?<br>▪ Which specific SB350 goals are challenging LGPs most? Is this applicable across all partnerships? Do certain LGPs, such as those serving rural areas, face special barriers? | |
| **EM&V Data Collection Methods.** Potential EM&V Data Collection and Analysis Methods and Approaches include:<br>• In-depth interviews with stakeholders that include IOU, LGP, and ED staff<br>• GIS Analysis (digitized map layers could have benefit in the study and in the field to visually present HTR regions and barriers to reaching them)<br>▪ In-depth interviews—for customer experiences with IOUs, LGPs;, and DI vendors triangulated by satisfaction surveys | |

| **Study Title:** Local Government Partnerships Rolling Comprehensive Process Evaluations: First Wave | **Budget:** $295,000 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** SoCalGas |
| **Description:** Each IOU will conduct comprehensive process evaluations on several of its LGPs each year, which it is thought would add some depth to an evaluation. By rotating to a new IOU each year, it is thought that each LGP in an IOU service territory will receive a comprehensive process evaluation every four or five years. Each IOU will oversee the evaluations for its own LGPs.<br><br>One common scope of work will be used for all individual process evaluations of LGPs so that findings can be compared year after year. The specific number of LGPs to be evaluated in each year will depend on the available budget each year. To avoid duplication with existing studies, at the start of each process evaluation, the IOUs will research and disclose those issues addressed by other LGP evaluation studies either planned or in progress.<br><br>For 2015, the LGPs that will be evaluated through this process are:<br><br>PG&E:<br>▪ Association of Monterey Bay Area Governments (AMBAG)<br>▪ San Luis Obispo County (implemented with SCG)<br>▪ San Mateo County<br>▪ Sierra Nevada<br>▪ Valley Innovative Energy Watch (VIEW, jointly implemented with SCE and SCG)<br><br>SCE/SCG:<br>▪ Los Angeles County | |

| **Study Title:** Local Government Partnerships Rolling Comprehensive Process Evaluations: First Wave | **Budget:** $295,000 |
|---|---|
| ▪ Riverside County<br>▪ San Bernardino County<br><br>SDG&E:<br>▪ City of Chula Vista | |
| **Objectives**: 1) Provide full documentation of each LGP's suite of activities at the time of the evaluation; 2) Provide customized recommendations to each LGP on how they can improve their progress towards their filed program objectives, taking into account the unique nature of each local government; 3) Gauge and track customer satisfaction with each evaluated LGP; 4) Document how each LGP has adopted and implemented the recommendations from the previous process evaluation. | |
| **Key Research Questions:** Based upon study areas described in the California Evaluation Framework (2004**)** the following will be examined<br>• How well does each partner (IOU, implementer, local government) understand its respective roles and responsibilities? How can they better collaborate together?<br>• Program design, goal setting, common vision, and the improvement process,<br>• Program staffing, staff skills, training, management and operations, institutional set-up,<br>• Program information and information support systems,<br>• Program targeting, marketing, and outreach efforts,<br>• Program theories, theory assumptions, and key theory relationships – especially their causal relationships,<br>• Program timing and timelines,<br>• Participant satisfaction (both overall and individual components that interact with the participant in order for these to be assessed),<br>• Quality control procedures and processes,<br>• Reasons for unexpected low (or high) participation rates,<br>• Reasons for overly high free riders, or too low a level of market effects, free- drivers or spillover,<br>• Use of new practices or best practices, and intended or unanticipated market effects, among others.<br>• And additional local research issues to be determined at the time of the project initiation meeting. | |
| **EM&V Data Collection Methods:** TBD but will conform to process evaluation methods per the California Evaluation Framework (2004) | |

| **Study Title:** Local Government Partnerships Rolling Comprehensive Process Evaluations: Second Wave | **Budget:** $100,000 |
|---|---|
| **Expected Completion Date:** Q1 2018 | **Study Manager:** SoCalGas |
| **Description:** This is a continuation of the Local Government Partnerships Rolling Comprehensive Process Evaluations, using the same scope of work with each wave budgeted annually. Please see the Description section in the First Wave study description.<br><br>For the 2016 program year, the number of LGPs to be evaluated is yet to be determined. | |
| **Objectives**: This is a continuation of the Local Government Partnerships Rolling Comprehensive Process Evaluations, using the same scope of work with each wave budgeted annually. Please see the Objectives section in the First Wave study description. | |

| |
|---|
| **Key Research Questions:** This is a continuation of the Local Government Partnerships Rolling Comprehensive Process Evaluations, using the same scope of work with each wave budgeted separately. Please see the Key Research Questions section in the First Wave study description. |
| **EM&V Data Collection Methods:** This is a continuation of the Local Government Partnerships Rolling Comprehensive Process Evaluations, using the same scope of work with each wave budgeted annually. Please see the PY2015 Comprehensive Process Evaluation plan for the common scope of work and data collection methods, available at: http://www.energydataweb.com/cpucFiles/pdaDocs/1590/FINAL%20Research%20Plan%20-%20LGP%20Process%20Evaluations%20-%20clean.pdf |

## Ex Ante Updates

Programs and activities in this sector use ex ante savings estimates and should be aware of updates to these estimates and studies needed to improve the savings estimates. However, a section on *ex ante* updates is not included in this chapter. The studies planned in this sector would not likely be designed to directly inform updates to ex ante savings estimates. Please see the customer specific research plans for discussion of updates to ex ante savings estimates. A companion Energy Division-led RENs impact assessment will likely be completed by summer 2017.

### 2.5.7. Related EM&V Studies that Inform Evaluation of Local Government Partnerships

The existing list of evaluations in progress and proposed for the LGPs is presented in Tables 16 and 18 above; they serve to frame the most pertinent and urgent questions and issues that the Energy Division has elevated by way of the stakeholder process.

In addition there are scores of related EM&V studies planned or ongoing that may touch on local government themes. Table 19, below, lists the other studies that may be of interest to local governments. To find out more about these studies, reference the specific roadmap indicated where the related study resides and look up the study description by funding cycle.

***Table 19. Other Studies that Inform IOU LGP Evaluation***

| N | Funding Cycle | Roadmap | Study Name | Study Type | Study Lead | Study Budget | Estimated Completion Dates | Notes on Study Relevant to LGPs |
|---|---|---|---|---|---|---|---|---|
| 1 | 2013-2014 | Finance | Impact Evaluation #1 – Cross-Cutting and Attribution Research | Impact | Energy Division | $350,000 | Q1 2016 | Would consider the attribution analysis method for local finance programs |
| 2 | 2013-2014 | Finance | Process Evaluation #2A – HERO Loan Program | Process | IOU | $200,000 | Q2 2016 | Expects to look at the role of local governments in this program |
| 3 | 2013-2014 | HVAC | Market Assessment to Identify Baselines and Barriers for Existing HVAC Conditions, Building Permit and Title 24 Compliance | Market | Energy Division | $1,450,000 | Q3 2016 | Evaluators may phone or go onsite to local government permit departments to pull permits |
| 4 | 2015 | HVAC | HVAC Permitting Characterization | Process | IOU (SCG) | $60,000 | Q4 2016 | Look at whether IOUs could perform outreach to municipalities through LGPs for better permitting system |
| 5 | 2015 | Residential | 12 – EUC-HU Process Evaluation Phase 2 | Process | IOU (PG&E) | $150,000 | Q3 2016 | Plans to interview local governments involved in the home retrofit and renovation marketplace |
| 6 | 2013-2014 | Commercial | 2013-2014 Impact Evaluation of Deemed, Direct Installation and Third Party Programs | Impact | Energy Division | $500,000 | Q2 2017 | Impacts would include some measures installed within areas covered by the LGPs, although not specific to LGPs |
| 7 | 2013-2014 | Commercial | Direct Install Process Evaluation | Process | Energy Division | $300,000 | Q2 2016 | Expected to be rolled into a single study using both 2013-2014 and 2015 funds. See 2015 Direct Install Process Evaluation study below. |
| 8 | 2013-2014 | Commercial | 3P Program Value and Effectiveness Study | Process | Energy Division | $600,000 | Q4 2015 | Study may cover third-party programs who service LGPs. |
| 9 | 2015 | Commercial | 2015 Impact Evaluation of Deemed, Direct Installation and Third Party Programs | Impact | Energy Division | $500,000 | Q2 2017 | Impacts would include some measures installed within areas covered by the LGPs, although not specific to LGPs |
| 10 | 2015 | Commercial | 2015 Direct Install Process Evaluation | Process | Energy Division | $360,000 | Q2 2016 | Rolled into a single study using both 2013-2014 and 2015 funds. Goal is to characterize DI programs. The LGP survey collected some information regarding DI during the recent Internet survey with local governments. The overlap between LGPs and 3Ps and how they work together are of particular interest in this evaluation and would include examining overall bene-fits of offering DI |

| N | Funding Cycle | Roadmap | Study Name | Study Type | Study Lead | Study Budget | Estimated Completion Dates | Notes on Study Relevant to LGPs |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | through the LGPs and 3Ps. |

## 2.6. Regional Energy Networks and Community Choice Aggregators

### 2.6.1. Background

The 2016 update of the EM&V Plan provides for this roadmap chapter to present the State's efforts to track and evaluate Regional Energy Network (REN) pilots and Community Choice Aggregators (CCAs). This update represents the second revision since this roadmap chapter was introduced in Q2 2015. The three non-IOU program administrators (PAs) represent an increasingly important position within the EE portfolio and are viewed as innovation drivers, giving special attention to targeting hard-to-reach niche markets and other untapped opportunities. At present, this chapter covers EE programs administered by the Bay Area Regional Energy Network, the Southern California Regional Energy Network, and Marin Clean Energy. These three PAs have representation within the Commission's EM&V programming and structure via the REN-CCA PCG-2, established in 2014. The REN-CCA PCG-2 and this stand-alone RENs-CCAs chapter of the EM&V General Plan are the Energy Division's efforts to grant the non-IOU PAs their own EM&V programming forum on a level with what has traditionally existed for the IOUs.

In addition, all seven of the state's PAs share in discussion of local government-related EE EM&V projects as members of the Energy Division's Stakeholder Advisory Group (StAG) a stakeholder group of interested parties, experts, and advocates who meet by conference call every eight weeks.

### RENs Background

In Guidance Decision 12-05-015, the CPUC requested that proposed REN pilots demonstrate in the applications the extent to which their activities:

- Leverage additional state and federal resources so that energy efficiency programs are offered at lower costs to ratepayers,
- Address the water/energy nexus,
- Develop and deploy new and existing technologies,
- Address workforce training issues, and
- Address hard-to-reach customer segments such as low to moderate residential households and small- to medium-sized businesses.[28]

In Decision D.12-11-015 (November 2012), the CPUC evaluated the RENs proposals according to three criteria:

1. Provide activities that utilities cannot or do not intend to undertake,
2. Pilot activities where there is no current utility program offering, and where there is potential for scalability to a broader geographic reach, if successful, and
3. Pilot activities in hard-to-reach markets, whether or not there is a current utility program that may overlap.[29]

[28] D.12-05-015, page 149-150.

[29] D.12-11-015, page 17.

*Sector and Program Area Long Term Research Roadmaps* - Regional Energy Networks and Community Choice Aggregators

The CPUC approved both the Bay Area Regional Energy Network (BayREN), encompassing the nine Bay Area counties, and the Southern California Regional Energy Network (SoCalREN), which serves the counties of Los Angeles, San Bernardino, Riverside, Ventura, Inyo, Imperial, and Mono, as well as portions of Orange, Kern, Tulare, Santa Barbara and Kings. The Decision also outlined the relationship between the RENs and the IOUs. Specifically, IOUs serve as fiscal managers to the RENs, but are independent of IOUs for program design and delivery. The RENs as pilots are at present ineligible to direct their own ratepayer-funded EM&V work. Described below is an in-progress EM&V study that assesses the RENs' value and effectiveness and that is being overseen by the Energy Division. A companion Energy Division-led RENs impact assessment is also near completion. Combined, these two REN studies cover and inform PY 2013-2015 program activities.

As described below in **Section 2.6.2.**, the RENs are newly authorized to administer ratepayer-funded EE programs as a Program Administrator.

## CCA Background

The California Legislature enacted AB117 in 2002, enabling the creation of CCAs as electricity service providers and allowing them to "apply to administer" energy efficiency programs. In mid 2012, Marin Clean Energy (MCE) became California's first community choice aggregator (CCA) authorized to administer ratepayer-funded EE programs. MCE's inaugural 2012 program activity and funding request came to the Commission by way of the "elect to administer" provision of the PU Code. This move was enabled by the Legislature's prior year legislation that introduced this new "low-bar" EE on-ramp for CCAs (SB790 (Leno, 2011), adding PU Code Sec. 381.1 (e) and (f)).

Some months later in late 2012, MCE approached the Commission again, requesting 2013-2014 program cycle funding via the more expansive but arduous "apply to administer" EE programs provision (AB117 (Midgen, 2002) adding PU Code Sec. 381.1 (a) thru (d)). In December 2013, the CPUC acted on MCE's apply to administer request by approving MCE's 2013-2014 application within D. 12-11-015.

MCE is authorized to administer ratepayer-funded EE programs as a Program Administrator. As the first CCA in California to undertake energy efficiency efforts, MCE is eligible to undertake evaluation efforts and expects to initiate its first EM&V before 2018.

Since the CPUC first authorized MCE in 2012 to administer EE programs, it has expanded outside of Marin County, annexing additional service territory within Contra Costa and Napa counties.[30]

Table 20. presents the *ex ante* first year savings and expenditures of the RENs and MCE for 2013-2015.

### 2.6.2. New Regulatory Developments Affecting REN and CCA EM&V Activities

In August 2016, the CPUC revised its rules to identify a clear funding stream for CCAs to conduct their own process evaluations. Relatedly, the same CPUC rulemaking also modified rules for RENs to lift the

[30] MCE's service area includes the cities of Benicia, Richmond, San Pablo, El Cerrito, Walnut Creek, and Lafayette. MCE also serves the entirety of Napa County and the five cities and towns within it.

prohibition on RENs conducting their own process evaluations and identified a source of ratepayer funds for these efforts.[31]

Thus, the RENs and MCE have been invited to initiate process studies that they would lead in 2016-2017 and that would be ratepayer funded. BayREN and MCE have indicated they intend to exercise this option and have submitted funding requests and study proposals. SoCalREN has indicated that it intends to not elect to exercise this option and will not be requesting 2016-2017 EM&V funding or undertaking a process evaluation.

***Table 20. 2013-2015 Regional Energy Networks and Community Choice Aggregator* Savings and Expenditures***

| Program Administrator | 2013-2014 Program Cycle | | | | 2015 Program Cycle | | | |
|---|---|---|---|---|---|---|---|---|
| | **Energy Savings (MWh)** | **Demand Savings (MW)** | **Gas Savings (Mtherms)** | **Program Expenditures ($000's)** | **Energy Savings (MWh)** | **Demand Savings (MW)** | **Gas Savings (Mtherms)** | **Program Expenditures ($000's)** |
| Bay Area Regional Energy Network (BayREN) | 1,923 | 1 | 238 | $33,980 | 3,988 | 1 | 350 | $16,747 |
| Marin Clean Energy (MCE) | 892 | 0 | 6 | $1,643 | 1,569 | 0 | 38 | $1,564 |
| Southern California Regional Energy Network (SoCalREN) | 466 | 0 | 26 | $25,011 | 1,506 | 1 | 69 | $20,968 |
| **RENs and MCE Total** | 3,281 | 1 | 270 | 60,635 | 7,062 | 2 | 457 | 39,280 |
| **Total EE Portfolio** | 6,829,335 | 1,110 | 100,790 | 1,636,984 | 5,904,569 | 1,336 | 45,742 | 1,203,733 |
| Percentage of Total EE Portfolio | 0.05% | 0.08% | 0.27% | 4% | 0.12% | 0.17% | 1% | 3% |

### 2.6.3. Considerations for Local-Regional Government EE Coordination

The REN pilots (see D. 12-11-015 for details) and the Marin Clean Energy CCA program operation in the local government space calls for close coordination between the IOUs and these new PA portfolios to avoid customer confusion and program redundancy.[32]

[31] "EM&V budgets for non-IOU program administrators, including CCAs and RENs, should be allocated from among the up to 40 percent of the EM&V budget that goes to program administrators, on a proportional basis (based on each program administrator's total program budget) within the utility service areas where the non-IOU administrators operate." Decision 16-08-019, August 18, 2016, Conclusions of Law No. 70, p. 107 http://docs.cpuc.ca.gov/SearchRes.aspx?docformat=ALL&DocID=166232537

[32] Combined, the three PAs offer EE services to some seven million households, which is about 70 percent of the population serviced within the combined IOU service territory.

With this in mind, and with the RENs remaining for now in the status of provisional pilots, the CPUC has placed an emphasis on more and rapid EM&V of the RENs to better understand their long-term prospects to drive California's EE goals, by way of savings achieved, and by way of their ability to grow capacity among the local agencies they serve. The CPUC policy change, described above in **Section 2.6.2.,** to allow RENs to conduct process studies should serve as a useful addition for contributing to the existing body of knowledge on RENs.

Table 24, below, outlines related EM&V studies outside of this roadmap chapter that are programmed or in progress that may contribute to the understanding of the RENs (and CCAs). Some of the more anticipated studies would include study areas such as Code and Standards, Financing Programs, and the single-family Residential Home Upgrade Program.

Energy Division, as the entity tasked with completing impact studies for the EE portfolio, has an obligation to deliver timely and useful REN evaluation reports that probe savings achieved, cost-effectiveness, and other pertinent bottom-line issues. In response, ED with the help of its consultant preparers has completed one 2013-2014 impact assessment and has in progress a 2013-2015 impact evaluation whose completion is expected before summer 2017.

The CPUC has made available an additional $838,332 in 2016 program year funds for Energy Division to complete a third round of evaluation for the RENs and CCAs.

As described above in **Section 2.6.1.**, the RENs were conceived to allow for additional resources to be put toward existing community-level gaps, which the IOUs cannot or do not intend to address. Thus, the RENs were approved and are evaluated according to qualifying compliance criteria. Four years after the RENs and MCE emerged as new EE Program Administrators (PAs), and as the CPUC has in hand some of the more elementary data, it may wish to move to the broader issue of how or whether to set additional parameters for each of the three types of EE PAs operating in California (IOU, CCA, and REN).

Energy Division anticipates that an important future CPUC need may be useful research to address remaining resolved questions regarding the appropriateness of some division of the EE market among the three PA types. As a response, Energy Division is proposing a new process evaluation within the LGP roadmap (in **Section 2.5.5.** above) to conduct a gap analysis that would, among other things, examine REN-CCA-IOU cooperation through the LGP lens. The LGP lens approach to appraising the existing condition of multiple PAs simultaneously operating in the local government space would seek to determine whether the LGPs, as a mature program, warrant revisions to ensure the LGP programs preserve their position as model leaders for innovation in the EE space. Thus, one sees that LGPs and RENs-CCAs, although treated separately within their own roadmap chapters, remain fairly intertwined when it comes to program delivery and planning.

As with the RENs, Energy Division expects the CPUC policy change described above in **Section 2.6.2** (to establish a defined funding allocation for CCAs to conduct process studies) would enable MCE to supplement Energy Division capacity to deliver evaluation findings on their CCA experience. This leverage of Energy Division capacity should grow understanding of this emerging Program Administrator and other CCAs who may come forward to request CPUC approval to conduct EE programs with ratepayer funds.

### 2.6.4. 2013-2015 RENs and CCA EM&V Studies

Table 21 shows three Energy Division-led studies funded with 2013-2015 funds expected to be completed in 2017.

***Table 21. 2013-2015 Regional Energy Networks and Community Choice Aggregator EM&V Studies, Budgets, and Expected Dates of Completion***

| 2013-2015 Study Area/Title | Study Type | Study Manager | Budget | Completion Date |
|---|---|---|---|---|
| **Studies In Progress** | | | | |
| PY 2013-2015 REN Impact Evaluation | Impact | Energy Division | $215,000 | Q2 2017 |
| PY 2013-2015 RENs Process Study: More Fully Assessing Program Efforts and Future Potential | Process | | $250,000 | Q4 2017 |
| Market Scalability Study of the RENs and MCE Multifamily Programs | Process | | $110,000 | Q4 2017 |

## 2.6.5. 2013-2015 RENs and CCA EM&V Study Descriptions

This section details CPUC-programmed funding to address evaluation needs for program years through 2015.

| **Study Title:** PY 2013-2015 REN Impact Evaluation | **Budget:** $215,000 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** Energy Division<br>**Consultant Preparer:** APEX |
| **Description:** This study would conduct an ex post analysis on the REN programs. The study would focus on the program-measure combinations that contribute the highest level of uncertainty in the lifecycle net savings values for the portfolio of RENs' programs. Activities for the multifamily whole building projects include calibrated simulation models, onsite visits, and baseline and net of free-ridership assessment. For the analysis of REN single-family Home Upgrade programs, the study would estimate gross savings impacts using a pooled fixed-effects billing analysis approach. To assess changes in energy usage and aid in comparison across years, the billing analysis would follow an approach similar to the one developed for the 2013-2014 REN home upgrade impact evaluation. | |
| **Objectives:**<br>▪ Estimate key impact parameters (e.g., NTGRs or gross realization rates) for REN multifamily and single family programs. | |
| **Key Research Questions:**<br>▪ What are the gross energy and demand savings (therms, kWh, kW) achieved by the BayREN and SoCalREN resource programs?<br>▪ What are the net energy and demand savings achieved by the programs?<br>▪ How can these programs improve their ex ante savings claims so that they align with ex post values? | |
| **Potential EM&V Methods:** Telephone surveys to develop NTGRs, onsite visits, calibrated simulation models, and billing analysis to estimate gross and net savings values and identifying attribution methodology. | |

| **Study Title:** PY 2013-2015 RENs Process Study: More Fully Assessing Program Efforts and Future Potential | **Budget:** $250,000 |
|---|---|
| **Expected Completion Date**: Q4 2017 | **Study Manager:** Energy Division<br>**Consultant Preparer:** RIA |
| **Description:** Process evaluation | |
| **Objective:** Further enhance understanding of benefit of Regional Energy Network pilots. This study would answer remaining questions not addressed in the PY 2013-2014 study. The study would be meant to inform the appropriateness of REN next steps and program expansion to inform the CPUC's direction on the issue, including whether continued probationary status is warranted, whether the RENs should be made permanent, and whether new REN applications would be invited. Proposed study would also address program areas that the PY 2013-2014 evaluation study did not cover including the Regional Energy Center pubic agency technical assistance, and Water-Energy Nexus efforts. The study would consider how RENs may be driving innovation within EE in California and | |

| **Study Title:** PY 2013-2015 RENs Process Study: More Fully Assessing Program Efforts and Future Potential | **Budget:** $250,000 |
|---|---|
| would attempt to characterize spillover benefit from this new program administrator. | |

**Key Research Questions:**

- How valuable and easy to use do customers find the SoCalREN Enterprise Energy Management Information System (EEMIS) and Community Energy Efficiency Project Management System (CEEPMS) software as well as any other Energy Management Software (EMS) tools?
- What would be the cost to scale up EMS training and support to a statewide level?
  - How do program administrators (RENs) leverage state government programs, and what are their motivations for offering energy efficiency programs?
  - Provide a comparison of goals vs. actual results for resource and non-resource activities;
  - Assessing the effectiveness of the roles that RENS play as program administrators?
  - How do program administrators (RENs) get the most of the state government programs, and what are their advantages (to offering energy efficiency programs)?
  - Document the progress of the recommendations made in the previous Value and Effectiveness Study for the RENs (ODC recommendation);
  - Systematically gather additional data specific to customer and contractor confusion
- An impact evaluation that replicates the non-resource assessment verification analysis with additional program years and non-resource databases and attempt an attribution analysis in order to quantify the benefits of the non-resource activities (Itron recommendation); and
- The value of the metrics currently tracked for non-resource programs is questionable as they are not linked directly back to specific program goals.
- Assess non-resource attribution caused by program efforts.

**Potential EM&V Methods:** Secondary data collection and analysis

| **Study Title:** Market Scalability Study of the RENs and MCE Multifamily Programs | **Budget:** $110,000 |
|---|---|
| **Expected Completion Date**: Q4 2017 | **Study Manager:** Energy Division<br>**Consultant Preparer:** ITRON |

**Description:** This study would characterize the presence of multi-family properties in both REN and MCE territories in order to determine the market potential of the REN multi-family whole building programs and MCE's multi-family rebate program. This study would apply historical program and project costs to the service areas to determine potential ratepayer costs to reach threshold market penetration goals.

**Objective:** To improve program design, implementation and outreach activities/outputs and outcomes as they relate to savings, cost-effectiveness, etc.

**Key Research Questions:**

- What are the common characteristics of the properties that have not been treated by the MF programs? Are these characteristics indicative of barriers to participation?
- What have the RENs and MCE accomplished with their multi-family properties and what would it take to reach 10, 20, and 30% of market area?
- Would it be cost-effective to scale these programs up? At this point the TRCs of their programs are well below 1.
- What are the vintages, building characteristics, owner profiles, and measure needs of the buildings that have been treated by the programs? In which areas are the buildings located that have participated in the program – are they in lower income areas?
- How many MF buildings are in the REN and MCE service areas that could still be served by the programs?
- Since MCE's program is designed more like the IOU MFEER programs, should the study take a different approach to examining the scalability of MCE's program compared to the whole building programs offered by the RENs?

| **Study Title:** Market Scalability Study of the RENs and MCE Multifamily Programs | **Budget:** $110,000 |
|---|---|
| **Potential EM&V Methods:** Secondary data collection and analysis | |

## 2.6.6. Active Programs for RENs and CCAs in 2016 and Beyond

The existing program list proposed for the RENs and CCAs are presented in Table 22 below; and set the scope for analysis that may be needed in the 2016 and beyond evaluations.

**Table 22: Revised and Proposed Budgets for 2016-2017- REN and CCA**

| IOU | Program ID | Program Name | 2016 Revised Budgets | 2017 Proposed Budgets |
|---|---|---|---|---|
| **Regional Energy Networks/Community Choice Aggregator** | | | | |
| BayREN | BAYREN01 | Single Family | 8,494,484 | 7,173,249 |
| BayREN | BAYREN02 | Multifamily | 6,476,600 | 6,476,600 |
| BayREN | BAYREN03 | Codes and Standards | 1,492,087 | 1,274,500 |
| BayREN | BAYREN04 | Financing | 1,535,351 | 1,612,651 |
| SoCalREN | SCR-EUC-A1 | Local Marketing and Outreach | 1,806,827 | 1,636,372 |
| SoCalREN | SCR-EUC-A2 | Green Building Labeling | 1,161,721 | 1,005,000 |
| SoCalREN | SCR-EUC-A3 | Flex Path Incentives | 5,206,770 | 2,307,154 |
| SoCalREN | SCR-EUC-A4 | Contractor Outreach and Training | 1,770,399 | 507,125 |
| SoCalREN | SCR-EUC-A5 | Multifamily Incentives | 11,932,034 | 4,771,901 |
| SoCalREN | SCR-EUC-A6 | Low-Income Single Family Residential | 199,802 | 350,000 |
| SoCalREN | SCR-FIN-B1 | Public Building Loan Loss Reserve | 680,637 | 100,000 |
| SoCalREN | SCR-FIN-B2 | EUC Residential Loan Loss Reserve | 3,519,109 | 1,737,500 |
| SoCalREN | SCR-FIN-B4 | Non-Residential PACE | 2,525,271 | 705,750 |
| SoCalREN | SCR-FIN-B5 | Public Agency Revolving Loan Fund | 54,234 | 236,000 |
| SoCalREN | SCR-REC-C1 | Aggregated Regional Procurement | 50,189 | 3,355,771 |
| SoCalREN | SCR-REC-C2 | Integrated Comprehensive Whole Building Retrofits | 7,225,310 | 3,328,601 |
| SoCalREN | SCR-REC-C3 | Regional Climate Action and Energy Plan | 421,957 | 395,120 |
| SoCalREN | SCR-REC-C4 | Water-Energy Nexus | 0 | 253,893 |
| SoCalREN | SCR-REC-C5 | Regional Energy Project Tracking and Permitting (CEEPMS) | 50,189 | 138,735 |
| SoCalREN | SCR-REC-C6 | Marketing, Outreach, Education, and Training | 933,137 | 672,078 |
| SoCalREN | SCR-REC-C7 | Workforce Development | 613,417 | 150,000 |
| MCE | MCE 01 | Multi-Family | 667,555 | 667,555 |
| MCE | MCE 02 | Small Commercial | 658,711 | 658,711 |
| MCE | MCE 03 | Single Family | 233,050 | 233,050 |
| MCE | MCE 04 | Financing Pilots | 27,031 | 27,031 |
| **Regional Energy Networks/Community Choice Aggregator Subtotal ('000s)** | | | **57,736** | **39,774** |

| IOU | Program ID | Program Name | 2016 Revised Budgets | 2017 Proposed Budgets |
|---|---|---|---|---|
| **Regional Energy Networks/Community Choice Aggregator** | | | | |
| **Total EE Portfolio ('000s)*** | | | **1,301,346** | **928,136** |
| **Percentage of Total EE Portfolio** | | | **4%** | **4%** |
| *NOTE: The 2016 and 2017 budgets include Codes and Standards program budgets but not Low Income Energy Efficiency program budgets with the exception of PG&E, which includes both | | | | |

### 2.6.7. 2016 and Beyond REN and CCA EM&V Studies

**Proposed Energy Division Budget**: $1,676,664 (2016 and 2017)

The Regional Energy Network and Community Choice Aggregator roadmap (this EM&V Plan chapter) has received new two-year (2016 and 2017) funding in the amount of $1.6 million for Energy Division-led studies. This funding is made available to program new impact, process, and market studies and evaluations to improve understanding and implementation of REN and CCA programs and activities.

The PY 2013-2014 Value and Effectiveness Study of the RENs identified several areas for additional investigation in future studies. These questions have been incorporated into the proposed RENs study described above and titled *PY2015 RENs Process Study: More Fully Assessing Program Efforts and Future Potential.*

Additional potential future study questions for RENs that do not fit into a programmed study include:

- How valuable and easy to use do customers find the SoCalREN Enterprise Energy Management Information System (EEMIS) and Community Energy Efficiency Project Management System (CEEPMS) software?
- What would be the cost to scale up EEMIS training and support to a statewide level?
  - How do program administrators (RENs) get the most of the state government programs, and what are their advantages (to offering energy efficiency programs)?
  - Systematically gather additional data specific to customer and contractor confusion

**Proposed Program Administrator Budgets**: $207,664 (2017)

The Regional Energy Network and Community Choice Aggregator evaluation funding was approved, but the mechanics of the transfer of funds has proven challenging. Energy Division staff are working with the REN and CCA implementers to resolve the issue per Commission direction. At the time of this draft, the final budgets for the REN and CCAs was not reconciled. Per D.16-08-019, EM&V funding will be distributed to RENs proportionally based on program budgets after the business plans are approved. This approval would not be granted prior to PY2018 The budgets will be clarified in the final version of the master plan. Some early concepts for studies are provided below. Further detail on study plans will be shared as they are developed further.

The 2017 EM&V budgets for RENs and CCAs are summarized in Tables 23 and 24 below.

***Table 23: Summary REN EM&V Budgets for 2016-2017***[33]

| Organization | 2016 Budgets | 2017 Proposed Budgets- Assuming a 27.5% Split |
|---|---|---|
| BayREN | N/A | $189,487 |
| MCE | N/A | $18,177 |
| SoCalREN[34] | N/A | $0 |

This section proposes future REN-CCA studies to assess project efforts through 2017 to be funded with 2015-2017 budget funds, as shown in Table 24 below.

***Table 24. 2016 and Beyond Proposed REN/CCA EM&V Studies, Budgets, and Dates of Completion (PY 2016 program funds)***[35]

| 2016-2017 Study Area/Title | Study Type | Study Manager | Budget | Completion Date |
|---|---|---|---|---|
| **Candidate Study Concepts and Placeholders** | | | | |
| PY 2016-2017 Enhancing and Enabling Replicability Potential and Other Non-quantified Benefits of the Non-IOU PAs. | Process | Energy Division | $250,000 | Q2 2018 |
| PY 2016-2017 EM&V Metastudy of Non-IOU PAs' Evaluation Efforts | Process | Energy Division | $250,000 | Q4 2018 |
| PY 2016-2017 Local Agency Internal EE/Sustainability Fund Proliferation Market Assessment | Process | Energy Division | $250,000 | Q1 2019 |
| PY 2016-2017: REN/CCA Impact Evaluations | Impact | Energy Division | $850,000 | Q4 2019 |
| PY 2016-2017 Process Study of BayREN EE Programs | Process | BayREN | ~$275,617* | Q4 2018 |
| PY 2016-2017 Process Study of MCE EE Programs | Process | MCE | ~$114,518* | Q4 2018 |

**Will require augmentation of additional funds from future years or program funds.*

## 2.6.8. 2016 and Beyond REN and CCA EM&V Study Descriptions

| | |
|---|---|
| **Study Title:** Enhancing and Enabling Replicability Potential and Other Non-quantified Benefits of the Non-IOU PAs. | **Budget:** $250,000 |
| **Expected Completion Date**: Q2 2018 | **Study Manager:** Energy Division<br>**Consultant Preparer:** TBD |
| **Description:** *Enhancing and Enabling Replicability Potential and Other Non-quantified Benefits of the Non-IOU PAs.* This study would propose to examine REN and CCA efforts to date that demonstrate whether these PAs' provide capacity-building and knowledge-transfer to other regional entities interested in borrowing know-how and lessons | |

[33] The 2016 EM&V Budgets were kept at the same funding levels as 2015 budgets, found in 2015 EM&V Budget from D.15-01-023 page 2 Figure 6 Total Approved Budgets for 2015 ($000). The 2017 budgets are based on an allocation of 4% of the total portfolio and then 27.5% split for the PAs.

[34] SoCalREN will have the opportunity to request funds in the next annual filing (September 2017) which will be post Business Plan submission/approval.

[35] As described above in Section 1.2.2., SoCalREN has indicated that it intends to not elect to exercise an option to lead a process study. Therefore, SoCalREN did not request 2016-2017 EM&V funding and was not provided funds.

| **Study Title:** Enhancing and Enabling Replicability Potential and Other Non-quantified Benefits of the Non-IOU PAs. | **Budget:** $250,000 |
|---|---|
| learned to initiate their own EE PAs. This study would also call out that the CCA's are not bound by a replicability requirement as are the RENs and therefore these differences are worth addressing.<br><br>The study would also attempt to assess and capture n*on-quantified PA program benefits that contribute to the State's goals. Examples might include solar, DR, EV, Aliso Canyon Emergency Response, and other non-ratepayer-funded program activities such as PACE financing that may directly or indirectly support and advance the State's energy and climate goals.* | |
| **Objective:** TBD | |
| **Key Research Questions:** To be scoped; study would be expected to build on findings from prior process evaluations in this area. The future study may or may not include CCAs in the scope of work; tbd at a later date. | |
| **Potential EM&V Methods:** TBD | |

| **Study Title:** PY 2016-2017 EM&V Metastudy of Non-IOU PAs' Evaluation Efforts | **Budget:** $250,000 |
|---|---|
| **Expected Completion Date**: Q2 2018 | **Study Manager:** Energy Division<br>**Consultant Preparer:** TBD |
| **Description:** *EM&V Metastudy of Non-IOU PAs' Evaluation Efforts.* As the RENs and CCAs begin non-direct program efforts and undertake first-time EM&V efforts as lead agency, ED supports monitoring their learning curve to ensure they have adequate resources and feedback to improve effectiveness and performance. | |
| **Objective:** TBD | |
| **Key Research Questions:**<br>• Provide a comparison of goals vs. actual results for resource and non-resource activities;<br>• Assess non-resource attribution caused by program efforts | |
| **Potential EM&V Methods:** TBD | |

| **Study Title:** PY 2016-2017 Local Agency Internal EE/Sustainability Fund Proliferation Market Assessment | **Budget:** $250,000 |
|---|---|
| **Expected Completion Date**: Q2 2018 | **Study Manager:** Energy Division<br>**Consultant Preparer:** TBD |
| **Description:** How can RENs and CCAs enable local agencies to require their departments to be held accountable for paying for the energy they consume? What solutions can be tested and replicated that would allow muni departments to capture energy cost savings to replenish their operating budgets? What strategies could RENs and CCAs employ to have local agency energy cost savings and incentives and rebates support an internal EE/Sustainability fund to allow for accelerate muni EE retrofit projects? | |
| **Objective:** Explore how price signals and behavior modification could motivate energy conservation activities in muni facilities. Explore ways that cost savings could create a catalyst for local agency sustainability funds to undertake those activities (EV, transportation, solar, climate adaptation planning, plan implementation) that are presently not eligible for EE program funding. Explore how existing ratepayer-funded EE muni savings incentive structure might be more effectively structured to achieve deeper EE savings, with higher local agency capacity, at lower cost. | |
| **Key Research Questions:**<br>▪ Can linking energy bill payment responsibility to individual muni departments serve as an effective motivator to save energy so as to stretch local agency dollars?<br>▪ Can advanced metering and energy management systems serve to increase awareness and transparency of the energy-use / energy-cost nexus among local agencies to promote this end? | |

- What can the State do to promote departmental billing responsibility so that local agencies embrace the change swiftly and voluntarily?
- Would some kind of State match or incentive "kicker" be necessary to motivate local agencies to effectively undertake this action?

**Potential EM&V Methods:** TBD

| **Study Title:** PY 2016-2017 RENs and CCAs Impact Evaluations | **Budget:** $850,000 |
|---|---|
| **Expected Completion Date**: Q4 2018 | **Study Manager:** Energy Division<br>**Consultant Preparer:** TBD |

**Description:** Conduct an impact evaluation of the REN and CCA activities in coordination with other impact evaluations of similar programs in the portfolio. This evaluation would continue to build on the current impact evaluation to determine if savings estimates are correct and appropriate for the resource programs and assess performance of program activities implemented in 2016 and beyond

**Objective:** TBD

**Key Research Questions:**

- An impact evaluation that replicates the non-resource assessment verification analysis with additional program years and non-resource databases and attempt an attribution analysis in order to quantify the benefits of the non-resource activities (ITRON recommendation); and
- The value of the metrics currently tracked for non-resource programs is questionable as they are not linked directly back to specific program goals.
- Conduct traditional impact evaluation activities of verifying deemed and custom savings claims through field verification for resource programs.

**Potential EM&V Methods:** TBD but likely a billing analysis comparison between participants and non-participants; review of program records and databases as well as field measurement.

| **Study Title:** PY 2016-2017 Process Study of BayREN Energy EE Programs | **Budget:** $189,487 |
|---|---|
| **Expected Completion Date**: Q2 2018 | **Study Manager:** BayREN<br>**Consultant Preparer:** TBD |

**Description:** The proposed study would conduct evaluations that seek to verify the non-resource benefits of programs such as the Small & Medium Commercial Building Performance Advisor and C&S Program efforts to promote energy code best practices. In addition, BayREN may seek to identify processes and procedures that would allow current non-resource programs (e.g., PAYS, C&S electronic tools) to transition to resource programs.

**Objective:** To conduct process evaluations regarding the effectiveness of BayREN's program offerings.

**Key Research Questions:**

- Document the progress of the recommendations made in the prior RENs Value and Effectiveness Study (ODC recommendations);

**Potential EM&V Methods:** TBD: customer surveys, in-depth interviews, review of program materials and records

| **Study Title:** PY 2016-2017 Process Study of Marin Clean Energy EE Programs | **Budget:** $18,177 |
|---|---|
| **Expected Completion Date**: Q2 2018 | **Study Manager:** MCE<br>**Consultant Preparer:** TBD |

| **Study Title:** PY 2016-2017 Process Study of Marin Clean Energy EE Programs | **Budget:** $18,177 |
|---|---|
| **Description:** Conduct process evaluation to provide a deeper understanding of the effectiveness of its program operations. | |
| **Objective:**<br>▪ Understanding the role of incentives vs. technical assistance in generating projects in the Multifamily Sector. Testing brand awareness of MCE as an energy efficiency resource in our service territory.<br>▪ Understanding customer motivation in the small commercial sector – effectiveness of contractor vs. vendor driven model, how recent changes to incentive levels affected participation rates.<br>▪ Impact assessment of small commercial projects using metered energy data. | |
| **Key Research Questions:**<br>TBD | |
| **Potential EM&V Methods:** TBD | |

## Ex Ante Update

Programs and activities in this sector use ex ante savings estimates and should be aware of updates to these estimates and studies needed to improve the savings estimates. However, a section on ex ante updates is not included in this chapter. The studies planned in this sector would not likely be designed to directly inform updates to ex ante savings estimates. Please see the customer specific research plans for discussion of updates to ex ante savings estimates.

There are dozens of EM&V studies planned or ongoing studies that may inform but are outside of the programmed studies included in this roadmap and which may relate to the RENs or MCE. Table 25 lists the studies thought to relate to the RENs or MCE. To find out more about these studies, go to the specific roadmap shown in the table and look in the study description area by funding cycle.

***Table 25. Other Studies that Relate to or Cover RENs and CCA Program Activities***

| N | Funding Cycle | Roadmap | Study Name | Study Type | Study Lead | Study Budget | Estimated Completion Date | Notes on Study Relevant to RENs or CCA |
|---|---|---|---|---|---|---|---|---|
| 1 | 2013-2014 | Codes & Standards | Compliance Improvement Process Evaluation for IOU Statewide Program and BayREN Codes and Standards Program | Process | Energy Division | $180,000 | Q4 2013 | Assessment of the BayREN delivery of their compliance improvement activities |
| 2 | 2013-2014 | Finance | Impact Evaluation #1 – Cross-Cutting and Attribution Research | Impact | Energy Division | $350,000 | Q2 2016 | Would consider the attribution analysis for local finance programs run by CCA and RENs |
| 3 | 2013-2014 | Finance | Impact Evaluation #3 – Regional Pilot/Program Study | Impact | Energy Division | $250,000 | Q4 2016 | Gross and net evaluation for regional finance programs run by CCA and RENs |
| 4 | 2013-2014 | Finance | Impact Evaluation #4 – Statewide Pilots; (4a) Evaluability Assessment and Study Planning and (4b) Impact Study | Impact | Energy Division | $800,000 | Q4 2016 for 4a and Q4 2017 for $b | Determine data available for evaluation and calculate gross and net energy savings from each financing pilot, including those run by CCA and RENs. |
| 5 | 2013-2014 | Marketing Education and Outreach (ME&O) | Cross-cutting Process Evaluation | Process | Energy Division | $900,000 | Q1 2016 | Plans to provide feedback on ME&O efforts conducted by CSE, the IOUs, and the RENs |
| 6 | 2013-2014 | Residential | 3A – Impact Evaluation of Comparative Energy Usage Report Problems | Impact | Energy Division | $584,342 | 2014 and 2015 | Includes MCE comparative feedback programs |
| 7 | 2013-2014 | Residential | 6B – Focused Impact Evaluation of MF-EUC/MIDI & MFEER | Impact | Energy Division | $200,000 | Q1 2016 | Looks at data collection by RENs to support program impacts |
| 8 | 2013-2014 | Residential | 8B – Focused Impact Evaluation for SF-WH Home Upgrade Basic/Flex Program | Impact | Energy Division | $300,000 | 2015-2016 | Looks at data collection by RENs to support program impacts |

| N | Funding Cycle | Roadmap | Study Name | Study Type | Study Lead | Study Budget | Estimated Completion Date | Notes on Study Relevant to RENs or CCA |
|---|---|---|---|---|---|---|---|---|
| 9 | 2013-2014 | Residential | 6A – MF-EUC/MIDI Pilots & MFEER Program Change Process Evaluation | Process | IOUs | $250,000 | 2014 | Looks at interactions with RENs |
| 10 | 2013-2014 | Residential | 8A – Focused Process Evaluations for SF WH Home Upgrade Program Change | Process | IOUs | $250,000 | 2014 | Looks at interactions with RENs |
| 11 | 2015 | Residential | 3A – Impact Evaluation of Home Energy Report Initiatives (includes Marin Clean Energy program) | Impact | Energy Division | $420,000 which includes a $75K budget for Marin Clean Energy | Q4 2016 | Includes MCE comparative feedback programs |
| 12 | 2015 | Residential | 8B – 2015 Residential Whole House Upgrade Impact Evaluation | Impact | Energy Division | $550,000 with $200K of this budget for RENs | Q3 2017 | Includes all REN Upgrade projects for both upgrade packages. |

# 2.7. Lighting

## 2.7.1. Background

### Sector or Program Area Description

As indicated in the Lighting Chapter of the California Energy Efficiency Strategy Plan, lighting comprises approximately one-fourth of California's electricity use; therefore, the widespread use of energy efficient lighting is a critical element. California's AB 1109 (known as —the Huffman Bill *) will phase-out traditional, low efficiency incandescent lamps by 2018 and help advance the Strategic Plan's goals. However, supporting strategies and implementation activities are needed to achieve the higher goal of a 60 to 80 percent reduction in energy usage for lighting.

Residential lighting comprises 22 percent of electricity use in the average California home. With more than 11 million homes and 500 million light sockets in California, there is substantial potential for energy savings and peak demand reduction.

Nonresidential lighting covers a wide range of applications including task lights on office desks and overhead lighting in industrial warehouses. In the commercial sector, lighting accounts for approximately 35 percent of electricity use. (Source: CEESP, 2011)

The Lighting Chapter of the California Energy Efficiency Strategy Plan outlined the following goals:

1. Develop and implement coordinated policies, procedures, and other market interventions that eliminate barriers, accelerate lighting market transformation* in California and provide incentives for best practice lighting technologies and systems.
2. Define and advance best practices for design, installation, operation and maintenance of integrated systems* to achieve sustainable* lighting solutions for all spaces.
3. Create widespread end user demand to purchase and use best practice lighting technologies and systems.
4. Develop research, development and demonstration (RD&D) networks to create, test, and deliver the lighting solutions needed to transform California's lighting market achieve ZNE goals.

The Lighting Chapter of the California Long Term Strategic Plan outlined a goal to reduce lighting energy consumption by 60%-80%. In order to achieve this kind of lighting energy reduction, the entire suite of IDSM options must be made available to Californians. This must include energy efficiency, demand reduction and dynamic pricing, solar and etc. options. For these Lighting programs to be successful it is important for all the participating and non-participating market actors to be part of the solution to educate and push the right purchase decisions and best installation efforts.

### Lighting Portfolio of Programs for 2013-2015

For 2013-2015, the lighting portfolio of programs has been substantially reorganized in the following:

- Lighting Market Transformation Program (LMT) – No change.
- Lighting Innovation Program (New)
- Primary Lighting Program (New)

The Lighting Innovation Program has been created to pick-up from the demarcation of the Emerging Technology lighting activities. The goal of the Lighting Innovation Program is to test both new

measures/technologies in a scaled environment but also to test programmatic and marketing experiments to gain implementation knowledge.

Most of the commercial lighting savings will come from the utility core deemed, direct install and custom/calculated programs. Savings from commercial lighting are not included in the next section because many of the programs offer more than just lighting measures. Please see the commercial roadmap for the list of commercial roadmap savings.

## Programs included in the Research Scope

For 2013-2015, the portfolio of lighting programs[36] account for 5% of the total portfolio program budget and will contribute 12% and 13% of the overall program KW and kWh energy savings, respectively. Below, please find a summary of sub-program budget and planned energy savings.

***Table 26. 2013-2015 Lighting Programs Savings and Budget Summary***

| IOU | 2013-2015 Program | kW | kWh | Budget |
|---|---|---|---|---|
| SCE | Lighting Market Transformation Sub-Program | - | - | $986,471 |
| SCE | Lighting Innovation Sub-Program | 18,945 | 101,181,484 | $19,479,794 |
| SCE | Primary Lighting Sub-Program | 61,741 | 380,521,984 | $51,849,051 |
| PG&E | Lighting Market Transformation Sub-Program | - | - | $1,996,928 |
| PG&E | Lighting Innovation Sub-Program | 425 | 2,438,821 | $5,800,052 |
| PG&E | Primary Lighting Sub-Program | 38,686 | 227,865,953 | $47,635,271 |
| SDG&E | Lighting Market Transformation Sub-Program | - | - | $989,971 |
| SDG&E | Lighting Innovation Sub-Program | - | - | $5,248,458 |
| SDG&E | Primary Lighting Sub-Program | 10,978 | 97,699,425 | $12,382,346 |
| | **Total Statewide Lighting** | **130,775** | **809,707,667** | **$146,368,342** |
| | % of Statewide Portfolio | **12%** | **13%** | **5%** |

[36] This only includes the main statewide programs and does not include savings or budgets from commercial lighting.

***Table 27. 2016 Lighting Programs Savings and Budget Summary***

| IOU | 2016 Program | kW | kWh | Budget |
|---|---|---|---|---|
| SCE | Lighting Market Transformation Sub-Program | - | - | 316,245 |
| SCE | Lighting Innovation Sub-Program | 5,973 | 29,355,055 | 6,812,979 |
| SCE | Primary Lighting Sub-Program | 27,837 | 198,656,346 | 30,204,626 |
| PG&E | Lighting Market Transformation Sub-Program | - | - | 670,738 |
| PG&E | Lighting Innovation Sub-Program | - | - | 1,692,692 |
| PG&E | Primary Lighting Sub-Program | 6,490 | 54,859,207 | 11,188,130 |
| SDG&E | Lighting Market Transformation Sub-Program | - | - | 68,487 |
| SDG&E | Lighting Innovation Sub-Program (res & non-res) | - | - | 200,761 |
| SDG&E | Primary Lighting Sub-Program | 3,532 | 29,313,037 | 5,994,117 |
| | **Total Statewide Lighting** | **43,832** | **312,183,645** | **57,148,775** |
| | % of Statewide Portfolio (through July 2016)[37] | 13% | 20% | 6% |

## Ex Ante Coordination

Ex ante processes (including DEER updates, Uncertain Measures List updates, work papers review, and custom projects review) incorporate data and results from the latest EM&V studies. The ex ante values that are relevant to this sector are highlighted in this section, they may also be included in other relevant chapters.

## Most recent DEER Update

DEER2016 Update (effective 1/1/2016):

Revises commercial indoor lighting profiles (hours of use and peak period coincident demand) based on 2010-2012 EM&V studies (**http://www.deeresources.com/index.php/deer-versions/deer-2016#LightingProfiles**), and

Incorporates disposition lighting measures from work papers into DEER (**http://www.deeresources.com/index.php/deer-versions/deer-2016#LightingMeasures**).

The Uncertain Measures List update (effective 1/1/2016):

[37] Please refer to the July 2016 monthly reports for PGE, SCE, and SDGE: http://eestats.cpuc.ca.gov/Views/Documents.aspx; The budget reflects 2016 operating budgets; both budget and savings excludes savings from ESA.

changes the hours of use, peak coincident demand, net to gross, and effective useful life of screw-in CFLs of all types (**http://www.deeresources.com/index.php/deer-versions/2015-uncertain-measures-update**) and

changes the baseline of T5 fluorescent lamps and fixtures replacing metal halide lamps based on recent EM&V studies (**http://www.deeresources.com/index.php/deer-versions/2015-uncertain-measures-update**).

Ex ante staff leads and ex post staff leads will coordinate processes, studies, and timelines to better align the flow of information between ex ante and ex post projects. Ex post evaluation studies provide data and results for ex ante updates. Planning for ex ante updates in the future will also require evaluation planning and input. Evaluation studies will need to budget time and schedule to provide input into ex-ante processes, such as DEER and the uncertain measure list. Currently, ex ante funding is budgeted under the overall ex ante contract. More information about the budget is provided in the Ex Ante Review section of this document.

## 2017 DEER Update

This section provides the 2017 DEER Updates from resolution E-4795 adopted by the Commission on August 18, 2016:

***Table 28. 2017 DEER Revisions***

| Measure/Value/Parameter | Content |
|---|---|
| Residential Lighting HVAC Interactive Effects | Residential lighting interactive effects are updated to account for all other code updates and correction identified for DEER2017 |
| Residential Lighting Use Profile | The residential lighting use profile has been updated to be in agreement with previously updated DEER Hours-of-Use and Coincident-Demand-Factors |

## Uncertain Measures List and 2016 Update

To assess what measures to move off and/or add onto the Uncertain Measures List requires looking ahead to IOU portfolios and analysis of ex ante and ex post teams. The current 2015 Uncertain Measures List (**http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF**, Attachment 3) contains the following items for this sector and shall be prioritized in the evaluation studies.

***Table 29. 2015 Uncertain Measures to be Prioritized***

| Utilities | Measure | Areas of Uncertainty |
|---|---|---|
| PGE, SCE, SDGE | Screw-in CFLs of all types with wattage values greater than 30. | Update of the gross baseline assumptions to account for the type and wattage of the lamp being replaced. Previous NTG studies have not focused on high wattage CFL lamps. |
| PGE, SCE, SDGE | Screw-in LED lamps including downlight replacement kits | Update baseline assumptions and net savings including replaced lamp for early retirement versus standard practice for normal replacement and |

| Utilities | Measure | Areas of Uncertainty |
|---|---|---|
| | | replace-on-burnout; market move to LED technology and rapidly changing products and pricing requires verification of assumptions. |
| PGE, SCE, SDGE | LED street lights and outdoor area lighting | Baseline assumptions and net savings including replaced lamp/ballast for early retirement versus standard practice for normal replacement and replace-on-burnout; market move to LED technology requires verification of assumptions. |
| PGE, SCE, SDGE | Occupancy sensor lighting controls - integrated and wall/ceiling | Code changes may change standard practice. |
| PGE, SCE, SDGE | De-lamping of T12 lamps in existing fixtures | De-lamping may normally be a required action during retrofit of surrounding fixtures thus subject to code or other baseline consideration. |
| SCE | LED night lights | Assumptions of replaced equipment and use uncertain. |

The current 2016 Uncertain Measures List contains the following items for this sector and shall be prioritized in the evaluation study planning in section 1.1.6:

***Table 30. 2016 Uncertain Measures to be Prioritized***

| IOU | Measure(s) | Discussion of uncertainty |
|---|---|---|
| PG&E, SCE, and SDG&E | Screw-in CFLs of all types and wattage values in non-residential use. | Examine and review whether an update of the gross baseline assumptions to account for the type and wattage of the lamp being replaced is required. There is uncertainty regarding the common applications (building types and operating hours) for high wattage CFLs and NTG for high wattage CFL lamps. |
| PG&E, SCE, SDG&E | Interior LED bay and high bay lighting | Examine and review whether updating metal halide baseline assumptions to consider high output linear fluorescent technologies as part of the standard practice (as indicated in recently published SCE/Navigant LED research findings) is needed. There is uncertainty in the standard practice assumptions of metal halide baselines. |
| PG&E, SCE, SDG&E | LED street lights and outdoor area lighting | Baseline assumptions and net savings including replaced lamp/ballast for early retirement versus standard practice for normal replacement and replace-on-burnout; market move to LED technology requires verification of assumptions. |

## Program Administrators' Planned Work paper Submissions

Program Administrators submit planned work papers for the upcoming portfolio cycle to Commission staff. These work papers often use DEER data and/or methodology to add technologies that are not in DEER to the energy efficiency portfolio. WP revisions will be per D.15-10-028 on an "as needed" basis and at a maximum of twice a month. Work papers incorporated into DEER/READI that are available for use by SDG&E will not be updated by SDG&E unless explicitly requested by CPUC Ex-Ante Staff.

## New Work paper Development for 2017

***Table 31. 2017 Work papers to be Developed***

| Program Administrator | Measure/Value/Parameter | Reason for New Work paper |
|---|---|---|
| SCE | Exterior Pole Mounted LED Luminaires | WP doesn't exist. Want to move from Custom to Deemed. In development for 2017. |
| SCE | LED Canopy Luminaires | WP doesn't exist. Want to move from Custom to Deemed. |
| SCE | LED Linear Ambient Luminaires | WP doesn't exist. |
| SCE | LED Tube | New WP based on Customized Project trial. This is complete and approved. |
| SCE | LED Pole Mounted & Decorative Exterior Fixtures | WP doesn't exist. |
| SCE | LED Parking Garage Interior Luminaires | WP complete and submitted. Part of deemification. |
| SCE | LED Ambient Commercial Fixtures - Retrofit Kits w/T12 Baseline | New WP based on PGE workpaper. This is complete and approved. |
| PG&E | 4pin LED CFL Lamp Replacement | Work Paper does not exist. |

## Existing Work paper Updates for 2017

***Table 32. Existing Work paper Updates 2017***

| Program Administrator | Measure/Value/Parameter | Reason for Work paper Update |
|---|---|---|
| SCE | Pin Based Exterior Compact Fluorescent Lamp (CFL) Fixture | Update costs. Interactive effect update. |
| SCE | Interior Integral Non-Dimmable (Screw-in) CFLs and Circlines | Lighting update - operating hours, cost. Add more solution codes |
| SCE | Wall Mounted Occupancy Sensors – Multifamily | Lighting update - cost |
| SDG&E | LED channel letter signage | Lighting update – cost. Copy from SDGE work paper |
| SCE | Low Wattage Cold Cathode Replacing Incandescent in Various Locations | Lighting update - cost |

| Program Administrator | Measure/Value/Parameter | Reason for Work paper Update |
|---|---|---|
| SCE | LED Pool and Spa Lighting | Lighting update - operating hours, cost, code updates |
| SCE | Upstream Interior 3-way and Dimmable CFLs | Lighting update - Interactive effect update |
| SCE | CFL Plug in Lamps | Lighting update - Interactive effect update |
| SCE | Integrated Linear Fluorescent Occupancy Sensor | Lighting update - operating hours, cost, Interactive effects |
| SCE | Interior Compact Fluorescent Fixture | Update cost, code, and interactive effects |
| SCE | Interior Linear Fluorescent Fixture | Lighting update - operating hours, cost, methodology, and add new construction |
| SCE | Fluorescent-to-Fluorescent Lamp and Ballast Retrofit | Lighting update - operating hours, interactive effects |
| SCE | Interior Bi-Level Stairwell Lighting | Lighting update – code, cost, and interactive effects |
| SCE | Fluorescent Lamp to Fluorescent Lamp | Lighting update – code and interactive effects |
| SCE | LED street lights | Lighting update – cost, add LS-1 eligibility, interactive effects |
| SCE | Fluorescent to LED Retrofits in Reach-In Display Cases | Lighting update – cost, code |
| SCE | Exterior Induction Lighting | Lighting update - cost, code |
| SCE | Interior LED Downlight Fixtures | Lighting update - cost, code, and interactive effects |
| SCE | LED Exterior Landscape Lighting Fixture | Lighting update - cost, code |
| SCE | Retrofit MR16, PAR30, and PAR38 Fixtures with LED Lamps | Lighting update – Methodology, code, cost, and can be potential copy from PG&E |
| SCE | Exterior LED Wall Pack Fixtures | Lighting update - cost, code, and interactive effects |
| SCE | Exterior LED Lamp Replacement | Lighting update - cost, code |
| SCE | LED High and Low Bay Fixtures | Lighting update – methodology change, cost, and potential copy of PG&E work paper |
| SCE | Exterior LED Luminaire with Integrated Occupancy Sensor | Lighting update. Revise per disposition, and add new construction. Cost and code update as well. |
| SCE | LED Residential Interior Fixtures | Lighting update - cost, code, and interactive effects |
| SCE | LED T8 Replacement Lamps UL Type A | Lighting update - cost, code, and methodology |

| Program Administrator | Measure/Value/Parameter | Reason for Work paper Update |
|---|---|---|
| SCE | LED Ambient Commercial Fixtures - Retrofit Kits | Lighting update - cost, code |
| SCE | LED Residential Exterior Fixtures | Lighting update - cost, code, NTG |
| PG&E | LED PAR Lamps | DEER 2017 Update |
| PG&E | LED Candelabra Replacements | DEER 2017 Update |
| PG&E | LED Globe Lamps | DEER 2017 Update |
| PG&E | LED BR/R Lamps | DEER 2017 Update |
| PG&E | LED A-Lamp | DEER 2017 Update |
| PG&E | LED Downlight | DEER 2017 Update |
| WPSDGENRLG0120 | T8T8 Fluorescent Lamp | Deer Update |
| WPSDGENRLG0081 | LED Display Case | Deer Update |
| WPSDGENRLG0028 | LED Pool and Spa Lighting | Deer Update |
| WPSDGENRLG0030 | Exterior Lighting Retrofits | Deer Update |
| WPSDGENRLG0026 | High Performance Linear Fluorescent Fixtures | Deer Update |
| WPSDGENRLG0022 | Permanent Lamp Removal | Deer Update |
| WPSDGENRLG0013 | Linear Fluorescent | Deer Update |
| WPSDGENRLG0021 | LED Channel Signs | Deer Update |
| WPSDGENRLG0007 | Ceramic Metal Halide Par Lamp | Deer Update |
| WPSDGENRLG0006 | Compact Fluorescent Fixtures | Deer Update |
| WPSDGENRLG0005 | Interior Pulse Start or Ceramic Metal Halide Fixtures | Deer Update |
| WPSDGENRLG0003 | Exterior Induction Fixtures | Deer Update |
| WPSDGERELG1057 | Outdoor Pathway LED | Deer Update |

### 2.7.2. 2013-2015 EMV&V Studies

The table below summarizes the 2013-2015 EM&V Studies that have been budgeted, some of which are in the process of being implemented and others are still in the planning stage.

***Table 33. 2013-2015 Lighting EM&V Studies, Budgets, and Timing***

| 2013-2015 Study Area/Title | Study Manager (ED/IOU) | Budget | Status | Completion Date |
|---|---|---|---|---|
| **Impact** | | | | |
| (Lighting-7) LED Lab Test | ED | $500,000[38] | Underway | 2017 |
| (Lighting-8) Lighting Interactive Study | ED | $450,000 | Complete | 2016 |
| (Lighting-9) Combined 2013-2014 Lighting Market Assessment and Focused Lighting Impact Evaluation Study | ED | $1,630,000 | Partially Complete | 2016 |
| (Lighting-20) 2015 Nonres Lighting Market Study | ED | $200,000 | On hold | N/A |
| 2013-2014 Nonresidential Downstream Deemed ESPI Impact Evaluation | ED | $2,165,000 | Completed | Q1 2016 |
| 2013-2014 Nonresidential Downstream Custom Lighting ESPI Impact Evaluation | ED | $1,215,000 | Completed | Q1 2016 |
| (Lighting -5) Nonresidential Downstream Deemed and Custom Lighting ESPI Impact Evaluation | ED | $1,475,000 | Underway | 2017 |
| (Lighting-16) 2015 Lighting impact evaluations and ESPI evaluations | ED | $560,000 (add-on) | Underway | 2017 |
| **Process** | | | | |
| (Lighting-3) 2013-2014 Lighting Solution Workbook Update | IOUs | $145,090 | Complete | 2014 |
| (Lighting-10) 2013-2014 Lighting Activity Workbook Update | IOUs | $24,950* | Complete | 2013 |
| (Lighting-4a) 2013-2014 Early M&E and Pilots/Trials to support Lighting Innovation: PG&E LED Midstream Trial Evaluation | IOUs | $116,743 | Complete | 2015 |
| (Lighting-4b) 2013-2014 Early M&E and Pilots/Trials to support Lighting Innovation: SCE LED Midstream Pilot Evaluation | IOUs | $101,798 | Complete | 2015 |
| (Lighting-4c) 2013-2014 Early M&E and Pilots/Trials to support Lighting Innovation: PG&E Dimming Ballast and CALCTP Training | IOUs | $28,325 | Complete | 2015 |

[38] PG&E, SDG&E, and SCE are contributing $25,000 to add some additional testing of retrofit kits. This amount is not coming from EM&V funds.

| 2013-2015 Study Area/Title | Study Manager (ED/IOU) | Budget | Status | Completion Date |
|---|---|---|---|---|
| Assessment | | | | |
| (Lighting-11) 2013-2014 Lighting Controls Training Assessment | IOUs | $75,000 ** | Complete | 2016 |
| (Lighting-12) 2013-2014 Evaluation of the San Diego Gas and Electric Lighting Field Services Effort | IOUs | $28,000 | Complete | 2014 |
| (Lighting-14) Statewide Lighting Customer Decision Study | IOUs | $325,000 | Planning | 2018 |
| (Lighting-15) 2015 Statewide Lighting Financing Whitepaper | IOUs | $0*** | N/A | N/A |
| Statewide Lighting Controls Training Assessment – 2015 add on | IOUs | $32,008 | Underway | 2016 |
| LED Lab Test Retrofit Kits | IOUs | $25,000 | Underway | 2016 |
| Nonresidential LED market characterization study | IOUs | $200,000 | On-hold | 2017 |
| TRC Res lighting scenario analysis | IOUs | $12,000 | Underway | 2016 |
| PG&E Advanced Lighting Controls System ALCS) Tool Trial Evaluation | IOUs | $155,000**** | Underway | 2016 |
| LED Price Webscraping | IOUs | $120,000 | Planning | 2017 |
| **Market** | | | | |
| (Lighting-17) 2015 In-home lighting inventory and metering study – Phase 1 | ED | $500,000 | Underway | 2016 |
| (Lighting-18) 2015 Shelf surveys and intercept surveys | ED | $250,000 | Complete | 2016 |

*Lighting Innovation Program funded effort
**Jointly funded through Lighting and WE&T M&E Roadmaps ($75K from Lighting M&E Roadmap and $20K from WE&T M&E Roadmap)

### 2.7.3. 2013-2015 Study Descriptions

A short narrative is provided for each of the proposed studies below. For a more detailed description of each study, please refer to the appendix information in the next section.

| | |
|---|---|
| **Study Title:** 2013-14 Nonresidential Downstream Deemed ESPI Impact Evaluation | **Budget:** $2,165,000 (Note that a portion of this budget was reallocated from the Lighting Roadmap, as this study is evaluating lighting measures). |
| **Expected Completion Date:** Completed | **Study Manager:** (ED) |
| **Description:** This study will develop ex post savings estimates of net and gross savings values for the | |

| **Study Title:** 2013-14 Nonresidential Downstream Deemed ESPI Impact Evaluation | **Budget:** $2,165,000 (Note that a portion of this budget was reallocated from the Lighting Roadmap, as this study is evaluating lighting measures). |
|---|---|
| nonresidential downstream deemed measures that were identified in the identified in the Efficiency Savings and Performance Incentive (ESPI) decision[39]. The evaluation will focus on high uncertainty measures or key measure-parameters (e.g., operating hours for LED lamps) and rely on a combination of new data collection, and existing data from relevant 2006-08 and 2010-12 impact evaluations. This study will develop separate reports for the 2013 and 2014 program years. | |
| **Objective:**<br>• Estimate ex post net and gross lifecycle savings values for nonresidential downstream deemed measures with high uncertainty as identified in Attachment 3 of the ESPI decision. | |
| **Key Research Questions:**<br>• What are ex post net and gross lifecycle savings values for nonresidential downstream deemed measures with high uncertainty as identified in Attachment 3 of the ESPI decision. | |
| **Potential EM&V Methods:** Phone surveys to develop NTGRs, on sites and monitoring to estimate key parameters for high uncertainty measures. | |

| **Study Title:** 2013-14 Nonresidential Downstream Custom Lighting ESPI Impact Evaluation | **Budget:** $1,215,000 (Note that this budget was reallocated from the IALC Roadmap, as this study is evaluating custom measures). |
|---|---|
| **Expected Completion Date:** Completed | **Study Manager:** (ED) |
| **Description:** This study will develop ex post savings estimates of net and gross savings values for the nonresidential downstream custom lighting measures to support the Efficiency Savings and Performance Incentive (ESPI) decision[40]. The evaluation will focus all nonresidential downstream custom lighting measures and rely on new monitoring and verification data collection. This study will develop separate reports for the 2013 and 2014 program years. | |
| **Objective:**<br>• Estimate ex post net and gross lifecycle savings values for nonresidential downstream custom lighting measures to support the ESPI decision. | |
| **Key Research Questions:**<br>• What are ex post net and gross lifecycle savings values for nonresidential downstream custom lighting measures. | |
| **Potential EM&V Methods:** Phone surveys to develop NTGRs, on sites and monitoring. | |

[39] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF

[40] D.13.09.023, Decision Adopting Efficiency Savings and Performance Incentive Mechanism. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M076/K775/76775903.PDF

| **Study Title:** (Lighting-3) 2013-2014 Lighting Solutions Workbook Update | **Budget:** $145,090 |
|---|---|
| **Expected Completion Date:** 2014 | **Study Manager:** IOUs |
| **Description:** In the 2010-2012 program cycle, an initial version of the Lighting Solution Workbook was developed with completed lighting studies from 2010-2012. This Lighting Solution Workbook is used as a statewide lighting planning document. For the 2013-2014 program cycle, Cadmus updated the Workbook. | |
| **Objective:** The goal of this study is to update the Lighting Solution Workbook to further both LMT and lighting strategic plan goals. This project will also provide necessary inputs to Lighting-1 study. | |
| **Key Research Questions:**<br>Can the Lighting Solution Workbook be updated with the completed lighting studies from 2010-2012 and updated for the 2013-2014 program cycle?<br>Note: This project was awarded to the Cadmus Group. The Lighting Solutions Workbook Update project was completed in December 2014. | |
| **Potential EM&V Methods:** | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-4a) 2013-2014 Early M&E and Pilots/Trials to support Lighting Innovation: PG&E LED Midstream Trial Evaluation | **Budget:** $116,743 |
|---|---|
| **Expected Completion Date:** 2015 | **Study Manager:** IOUs (PG&E-only study) |
| **Description:** This study is an evaluation of PG&E's Lighting Innovation Midstream Trial. The trial relies on midstream incentives through participating electrical distributors to increase the sales of LED retrofit lighting products into the commercial market. | |
| **Objective:** Determine how effective the trial's midstream incentive approach is for increasing the sales of energy efficient lighting in the commercial sector. | |
| **Key Research Questions:**<br>• Are there contractors and end-users that have participated in more than one of the three key commercial sector LED programs (i.e., the midstream trial, the downstream/Trade Professional Alliance, and direct install programs)? Or is there little overlap?<br>• How does the midstream delivery mechanism compare to the downstream/Trade Professional Alliance and direct install programs (e.g., estimated savings? Types of customers? Size and types of projects?)<br>• Are the types of lighting measures different or similar between the midstream trial and the direct install programs?<br>• Are the projects (e.g., size, building type) similar or different between the midstream trial, the direct install program, and the downstream program (via the Trade Professional Alliance)? Does this cannibalize or optimize the downstream program?<br>• How satisfied are contractors, distributors, manufacturers, and end-users participating in the trial with their experience?<br>• How likely are additional (i.e., non-participating) distributors and contractors to participate in a midstream incentive program (i.e., if the trial is expanded)? | |
| **Potential EM&V Methods:** Surveys and interviews, program tracking data analysis. | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-4b) 2013-2014 Early M&E and Pilots/Trials to support Lighting Innovation: SCE LED Midstream Pilot Evaluation | **Budget:** $101,798 |
|---|---|
| **Expected Completion Date:** 2015 | **Study Manager:** IOUs (SCE-only study) |
| **Description:** The SCE midstream pilot engages midstream distributors, a previously unaddressed distribution channel for energy efficient lighting products. During the pilot, distributors will provide SCE-backed incentives for LED lighting products to contractors. | |
| **Objective:** This process evaluation will study program design feasibility and the effectiveness of offering incentives using a buy down strategy through distribution of energy efficient lighting products. It will seek to understand the complex commercial lighting channels and develop a strategy to best influence the specification lighting industry. In addition, the process evaluation will focus on investigating the characteristics and viability of the midstream option compared to downstream programs. | |
| **Key Research Questions:**<br>• How does the midstream delivery mechanism compare to downstream programs (e.g., estimated savings? Types of customers? Size and types of projects?)<br>• Is this an effective delivery mechanism (e.g., uptake, satisfaction; ease of participation) that SCE should consider scaling up?<br>• What is the degree of overlap with downstream programs? Does this cannibalize or optimize/supplement the downstream program?<br>• How satisfied are contractors, distributors, and end-users participating in the pilot with their experience?<br>• Are current participating distributors and contractors unique from the general pool of distributors and contractors that sell lighting products to SCE businesses?<br>• How likely are additional (i.e., non-participating) distributors and contractors to participate in a midstream incentive program (i.e., if the pilot is expanded)? | |
| **Potential EM&V Methods:** Surveys and interviews, Program tracking data analysis | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-4c) 2013-2014 Early M&E and Pilots/Trials to support Lighting Innovation: PG&E Dimming Ballast and CALCTP Training Assessment | **Budget:** $28,325 |
|---|---|
| **Expected Completion Date:** 2015 | **Study Manager:** IOUs (PG&E-only Study) |
| **Description:** The PG&E Dimming Ballast and CALCTP Midstream Trial Program provided rebates to contractors from September 2013 to June 2014 for the installation of dimming ballasts with at least 20% task tuning that can be combined with individual or bundled control solutions. In addition, contractors were eligible to receive a bonus rebate for installations that were completed by a CALCTP-certified contractor or electrician. | |
| **Objective:** PG&E PIP requires an assessment of the Trial's midstream incentive approach for preparing the market for the Title 24 code requirements and increasing the sales of dimming ballasts and basic controls in linear fluorescent fixtures among non-residential office customers. This assessment will be qualitative in nature as pre-inspections were not performed in the Trial. | |
| **Key Research Questions:** | |

| **Study Title:** (Lighting-4c) 2013-2014 Early M&E and Pilots/Trials to support Lighting Innovation: PG&E Dimming Ballast and CALCTP Training Assessment | **Budget:** $28,325 |
|---|---|
| • How satisfied are commercial lighting manufacturers and contractors participating in the trial with their experience?<br>• What are the experiences and perceptions of PG&E sales representatives regarding the trial?<br>• How satisfied are end-user customers regarding their experiences with the products and systems installed through the trial?<br>• What is lighting manufacturer, contractor and end-user customer understanding of and experience with dimming ballasts and basic controls in linear fluorescent fixtures and CALCTP?<br>• What is lighting manufacturer, contractor and end-user customer awareness and understanding of Title 24 code requirements?<br>• What is the cost-effectiveness and pay-back of the trial?<br>• What are the energy and non-energy benefits of complying with Title 24 code requirements? | |
| **Potential EM&V Methods:** Interviews, cost effectiveness and pay back analysis. | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-11) Lighting Controls Training Assessment | **Budget:** $75,000* |
|---|---|
| **Expected Completion Date:** 2015 | **Study Manager:** IOUs (SCE is the statewide lead) |
| **Description:** Assessment of lighting contractor trainings including manufacturer-offered training and CALCTP. | |
| **Objective:** This assessment aims to characterize CALCTP training in context with other lighting controls training options, with a focus on manufacturer-provided training. | |
| **Key Research Questions:**<br>• What is the lighting contractor awareness level of lighting controls training options?<br>• What are lighting contractor opinions on the effectiveness, availability, and need for lighting controls training?<br>• What are lighting contractor opinions on defining and measuring "work quality" and "installation quality"? | |
| **Potential EM&V Methods:** Materials from different training programs will be assessed, managers and instructors interviewed, and contractors surveyed from various training backgrounds. | |
| **Potential Ex Ante Uses:** | |

*This reflects the lighting portion of the study budget only. WE&T sector also contributed an additional $20,000 to the study budget.

| **Study Title:** (Lighting-12) 2013-2014 Evaluation of the San Diego Gas and Electric Lighting Field Services Effort | **Budget:** $28,000 |
|---|---|
| **Expected Completion Date:** 2014 | **Study Manager:** IOUs (SDG&E only study) |
| **Description:** SDG&E contracted with Evergreen Economics to conduct field services to support the 2013-2014 lighting program, which is implemented at approximately 420 participating retailer outlets. The | |

| **Study Title:** (Lighting-12) 2013-2014 Evaluation of the San Diego Gas and Electric Lighting Field Services Effort | **Budget:** $28,000 |
|---|---|
| contractor provided management of participating retailers (including small retailers and big box retailers), and development and production of point-of-purchase materials. The contractor's performance is measured based on six Key Performance Indicators (KPIs), which are reported periodically to SDG&E via monthly reports, emails and phone calls. The final report provides findings from a review of contractor documentation on KPIs and gathers feedback from participating retailers and field service representatives. | |
| **Objective:** The overall objective of the research was to identify ways the program can maximize the sales of energy efficient lighting through consumer and retailer education and marketing. The research was primarily focused on evaluating the effectiveness of the contractor's program delivery (e.g., whether it is fulfilling its contract obligations, if SDG&E and the retailers they serve are satisfied with its performance, if there are ways in which program delivery could be improved to be more effective and/or efficient). In addition, we also attempted to provide insights about the effectiveness of program design and market feedback. | |
| **Key Research Questions:**<br>How can the program maximize the sales of energy efficient lighting through consumer and retailer education and marketing?<br>What is the effectiveness of the contractor's program delivery? | |
| **Potential EM&V Methods:** | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-6) 2013-2014 LED Market Characterization and Work Paper Update Study | **Budget:** $500,000 |
|---|---|
| **Expected Completion Date:** 2015 | **Study Manager:** IOUs (SCE is the statewide lead) |
| **Description:** To update existing lighting work papers with timely data collection efforts | |
| **Objective:**<br>• To help update key parameters and methodologies used in LED lighting work papers across the state. The research objectives of this study focus on three key topics for high priority LED product categories:<br>• The ability of the currently used **savings estimation methods** to predict baselines (e.g., wattage reduction ratio and wattage ranges),<br>• Non-residential baseline wattages (which inform the selection of appropriate wattage reduction ratios or wattage ranges), and<br>• LED pricing. | |
| **Key Research Questions by study topic include:**<br>**Savings Estimation Methods:**<br>• Do the multipliers used in current wattage reduction ratios reflect the average delta watts achieved by non-residential customers?<br>• Are other methods more accurate? If so, what makes them so and can that be used to improve the ratio?<br>• If wattage reduction ratios continue to be used, how should those ratios be determined?<br>**Nonresidential Baseline:** | |

| **Study Title:** (Lighting-6) 2013-2014 LED Market Characterization and Work Paper Update Study | **Budget:** $500,000 |
|---|---|
| • Are non-residential decision-makers more inclined to replace lighting equipment before the end of its useful life in the case of LEDs vs. other replacement technologies? Is the decision making for LEDs unique such that it warrants more rigorous research on ER vs ROB baselines?<br>• For a given LED product, what are the market baseline technologies: what the customer would have chosen if not an LED (types, wattages, performance specs)?<br>**Pricing:**<br>• What is the range of prices for LED products of focus (addressing both residential and non-residential measures, but limiting to the LED Quality Standard List for residential measures)?<br>• How are LED price ranges anticipated to change as the market becomes more mature, looking forward 3 years and 5 years?<br>• At what rate are prices changing, and how often should price assumptions be updated?<br>• This study was awarded to Navigant. | |
| **Potential EM&V Methods:** Price web scraping and modeling, Surveys, Program tracking data analysis | |
| **Potential Ex Ante Uses:** Update key parameters and methodologies used in LED work papers. | |

| **Study Title:** (Lighting-7) LED Lab Testing | **Budget:** $500,000 |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** ED |
| **Description:** Similar to the CFL switching lab testing study, this study will perform lab testing to verify LED product specifications and performance. Added $25,000 from IOUs to fund testing of LED retro-fit kits. | |
| **Objective:** The goal of this study is to collect LED performance data and to validate - assumptions | |
| **Key Research Questions:** (not exhaustive)<br>• How does switching LED lights on/off impact the life and performance of the LED lights?<br>• Are the manufacturers' specifications for LED effective useful life accurate?<br>• Are the LED work-paper's assumptions properly stated? | |
| **Potential EM&V Methods:** | |
| **Potential Ex Ante Uses:** Update key parameters and methodologies used in LED ex ante claims | |

| **Study Title:** (Lighting-8) Lighting Interactive Study | **Budget:** $450,000 |
|---|---|
| **Expected Completion Date:** 2016 | **Study Manager:** ED |
| **Description:** To conduct an impact evaluation to isolate the interaction between efficient lighting (i.e., CFLs and LED) on other energy applications within the customer's facility. | |
| **Objective:** The goal of this study is to collect necessary data to validate the lighting interactive effect. This result will be used to update lighting work-papers and other planning documents. This is a highly contentious study topic. We are aiming to use this study result to resolve open debates. | |
| **Key Research Questions:**<br>• Are we able to expand on the current literature by analyzing electric and natural gas billing data from lighting program participants from all three IOU electric and natural gas service territories?<br>• Are we able to expand on the current literature by including both a residential and non-residential component by focusing analysis on the retail segment? | |
| **Potential EM&V Methods:** The proposed billing analysis will be designed to determine if there are | |

| **Study Title:** (Lighting-8) Lighting Interactive Study | **Budget:** $450,000 |
|---|---|
| heating energy usage increases and/or air conditioning energy usage decreases that are statistically different from zero by sector using lighting installations from historical program participants. The analysis will separately analyze former program participants in both the residential and the non-residential sectors using large samples of participants. This approach will maximize the potential to observe IE, while relying on existing information. | |
| **Potential Ex Ante Uses:** Contribute to an update interactive effects in DEER and work papers for ex ante review. | |

| **Study Title:** (Lighting-9) Combined 2013-2014 Lighting Market Assessment and Focused Lighting Impact Evaluation Study | **Budget:** $1,630,000 |
|---|---|
| **Expected Completion Date:** 2016 | **Study Manager:** ED |
| **Description:** 2013-2014 Lighting Market Assessment Study and the remaining components of the Focused Lighting Impact Evaluation for 2013-2014 Program Cycle (i.e., the nonresidential upstream and all residential impact evaluation elements) in one study. Also includes LED pricing trend analysis originally proposed to be funded by the IOU process study for 2015. | |
| **Objective:** The goals of this study are: Collecting impact evaluation data on selected lighting measures for the 2013-2014 IOU lighting programs (and providing results as rapidly as possible); and Continuing current efforts to monitor and profile market changes in the lighting sector. | |
| **Key Research Questions:**<br>• What are the ex post savings results?<br>• How has the composition of replacement lamps on retail store shelves changed since 2012?<br>• What do lamp suppliers consider to be the most prominent changes in the residential lighting market during 2013 and 2014 (including emerging technologies/ applications)? What are the implications of these changes for consumers and other market actors?<br>• What is the appropriate baseline for residential upstream LED lamps?<br>• What is the free ridership level for residential upstream LED lamps?<br>• What is the free ridership level for residential upstream CFLs?<br>• Of the CFLs/LEDs purchased in 2013 and 2014, how many of these were not installed and will never be installed?<br>• What percentage of LED lamp users report early removal or failure of LED lamps in residential applications? What are the primary reasons for removal (in addition to failure)?<br>• How are consumers using LED night lights in residential applications? Are LED nightlights replacing other night lights (and if so what technologies)? What are the hours of operation?<br>• For LED Pricing Trend Analysis<br>  ○ What are the past and future trends around cost of LED lamps in California retail stores?<br>  ○ What are the geographic differences in LED pricing in California?<br>  ○ What are the expected changes in market share by lamp technology based on increased availability of LED lamps and reduced pricing over 2014 levels?<br>  ○ What are the current (and recent past) LED lamp stock and pricing among the various retail channels in the three IOUs service territories? | |
| **Potential EM&V Methods:** Methods include a telephone survey with residential electric customers of PG&E, SCE, and SDG&E; in-store shopper intercept surveys; lighting retailer shelf surveys; in-depth | |

| **Study Title:** (Lighting-9) Combined 2013-2014 Lighting Market Assessment and Focused Lighting Impact Evaluation Study | **Budget:** $1,630,000 |
|---|---|
| interviews with lamp suppliers; tracking data analyses; lamp choice modeling; and data mining. | |
| **Potential Ex Ante Uses:** Update key parameters and methodologies for lighting measures in DEER and in work papers. | |

| **Study Title:** (Lighting-20) 2015 Nonres Lighting Market Study | **Budget:** : $200,000 |
|---|---|
| **Expected Completion Date:** On hold | **Study Manager:** ED |
| **Description:** | |
| **Objective:** | |
| **Key Research Questions:** | |
| **Potential EM&V Methods:** | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-10) 2013-2014 Lighting Activity Workbook Update | **Budget:** $24,950 |
|---|---|
| **Completion Date:** 2013 | **Study Manager:** IOUs |
| **Description:** The Lighting Activity Workbook will serve as a comprehensive database of current lighting-related research. It will be instrumental in documenting and coordinating research efforts across the utilities to advance lighting energy efficiency in California and to ensure research is not repeated. The Workbook Update will include the efforts of other leading efficiency organizations as well as other technology categories. This activity is funded by PG&E Lighting Innovation Program in exchange for SCE funding a similarly priced project. Waypoint Building Group completed the initial Lighting Activity Workbook and the Update.<br><br>Waypoint Building Group developed the initial Lighting Activity Workbook and completed the Workbook Update in October 2013. | |
| **Objective:** The goal of this study is to update the Lighting Activity Workbook to further both LMT and lighting strategic plan goals. | |
| **Key Research Questions:**<br>PG&E led a statewide effort to update the Lighting Activity Workbook which documents research efforts across the utilities and other efficiency organizations, supporting the coordination of research efforts to advance lighting energy efficiency in California. | |
| **Potential EM&V Methods:** | |
| **Potential Ex Ante Uses:** | |

| **Study Title: (Lighting 5) 2015 Nonresidential Downstream Deemed and Custom Lighting ESPI Impact Evaluation** | **Budget: $1,475,000** |
|---|---|
| **Expected Completion Date: Q1 2017** | **Study Manager: (ED)** |
| **Description:** This study will develop ex post savings estimates of net and gross savings values for the | |

| **Study Title: (Lighting 5) 2015 Nonresidential Downstream Deemed and Custom Lighting ESPI Impact Evaluation** | **Budget: $1,475,000** |
|---|---|
| **Expected Completion Date: Q1 2017** | **Study Manager: (ED)** |
| nonresidential custom lighting measures and downstream deemed lighting measures that were identified in the 2015 EPSI uncertain list[1]. For custom lighting measures, the evaluation will include all nonresidential custom lighting measures and rely on new monitoring and verification data collection. For deemed lighting measures, the evaluation will focus on high uncertainty measures or key measure-parameters (e.g., operating hours for LED lamps) and rely on a combination of new data collection, and existing data from relevant 2006-08, 2010-12 and 2013-14 impact evaluations. | |
| **Objective:**<br>• Estimate ex post net and gross lifecycle savings values for nonresidential custom lighting downstream deemed lighting measures with high uncertainty as identified in the 2015 EPSI uncertain list. | |
| **Key Research Questions:**<br>• What are ex post net and gross lifecycle savings values for nonresidential custom lighting measures and downstream deemed lighting measures with high uncertainty as identified in the 2015 EPSI uncertain list. | |
| **Potential EM&V Methods:** Phone surveys to develop NTGRs, on sites and monitoring to estimate key parameters for high uncertainty measures. | |

| **Study Title:** Statewide Lighting Customer Decision Study | **Budget:** $325,000 |
|---|---|
| **Expected Completion Date:**<br>2017 - 2018 | **Study Manager:** IOUs (PG&E is the statewide lead) |
| **Description:**<br>The Residential Lighting Customer Decision Study will provide insights into residential customer decision-making preferences to guide program design with regard to product specifications and incentive design. This latent class discrete choice study will generate purchaser groups for both LED A-lines and LED reflectors (budget permitting, reflectors may be split into BP, PAR, and recessed retrofit) by identifying product attribute preferences through a trade-off analysis. It will provide latent customer segmentations, customer purchase priorities, and desired product features for LED lamps to guide future program design. The focus groups and customer surveys will provide additional insights including general customer perception of LEDs and satisfaction with LED quality. | |
| **Objective:**<br>• The latent class discrete choice analysis will provide insights into customer decision making to guide program design with regard to product specifications and incentive levels:<br>• Identify customer purchase priorities by LED product attribute | |

[1] http://www.cpuc.ca.gov/NR/rdonlyres/9F79154A-065B-4E80-B1AC-58A6E7223F91/0/Final_2015_ESPI_Uncertain_List.pdf

| **Study Title:** Statewide Lighting Customer Decision Study | **Budget:** $325,000 |
|---|---|

- Classify customers into segments based on their purchase considerations
- Develop market adoption models
- Include halogens and advanced CFLs as a new technology option to understand whether the availability of a new baseline technology changes preferences on LEDs
- Include decision scenarios related to CEC specifications

**Key Research Questions:**

Product Attributes:

- Given LEDs' increasing maturity, what is the current state of consumer preferences for LED attributes (wattage equivalent, CRI, color temperature, etc.) and price?
- What are consumer preferences with regard to lamp attributes as specified by the CEC spec?
- Can consumers differentiate between CEC spec and non-CEC spec lamps, and are these differences important to customer satisfaction?
- How do consumers judge the potential "quality" of an LED bulb (price, rated life, Energy Star labeling, CEC spec LEDs versus "value price LEDs", etc.)?
- Have preferences for various LED types changed since the 2012 SCE study? In the 2012 SCE study, customers were more receptive to purchasing reflectors than A-lines because reflectors were often in physically less accessible sockets where the convenience of the longer lifetime justified the extra cost versus an incandescent bulb. Now that the price of LEDs has fallen, are customers more receptive to other LED types (A-lines, etc.)?
- Have consumers started seeing lumens, rather than wattage, as a measure of bulb brightness?
- Do demographics have an effect on LED product uptake?

Influence of Other Technologies:

- What is the influence of halogens and advanced CFLs on consumer preferences for LEDs?
- How do cross-measure substitution effects[41] affect the uptake of incentivized LEDs?
- What types of bulbs are being replaced with LEDs (halogens, incandescents, CFLs), and how does that affect the effectiveness of the programs?
- Has the negative view of LEDs that customers had based on bad past experience with CFLs changed since the 2012 SCE study?

Marketing Recommendations:

- What are the preferred LED attributes for each delivery channel based on customer segmentation, and how should LEDs be marketed within these channels keeping the purchasing priorities of those segments in mind?
- Does utility branding (on the box, aisle violators, etc.) influence the purchase decision?

[41] **Cross-measure substitution effects within the program.** The basic program theory is that providing incentives for a lamp will pull sales away from non-discounted lamps and toward program discounted lamps. The upstream lighting program provided discounts for lamps in multiple measure groups in many retail channels and as such, incentives for one program-discounted upstream lighting measure group pull sales away one or more other program-discounted upstream lighting measure Groups: DNV GL, Impact Evaluation of 2013-14 Upstream and Residential Downstream Programs, DNV GL, p. 103.

| **Study Title:** Statewide Lighting Customer Decision Study | **Budget:** $325,000 |
|---|---|
| • How should LED incentives be optimally allocated to maximize energy savings? How should program design change as the market changes? | |
| **Potential EM&V Methods:** This study will use a latent class discrete choice model. The LCDC technique uncovers trade-offs between product choice while considering customer heterogeneity. | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-15) 2015 Statewide Lighting Financing Whitepaper | **Budget:** $0<br>(project will be funded by the Finance M&E roadmap) |
|---|---|
| **Expected Completion Date:** 2015 | **Study Manager:** IOUs (PG&E is the statewide lead) |
| **Description:** The Lighting Action Plan (LAP) component of California's 2013 – 2015 Energy Efficiency Strategic Plan sets an ambitious goal of 60-80% reduction in the energy used for lighting by 2020. The LAP committee proposes to explore the potential for financing, a key market transformation tool in many programs, to encourage uptake of highly efficient lighting technology. Specifically, the LAP calls for development of a white paper to categorize the demand for and availability of financing options for best practice lighting technologies. This research will investigate the financing landscape for commercial lighting projects and the best designs to promote market transformation. | |
| **Objective:**<br>▪ Understand the demand for and availability of financing for highly efficient lighting technologies.<br>▪ Characterize how greater access to financing would influence adoption of highly efficient lighting technologies.<br>▪ Gauge how availability of financing might be used in program design. | |
| **Key Research Questions:**<br>▪ What is the demand for financing in the lighting sector?<br>▪ What are current financing programs and products that support lighting installations?<br>▪ To what extent are installers involved in arranging financing?<br>▪ How can financing of lighting measures be leveraged for more comprehensive retrofits? | |
| **Potential EM&V Methods:** Interview lighting installers, manufacturer interviews, existing programs review | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-11) Lighting Controls Training Assessment – 2015 add-on | **Budget:** $32,800* |
|---|---|
| **Expected Completion Date:** 2016 | **Study Manager:** IOUs (SCE is the statewide lead) |
| **Description:** Assessment of lighting contractor trainings including manufacturer-offered training and CALCTP. The IOUs added a small amount to the total budget to complete additional interviews. | |
| **Objective:** This assessment aims to characterize CALCTP training in context with other lighting controls training options, with a focus on manufacturer-provided training. | |
| **Key Research Questions:**<br>▪ What is the lighting contractor awareness level of lighting controls training options?<br>▪ What are lighting contractor opinions on the effectiveness, availability, and need for lighting controls training? | |

| **Study Title:** (Lighting-11) Lighting Controls Training Assessment – 2015 add-on | **Budget:** $32,800* |
|---|---|
| ▪ What are lighting contractor opinions on defining and measuring "work quality" and "installation quality"? | |
| **Potential EM&V Methods:** Materials from different training programs will be assessed, managers and instructors interviewed, and contractors surveyed from various training backgrounds. | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-) LED Lab Test Retrofit Kits | **Budget:** $25,000 |
|---|---|
| **Expected Completion Date:** 2016 | **Study Manager: CPUC** |
| **Description: This is a small add-on to the LED Lab Test. Due to program changes after study scoping; the IOUs wished to add LED retrofit kits.** | |
| **Objective: Cover full bandwidth of LED measures** | |
| **Key Research Questions:** see LED Lab Test | |
| **Potential EM&V Methods:** see LED Lab Test | |
| **Potential Ex Ante Uses:** see LED Lab Test | |

| **Study Title:** (Lighting-) Nonresidential LED market characterization study | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** TBD | **Study Manager: SDG&E** |
| **Description:** This study is currently on hold. In October 2015, Navigant on behalf of DLC, conducted a QPL Impact Study, which estimated what proportion of annual LED sales and products are on the QPL. Meister Consultants is doing a follow up to that study. The IOUs are waiting on the results of the Meister Consultants study before deciding whether or not to reinstate this Nonresidential LED Market Characterization Study. | |
| **Objective: TBD** | |
| **Key Research Questions:** | |
| **Potential EM&V Methods:** | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-) TRC Residential lighting scenario analysis | **Budget:** $12,168 |
|---|---|
| **Expected Completion Date:** 2016 | **Study Manager:** PG&E |
| **Description:**<br>TRC was contracted to perform analysis of existing data for the development of a model for use in scenario analysis. The model will be used to predict future residential lighting energy usage under a variety of different purchasing trends and regulatory scenarios. | |
| **Objective:**<br>The purpose of this contract is to explore California residential lighting energy usage patterns under a variety of policy and purchasing scenarios. | |
| **Key Research Questions:** The main outputs of this contract will be: (1) A predictive analysis of residential lighting electricity consumption under different purchasing trends and rebate strategies. This task will use existing data to simulate energy usage under several scenarios, including a). Replacement of all lamps upon burnout with low efficacy products; b). A status quo scenario that assumes half of lamps purchased are high | |

| **Study Title:** (Lighting-) TRC Residential lighting scenario analysis | **Budget:** $12,168 |
|---|---|
| efficacy (LEDs and CFLs) and half are low efficacy (halogens and incandescents); c). Replacement of all lamps as they burn out with LEDs and d). Immediate replacement of all lamps with LEDs. Though some of these scenarios are highly unlikely, they will show where the more plausible scenarios lie on the spectrum of technical potential, thus giving context for comparison with the aggressive goals of the Strategic Plan. (2). Adding availability of Energy Star LED products to existing figures that TRC produced in 2015 that show CEC-Spec product availability. (3) OPTIONAL: A delineation of current EISA regulatory and technological loopholes that allow the ongoing production and sale of incandescent bulbs. (4) OPTIONAL: Developing lamp sales estimates for low efficacy technologies for 2012 – Q2 of 2015. | |
| **Potential EM&V Methods:** Predictive analysis | |
| **Potential Ex Ante Uses:** | |

| **Study Title:** (Lighting-) PG&E Advanced Lighting Controls System (ALCS) Tool Trial Evaluation | **Budget:** $155,000* |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager: PG&E** |
| **Description:**<br>This study is an evaluation of PG&E's Advanced Lighting Controls System Trial. The ALCS Tool is designed for use by lighting contractors when assessing the energy and demand savings potential of possible commercial lighting retrofits. This study is being jointly funded out of the Lighting Innovation budget ($125,000) and the EM&V budget ($155,000) for a total budget of $280,000. | |
| **Objective:** The goal of this study is to evaluate the ALCS Tool during the upcoming PG&E ALCS Tool Trial and provide recommendations that will support wide-scale use of the Tool by program staff and implementation contractors. The evaluation will include verifying the accuracy of savings calculations generated by the Tool and assessing usability and satisfaction with the Tool. | |
| • **Key Research Questions:**<br>• Required Research Objective 1: Assessment of the accuracy of savings calculations generated by the Tool based on existing conditions baselines and identification and quantification of the reasons behind discrepancies.<br>• Required Research Objective 2: Assessment of the accuracy of savings calculations generated by the Tool based on Title 24 requirement baselines and identification and quantification of the reasons behind discrepancies.<br>• Required Research Objective 3: An analysis of the overall satisfaction of contractors and others using the ALCS Tool, the issues they discovered, and their experiences marketing the ALCS savings estimates to end users in the promotion of more extensive retrofits.<br>• Optional Research Objective 4: An analysis of the satisfaction of facilities managers with the retrofit marketing and implementation process, including the influence of the Tool over their decision making regarding more extensive retrofits.<br>Optional Research Objective 5: An analysis of the satisfaction of building occupants after a time period (1 – 2 months) of adjusting to and using the new lighting systems. An assessment of the degree to which the Tool influenced customer decision making around the lighting retrofit. | |
| **Potential EM&V Methods:**<br>Review of ALCS Tool formulas and theory; sensitivity analysis and variable view; in-depth interviews; on-site metering; in-depth interviews. | |
| **Potential Ex Ante Uses:** | |

*Actual total budget is $280,000. EM&V is funding $155,000 and Lighting Innovation is funding $125,000.

| **Study Title:** (Lighting-) LED price web scraping update | **Budget:** 120,000 |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** SCE |
| **Description:** This is an update of the 2013-14 web scraping study to determine price points for LED lamps. | |
| **Objective:** Workpaper and measure cost updates; future program planning | |
| • **Key Research Questions:** What is the range of prices for LED products of focus (addressing both residential and non-residential measures, but limiting to the LED Quality Standard List for residential measures)?<br>• How are LED price ranges anticipated to change as the market becomes more mature, looking forward 3 years and 5 years?<br>• At what rate are prices changing, and how often should price assumptions be updated? | |
| **Potential EM&V Methods:** Web scraping and price modeling | |
| **Potential Ex Ante Uses:** Update measure prices | |

| **Study Title:** (Lighting-16) 2015 Lighting impact evaluations and ESPI evaluations | **Budget:** $560,000 |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** ED |
| **Description:**<br>• This study will conduct impact evaluations for the 2015 lighting programs and well as determine the savings estimates needed for the 2015 ESPI mechanism.<br>• This study will quantify the ex-post UES, NTGR, and install rates for the upstream lighting programs, as well as any deliverables needed for the 2015 ESPI. | |
| **Objective:** The goal of this study is to collect impact evaluation data on selected lighting measures for the 2015 IOU lighting programs (and provide results as rapidly as possible). | |
| **Key Research Questions:**<br>Question 1 (What are the ex post savings results?) addresses the key research question in the January 2016 EM&V Plan as well as the 2015 uncertain measure list's requirement to "update … net savings" for screw-in LED lamps for PG&E, SCE, and SDG&E (as well as updating net savings for other measures).[42]<br><br>Question 2 (What is the appropriate baseline for residential upstream LED lamps?) addresses the 2015 uncertain measure list's requirement to "update baseline assumptions … including replaced lamp for early retirement versus standard practice for normal replacement and replace-on-burnout" for PG&E, SCE, and SDG&E. To clarify, however, the evaluation team's interpretation of the phrase "replaced lamp | |

[42] CPUC ED, 2016. Table 44 (2015 Uncertain Measures to be Prioritized). Pages 181—182. The same source serves as the basis for all remaining quotations in this section of the research plan (Section **Error! Reference source not found.**).

| **Study Title:** (Lighting-16) 2015 Lighting impact evaluations and ESPI evaluations | **Budget:** $560,000 |
|---|---|

for early retirement versus standard practice for normal replacement and replace-on-burnout" is that the uncertainty lies in the extent to which "normal replacement" activities (or "standard practice") involve "early retirement" or "replace-on-burnout." As such, the evaluation team will focus evaluation efforts (in part) on understanding the share of installed LED lamps that replace functioning lamps (early retirement) versus lamps that have stopped working (replace-on-burnout). The evaluation will also address the baseline technology mix for LED lamps.

Question 3 (What is the appropriate baseline for residential upstream CFLs?) addresses the 2015 uncertain measure list's requirement to "update … the gross baseline assumptions to account for the type and wattage of the lamp being replaced" for "screw-in CFLs of all types with wattage values greater than 30 Watts" for PG&E, SCE, and SDG&E.

Question 4 (What is the free ridership level for residential upstream LED lamps?) and Question 5 (What is the free ridership level for upstream CFLs?) address concerns raised by program administrators and other stakeholders during discussions regarding results from the Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Program[43] and discussions of study priorities for the 2015 impact evaluation.

Question 6 (Is there any evidence that consumer satisfaction differs with LED lamps that meet the California Quality LED Specification versus LED lamps that do not meet the spec?) arose from the same discussions and IOU comments on the 2013-14 upstream and residential downstream lighting program impact evaluation report.

- Question 6 (regarding the California Quality LED Specification): the in-home inventory and metering study will provide a more concrete opportunity to investigate satisfaction with LED lamps in use in IOU customer households. That study will thus provide a more appropriate vehicle for addressing the IOUs' concerns regarding the possible market transformational effects of their incentives for LED lamps that meet the spec. The 2015 upstream and residential downstream lighting impact evaluation will provide high-level insights regarding IOU customer satisfaction with LED lamps in general.

**Potential EM&V Methods:** The 2015 impact evaluation will build on the methods from 2010-12 and 2013-14 upstream lighting impact evaluations. The proposed approach for 2015 will still result in estimates of gross savings, net savings, and NTG ratios but will attempt to calculate net savings at the market level. The approach relies upon market-level estimates of energy consumption by technology and measure group (including technologies such as incandescent and halogen lamps, which are not included in the IOUs' programs).

**Potential Ex Ante Uses:** Update key parameters and methodologies for lighting measures in DEER and in work papers.

[43] DNV GL, 2016.

| **Study Title:** (Lighting-17) 2015 In-home lighting inventory and metering study – Phase 1 | **Budget:** $500,000 |
|---|---|
| **Expected Completion Date:** 2016 | **Study Manager:** ED |
| **Description:** The first phase of this study will set the stage for a rigorous lighting in-home inventory and metering study utilizing new lighting meters to inform how lights are being used in homes in the state. | |
| **Objective:** Identify the appropriate scope and methodology for an in-home lighting inventory and metering study in PG&E's, SCE's, and SDG&E's electric service territories. | |
| **Key Research Questions:**<br>• What is the appropriate scope of this effort?<br>• Which sampling approach will most appropriately balance the needs for representativeness and cost-effectiveness of the study?<br>• Which metering technology (or technologies) will best serve the study objectives? | |
| **Potential EM&V Methods:** The study team will likely rely on literature reviews and in-depth interviews with industry experts to develop an appropriate scope of work and sampling approach for this study. | |
| **Potential Ex Ante Uses:** Update hours of use for lighting measures in DEER and in work papers. | |

| **Study Title:** (Lighting-18) 2015 Shelf surveys and intercept surveys | **Budget:** $250,000 |
|---|---|
| **Expected Completion Date:** 2015 | **Study Manager:** ED |
| **Description:** This study will collect data on the availability, diversity and pricing of residential lamps as well as provide insights into consumer decision-making and how that is changing over time as availability, diversity, and prices changes in this rapidly evolving market. | |
| **Objective:** | |
| **Key Research Questions:**<br>• How has the composition of replacement lamps on retail store shelves changed since 2014?<br>• How have lamp prices on retail store shelves changed since 2014?<br>• What factors affect consumer decision-making regarding lamp purchases?<br>• What lamp technologies do consumers intend to replace with their newly-purchased lamps? | |
| **Potential EM&V Methods:** The shelf surveys will gather detailed information regarding all residential replacement lamps stocked in the stores other than linear fluorescent lamps. The shopper intercept surveys will include consumers who are shopping for lamps and focus on purchasing decisions and installation intentions for the newly-purchased lamps. | |
| **Potential Ex Ante Uses:** Updated shelf pricing | |

### 2.7.4. Key Research Questions for 2016 and 2017

**Proposed 2016 and 2017 Energy Division Budget: $5,449,158**

**Proposed 2016 and 2017 Program Administrator Budget: $900,000**

The Lighting evaluation area continues to cover a large portion of the deemed savings generated by the portfolio in residential and commercial activity. **Readers should note that changes in the portfolio as a result of the business plan updates in 2017 may warrant additional data collection not addressed in the study ideas in this section.** In upcoming years, the lighting research area will continue to integrate with the deemed savings estimation and work paper development. The completion of current studies

may reveal some new areas of interest and market study needs for emerging usage of LEDs. Impact and uncertain parameter updates will continue to be an important focus for this research area.

The following studies try to address any gaps in lighting research for the 2016 and beyond period. The studies are in no particular order but are grouped into (a) continuing and (b) new studies:

a. **Possible Continuing Studies**
   i. **Update LED pricing web scraping data**: it is important to include res and non-res pricing. Prices continue to decline rapidly and work papers continue to evolve, meaning that the pricing data needs to be updated continuously. Web scraping is a fast and low cost method to do this. We should also explore whether we can use NEMA data and midstream programs data to obtain information on non-res LED pricing.
   ii. **Midstream lighting WP updates**: The midstream channel may require work paper updates. We need to better understand attribution and savings claims issues. We are collecting downstream level (end-user) information in midstream programs today, even though they function much more like upstream programs. We can't evaluate everything like a downstream program. We are looking for guidance on how to evaluate each of the streams. It is also important to evaluate the trade-off between ease of participation and data intensity. For instance, SCE is collecting a lot more information, which may be a barrier to program participation. What would the in-service rate (gross realization rate) be if we are collecting less information?
   iii. **Net-To-Gross Research**: Should continue for upstream and C&I downstream markets. There will be more mid-stream approaches so perhaps NTG studies need to be done for mid-stream as well.
   iv. **Lighting Market Assessment Research**: Includes shelf surveys, upstream interviews, intercepts, and web-scraping to track price trends across a wide range of product categories.
   v. **Lighting decision making**: There is a continued need for assessing lighting decision making, given the changes in markets under EISA, continuous rapid price declines for LEDs, increased customer familiarity with LED, removal of most CFL incentives, and the increased market share of halogens.
   vi. **Program opportunities after new EISA code takes effect on January 1, 2018**. What are the opportunities for Lighting? What can lighting programs look like in 2018? EISA only touches the middle lumen bins. What's the market for high and low lumen bins? What market share doesn't EISA touch? This could also include a small study to document EISA requirements. This includes **PARs research**: PARs are a key remaining opportunity in 2018. A halogen is the only thing a PAR can replace. A study on PARs may be needed for work paper updates.
   vii. Persistence/maintenance of control technologies. This could possibly be a follow on to the current ALCS tool trial/pilot evaluations. We would follow up with the same study participants after a period (1 to 5 years) to check in with

them. It would be good to understand what ED's point of view is on persistence and lighting controls. This is more likely to be a 2018 study.

viii. Niche market opportunities
   i. Airport run way lights
   ii. Pool lighting
   iii. Parking garage baselines:

**b. Possible New Studies**

i. **In-Home Inventory and Metering Study/Lighting hours of use**: This study is being scoped out with 2015 funds but will be conducted with 2016 EM&V funding. Due to the expected size of the study, and the limited evaluation budget each year, this study will likely need to be funded over multiple years.

ii. **Persistence/maintenance of control technology savings:** Most assessment of control technologies is verification of installation. There is little information about performance over time. There may be an opportunity for commissioning programs to maintain savings over time. *Is this something we should study in 2017 – or do we need to study in 2016 so we can apply in a 2017 program? We may want to get national collaboration on a study like this.*

iii. **Market characterization study for LED Troffers and T-LEDs:** There is a need to define the market for LED troffer fixtures (all non-res LED fixtures indoor and outdoor). Manufacturer surveys to define quality (reliability) of LED troffers would also be of interest. What are the criteria for determining quality and reliability? In addition, T-LED may present a new market opportunity and this market should be characterized.

iv. **LED Impact Evaluation Studies:** Although LEDs are not on the uncertain measure list, this technology should still be studied

v. **Lighting in the Hard-to-Reach Sectors:** Have programs targeting the hard-to-reach sector picked the low hanging fruit in this sector or are they implementing comprehensive lighting retrofits? Are there any savings left on the table, if so for which measures and why? What is the awareness and understanding of the small hard-to-reach commercial sector of T24 requirements? If they did not opt for comprehensive lighting retrofits, why? How did they finance their portion of costs? If loan were facilitated, would they have implemented more lighting (including a couple of questions here from the IOU-proposed lighting finance study)? This study could look at participants from this sector over the last few years, combined with site visits and decision-maker interviews.

vi. **Smart Lamp Study** – Market study on the expected impact of smart LED lamps on lighting end-use energy consumption.

vii. **LED Lab Test extension and Follow up to LED Lab Test to determine reason for failures –** The LED lab test will identify which lamps reach failure in a lab setting, but

it will not identify which component of the lamp actually failed. There also may be some value to extend the testing since the set-up is already in place and additional testing may reveal important insight into the performance of LED lamps.

*Program Administrator study plans for this sector were combined with Energy Division ideas.*

# 2.8. Integrated Demand-Side Management

## 2.8.1. Background

### Integrated Demand Side Management (IDSM) Program History and Overview

The Commission began directing the IOUs to promote integration of programs and technologies for customers in the Energy Efficiency (EE), Demand Response (DR), Distributed Generation (DG) and Low Income Energy Efficiency (now Energy Savings Assistance Program) proceedings starting in 2007. Integration efforts were directed to promote energy efficiency, demand response, and distributed generation improvements and measures. Although each proceeding continues to have separate budgets and goals, the expectation of the Commission is that the IOUs coordinate across proceedings to deliver comprehensive solutions to customers. The CPUC further outlined integration needs in the Long Term Energy Efficiency Strategic Plan (Strategic Plan) with specific strategies to improve integration across IOU programs. IDSM approaches should bring benefits to the customer through the delivery of the right solutions to the right customer at the right time.

The IDSM statewide program is a strategic planning program implemented by all four of California's energy IOUs. The program aims to ensure that the IOUs work together and pool their actions, lessons learned, and resources to develop and promote programs and strategies that seek to provide integrated demand side energy solutions to customers in all market segments (residential, commercial, agriculture, and industrial). As a statewide program, the IDSM Program has a dedicated budget, specific objectives and goals, and the IOUs must report on the progress of these activities to Energy Division on a quarterly basis.

Below are the 2013 – 2015 and 2016 IOU IDSM program budgets. While this budget allocation is small relative to other program budgets within the portfolio, it supports the core collaborative and coordination functions of the IOUs while other activities of the IDSM program are funded via other programs throughout the IOU portfolio (i.e. onsite integrated audits are funded by industrial sector programs, etc.) Note: IDSM is a statewide strategic program that touches on many programs in the IOU portfolio. Evaluation studies conducted under the IDSM Research Roadmap, while not targeting specifically identified programs, will have implications and be relevant for many programs including IOU energy efficiency, distributed generation, and demand response programs.

***Table 34. 2013-2016 IDSM Programs and Budgets***

| Utility | 2013-2015 Budget | 2016 Budget |
|---|---|---|
| Southern California Edison | $2,052,374 | 697,374 |
| Pacific Gas and Electric | $2,103,757 | 714,617 |
| San Diego Gas and Electric | $624,855 | 395,958 |
| Southern California Gas | $1,231,750 | 581,750 |
| **Total** | **6,207,173** | **2,389,699** |

*These budgets support only the core collaborative and coordination functions of the IOUs while other IDSM strategies are funded via other programs throughout the IOU's portfolio. The IDSM program is considered a strategic planning program driving energy savings via other resource incentive programs. As such, specific energy savings are not currently allocated to this program.

Core tasks to be supported by the IDSM program are listed below (D.09-09-047, p. 211):

1. Development of a proposed method to measure cost-effectiveness for integrated projects and programs including quantification and attribution methods that includes GHG and water reductions benefits and the potential long-term economic and electric / gas hedging benefits;
2. Development of proposed measurement and evaluation protocols for IDSM programs and projects;
3. Review IDSM enabling emerging technologies for potential inclusion in integrated programs;
4. Development of cross-utility standardized integrated audit tools using PG&E's developed audits as a starting point;
5. Track integration pilot programs to estimate energy savings, develop best practices and lessons learned and develop standard integration best practices that can be applied to all IOU programs based on pilot program evaluations and the results of additional integration promoting activities (i.e., EM&V and cost-benefit results);
6. Develop regular reports on IDSM progress and recommendations to the Commission;
7. Organize and oversee internal utility IDSM strategies by establishing internal Integration Teams with staff from EE, DR, DG, marketing, and delivery channels; and
8. Provide feedback and recommendations for the IOU's integrated marketing campaigns including how the working group will ensure that demand response marketing programs approved as category 9 programs are coordinated with energy efficiency integrated marketing efforts.

The results of the IDSM Omnibus Process Evaluation (completed October 2012), provides numerous recommendations for how to continue to accomplish these tasks.

Decision D.12.05.015 also directed the IOUs to continue and expand integration efforts in the following areas:

- Increased Coordination: Increased coordination across different proceedings with the IDSM Task Force as lead IDSM Funding: Consideration of appropriate funding from the other proceedings to support IDSM efforts
- Increased Involvement of Stakeholders: Inclusion of stakeholders and experts in the efforts of the IDSM Task Force
- Information on IDSM Projects: Detailed information on the pilot programs and
- Projects
- Audits: Continued development of the integrated audit tool
- IDSM Marketing: Increased integrated marketing efforts and improved reporting/ communication with the Energy Division
- IDSM Tracking Databases: Improved databases for tracking integrated projects

In D. 14-10-046, the Commission provides additional guidance to the IOUs on IDSM. The Commission directed the IOUs to focus not only on integration of EE and DR, but to include DG in their IDSM efforts as well and to a reasonably equal degree.

"The IOUs have identified programs as IDSM programs if they support two out of the three demand side technology types (energy efficiency, demand response, and distributed generation). In most cases, the two technologies that are identified as part of an "IDSM" program are demand response and energy efficiency. We do not take issue with these definitions now. We note, however, the distributed

generation should not always be the "odd man out." We elect not to provide guidance on this now, but may revisit whether to do so if we learn that distributed generation is being left by the wayside.[44]"

In 2015 and 16, the Statewide IDSM Task Force, which includes program managers from the California IOUs, tracked multiple integrated emerging technologies and reviewed various programs, projects, IDSM Pilots and activities to identify integration efforts and opportunities, as well as to develop best practices.

The IOUs submitted four, joint quarterly reports for 2015, including an Executive Summary section, to provide Energy Division staff with updates on the eight IDSM directives. All quarterly reports were uploaded and available for viewing on California Energy Efficiency Statistics Data Portal (EE Stats).

The IOUs have developed well-established processes ensuring delivery of integrated messaging via marketing, education and outreach to residential and business customers. Delivery of IDSM marketing has become more than just promotion of multiple programs within specific tactics like collateral or websites; it is now a key component in the planning phases of integrated marketing, education and outreach to help provide the right solutions to the right customer, at the right time.

The Statewide Online Integrated Audits team continues to coordinate to deliver a consistent online integrated audit tool that works with each IOU interface and educates customers on managing their energy use costs.

## IDSM Policy Developments

In late 2014 the Commission initiated a stand-alone rulemaking to provide the requisite platform for better coordination of certain electric vehicle, demand response, distributed generation, energy efficiency, distributed energy storage, marketing education and outreach, smart grid, rate design, and water-energy issues. This Rulemaking (R.14-10-003) was initiated with the intention to:

- *"…consider the development and adoption of a regulatory framework to provide policy consistency for the direction and review of demand-side resource programs"*[45].

The introduction of this new Rulemaking represented a significant step towards a unified governance of all demand side management resources in pursuit of California's energy savings, load shaping and GHG reduction goals. With this as a starting point, the considerations of the Rulemaking led to a greater broadening of goals and scope for both the Rulemaking and for the integration of power resources in California. In September, 2015 the Commission issued Decision 15-09-022 adopting an Expanded Scope, a Definition, and a Goal for the Integration of Distributed Energy Resources (IDER). With this Decision, the efforts of the Rulemaking now encompass an end-to-end framework spanning all aspects of the energy production and delivery system, from the customer side to the utility side. The envisioned framework considers not only what the energy suppliers can offer customers—or integrated DSM—but also what customers can offer the grid, and hence the integration of distributed energy resources (IDER).

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[44] D. 14-10-046, October 16, 2014, Page 101

[45] Order Instituting Rulemaking to Create a Consistent Regulatory Framework for the Guidance, Planning, and Evaluation of Integrated Demand-Side Resource Programs. California Public Utilities Commission; Filed October 2, 2014. San Francisco, California; Rulemaking 14-10-003

D. 15-09-022 defines the integration of distributed energy resources (IDER) as:

- *A regulatory framework that enables customers to effectively and efficiently choose from an array of distributed energy resources. The framework is based on the impact and interaction of such resources on the system as a whole, as well as on a customer's energy usage, and on the environment.*

The IDER rulemaking seeks to create the means through which all elements contributing to the provision of power in California can interact and find optimal energy solutions, as defined by the Commission's goal for IDER, which is:

- *To deploy distributed energy resources that provide optimal customer and grid benefits, while enabling California to reach its climate objectives.*

In support and recognition of this goal, the IDER rulemaking established a working group[46] tasked with developing a competitive solicitation framework targeting the distribution grid's locational reliability identified in its "companion" proceeding, the Distribution Resources Plan (DRP) Rulemaking (R. 14-10-013). That is, while the DRP is charged with identifying the distribution grid's reliability needs through an Integration Capacity Analysis and a Locational Net Benefits Analysis, the IDER is tasked with determining how distributed energy resources ("non-wires" solutions) can meet system needs as an alternative to traditional grid investments ("wires" solutions).

The IDER's Competitive Solicitations Framework Working Group (CSFWG) was assigned to determine how distributed energy resources, through an IOU-issued competitive solicitation process, i.e., Request for Offer (RFO), could target the reliability needs within the areas identified by the Integration Capacity Analysis (ICA) and the Locational Net Benefits Analysis (LNBA) performed in the DRP. The CSFWG submitted its Final Report on August 1, 2016 with recommendations on the following ruling elements:[47]

a. Defining the services to be bought and sold within the identified areas;

***b. Develop methodologies to count services provided and ensure no duplication with procurement in other proceedings, i.e., ensure these resources are incremental to existing efforts and avoid double-counting of resources (highlighted for emphasis due to its primary relevance to EE resources);***

c. Develop solicitation rules or principles such as constraints on procurement, e.g., floors and ceilings on volume procured, price paid, etc.;

d. Develop solicitation oversight needs, e.g., procurement plans, procurement review groups, etc.;

e. Develop solicitation evaluation methodology to include the valuation of any deferred distribution system upgrade;

f. Develop solicitation pro forma contracts.

Concurrently, the Commission issued an Amended Scoping Memo[48]combining into one phase the issues of the rulemaking:

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[46] CPUC R. 14-10-003, "ALJ's Ruling Establishing a Working Group to Develop the Competitive Solicitation Framework," Filed March 24, 2016.

[47] *Ibid*., p. 3.

[48] CPUC R. 14-10-003, "Amended Scoping Memo and Ruling of Assigned Commissioner and Administrative Law Judge," Filed September 1, 2016.

1. Developing of technology-neutral cost-effectiveness methods and protocols;
2. Leveraging the work being performed in the DRP Demonstration Projects to advance the competitive solicitation framework;
3. Utility role, business models, and financial interests with respect to distributed energy resources deployment, including consideration of a pilot for financial shareholder incentives (and requisite incentive level);
4. The aforementioned competitive solicitation framework, which targets reliability needs identified in the DRP rulemaking.

In issuing the revised Scoping Memo the Commission recognized that, due to multiple existing barriers in procurement and adoption of DERs,[49] an incentives pilot (incorporating elements from the CSFWG) is necessary to test how earnings opportunities affect IOU DER sourcing behavior. For the purpose of the short-term pilot, the Assigned Commissioner (AC) proposes an incentive for the deployment of cost-effective DERs that displace or defer an IOU expenditure based on a fixed percentage calculation. The AC proposal favors a straightforward approach of applying the percentage incentive to the payments made to the DER provider, potentially at a higher value than might otherwise be offered. The approach is akin to the current Efficiency Savings and Performance Incentive (ESPI) for energy efficiency. This "incentives" proposal is currently under consideration by the Commission.

Upon Commission adoption of the proposed pilot, the IOUs would establish a Distribution Planning Advisory Group (DPAG) and identify at least two projects wherein the cost-effective deployment of DERs (consistent with the valuation elements from the CSFWG) on its system could displace or defer the need for capital expenditures on traditional infrastructure. Subsequent evaluation of the pilot will take place 17 months from the establishment of the DPAG.[50] It is the AC's intention that the proceeding concludes by March 1, 2018.

### Implementation Uncertainties and Challenges to be Addressed by Evaluation

Ultimately, customers do not think of their energy usage and service requirements in terms of the regulatory proceedings associated with the various policy initiatives in California. When it comes to energy-related programs and services for their home or business with demand side management (DSM) programs, they think in terms of comprehensive and overall Energy Savings, Cost Reductions, Operational Improvements, Greenhouse Gas Reductions, Capital Investments, and Return on Investment (ROI).

To the extent that the integration of DSM programs and any future DER offerings can lead to a smoother decision making process for customers, while lowering their costs, maximizing incentives and optimizing their return on investment, then the integration of IOU programs can be a successful strategy for utility customers and utilities alike.

Within the IOUs, the integration of utility non-residential programs among large load customers occurs when account representatives pull together various programs and incentives to create whole building integrated solutions. For smaller business and residential customers, integration is achieved through

[49] *Ibid*., pp. 3-4: Some barriers noted by parties and the Commission include institutional barriers, contract administration, lack of real-world data, lack of clarity in expected changes to IOUs' distribution planning process, uncertainty in commercial ability to provide operational and cost-effective DERs

[50] *Ibid*., pp. 12-13: Incentives pilot timeline.

marketing channels via messaging. By leveraging various delivery channels across all customer segments integration of DSM programs and services can be achieved.

## Evaluation and Information Needs

Coordination with, and support for the IDER Proceeding (R.014-10-003) proceeding is a critical priority to the activities conducted within this IDSM Roadmap. The concerns and issues historically addressed within the IDSM Research Roadmap align closely with those addressed by the IDER Proceeding. A major component of the IDER proceeding is to work in a complementary fashion with the Distribution Resource Planning Proceeding (DRP) proceeding, which is focused on optimizing infrastructure and energy supply to maximize value for ratepayers and also achieve a low-carbon grid. The work of both the IDER and DRP proceedings involve coordination with multiple other CPUC proceedings, as well as the CALISO and its ESDER / DERP efforts.

The information needs addressed by this Roadmap for 2016 and beyond will be informed by the IDER, and by extension also consider the needs and activities of the DRP. Moreover, the research planned here will be coordinated appropriately with activities of other proceedings, to avoid redundancy, to fill gaps and to utilize opportunities for leveraging. The IDER Proceeding is evolving rapidly, and related support needs have a dynamic component. Thus, we continue to hold back 2015 IDSM/IDER evaluation funds in order to support research needs we anticipate will emerge in the future.

Further, similar to the IDER Proceeding, the issues and concerns of the IDSM Roadmap have close ties and overlap with other ongoing proceedings. For example, the Distributed Resource Planning (DRP) Proceeding is considering issues related to Locational Targeting; any work done via this Roadmap that is in relation to Locational Targeting will need to be carefully coordinated with the DRP Proceeding.

Past evaluation findings indicate a need for adequate data collection to sufficiently evaluate IDSM activities within the portfolio. There is a need for an integrated tracking database or system that includes information on the rebated EE, audit, DR, DG, and web-based smart grid programs that a building, site, account, or meter has participated in. This form of tracking is needed to better understand site level integration. If evaluations are going to evaluate the ability of integrated program design and activities to save more energy at lower cost, it will be necessary to have a truly integrated database or system.

### 2.8.2. 2013-2015 IDSM EM&V Studies

The table below summarizes the 2013-2015 EM&V Studies that have been budgeted, some of which are complete and others are in the process of being implemented. The table provides the study manager, work order under which the study is being conducted, the corresponding budget, implementation status and expected completion date for each study.

***Table 35. 2013-2015 IDSM EM&V Studies and Budgets***

| Study | Study Lead (ED/IOU) | Work Order # | Budget | Completion Date |
|---|---|---|---|---|
| **2013-2014 Studies** | | | | |
| IDSM Market Characterization Study: Residential and Small Commercial Markets | IOU | | $80,000 | August 2014 |

| Study | Study Lead (ED/IOU) | Work Order # | Budget | Completion Date |
|---|---|---|---|---|
| IDSM Case Study Report | ED | ED_O_IDSM_2 | $150,000 | May 2016 |
| IDSM: A Study of Preferences and Patterns of IDSM Uptake in California's Residential and Small Commercial Markets | ED | ED_O_IDSM_3 | $150,000 | October 2015 |
| **Total 2013-14** | | | **$380,000** | |
| **2015 Studies**[a] | | | | |
| Tracking Database Development: Statistical Analysis and Characterization of the Adopter Population | ED | ED_O_IDSM_4 | $88,000 | Q42016 |
| Nonresidential IDSM Market Research: Characterization of Selected Market Segments, and Customer IDSM Drivers and Barriers | ED | | $200,000 | Cancelled |
| IDER Contextual and Market Research characterizing DER market structures, market actors, emerging/existing business models, trends and technical developments | ED | | $295,000 | Cancelled |
| IDER Support: (policy research; ad-hoc tasks) | ED | | $200,000 | ongoing |
| Cost-effectiveness Framework Whitepaper Update | IOUs | | $100,000 | Cancelled |
| **Total 2015 Budget** | | | **$882,443** | |
| *Remaining 2015 budget* | *ED/IOUs* | | *$695,000* | |
| **Additional IDSM Studies Funded by Other Areas** | | | | |
| IDSM Inventory and IDER Support | ED | ED_D_Mkt_6 | See Market Studies Roadmap- | Q4 2015 |
| **Total Budget (2013-15)** | | | **$1,262,443** | |

### 2.8.3. 2013-2015 Study Descriptions

Below are descriptions for each of the 2013-2015 studies, which include the key research questions and EM&V methods applied.

| | |
|---|---|
| **Study Title:** IDSM Market Characterization Study: Residential and Small Commercial Markets (CALMAC ID: SDG0286.01) | **Budget:** $80,000 |
| **Completion Date:** August 2014 | **Study Manager:** IOU |

| **Study Title:** IDSM Market Characterization Study: Residential and Small Commercial Markets (CALMAC ID: SDG0286.01) | **Budget:** $80,000 |
|---|---|

**Description:** Market Assessment for Commercial and Residential IDSM Markets

**Objective:**

- Based on an analysis of integrated projects and other forms of primary and secondary research will identify demographic/firmographic or industry/segment predicators of IDSM participation.
- Will examine customer decision-making associated with integrated projects.
- Will investigate patterns of adoption by customer type vis a vis the adoption of integrated DSM solutions.

**Key Research Questions:**

- In the residential and non-residential sectors what customers are more likely to adopt an integrated solution?
- What is the decision-making process behind customer participation in demand side management programs?
- What channels or marketing efforts / messaging are most effective for the residential and small business segments?
- What are the drivers behind customer purchasing decisions for integrated solutions?

**EM&V Methods:** Literature review, in-depth interviews, analysis of marketing material and product documentation, other secondary sources, IOU tracking data analysis

**High-Level Findings:**

- Customer needs and wants with respect to IDSM solutions are oriented toward the personal:monetary savings, long-term energy savings, convenience, ease-of-use and low risk with respect to return-on-investment top the list of priorities. Customers are more likely to act if there is a clear benefit and only simple tasks required to obtain that benefit, and a high degree of personalization in messaging. Thus, there is an underlying incompatibility of customer preferences and IDSM messaging goals. Customer preferences lean toward the simple and easy, while IDSM solutions tend toward the complex. This is a primary barrier to uptake of IDSM.
- A second barrier relates to the current market structure for Solar PV. The relationship of Solar PV to utilities and regulatory systems is evolving and rapidly taking shape, as are embedded issues related to EE, DR, storage and the smart grid. The pace of change creates a challenging environment to create and implement policies supporting optimized integration. The importance of the loading order (i.e. minimized DG system size) and the critical role of load shifting and DR in the successful integration of renewables is not at the front and center of the agenda of the private sector companies distributing PV systems to the residential and small commercial sectors. We also identified a number of drivers.
- One such driver is emerging IDSM-related trends drawing from advancements in technology and communications. There is growing interest in the access to and use of real-time energy consumption data that is IDSM -enabling, and a growing number of products and services built around web-connected building monitoring and controls, such as EMS, smart thermostats and HAN/in-home displays.
- Another leading market driver for IDSM are recent changes in public policy that affect energy costs and building codes, such as California's ZNE program and goals. The ZNE approach mandates integrated solutions and so has been one of the major drivers of IDSM solutions and integrated new construction designs in the market. The ZNE building design is a particularly strong driver for EE and

| **Study Title:** IDSM Market Characterization Study: Residential and Small Commercial Markets (CALMAC ID: SDG0286.01) | **Budget:** $80,000 |
|---|---|
| DG. It is also a driver for DR, but much less so. This is challenging because greater saturation of DG increases the value of effective DR, which has the ability to offset variability in renewable production. | |

| **Study Title:** IDSM Case Study Report (CALMAC Study ID: CPU0121.01) | **Budget:** $150,000 |
|---|---|
| **Completion Date:** 2016 | **Study Manager:** ED |
| **Description:** Examine customer-side costs and benefits of selected IDSM projects, potentially isolate the incremental effects of an integrated approach. | |
| **Objective:** The primary objective of this study is to identify the cost and benefit parameters that change due to an integrated approach, and to understand the manner and extent that the streams of costs and benefits are affected. | |
| **Key Research Questions:**<br>• What are the data needs to inform understanding of integrated cost- effectiveness?<br>• Is conducting a preliminary analysis of pilot IDSM program and project cost-effectiveness analysis possible given existing data?<br>• What are the data needs to inform understanding of integrated cost- effectiveness?<br>• Is conducting a preliminary analysis of pilot IDSM program and project cost-effectiveness analysis possible given existing data? | |
| **EM&V Methods:** Case Studies, documentation/desk reviews, Tracking and billing data analysis, in-depth interviews | |
| **High-Level Findings:**<br>• All organizations had an interest or public mandate to minimize operating expenses: AB 32 legislation, ARRA funding and a variety of programs oriented to energy conservation promoted the development of formal policies and goals for energy management.<br>• All organizations made a formal commitment to energy conservation and sustainability during the 2008/2009 period, as evidenced by a formalized energy policy or Climate Action Plan; a permanently assigned energy manager; or completion of an integrated energy audit.<br>• Each organization had regular interactions with non-profits, utilities, and government programs that supported energy conservation in a variety of ways. School districts in the study viewed energy conservation as an integral part of their educational curricula.<br>• Funding opportunities offered significant cost savings for energy improvements (ARRA, Proposition 39, the California Solar Initiative, utility programs, and local government partnerships). Local bond measures and solar vendors offering lease structures also facilitated project uptake.<br>• The demand side management programs utilized in retrofit projects highlighted in this report underscore the typical delivery mechanisms for integrated offerings. Typically, IDSM offerings are not delivered via programs that combine resources, but by human resources that support the intelligent combining of programs. There are strong program drivers leading customers to take action outside the typical utility-customer relationship. Further consideration is needed on how external non-utility market actors and funding sources drive customer behavior and what incentives utility rates provide to encourage IDSM in line with California loading order and climate goals. A | |

| **Study Title:** IDSM Case Study Report (CALMAC Study ID: CPU0121.01) | **Budget:** $150,000 |
|---|---|
| fuller integration of demand side management activities would need to encompass coordination or alignment of incentives and resources provided to customers within and external to the utility-customer relationships. While that might be difficult with federal initiatives, such as ARRA, state-level policies and programs could be coordinated more closely. | |

| **Study Title:** IDSM: A Study of Preferences and Patterns of IDSM Uptake in California's Residential and Small Commercial Markets (CALMAC Study ID: CPU0120.01) | **Budget:** $150,000 |
|---|---|
| **Completion Date:** October 2015 | **Study Manager:** ED |
| **Description:** Understand customer segments, and segment-specific drivers and barriers to IDSM uptake. | |
| **Objective:**<br>• **Characterize the current distribution of customer characteristics, market context and particular processes leading to IDSM adoption within the residential and small commercial markets. This effort will work to refine our understanding of primary drivers and barriers related to the uptake of IDSM solutions in California's mass markets.**<br>• Support the development of a program and marketing strategy that will leverage high levels of customer receptivity while also meeting preferences for content of IDSM information, leading to greater IDSM knowledge and higher levels of uptake<br>• **Investigation of Need States as IDSM Driver**:<br>  ○ Investigate Barriers to IDSM and Customer Preferences for IDSM Information and Marketing. | |
| **Key Research Questions:**<br>• Ultimately we seek to understand the underlying dynamics of customers' perceived value of DSM options; to understand how those preferences vary across individually considered DSM adoptions versus grouped or sequenced adoptions. The IOU-led IDSM small commercial and residential market characterization study collected supply-side data and conducted interviews to take a snapshot of current trends and offerings in IDSM products and services. This study builds on those findings through primary customer research.<br>• **What are the roles and relative importance of various Need States as Drivers of IDSM uptake?**<br>• **Do IDSM adopters have shared characteristics? What are they?**<br>• **What paths do IDSM adopters typically follow that lead to IDSM project uptake?**<br>• **What implications do these have on optimal approach to raising IDSM awareness and increasing IDSM uptake?**<br>• What are the primary Barriers to IDSM what are effective ways to address barriers to IDSM uptake?<br>• What are Customer Preferences and for receiving IDSM Information and Marketing material, and how do these effect receptivity?<br>• What are residential customer preferences for IDSM information and marketing? | |
| **EM&V Methods:**<br>• In-Depth interviews with IOU staff,<br>• Analysis of residential UEAT usage patterns, | |

| **Study Title:** IDSM: A Study of Preferences and Patterns of IDSM Uptake in California's Residential and Small Commercial Markets (CALMAC Study ID: CPU0120.01) | **Budget:** $150,000 |
|---|---|
| • Computer assisted telephone interviews (CATI) surveys focused on residential customers that have recently adopted IDSM solutions, as well as a group has not, for comparison. | |
| **High-Level Findings:**<br>• Residential customers installing DG/EE projects are more likely to live in larger and more recently remodeled homes, and have been living in their homes for a longer time than other customers. Their households are larger, and more likely to include a member over the age of 65. They are more likely to have central AC; to use a smart thermostat; and to own a pool, hot tub or spa.<br>• In contrast, customers that adopted demand response (DR) and EE measures are characterized by a greater likelihood of being a renter and living in a multifamily home. They also are more likely to have electric heat.<br>• Among surveyed EE/DG adopters, only a minority (28%) used an integrated approach. However, the proportion of customers endorsing such an approach is larger than the proportion that implemented one (37% versus 28%).<br>• Among residential customers considering DSM investments, we found that initial cost, concern over whether energy bills substantiated DSM investments/ length of payback, and motivational factors were common barriers to adoption.<br>• Residential customers implementing EE/DG measures had a longer planning horizon than single DSM adopters. However, neither group found the planning process to be a concern or barrier. Direct sales efforts of DG contractors were found be an important driver of EE/DG adoptions.<br>• We found the following life events or circumstances to be drivers of multi-DSM adoptions: Receiving an unusually high bill, learning about rebates/incentives/financing, and experiencing an increased concern about energy use and the environment. Conversely, home purchase and home renovation projects did not drive multi-DSM adoptions, but were important drivers of EE-only upgrades.<br>• Among small commercial customers, we found markedly different rates of uptake for multi-DSM solutions across business types. Schools were much more likely than any other business type to adopt multi-DSM solutions, particularly those including DG. Adoptions that combined DR and EE (but not DG) were most common among food/liquor establishments. Offices, restaurants, and managed properties had the lowest propensity to adopt multi-DSM projects. | |

| **Study Title:** IDSM Tracking Database Development: Statistical Analysis and Characterization of the Adopter Population | **Budget:** $88,000 |
|---|---|
| **Expected Completion Date:** 12/2016 | **Study Manager:** ED |
| **Description:** The CPUC Data Management Team and the efforts of the 2013-2014 IDSM evaluations together yield databases representing the residential and nonresidential IOU customer populations, and aspects of IDSM uptake. These databases include records of downstream ratepayer funded energy efficiency program participation; use of IOU online audit tools; and interconnection / net energy metering participation. In this Study we will update and augment these database resources with additional IOU tracking records, including demand response programs, low-income programs, AMI-enabled behavior programs (e.g. Energy Alerts and OPower Energy Reports), distributed | |

| **Study Title:** IDSM Tracking Database Development: Statistical Analysis and Characterization of the Adopter Population | **Budget:** $88,000 |
|---|---|
| generation programs (CSI, Self-Generation Incentive Program). We can also expand these data resources using U.S. census data. Once assembled, statistical analysis of the population can be done to identify IDSM saturations and trends over time, including trends and patterns in geography/climate, size, business type, technologies and measures, and the various demographic and economic attributes available at the census block level. This study will be coordinated closely, and perhaps cooperatively funded, with the CPUC Data Management Team. | |
| **Objective:** Create a shared resource for all evaluators; improve understanding of the current population of known IDSM adoptions; document a baseline of saturation and rates of uptake; leverage database characteristics to guide efforts to support and expand IDSM uptake. In addition, through the process of assembling an expansive tracking system we will identify any shortcomings in tracking systems that block or create unnecessary costs. | |
| **Key Research Questions:** Which customers/facilities in IOU service territory have completed an IDSM project? Which have completed DSM projects? What measures, programs and IDSM supporting technologies contributed to completed IDSM projects? Which have completed an integrated audit and which used the IOUs' integrated toolkit? | |
| **Potential EM&V Methods:** Collection and analysis of IOU customer and rate data, interconnection data, billing data, IOU energy efficiency program tracking data, distributed generation and Self-Generation Incentive Program tracking data, demand response program enrollment and event data, and smart-meter enabled behavior program enrollment data. | |

## Additional 2013-2015 IDSM-Related Studies Funded by Other Roadmaps

| **Study Title:** IDSM Inventory and IDER Support | **Budget: $305,400** (funded by Market Studies) |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |
| **Description:** This study was established soon after the IDER proceeding was initiated (October, 2014). The study has two primary components. The first component was designed to meet needs that arose in some of the early proceeding activities including workshops. The focus of the proceeding shifted during its first year of operation, and the second component of this study arose in response to that shift in focus.<br>Thus the first component of this research is focused on integrated DSM offerings to customers, while the second component is concerned with facilitating the inter-proceeding coordination and planning activities of the IDER proceeding.<br>More specifically, the first component offers documentation of the current designs and delivery strategies of integrated DSM programs to customers. The investigation began with a review of approaches in place outside California, followed by an assessment of the ratepayer funded DSM offerings within California. The assessment describes major types of IDSM programmatic and promotional strategies in place; the range of designs; and particulars surrounding the distribution of those program offerings across the nation. To enhance the illustrations of some of the more typical designs, we selected specific programs examples and provided a more comprehensive characterization. The DSM programs within California were mapped to a comprehensive database that contains many descriptive elements including budget, customer segments, technologies and | |

| **Study Title:** IDSM Inventory and IDER Support | **Budget: $305,400** (funded by Market Studies) |
|---|---|
| DSM strategies.<br>The second component is to act as facilitator and to providing supporting services for the development of a Multi-Proceeding IDER Work plan. This work plan draws on the vision and goals of proceedings across three different "swim-lanes" including:<br>• Rate Reform and Time of Use Rates<br>• Integrated Distributed Energy Resources and Integrated Resource Planning<br>• Interconnection, Storage, Electric Vehicles and Demand Response<br><br>The Work Plan draws on the vision and goals for the year 2020 for each of these areas. However, it draws only from selected aspects of each of these issues areas, where there are opportunities for leverage, or critical inter-dependent elements that must be regularly communicated and coordinated across various proceedings. Working backwards from the 2020 vision and goals, the Work-Plan specifies the supporting activities and milestones within each swim-lane area that are needed to reach the 2020 goals. It serves as a coordination and planning tools for the inter-dependent elements and ensures the gains are realized from cross-proceeding opportunities for leverage. | |
| **Objective:** The goal of this project is to provide support for activities and concerns of the IDER Proceeding. The first component of this project offers a characterization of integrated DSM offerings –both outside and inside California's IOU-ratepayer funded portfolio. The second component provides information and resources to enable efficient and timely coordination across proceedings and agencies associated with meeting the objectives of the IDER and SB 350. | |
| **Key Research Questions:**<br>• What are the characteristics of the current set of integrated programs and portfolio strategies being implemented in jurisdictions outside California? What lessons-learned from these efforts might be worth consideration by policy-makers in California?<br>• What are key descriptive and integrated characteristics of the set of DSM programs offered to IOU-ratepayers in California?<br>• What are the activities, objectives, milestones and timelines governing CPUC proceedings and the activities of other agencies that bear upon the concerns of the IDER proceeding.<br>• What are the important particulars of these elements within other proceedings? What are potential interactions in these elements? What bearing do alternative outcomes have on the IDER? How would these elements be most effectively tracked and managed? | |
| **EM&V Methods:** This effort is supported by review and analysis of secondary sources, such as policy documents, reports, databases, published research. | |

### 2.8.4. 2016 and Beyond EM&V Budgets and Study Descriptions

For the 2016 and beyond period the Energy Division and the IOUs have budgets set aside to address integrated demand side issues. The details for these projects will be defined at a later date once contractors are brought on board. Based on public comments and the current status of policies, the following studies will be considered but my change as we prioritize next year.

| Study | Study Lead (ED/IOU) | Work Order # | 2016 Budget | 2017 Budget |
|---|---|---|---|---|
| **2016-2017 Studies** | | | | |

| Study | Study Lead (ED/IOU) | Work Order # | 2016 Budget | 2017 Budget |
|---|---|---|---|---|
| IDER/IDSM studies | ED | NA | $838,332 | $838,332 |
| IDSM | IOUs | NA | $0 | $200,000 |
| **Total Budget** | | | **$838,332** | **$1,038,332** |
| [a] Note that no 2015 studies have yet been launched. $782,443 remains from the 2015 budget (see Table 51) | | | | |

Based on public comments and current policy context, Energy Division proposes further consideration of the following studies for 2016 and beyond.

| Issue | Potential Research Need |
|---|---|
| IDSM pilots and future programs may need support from many non-resource acquisition programs and efforts to achieve their goals – to market their programs, to identify appropriate technologies, and recruit allies to support program outreach. However, to date, IDSM efforts do not appear to have formally leveraged Emerging Technologies Program (ETP), Finance, Marketing Education & Outreach (ME&O) or Workforce, Education & Training (WE&T) resources to support supply of integrated programs/technologies, or customer demand and engagement with IDSM resources. | A study to identify what roles and resources non-resource acquisition programs can play in support of IDSM strategies, pilots and future programs, and document efforts conducted to date may be helpful. |
| The role of IDSM programs and pilots (as well as DERs) in serving moderate and low-income customers is not clearly defined. What effect do IDER and IDSM have on these populations? Are customers unduly burdened by proposed changes to rate and tariff structures, and are DER suppliers providing solutions to these customers? | A study to identify barriers and challenges to adoption of IDSM and IDER solutions for low-income and moderate-income customers may be helpful. This would include an assessment of the current adoption of these solutions by this sector, interviews with customers who have and have not adopted IDSM solutions, and key barriers associated with adoption.. |

The program administrators propose one study at this time, which is described in the following table.

| **Study Title:** IDSM Integration with IDER, DRP | **Budget:** $200,000 |
|---|---|
| **Completion Date:** TBD | **Study Manager:** IOU |
| **Description:** Integrate Elements of IDER and DRP with the IDSM strategic plan mandates | |
| • Even though IDER and DRP proceedings are at their infant stage, the IOUs plan to conduct process evaluation studies which will provide integration of the IDER, DRP as they become more resolved.<br>• Draw from both the IDER's Competitive Solicitation Framework Working Group and DRP proceeding<br>• Locational targeting | |

| **Study Title:** IDSM Integration with IDER, DRP | **Budget:** $200,000 |
|---|---|
| • Study plan will be more defined after business plan is approved. | |

# 2.9. Codes and Standards

## 2.9.1. Background

The Codes and Standards (C&S) program saves energy by influencing continuous improvements in energy efficiency regulations, improving compliance with existing codes and standards, and working with local governments to develop ordinances that exceed statewide minimum requirements. Both the C&S program advocacy and compliance improvement activities extend to virtually all buildings and potentially any appliance in California.

This update to the C&S chapter updates scope and budgets of previously planned studies as well as new studies funded with approved 2015 funds.

The C&S Evaluation Team (Commission staff, IOU staff, and consultants) identified the following research needs and high level study proposals for 2016. All research needs are yet to be prioritized for development given timing and resources available.

## Programs included in the Research Scope

The Codes and Standards program accounts for 23% of the statewide projected energy savings but only

1.44% of the IOU approved budget for 2013-2015 cycle. About 60% of the program's savings are expected to come from Appliance Standards advocacy activities and 40% from Title 24 Code advocacy activities.

The program design has changed slightly from previous cycles. The 2013-2015 cycle has two new subprograms:

### *Compliance Improvement (non-resource)*

The Compliance Improvement subprogram is a new subprogram that combines the previous Extension of Advocacy and Compliance Enhancement subprograms. It provides education, training, and other activities targeting building departments and other industry actors responsible for compliance with Building Energy Code and Appliance Standards requirements. Activities may include development of "best practices tools" and other infrastructure elements that serve multiple compliance improvement objectives.

### *Planning and Coordination (non-resource)*

The Planning and Coordination Subprogram supports planning activities that improve alignment across the IOU energy efficiency portfolio with respect to future C&S program activities. This newly developed subprogram supports efforts to prepare the market for future code adoption (i.e., improve code readiness), to ensure higher code compliance rates and advance the CPUC Strategic Plan goals for achieving zero net energy.

Building and appliance standards advocacy activities comprise the majority of the budget and claimed savings approved for the 2013-2015 cycle. The reach codes subprogram design remains unchanged from 2010-2012 cycle.

The 2017 Advice Letter files a new subprogram called Code Readiness. This new subprogram may be funded for 2017. This program would support code activities that create market support that would make future code adoptions easier.

### *Code Readiness (non-resource)*

The Code Readiness subprogram is specific to PG&E and includes two main areas of work. The first is to introduce new building systems and appliances to actors within various building industry supply chains through knowledge transfer and demonstrations aimed at future building codes and appliance standards. While the main objective of this work is to quickly produce information for future rulemakings or CASE proposals, data are collected to inform work papers and incentive program design. This area of research is intended to compliment, not duplicate or replace the Emerging Technologies (ETP) program work. The second area of work entails leveraging C&S research to support new incentive program measures by summarizing DOE and CASE study research in a format that can be easily extracted to support work paper development. DOE produces extensive technical reports that include valuable cost and benefits information, for example, and there is sometimes a period of several years between the research and the eventual effective date of the standard.

The Business Plans in development will propose a broadening of the code readiness subprogram to include forward looking research and analysis not included in CASE study development for existing or near-term rulemakings: field surveys that produce population data, tactical field surveys and studies aimed at specific building codes or appliance standards, lab testing, simulation models, tear-down analyses, collection of cost and other data over time such as amenity and human response to physical attributes, equipment operation, etc.

## Uncertainty and Challenges to Successful Implementation

Much of the uncertainty and many of the challenges that the program currently faces lie in the California Energy Commission's (CEC) building code and appliance standards adoption process. Since the CEC ultimately decides which codes and standards will be adopted, the savings from program efforts in supporting various codes are often at risk as the benefits from new or more stringent codes are weighed against other factors that emerge in the public process. Additionally, strategic planning for new codes and standards is challenging for the program since the IOU's agenda must largely coincide with CEC code changes priorities. Strategic alignment during the planning phases has been challenging in the past for a variety of reasons. However, the Codes and Standards Action Plan [51]has identified key processes that should help strengthen coordination among the CEC, the CPUC, and the IOUs, as well as other stakeholders.

Another challenge lies in the coordination of the C&S program with other energy efficiency programs across the Program Administrators' portfolios. Strategic coordination between the C&S program and the wide array of ratepayer-funded EE programs – from new construction programs, to residential and commercial appliance programs, Emerging Technologies programs, and WE&T programs – is vital to achieving California's long- term energy efficiency goals. The purpose of the newly developed C&S

[51]This Action Plan is part of the implementation of the Long Term Energy Efficiency Strategic Plan, available at http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/.

Planning and Coordination subprogram is to lead strategic planning and coordination efforts within and across the utilities. This will help to more effectively move incentive measures through EE programs and into code. It also will support compliance improvement activities through training, outreach, and other interventions in the market.

Finally, improving code compliance is increasingly a larger goal for the C&S program, especially as code stringency increases to support the CPUC's Zero Net Energy (ZNE) goals set forth in the California Long Term Energy Efficiency Strategic Plan (2008 and 2011 update). These ZNE goals also pose challenges for how Energy Efficiency Portfolio programs and C&S programs more specifically are able to address the intersection of the energy efficiency with distributed generation, energy storage and demand response technologies and deployment strategies required for ZNE. For the C&S program, significant challenges lie in designing programs around compliance improvement. There are challenges in evaluating compliance with both building codes and appliance standards and identifying the factors that lead to low compliance. Improving knowledge about compliance rates, developing better methods and data sources for evaluating compliance, and delving deeper into the measure- and market-specific drivers of low compliance will help greatly in program planning and implementing compliance improvement efforts.

## Emerging Evaluation and Information Needs

The following are stakeholders to the C&S program whose known data and research needs to date are reflected in this chapter: CPUC, IOUs, CEC, EE voluntary programs, Emerging Technologies program, building industry, and new construction energy efficiency advocates.

It is important to realize that constraints such as resources, time and access to building department data, as well as, access to buildings to perform audits requires that we target key sectors with manageable sample sizes. These constraints may result in studies not being able to focus on all sectors with large sample sizes in every cycle.

The following research needs were defined based on results of previous evaluations and emerging research needs.

### 2.9.2. Key Research Questions Addressed in 2013-2015 EM&V

***Table 1. 2013-2015 C&S EM&V Research Questions Summary***

| Study Name | Research Questions [2013-2015] |
|---|---|
| **Impact** | |
| 2013-2015 C&S Impact Evaluation | What are the compliance rates for Title 24, Federal and Title 20 standards?<br>Is prescriptive or performance the most common method of compliance for Multi-Family (MF) buildings? What is a robust method to sample, audit and calculate compliance? Multi-family was not in scope for 2013-2015<br>How to treat interactive effects and other effects when measuring compliance for MF buildings?<br>How to determine UES for MF buildings? What type of modeling tool is necessary to capture these savings?<br>What is a robust method for determining the baseline and impact of residential alterations?<br>Is it possible to determine compliance at the measure level when using a whole building compliance approach? What are the limitations?<br>Can Title 24 field audits collect information to improve compliance improvement efforts? |
| Assessment of Cost-Effectiveness Tools for C&S Program | Can methods and approaches to determine baselines for building and appliance standards be aligned given available data and previous evaluation findings?<br>What is a robust method for determining cost-effectiveness and relevant inputs to a cost effectiveness calculation for the Codes and Standards program?<br>Are the current methods and assumptions used for determining inputs (e.g. measure EUL, measure cost forecasts, benefit streams) to the TRC cost-effectiveness calculation adequate for C&S?<br>What is the feasibility and cost of collecting information to inform parameters for cost-effectiveness?<br>Are the inputs as defined in the calculator comparable to the findings and how can they be aligned? |

| Study Name | Research Questions [2013-2015] |
|---|---|
| **Process** | |
| Compliance Improvement Process Evaluation for IOU Statewide Program and BayREN Codes and Standards Program | What is the ongoing effect of the "best practices" report on local jurisdictions in California to improve their code enforcement practices (the report was produced by the CEP in 2010-2012 but the question was not addressed in the study)<br>How is the BayREN implementing the activities proposed in the Program Implementation Plans?<br>How is the IOU Statewide Program implementing the activities proposed in the Program Implementation Plan?<br>How are the activities of the BayREN and the IOUs (PG&E more specifically) complementing each other? How they collaborating in planning, implementation? Are there areas for improvement?<br>What are appropriate metrics to track the improvement in code enforcement? (not addressed in study)<br>What are the outcomes of the BayREN and IOUs' activities? How are they contributing to compliance improvement with Title 24? |
| **Market** | |
| Assessment of Compliance Improvement for Previously Evaluated Codes & Standards and Barriers to Code Compliance | To what extent has code compliance improved over time for previous codes?<br>What are the barriers to code compliance for recently adopted codes (i.e., 2008/2013 updates) with low compliance?<br>How can the C&S program more strategically address the barriers to higher compliance rates? |
| Analysis of 2008 Title 24 nonresidential compliance site audits | What can be learned about installation practices when analyzing site audit data from 2010-2012 nonresidential Title 24 compliance analysis? |
| Underlying Assumptions for Calculation of Savings Potential for Lighting Alterations | How do code changes affect standard practice, the level of unpermitted work, or decisions to defer or go ahead with projects?<br>Is the outcome determined by the change or the extent of change relative to standard practice? |
| Determinants of Code Compliance for Lighting Alterations | How do code changes affect standard practice, the level of unpermitted work, or decisions to defer or go ahead with projects?<br>Is the outcome determined by the change or the extent of change relative to standard practice? |
| Code Savings Analysis using Billing Data | Is consumption per square foot decreasing along with code changes in the residential sector?<br>How feasible is statistical analysis? |
| Determination of Code Readiness | How can incentive program planning better incorporate intentions to move measures to code as quickly and cost efficiently as possible? What are the barriers to better integrating incentive program planning with C&S program planning? |

| Study Name | Research Questions [2013-2015] |
|---|---|
| Methods for Title 24 Improvement | What aspects of current Title 24 Standards contribute most to the cost of implementing and complying with new standards?<br>How might Standards language/methods be simplified in order to facilitate standards adoption and enforcement? |

### 2.9.3. Evaluation Activities for 2013-2015

NOTE: Due to budget constraints only the prospective IOU studies that are identified as having a "High" priority are included in ***Table 2*** & ***Table 3***. The available 2013-2014 budget for C&S and ZNE Evaluation Measurement and Verification (EM&V) studies will be allocated to high priority studies in ***Table 2*** &

***Table 3***. Scoping efforts for the studies has started and due to resource constraints, it is possible that not all research questions below will be addressed this cycle.

***Table 2. 2013-2015 C&S EM&V Studies, Budgets, and Timing***

| Codes & Standards Study | EstimatedBudget | Study Lead | Completiondate |
|---|---|---|---|
| 2013-2015 C&S Impact Evaluation Phase 1 and 2 | $3,974,000 | ED | Q3 2016 (Ph1) Q2 2017 |
| Assessment of Cost-Effectiveness Tools for C&S Program - Operationalizing Appropriate Policies in Cost Effectiveness Calculations | $120,000 | ED | Q4 2016 (Ph1) Q2 2017 (Ph2) |
| Compliance Improvement Process Evaluation for Utility Statewide Program and BayREN C&S | $220,635 | ED | Q2 2016 |
| Assessment of Compliance Improvement for Previously Evaluated Codes & Standards and Barriers to Code Compliance; Evaluation of the Rate of IMC Decline for Selected Measures | $530,000 | PG&E | Q3 2017 |
| Assessment of Standards Overlap On Program Savings– Policy Thought Paper | $30,000 | PG&E | Q3 2016 |
| Determining Baselines for Building Alterations – Policy Thought Paper | $85,000 | SDG&E | Q1 2017 |
| Analysis of 2008 Title 24 Nonresidential Compliance Site Audits | $105,000 | SCE | Q4 2016 |
| Underlying Assumptions for Calculation of Savings Potential for Lighting Alterations | $250,000 (not funded to date) | ED | TBD |
| Determinants of Code Compliance for Lighting Alterations | TBD (notfunded to date) | ED/IOU | TBD |
| Code Savings Analysis using Billing Data | $300,000 (not funded to date) | ED | TBD |

| Codes & Standards Study | EstimatedBudget | Study Lead | Completiondate |
|---|---|---|---|
| Determination of Code Readiness | $95, 000 | PG&E | Q3 2017 |
| Methods for Title 24 Improvement | $95,000 | SCE | Q4 2017 |
| Process Evaluation for IOU C&S Trainings, Classes, and Tools | $50,000 | IOU | Q3 2016 |
| **Total ED C&S EM&V Budget** | | | **$4,864,635** |
| **Total IOU C&S EM&V Budget** | | | **$990,000** |
| **Total CPUC-ED C&S EM&V Budget** | | | **$5,854,635** |

### 2.9.4. Study Descriptions for 2013-2015

#### High Priority Studies

| **Study Title: 2013-2014 Codes and Standards Impact Evaluation** | **Budget: $2,940,000 for 2013-2014<br>2015 Add-on: $1,034,000** |
|---|---|
| How to deal with interactive effects and other effects from these types of buildings?<br><u>Title 20</u><br>What is the impact of new appliances from Federal Appliance standards adopted in 2013-2015?<br>What is the impact of the Title 20 battery charger standards?<br>What is the savings impact of key regulated products such as televisions, lighting, pool pumps, etc. using market data for the years 2013-2015?<br>Are there any previously evaluated Title 20 or Federal standards for which compliance should be re-evaluated?<br>Are savings from Title 20 Lighting appliance standards also being counted under Title 24 LPD requirements? | |
| **Potential EM&V Methods:**<br>• Re-run the ISSM (Integrated Standards Savings Model) model with the combination of new inputs and old values for all measures.<br>• Engineering methods for calculation of UES, compliance rates.<br>• Field survey methods for appliances compliance.<br>• Other methods necessary given the scope of the report.<br>Select simulation software that best represents the energy use of low-rise and the high-rise multifamily buildings, respectively, in order to evaluate the reasonableness of the savings claims.<br>Select simulation software that best represents the energy use of low-rise and the high-rise multifamily buildings, respectively, in order to evaluate the reasonableness of the savings claims.<br>Develop sampling methods and approach for MF buildings<br>Investigate applicable parameters for NOMAD for multifamily, as it may differ for parameters normally used for single-family buildings.<br>Re-run the ISSM (Integrated Standards Savings Model) model with the combination of new inputs and old values for all measures.<br>Engineering methods for calculation of EUS, compliance rates.<br>Field survey methods for appliances compliance. | |

| **Study Title: 2013-2014 Codes and Standards Impact Evaluation** | **Budget: $2,940,000 for 2013-2014<br>2015 Add-on: $1,034,000** |
|---|---|
| Other methods necessary given the scope of the report. | |

| **Study Title: Assessment of Cost-Effectiveness Inputs for C&S Program and Reporting Practices** | **Budget: $120,000** |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |
| **Description:** The Cost-Effectiveness calculator as currently configured may not properly capture the full benefits of the C&S program. This study will investigate the inputs to the existing cost-effective calculation and their relationship to the C&S program. This study will then serve as basis for stakeholder input as to how the existing C-E inputs need to be defined to capture the characteristics of the program. | |
| **Objective:**<br>Define existing C-E inputs to better capture the characteristics of C&A programs.<br>Resources allowing, align ISSM tool and CPUC Cost-effectiveness Tool (CET). | |
| **Key Research Questions:**<br>How key inputs are currently defined in the C-E methods?<br>Appropriate measure life<br>Diminishing measure costs due to code becoming common practice<br>Consideration of how Net Effects is defined in the calculator and its applicability to C&S<br>How to define benefit streams for C&S program?<br>How to define and capture code readiness activities?<br>What are the key adjustments to existing cost-effectiveness inputs? | |
| **Potential EM&V Methods:**<br>This project involves hiring a multi-skilled contractor to review CPUC decisions, EUL studies, incremental measure cost (IMC) studies, trends in new product costs due to commoditization, and to be fully knowledgeable about the existing cost-effectiveness calculator.<br>Knowledge of codes and standards costs and benefits parameters, code readiness and market transformation concepts.<br>The contractor should take their findings through a facilitated public process with stakeholders to gather input on the appropriate way to move forward on C&S cost-effectiveness.<br>Familiarity with ISSM and CPUC CET logic Knowledge of codes and standards costs and benefits parameters, code readiness and market transformation concepts.<br>The contractor should take their findings through a facilitated public process with stakeholders to gather input on the appropriate way to move forward on C&S cost-effectiveness.<br>Familiarity with ISSM and CPUC CET logic. | |

| **Study Title: Compliance Improvement Process Evaluation for IOU Statewide Program and BayREN** | **Budget: $220,635** |
|---|---|
| **Expected Completion Date:** Q2 2016 | **Study Manager:** ED |

| **Study Title: Compliance Improvement Process Evaluation for IOU Statewide Program and BayREN** | **Budget: $220,635** |
|---|---|
| **Description:** Both the IOU Statewide Program and the BayREN administered programs aim at supporting and improving compliance with Title 24. According to D.12-11-015, both program administrators should coordinate activities and avoid duplication. This study will investigate the delivery of the programs, the effectiveness of coordination and how complimentary activities were. In addition, this study will investigate the ongoing effectiveness of the Best Practices study implemented by the IOU SW Compliance Enhancement subprogram in 2010-2012. | |
| **Objective:**<br>This process evaluation will investigate the delivery of compliance improvement activities of the IOU SW program, most specifically PG&E, and the BayREN. This is the first time that CPUC authorized two administrators for such activities.<br>How did the IOUs apply the knowledge of the Best Practices Pilot? | |
| **Key Research Questions:**<br>How is the BayREN implementing the activities proposed in the Program Implementation Plans?<br>How is the IOU Statewide Program implementing the activities proposed in the Program Implementation Plan?<br>How the activities of the BayREN and the IOUs (PG&E more specifically) complement each other?<br>How they collaborate in planning, implementation? Are there areas for improvement?<br>What are the metrics to determine the improvement in code enforcement and compliance?<br>What are the outcomes of the BayREN and IOUs activities? How are they contributing to compliance improvement with Title 24?<br>Are participating jurisdictions still following the recommendations of the BP study?<br>How did the study impact non-participating jurisdictions?<br>Did the process contribute to improving compliance? | |
| **Potential EM&V Methods:**<br>The contractor should be able to propose a method for analyzing delivery of similar but not identical services by two distinct entities. Additional methods:<br>Sampling methods<br>Interview and analysis methods<br>Review of documentation Interview and analysis methods<br>Review of documentation | |

| **Study Title: Assessment of Compliance Improvement for Previously Evaluated Codes & Standards and Barriers to Code Compliance and Evaluating the Rate of Incremental Measure Cost Decline for Selected Measures** | **Budget: $530,000** |
|---|---|
| **Expected Completion Date:** Q3 2017 | **Study Manager:** PG&E |
| **Description:** Currently, there are insufficient data in how compliance improvement rates have changed over time. This study will assess select codes from previous code adoption years to determine the extent to which compliance improvement has changed. This will inform program strategic planning, savings determination, and program implementation around compliance improvement activities. This study will also investigate historic costs of measures covered by selected | |

| **Study Title: Assessment of Compliance Improvement for Previously Evaluated Codes & Standards and Barriers to Code Compliance and Evaluating the Rate of Incremental Measure Cost Decline for Selected Measures** | **Budget: $530,000** |
|---|---|

codes adopted in previous years to determine if incremental measure costs tend to decrease over time post-code adoption

**Objective:**

To determine whether compliance rates improve over time and if so, whether IOU efforts influence that improvement.

Identify 2008/2013 codes with low compliance and investigate barriers to compliance

Identify and assess implication of definitional differences of compliance among market actors

Provide programmatic recommendations on strategic approaches to engaging in compliance improvement interventions

This study intends to leverage the results of, or contribute to, a related HVAC EM&V research effort to estimate baselines for HVAC installation permit and Title 24 compliance as well as a baseline for the existing conditions of HVAC systems statewide.

Identify methods for determining incremental measure costs for meeting previously adopted codes.

Identify methods for estimating trends in incremental measure costs.

Develop estimates of historical trends in incremental measure costs for measures covered by targeted codes.

**Key Research Questions:**

To what extent has code compliance improved over time for previous codes?

What are the barriers to code compliance for recently adopted codes (i.e., 2008/2013 updates) with low compliance?

How can the C&S program more strategically address the barriers to higher compliance rates?

Is it possible to determine historical incremental costs for measures covered by previous codes?

Can trends in historical IMCs be developed?

To what extent have incremental measure costs decreased over time?

**Potential EM&V Methods:**

Depending on scope of 2013-2014 field analysis, conduct a comparative analysis of new compliance results collected by the 2013-2014 C&S Impact Evaluation on a sample of building and appliance measures evaluated in the 2006-08 and 2010-2012 C&S Impact Evaluations against previous compliance results from those evaluations to ascertain compliance improvement figures.

Determine whether results from the sample can be extrapolated.

Survey participants in compliance-related utility training courses to collect observations on compliance improvement for Title 20 and Title 24 code.

Leverage 2010-2012 Impact Evaluation results to identify 2008 T24 codes with low compliance rates

Literature review and market actor surveys to identify 2013 T24 codes likely to have low compliance rates

Interviews/focus groups with different market actors in building industry and in municipal building inspection/permitting departments to identify barriers to compliance

Sample building Title 24 Document/building plan review

Qualitative assessment to identify market intervention strategies to address compliance barriers

Recommendations for implementing market intervention strategies.

Engage local governments, building professionals, and third party raters and providers (i.e., HERS raters and CalCerts; Lighting Acceptance Test Technicians and Acceptance Test Technician Certification Providers) to

| **Study Title: Assessment of Compliance Improvement for Previously Evaluated Codes & Standards and Barriers to Code Compliance and Evaluating the Rate of Incremental Measure Cost Decline for Selected Measures** | **Budget: $530,000** |
|---|---|
| address gaps in the third party verification system. Consider collaboration efforts with RENs.<br>Secondary analysis on 2008 Title 24-compliant building measure cost data.<br>Interviews with market actors on efficiency measure costs.<br>Econometric and other analyses. | |

| **Study Title: Assessment of Standards Overlap On Program Savings – Policy Thought Paper** | **Budget: $30,000** |
|---|---|
| **Expected Completion Date:** Q3 2016 | **Study Manager:** PG&E |
| **Description:** Some aspects of current codes and standards overlap particular end-uses/measures. This may cause total savings from codes and standards efforts to be overstated. This study will identify the nature and magnitude of potential overlaps. | |
| **Objective:**<br>Identify which Title 20, Title 24, and federal standards may overlap.<br>Determine the magnitude of the potential overlap that may be embedded in established savings estimates by end-use/measure group.<br>Suggest methods for adjusting savings estimates to prevent double-counting.<br>Estimate the cost of adjusting savings reporting processes versus ex-post adjustment in order to address potential overlaps. | |
| **Key Research Questions:**<br>For what end-uses/measures does overlap in reported savings exist?<br>What is the magnitude of savings overlap?<br>What is the cost of reducing/eliminating the overlap in savings estimates versus the likely increase in savings accuracy? | |
| **Potential EM&V Methods:** Whole building versus individual code assessments for overlapping measures. | |

| **Study Title: Determining Baselines for Building Alterations – Policy Thought Paper** | **Budget: $85,000** |
|---|---|
| **Expected Completion Date:** Q3 2017 | **Study Manager:** SDG&E |
| **Description:** Given the size of California's building stock the greatest potential savings from codes and standards activities involve existing buildings. Calculating Codes & Standards savings from codes triggered by building alterations can be difficult given: 1) the broad spectrum of existing equipment holding and usage prior to the alteration, 2) difficulties in determining baselines given the mix of performance and prescriptive standards that come into play, and 3) rapidly changing product adoption trends due, in part, to accelerated shifts in price/performance tradeoffs between competing technologies. Establishing realistic baselines for building alteration activities is key not only for calculating savings, but also for targeting subsequent standards at performance levels appropriate for the marketplace. This whitepaper will outline and explore the ramifications of various methods for setting baselines for building alteration savings. The paper will also provide a preliminary scoping assessment of building alteration activity (by building type and region) in order to inform the development and scoping of a needed market baseline study that would be managed by ED. | |

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|---|
| **Objective:**<br>Identify approaches to setting baselines for building alteration-related codes and standards savings calculations.<br>Estimate costs of implementing the various approaches into the current reporting framework.<br>Provide information to help scope a subsequent market baseline study for building alterations. |
| **Key Research Questions:**<br>What are the possible approaches to establishing baselines for building alteration-related codes?<br>How can credible baselines be established for C&S efforts that mix performance and prescriptive approaches impacting the same end uses?<br>What is the cost of implementing each of the possible reporting approaches?<br>What types of building alteration activity are most problematic in terms of setting appropriate baselines?<br>What types of building alteration activity represent the greatest share of potential savings (by building type, region, end-use) such that a reasonable sampling plan can be designed for the subsequent market baseline study. |
| **Potential EM&V Methods:** TBD |

| **Study Title: Analysis of 2008 Title 24 Nonresidential Compliance Site Audits** | **Budget: $105,000** |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** SCE |
| **Description:** The 2010-2012 Codes and Standards Impact study found that a significant number of sampled sites had exceeded the expected T24 savings above current code requirements. This was especially true of lighting alteration projects that triggered review. This study will review the site-specific data collected by Cadmus for their Title 24 impact assessment to ascertain the characteristics of customers that exceeded code (and did not exceed code) as well as the measures that were employed by customers in the sample. | |
| **Objective:**<br>Determine how and why customers exceeded code requirements.<br>Determine characteristics of customer segments that over-complied versus those who merely met compliance minimums or failed to comply with current T24 code. | |
| **Key Research Questions:**<br>What are the customer and building characteristics of compliant versus non-compliant sampled buildings?<br>What are the reasons that customers significantly exceeded new code requirements? | |
| **Potential EM&V Methods:** Customer survey | |

| **Study Title: Underlying Assumptions for Calculation of Savings Potential for Lighting Alterations 2** | **Budget: $250,000** |
|---|---|
| **Expected Completion Date:** 12 months | **Study Manager:** ED [not funded] |
| **Description:** Map triggers and frequency for building alterations. | |
| **Objective:**<br>Test the hypothesis that the frequency of lighting replacement is dependent on building and space type. Investigate factors that may determine the general frequency of lighting system replacement | |

| |
|---|
| **Key Research Questions:**<br>How frequently are lighting systems replaced and why |
| **Potential EM&V Methods:**<br>Develop estimates based on empirical data on the frequency of lighting system replacement and upgrades.<br>Analyze third-party data sets (Dodge, CoreLogic, CoStar, others?) |

| **Study Title: Barriers to Compliance for Lighting Alterations** | **Budget: TBD** |
|---|---|
| **Expected Completion Date:** TBD | **Study Manager:** ED or IOU [not funded] |
| **Description:** Investigate barriers to non-compliance with lighting alterations**.** | |
| **Objective:**<br>Investigate and document barriers to compliance with code requirements<br>Investigate barriers to pulling permits for lighting retrofits | |
| **Key Research Questions:**<br>How do code changes affect standard practice, the level of unpermitted work, or decisions to defer or go ahead with projects?<br>Is the outcome determined by the change or the extent of change relative to standard practice | |
| **Potential EM&V Methods:** Conduct interviews, surveys, database analysis, and site visits. | |

| **Study Title: Determination of Code Readiness** | **Budget: $95,000** |
|---|---|
| **Expected Completion Date:** Q3 2017 | **Study Manager:** PG&E |
| **Description:** An assessment of how to collect data from EE program operations that will support determination of code readiness for individual measures/end-uses in order to better coordinate initial incentive program efforts with code development efforts. | |
| **Objective:** Development of a process that better integrates planning for incentive program efforts with C&S program efforts | |
| **Key Research Questions:**<br>How can incentive program planning better incorporate intentions to move measures to code as quickly and cost efficiently as possible?<br>What are the barriers to better integrating incentive program planning with C&S program planning? | |

| **Study Title: Methods for Title 24 Improvement** | **Budget: $95,000** |
|---|---|
| **Expected Completion Date:** Q4 2017 | **Study Manager:** SCE |
| **Description:** A study that examines the benefits and costs of simplifying Title 24 with the aim of improving regulatory adoption and customer compliance. | |
| **Objective:** Determine how Title 24 Standards might be simplified to enhance adoption probability and reduce compliance burdens. | |
| **Key Research Questions:**<br>What aspects of current Title 24 Standards contribute most to the cost of implementing and complying with new standards?<br>How might Standards language/methods be simplified in order to facilitate standards adoption and enforcement. | |

| |
|---|
| **Potential EM&V Methods:**<br>Survey of regulatory actors<br>Survey of code officials |

## Medium/Low Priorities

| **Study Title: 2013-2014 Code Savings Analysis using Billing Data** | **Budget: $50k (pilot), Add-on: $300,000 to expand analysis statewide** |
|---|---|
| **Expected Completion Date:** 4 months (TBD if we will do this project) | **Study Manager:** ED [not funded to date] |
| **Description:** Comparison of engineering models and statistical analysis for savings. | |
| **Objective:**<br>Determine if savings from code changes can be detected as trends in whole house energy consumption<br>Expand analysis statewide if pilot proves feasible | |
| **Key Research Questions:**<br>Is consumption per square foot decreasing along with code changes in the residential sector?<br>How feasible is statistical analysis? | |
| **Potential EM&V Methods:**<br>Billing analysis using monthly billing and/or interval meter data<br>The data required to conduct the study include the following:2<br>Electric and gas billing data from homes with a service start date from May 2006 through December 2011 for the period from the service start date through 2012<br>Floor area data<br>Premise service date<br>Location<br>Other home characteristics, such as the presence of swimming pools, if available<br>Pilot using one service territory (SDG&E?), by climate zone<br>Conduct interviews, surveys, database analysis, and site visits. | |

| **Study Title: Process Evaluation for IOU C&S Trainings, Classes, and Tools** | **Budget: $50,000** |
|---|---|
| **Expected Completion Date:** Q3 2017 | **Study Manager:** IOU |
| **Description:** The IOUs would like to better understand the effectiveness of the trainings offered through their C&S programs. These trainings include classes, tools, and various other program related materials that are designed to assist participants in improving C&S outcomes including compliance. A thorough study of these trainings and tools is necessary to assist programs in supplementing trainings, targeting trainings to those it will benefit most, and potentially eliminating those that add little value.. | |
| **Objective:**<br>Examine the IOU and REN classes, trainings, and tools.<br>Identify which training options provide the best value add. Provide information to help improve these trainings | |

| **Key Research Questions:**<br>Which classes, trainings, and tools provide the most substance to participants, leading to greater program success?<br>Does the effect of a training program vary by audience? Does delivery method effect success?<br>Which approach is most cost effective or provides the most value add? |
|---|
| **Potential EM&V Methods:** Process evaluation with in-depth interviews, online surveys, focus groups. |

## Other Important Considerations

This roadmap intends to leverage the results of, or contribute to, a related HVAC EM&V research effort to estimate baselines for HVAC installation permit and Title 24 compliance as well as a baseline for the existing conditions of HVAC systems statewide.

This roadmap also intends to align C&S evaluation policies to policies for demand forecasting, setting of program goals and calculating cost-effectiveness.

Finally, as two IOU led studies were cancelled, this roadmap has unallocated funds. The PCG has not yet defined who would be leading an investigation of barriers to compliance in lighting alterations, so this study may be allocated to the IOU roadmap. The PCG will determine if there are other evaluation priorities in the upcoming year, or if we should develop studies with lower priorities.

### 2.9.5. Study needs for 2016 and Beyond

**Proposed 2016-2017 Energy Division Budget: $2,095,830**

**Proposed 2016-2017 Program Administrator Budget: $200,000 [$950,000 for C&S, Non Res/ New Construction / ZNE]**

***Table 3. 2016 C&S EM&V Priorities***

| Codes & Standards Study | Estimated Budget | Study Lead | Completion date |
|---|---|---|---|
| 2016+ C&S Impact Evaluation | TBD | ED | TBD |
| Compliance Rates, Barriers and Determinants | TBD | ED/IOU | TBD |
| Baselines For Compliance Improvement Subprogram Metrics | $200,000 | PG&E | Q4 2017 |
| Continue to improve data collection and assumptions to inform rates of turnover of existing stock to inform calculation of potential | TBD | ED/IOU | TBD |
| **Total ED C&S EM&V Budget** | **TBD** | | |
| **Total IOU C&S EM&V Budget** | **$200,000** | | |
| **Total CPUC-ED C&S EM&V Budget** | **TBD** | | |

The Codes & Standards study area will continue to execute the impact evaluation protocol. Evaluation adaptations emerging from the implementation of AB802 related to baseline changes

and meter-based program designs may also need to be addressed in this evaluation plan for the future. ED is also interested in future studies that:

- Investigate how to incorporate more comprehensive interactive effects evaluated by existing IOU studies into the current evaluation. This will include review of the Energy Commission Impact Analysis and other existing studies with respect to how measures were modeled , building types considered and other parameters.
- Revisit how to quantify the effects of codes and how disaggregated savings compare to whole building savings.
- Evaluate the effects of alternate choices of T-24 compliance software on the savings estimates due to code changes.
- Investigate any issues due to double counting of savings between T-24 building codes and T-20 and federal minimum appliance standards. Other double counting issues may include upstream and other IOU programs as well as not taking into account interactive effects. In addition, as a result of policies from AB802, other double counting issues due to changing baselines need to be investigated.
- Investigate changes in codes & standard policies that may be needed as a result of SB350.
- Investigate how Energy Efficiency Portfolio programs and C&S programs more specifically are able to address the intersection of the energy efficiency, distributed generation, energy storage, and demand response technologies and deployment strategies required for ZNE.
- Investigate the impact of residential alterations for Title 24. Investigate availability of data and magnitude of impacts as a percentage of the total C&S savings.
- Continue evaluation of REN C&S activities taking note of any changes from previous studies.
- Investigate the effects of sample selection on non-residential compliance impacts. Compare sites volunteered to a random sample of sites for the effect on compliance of Title 24.
- Continue investigating reasons that building performance may not meet code in some cases but exceed code in others.
- Determine the energy impacts of mandatory measures in Title 24 and the impacts of not complying with mandatory measures.
- Research volume and frequency of building alterations affected by code.
- Research market conditions for multifamily buildings. Multi-family buildings have recently been shown to be a large part of the residential market.
- Update the Codes and Standards protocol to reflect the adjustments and changes made over the course of three code cycles.
- Initiate a pilot project to evaluate modeled Title 24 savings. This would include the effect of actual and default building schedules.
- Develop methods or evaluating integrated products such as motors and pumps that are now part of a recent approach to developing appliance/equipment standards.

- Review recent plug load studies to determine the effect on total building load and energy savings. This could also be useful to reconcile billing analysis data with modeled building data.
- Study M&V methods for determining compliance for both building codes and appliances and its effect on energy savings. Randomized Control Trials can be used to compare alternate Compliance improvement methods.
- Compare the use of prescriptive to performance approach to determine building Title 24 compliance.

New studies from the Program Administrator are listed below.

| **Study Title:** Baselines For Compliance Improvement Subprogram Metrics | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** Q4/2017 | **Study Manager:** PG&E |

**Description**:
Appliance standards compliance rates are relatively straightforward to estimate through the use of stocking surveys. Title 24 building alteration compliance is notoriously difficult and expensive to estimate due to difficulties in: 1) locating businesses/households that have recently remodeled or installed new equipment, particularly given failures to pull and/or closeout permits; and 2) obtaining permission to evaluate whether the alterations are compliant with Title 24 Standards. This study would endeavor to develop compliance baselines for a subset of key Title 24 codes – non-residential lighting alterations and residential HVAC alterations/replacements. The goal is to establish cost efficient methods for compliance tracking and to set baselines for compliance that can serve as the basis for subprogram metrics.

**Objectives:**

- Shed light on the rate of customer compliance with Title 24 lighting alteration code and code sections governing residential HVAC replacement.
- Set baselines for code compliance subprogram metrics.
- Determine the cost and cost efficiency of survey-based compliance measurement for Title 24.

**Key Research Questions:**

- How can we more cost efficiently measure code compliance?
- What is the compliance rate for non-residential lighting alterations covered by the 2013
- Title 24 code update?
- What is the compliance rate for residential HVAC replacement/alteration as dictated by the 2013 Title 24 code and associated appliance standards?
- Are selected compliance measurement methods extendable to other codes?
- How can sampling costs be reduced?
- - Are current compliance improvement efforts having a measureable effect on compliance rates for selected measures?

**Potential EM&V Methods:**

- Customer telephone survey and follow-up site survey.
- Building simulation modeling
- Use of existing field survey sample to establish baseline compliance.
- Use of incentive program participant lists to establish compliance sample.

| **Study Title: Revisit Attribution Methodology for Codes & Standards** | **Budget: TBD** |
|---|---|
| **Expected Completion Date:** Q4 2017 | **Study Manager:** SCE |
| **Description:** A study that examines the current attribution model and investigate if and how it can be improved to appropriate attribution for each IOU based on level of support and involvement (based not solely on expenditure). | |
| **Objective:** Determine how current Codes & Standards attribution model can be improved to simplify modeling efforts and allow for attribution nuances by IOU. | |
| **Key Research Questions:**<br><br>Are there any overlaps in the data collected for C&S program and EM&V studies?<br>What is the most optimal approach to data collection for the attribution model?<br>How can the attribution model be simplified and/or improved? | |
| **Potential EM&V Methods:** Literature review, database/documentation analysis. | |

| **Study Title: Market Characterization of Non-New Construction** | **Budget: TBD** |
|---|---|
| **Expected Completion Date:** Q4 2017 | **Study Manager:** SCE |
| **Description:** A study that examines the permits being pulled for non-new construction projects | |
| **Objective:** Investigate how to better align Codes & Standards efforts with real-world applications. | |
| **Key Research Questions:**<br><br>What lessons can be learned about the real world from an analysis of permits pulled for non-new construction projects? | |
| **Potential EM&V Methods:** Stakeholder survey, database analysis**.** | |

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# 2.10. Zero Net Energy/New Construction

## 2.10.1. Background

The Program Administrators will be filing Business Plans in early 2017. Within these Business Plans will be suggested evaluation activities by sector and ZNE and New Construction will be part of the Residential and Commercial Business Plan Sectors. The next update to the EM&V Roadmap will include information based on the Business Plans.

### Sector or Program Area Description

California continues to lead the nation in the design, construction and operation of Zero Net Energy (ZNE) buildings. The 2015 New Buildings Institute (NBI) Update identifies 39 existing and 152 emerging Zero Net Energy or ultra-low energy use non-residential buildings nationally while the Spring 2016 NBI California ZNE Watchlist identifies 108 California commercial buildings (including multi-family), including 17 verified ZNE buildings and 91 buildings emerging towards that target.[52] Similar to nationwide trends, many of these California-specific ZNE buildings (40%) are in the education sector. According to NBI, as Proposition 39[53] funding continues, it is possible that still more educational facilities will soon be moving towards ZNE.

IOUs report contributing financial, technical, design and other resources to 75 out of 81 known ZNE or ultra-low energy use commercial buildings in California since 2008. Most of these are publicly owned, and operated, including schools, libraries, and local government buildings, but an increasing number are large, private facilities exceeding 50,000 $ft^2$ in size.[54]

In the residential new homes market, a 2014 PG&E study found about one thousand "ZNE-type" homes in existence in California, including 16 fully ZNE homes, 150 "ZNE-ready" homes, and approximately 950 "near-ZNE" homes. The study defined "ZNE-type" homes as exceeding Title 24 efficiency requirements by at least 40%; when dropped to a 30% threshold, the number of ZNE-type homes exceeds 10,000. TRC researchers also reported that ZNE-type homes comprised just 1% of the new homes market in 2014 and recommended a range of new program design and other activities if California is to reach its ZNE 2020 new homes goals.[55]

CPUC and IOU activities supporting market growth in ZNE buildings have included active "ZNE Commercial Action Plan" stakeholder meetings convened by Commission staff between 2010-2014, and ongoing ZNE Action Plan implementation activities since then (ZNE Early Adopter trainings for state, local governments and school building managers; the ongoing electronic ZNE Bulletin; additional ZNE building case studies and a ZNE Messaging Toolkit). PG&E published a ZNE Commercial Building Monograph presenting in-depth case studies of non-residential buildings in 2014[56], and IOU-

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[52] http://newbuildings.org/wp-content/uploads/2016/07/CA_ZNE_Watchlist_SpringSummer2016.pdf

[53] http://www.energy.ca.gov/efficiency/proposition39/

[54] Energy Division data request to IOUs, self-reported IOU data; August 2014.

[55] Residential ZNE Market Characterization – Final Report" (TRC, 2012).

[56] "Zero Net Energy Case Study Buildings," (Dean, 2014). http://energydesignresources.com/resources/publications/case-studies/case-studies-zne-non-residential-buildings.aspx

administered ZNE and Sustainable Communities Pilots continue to support financial, technical and design assistance to ZNE buildings and communities.

In 2014, IOUs launched a new incentive design for their residential new construction program (California Advanced Homes Program), and initiated planning for a 2015 planned CAHP program element to support a targeted set of advanced builders to incorporate high performance walls and attics into their business models in advance of the expected inclusion of these measures in the 2016 Title 24 standards update. CPUC staff launched a ZNE Residential Action Plan and related stakeholder process in 2015, which has been managed by Bluepoint Planning. A ZNE Residential Stakeholder Group was formed and has since participated in several workshops addressing Community-Scale ZNE solutions and the labeling of ZNE buildings and homes. CPUC staff, in conjunction with CEC, published the Strategic Plan for New Residential Buildings in June 2015.[57]

The Energy Commission Electric Program Investment Charge (EPIC), starting in 2015, is soliciting over $30 million for ZNE research projects.[58] Additionally, the ongoing California Solar Initiative Research, Development, Demonstration, and Deployment(RD&D) Program has demonstrated the feasibility of new technologies and approaches in support of ZNE goals.[59]

Key EM&V ZNE studies that continue to support ZNE buildings and activities have used the 2012 PG&E-managed studies "Road to ZNE: Mapping Pathways to ZNE Buildings in California," and "The Technical Feasibility of Zero Net Energy Buildings in California" as foundational research. The on-going and proposed studies explore a broad range of topics to support the pursuit of CA's ZNE goals, including (but not limited to) an exploration of ZNE building verification methodologies, ZNE compliance options using distributed energy resources and community-scale solutions, miscellaneous electric loads, and commercial, state building, and K-14 market characterizations.

The ZNE/New Construction sector previously shared a roadmap with Codes & Standards. Then, starting in the 2015 cycle, ZNE/New Construction was split into its own roadmap; however, ZNE and New Construction activities continue to occur throughout the other sectors of the energy efficiency portfolio.

Table 36 shows the expected energy savings for the programs within the ZNE/New Construction Roadmap, administered by all four IOUs and in both the commercial and residential sectors.

***Table 36. 2016 ZNE/New Construction Expected Program Savings***

| PA | Program ID | Sector | Program Name | kW | MWh | Therms |
|---|---|---|---|---|---|---|
| PG&E | PGE211025 | Commercial | Savings By Design | 2,491 | 15,893 | 537,229 |
| PG&E | PGE21005 | Residential | Residential New Construction | 3,100 | 1,665 | 575,000 |
| SCE | SCE-16-SW-002G | Commercial | Savings By Design | 7,300 | 35,527 | 0 |

[57] http://www.cpuc.ca.gov/general.aspx?id=10740

[58] For a complete listing of the EPIC funding decisions, visit: http://www.energy.ca.gov/contracts/epic.html

[59] http://www.calsolarresearch.org

| PA | Program ID | Sector | Program Name | kW | MWh | Therms |
|---|---|---|---|---|---|---|
| SCE | SCE-16-SW-001F | Residential | Residential New Construction | 1,418 | 801 | 0 |
| SCG | SCG3707 | Residential | CALS-Residential New Construction | 0 | 0 | 322,665 |
| SDGE | SDGE3222 | Commercial | Calculated Incentives – Savings by Design | 3,210 | 15,987 | 1,708 |
| SDGE | SDGE3213 | Residential | CAHP/ESMH-CA Advanced Homes | 651 | 883 | 46,194 |

These programs are not specific to ZNE, though several focus on New Construction. Note that Table 36 does not include ex ante information such as uncertain measures or work paper submissions.

### 2.10.2. Evaluations for 2013-2015

## Activities and Estimated Budgets

Table 37, below, summarizes the 2013-2015 EM&V studies that have been budgeted. Four of these studies are completed, one is on hold, and five are in progress. The Project Status Report Identifier (PSR ID) is included for reference on the CPUC Project Status Report site.[60] Each study is detailed more fully in Section 2.10.3.

***Table 37. Current and Planned ZNE/New Construction EM&V Studies***

| Study Title | PSR ID | Manager | Evaluator | Estimated Budget | Expected Completion |
|---|---|---|---|---|---|
| Residential ZNE Market Characterization | 2002 | IOU | TRC Team | $468,750 | Completed |
| ZNE Evaluation Methodology Study, Phase I | 2118 | IOU | TRC Team | $109,484 | Completed |
| Miscellaneous Energy Loads Study, Phase I | 2003 | IOU | Energy Solutions | $75,386 | Completed |
| Miscellaneous Energy Loads Study, Phase II | 2004 | IOU | Cadmus | $100,000 | Completed |
| Miscellaneous Energy Loads Study, Phase III | N/A | IOU | TBD | $293,364 | On Hold |
| ZNE Evaluation Methodology Study, Phase II | 2079 | IOU | TBD | $112,500 | Q3 2017 |
| ZNE Compliance Options for Distributed Energy Resources, | 2080 | IOU | TRC Team | $112,500 | Q2 2017 |

[60] http://eestats.cpuc.ca.gov/Views/PSRViewer.aspx

| Study Title | PSR ID | Manager | Evaluator | Estimated Budget | Expected Completion |
|---|---|---|---|---|---|
| Phase I | | | | | |
| K-12 and Community College ZNE Retrofit Readiness Market Characterization Study | ED_D_ZNE_1 | ED | NBI | $293,699 | Q2 2017 |
| State Building Decision Maker Study | ED_D_ZNE_2 | ED | Opinion Dynamics | $354,060 | Q2 2017 |
| **Total IOU Budget** | | | | **$1,271,984** | |
| **Total CPUC-ED Budget** | | | | **$647,759** | |
| **Total Budget** | | | | **$1,919,460** | |

### 2.10.3. 2013-2015 Study Descriptions

The following tables outline each of the ZNE and New Construction studies funded through the 2013-2015 budget. The tables include estimated or realized budgets, which organizations will function as the study managers, main objectives, key research questions that will be addressed, and the EM&V methods planned or used.

***Table 38. Residential ZNE/NC Market Characterization Study Description***

| | |
|---|---|
| **Study Title:** Residential Zero Net Energy New Construction Market Characterization | **Budget:** $468,750 |
| **Expected Completion Date:** Completed | **Study Manager:** Pacific Gas & Electric Co. |
| **Description:**<br>The research priorities for this study flowed from the "Road to ZNE: Mapping Pathways to ZNE Buildings" project completed under the 2010-2012 EM&V Plan. The study seeks to provide a deeper understanding of market opportunities for residential zero net energy (ZNE) new construction. | |
| **Objectives:**<br>• Characterize the residential ZNE new construction market.<br>• Assess residential ZNE rating systems and financing opportunities.<br>• Assess drivers, barriers, and opportunities to messaging, building, financing, and purchasing residential ZNE new construction. | |
| **Key Research Questions:**<br>• Conduct qualitative assessment of the structure and functioning of the single-family residential ZNE new construction market.<br>• Assess potential for California residential building rating and/or labeling systems to complement residential ZNE new construction market and meet needs of state and national financial appraisers' institutions.<br>• Assess the viability of aligning the CAL-HERS system, the national HERS rating and the CBECC design ratings.<br>• Assess the need for enhancing the TDV metric to reflect both the value of energy exports from buildings and any costs associated with exporting significant, increasing quantities of electricity to California's distribution grid. | |

| **Study Title:** Residential Zero Net Energy New Construction Market Characterization | **Budget:** $468,750 |
|---|---|
| **Expected Completion Date:** Completed | **Study Manager:** Pacific Gas & Electric Co. |

- Determine the drivers, barriers, and opportunities for building, financing, and purchasing residential ZNE new construction by assessing awareness, needs, and attitudes of residential new construction builders.
- Characterize demand for residential ZNE new construction.
- Recommend market intervention strategies (including IOU programs activities) to overcoming identified barriers to messaging, building, financing, and purchasing residential ZNE new construction.

**EM&V Methods:**

- Literature Review
- In-depth Interviews
- Focus Groups
- Market Survey

**Findings:**

- This study identified 16 ZNE homes according to the CAHP and RFI data, representing 0.01% of the total market share. However, this study found almost one thousand near ZNE homes (i.e., highly efficient with distributed generation), and it found that near ZNE homes represented approximately 1% of the market in 2014. The number of near ZNE homes also appears to be higher than the number of ZNE-ready (i.e., highly efficient without distributed generation) homes. The prevalence of near ZNE home and scarcity of ZNE homes indicates that the market may be more ready to embrace near ZNE construction than ZNE construction than ZNE construction in the short term. Incremental cost is the biggest barrier to all ZNE-type home construction.
- ZNE-type and energy efficient homeowners indicated that their willingness-to-pay for their next ZNE-type home increased with their perceived value of their current home. Consequently, once an owner purchases a ZNE-type or an energy efficient home, he/she may be more likely to pay for a ZNE home.
- Currently, under most of the PAs' programs (including the IOU programs), builders use two different programs to receive all possible incentives for energy efficiency and PV (CAHP and NSHP), which is cumbersome. Also, some program managers reported the need for improved collaboration between these programs, including better data sharing. The TRC team concurred with program managers after reviewing the CAHP and NSHP databases and finding various differences in how these programs track projects. In addition, the previous PV kicker for some IOU CAHP programs required that all homes in a development have PV to receive an incentive.
- There are various organizations working towards the ZNE goal, but they track homes using different metrics and database formats. This hinders the ability for any one organization to quantify the number of ZNE-type homes and track progress towards ZNE goals.
- Builders reported that many subcontractors and builders of code-compliant homes do not have the knowledge needed to execute advanced building practices successfully. Building officials reported challenges in the code compliance process, both with homes built to code and those built above code.
- ZNE-type homes present a quandary to the lending community. Lenders need larger volumes of energy efficient or ZNE-type homes to make financing these products through EEMs or other

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mechanisms worth their while due to the increased paperwork and home rating requirement presented by EEMs. Lenders noted that most homebuyers are not aware of EEMs; if they are, they usually learn about them after they have identified a home for purchase, not during the decision-making stage. Lenders also noted that they have a shortage of appraisers with the necessary training to conduct valuations of ZNE-type homes.

- Lender interviews indicated that one partial solution to the lack of consumer demand for EEMs would be if they collaborated with production ZNE-type builders.
- Two lenders described success with EEMs using a facilitator model, in which an independent contractor (on the assessment side) handled the extra work involved with an EEM on behalf of the lender.
- Lenders reported difficulty in finding appraisers that are adequately trained to develop valuations for ZNE-type or high performance homes. Appraisers reported that some lenders will not accept appraisers' valuations of ZNE-type homes.
- While the lenders reported difficulty finding trained appraisers, the appraisers interviewed—all of whom had at least some level of training and experience with valuing high performance homes—reported they are rarely requested to provide a valuation of a ZNE-type home.
- Appraisers and lenders reported the need for realtor training for better understanding and promoting the benefits of ZNE-type homes.
- Builders reported they have concerns that owners will misinterpret ZNE. This was supported by feedback from owners. Among owners that reported to be aware of the term ZNE, approximately one-third interpreted ZNE as either zero bill or a home that is off-the-grid. Two ZNE-type owners reported that "zero" is unachievable, and is a term that should not be used lightly.
- Builders and building industry experts recommended the use of demonstration homes. This was supported by reports from owners in the ZNE-type forum, who reported that the demonstration was influential in their purchasing decision and who could recall specific aspects of the demonstration years after touring it. In addition, approximately one-third of the ZNE-type and Energy Efficient owners that were familiar with the term ZNE reported that their source of awareness was a showcase home.
- About half of production ZNE-type owners and Energy Efficient owners reported they had concerns at the time of home purchase about resale value. However, studies have shown that homes with energy efficiency labels or PV sell for a higher value on average compared to Code-built homes (e.g., Kok 2012, LBNL 2013b, LBNL 2011, and ConSol 2008).
- Per the state's loading order established in the state's Energy Action Plan (CEC and CPUC 2013) and the CEC's 2013 IEPR, achieving ZNE residential new construction goals requires equitable promotion of energy efficiency and distributed generation measures to maximize the benefits of ZNE. Currently, there are several policies to promote distributed generation, such as rebates, tax credits and net energy metering policies. All of these policies are undergoing potential changes. Navigant (2014a-c) indicated that confusion in the market over net metering may hinder market adoption of PV. In this study, builders and program managers reported that consumers questioned how they will be compensated for energy supplied to the grid. (This study did not ask owners directly about their net metering concerns.) In this study, some owners with PV reported they did not expect the annual "true up bill" they received from their utility, and that this was a

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source of dissatisfaction. Owners in this study expressed confusion over the PV leasing process. In addition, the literature indicates that roofing maintenance can cause unexpected costs for leased PV systems.

- Owners in this study expressed confusion over the PV leasing process. In addition, the literature indicates that roofing maintenance can cause unexpected costs for leased PV systems.
- ZNE is technically feasible, but the biggest barrier is incremental cost, and builders' concern that consumers may not pay this incremental cost. Based on interviews with high performance builders, building industry experts, and program managers, the incremental cost for a ZNE home is approximately 5-15% more than the cost to build a Code-built home. ZNE-type owners and Energy Efficient owners, reported they were willing to pay approximately 8-12% more, and 1-10% more, respectively, for their next home to be a ZNE-type home compared to a Code-built home.
- Comfort appears to be an important purchasing criterion for owners, and builders include comfort benefits in their messaging of ZNE-type homes. Based on the small number of owners in this study, ZNE-type and Energy Efficient owners indicated they were generally satisfied with the comfort provided by their homes, while several Code-built owners expressed dissatisfaction with the comfort of their homes.
- About one-quarter (12 of 42) of ZNE-type owners and one-third (34 of 109) of Energy Efficient owners reported they had initial concerns about managing high tech features, including the monitoring or operation of PV systems, HVAC systems, or other measures. Owners of homes with PV were significantly more likely to report a concern managing high tech features at the initial time of purchase. This study did not rigorously explore whether these concerns were actual or perceived, although two ZNE-type owners mentioned that they do have difficulties managing high tech features.
- Several owners in this study described that they liked the in-home display feature of their PV system. In addition, many market actors pointed to the need for owners to be aware of the impact of their behaviors on their home's energy performance.
- Owners indicated a preference for natural gas appliances. However, some builders consider ZNE to refer to electricity only (e.g., zero out electricity use only, or believe that a ZNE home must be all-electric), and one voluntary labeling program only considers electricity in its definition of ZNE. In addition, as the penetration of distribution generation and renewable energy increase, the cost effectiveness of, and greenhouse gas emissions from, electric appliances will change.
- CAHP program managers noted the difficulty for programs to track progress towards ZNE using a Title 24-based metric, because it does not include all energy loads, and it does not indicate a ZNE home. The TRC team concurs that this is a challenge after conducting market size analysis for this study.
- While the state agencies continue to make progress on clarifying how TDV addresses energy efficiency, there is no clear policy on how distributed generation, and PV in particular, will be addressed. With potential changes to net energy metering, it is important that the TDV metric keep pace with future changes. One risk of assuming status quo for PV valuation in the next round of TDV updates is that any changes in net energy metering or tax credits that are not captured in TDV will result in a disconnect between valuation in codes and valuation in the real world. This is especially true if TDV assigns higher value to PV exports than regulatory policies assign in the

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future. In an extreme scenario, TDV could require oversized PV systems that provide value to the owner on paper; but in reality, the owner does not capture that value in their levelized cost of energy paid for the system. On the other end of the spectrum, if TDV assigns a lesser value to PV exports than those assumed in net energy metering and other proceedings, codes could appear to be punitive to distributed generation.

- One city planner noted that not every home can feasibly achieve ZNE on its own, due to lack of roof space or orientation. In addition, other researchers (e.g., Goldstein 2012) have pointed to the need to consider additional energy uses related to a home (e.g., embedded energy of water, proximity to public transportation or walkable neighborhoods) in the definition of ZNE.
- City planners reported that jurisdictions are aware of ZNE, but they generally do not see ZNE ordinances as politically viable or cost effective from builders' perspectives under current market conditions. In addition, most planners noted that their jurisdictions are "waiting and seeing" what happens at the state level for ZNE. Planners also noted that voluntary provisions can be politically easier to pass than mandatory requirements.
- Appraisers' most noted barrier is the lack of sales data for high performance homes. They further reported that another barrier is inconsistent reporting of high performance elements by realtors in the MLS databases.
- Based on interviews with ZNE-type owners, homeowners may interpret ZNE based on actual energy performance, but builders, policy makers, and the PAs currently interpret ZNE based on projected energy performance. In addition, owners indicated that their primary driver for purchasing an Energy Efficient home or a ZNE-type home was reduced utility bills. However, builders are wary of making energy bill promises, because the actual performance can vary widely due to occupancy and behavior. About half of builders indicated that they do not use HERS in discussions with owners because they think it is too confusing. This was confirmed by owners, who generally could not recall what information the HERS rating provided.
- This study developed a catalog of energy performances in Section 3.4.2, which included Code-built, Energy Efficient, ZNE-ready, near ZNE, and ZNE homes.
- This study had several limitations, including that the TRC team targeted ZNE-type market actors (rather than the broader market) for feedback, focused on the single-family homes market, and collected data at one point in time.
- The TRC team generally asked broad questions regarding distributed generation, but almost all market actors responded by discussing rooftop PV rather than community-scale distributed generation or other community-scale distributed energy resources (DERs). In addition, the ZNE-type home case studies reviewed by the TRC team did not use community-scale DERs.
- A study by the U.S. DOE (2011) found that the heavy focus on air sealing without designed ventilation provisions could negatively affect health, safety, and durability. Many owners, including production Energy Efficient owners and custom ZNE-type owners, reported that they had initial concerns (at the time of home purchase) regarding sufficient ventilation. Many ZNE-type and Energy Efficient owners also reported having initial concerns about operating their homes high-tech features. This study did not ascertain whether these concerns are perceived or actual.

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**Recommendations:**

- Expand programs targeting ZNE, and for ZNE-ready and near ZNE homes, particularly within 5-10% of the incremental cost compared to a code-built home.
- Continue programs for Energy Efficient homes as a stepping-stone for ZNE, but target builders that have been non-participants to date.
- Transition to a single market transformation program for energy efficiency and distributed generation.
- Because different organizations track ZNE-type homes using different metrics, develop a central repository of ZNE-type homes or (at a minimum) consistent tracking metrics for tracking progress towards ZNE goals.
- Continue and expand education efforts for builders and their contractors and trades regarding code compliance and above code building practices.
- Support real estate agents and lenders by holding symposiums for builders, appraisers, lenders, and realtors with interest and training in ZNE-type homes; bringing together ZNE-type homebuilders and Energy Efficient Mortgage (EEM) lenders; investigating a model through which a facilitator handles the additional paperwork of an EEM; providing a platform for connecting lenders with appraisers trained on ZNE-type homes; and providing training for realtors on how to recognize and promote ZNE-type home features.
- Work with builders to develop clear and consistent messaging for the 2013 IEPR's ZNE definition that builders are comfortable promoting, and expand the reach of ZNE-type demonstration homes.
- Provide educational toolkits to help builders address homebuyers' concerns about the re-sale value of ZNE-type homes, by promoting study results showing higher resale values of Energy Efficient and solar homes.
- Once the State agencies update net-energy metering and other policies, work with these agencies, builders, and PV installers to educate homebuyers on how these policies affect them.
- Reframe the incremental cost paradigm by providing additional incentives and technical assistance to builders that meet the following challenge: using an identical budget for your non-ZNE home, how would you build a ZNE home that is as comparable as possible?
- Support builders in highlighting comfort benefits of ZNE-type homes through customer testimonials.
- Address homebuyers concerns about managing high tech features by providing template homeowner orientations to builders.
- Based on customers' satisfaction with PV displays, encourage builders to install home energy monitoring systems.
- Investigate consumer preferences, greenhouse gas emissions, and cost effectiveness impacts (to the owners and the utilities) of equipment with different fuel sources, under an evolving grid.
- To address the difficulty of tracking progress towards ZNE under a Title-24 based metric, identify an EUI-based metric for tracking projects in energy efficiency and distributed generation programs.
- Finalize policies for how TDV will account for PV generation in the CEC's TDV-Lifecycle cost update

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| **Expected Completion Date:** Completed | **Study Manager:** Pacific Gas & Electric Co. |

process.

- Because not all homes can feasibly achieve ZNE on their own (e.g., due to lack of roof space for PV), develop equivalencies for the distributed generation aspect of ZNE.
- Work with planners to develop short-term voluntary provisions, with carrots for ZNE-type construction.
- To address appraisers' challenges from the lack of sales data for ZNE-type homes, work with the National Association of Realtors and the California Bureau of Real Estate (CalBRE) to encourage realtors to provide energy use disclosures.
- Because owners may interpret ZNE based on actual rather than modeled energy performance, collect performance data from occupied ZNE-type homes to: (1) understand how occupant behavior can affect energy use, (2) develop ranges of energy use based on actual ZNE-type homes, and (3) improve energy modeling.
- In future ZNE-type home studies, use and improve the catalog of energy performances developed in this study.
- Develop an evaluation research plan to support the State's ZNE goals including a full market baseline study that gathers feedback from the broader market, a market transformation study around 2018, and a market characterization of multifamily homes.
- The lack of market actor experience with renewable energy resources beyond rooftop PV demonstrates the need to understand barriers and opportunities for community-scale Distributed Energy Resources (DERs) options for ZNE-type homes.
- Track operational issues with ZNE-type homes so that builders can improve construction practices to address actual homebuyer concerns and develop messaging to address perceived concerns.

| **Study Title:** ZNE Evaluation Methodology Study, Phase I | **Budget:** $109,484 |
|---|---|
| **Expected Completion Date:** Completed | **Study Manager:** Pacific Gas & Electric Co. |

**Description:**
Recognizing the imminent need to evaluate residential and commercial ZNE projects, the overarching goal of this Study is to explore and establish methodologies for evaluating new construction and retrofit ZNE residential and commercial buildings in California. Phase 1 of this study will test the methodologies on available data for new construction residential single-family and multi-family projects pursing the 2020 ZNE goal and school projects pursuing ZNE pursuant to Prop 39. Subsequent phases will test and finalize new construction and retrofit evaluation methodologies on building types not covered in Phase 1.

**Objectives:**

- Develop Evaluation Methodologies for New Construction and Retrofit ZNE Buildings in California
- Test Evaluation Methodologies on Sample of New Construction Single Family, Multi-family, and School ZNE Projects
- Propose Final Evaluation Methodologies for New Construction Single-Family, Multi-family, and School ZNE Projects

| **Study Title:** ZNE Evaluation Methodology Study, Phase I | **Budget:** $109,484 |
|---|---|
| **Key Research Questions:**<br>Develop ZNE modeling standards and criteria to enable consistent, market- driven development of integrated tools for ZNE residential projects. | |
| **EM&V Methods:**<br>Literature review, in-depth interviews with building and program managers, gap analysis of available building data. | |
| **Findings:**<br>• ZNE Code Assessment: The Building 11 amongst the case studies was the only project which targeted a ZNE Code status. However, to be able to verify the ZNE methodology or the targeted ZNE Code goal for the building due to the lack of TDV values available for the assessment.<br>• ZNE Design - Site/Source Assessment: the study team was unable to verify if any of these buildings were designed to be ZNE Design projects due to lack of modeled renewable energy generation data and the ERI values for any of the projects.<br>• ZNE Performance (Site/Source) Assessment: the study team was adequately able to conduct a ZNE site and source performance assessment of all the case studies available for this project. The building provided only the site performance data for all projects, and the study team had to use DOE's energy multipliers to convert the site energy consumption/generation to source metrics. This implies that most projects will not be able to provide source energy metrics and it might be worthwhile to build these conversion factors in California's approved building energy performance software tools. Figure 29 summarizes the results from the ZNE Performance assessment. Eleven out of the twelve buildings are ZNE according to the site energy use metrics, but Building 10 and 11 do not meet the ZNE Site - Performance criteria. As mentioned earlier, Building 3 does not meet either the ZNE Site or the ZNE Source - Performance metrics. | |
| **Recommendations:**<br>• Establish standard documentation requirements<br>• Identify entities that will be responsible for ZNE verification<br>• Develop standardized registries for ZNE buildings<br>• Develop rulesets for ZNE code design nonresidential modeling<br>• Develop verification methodologies for ZNE retrofits in existing buildings | |

| **Study Title:** Miscellaneous Energy Loads Study, Phases I, II, and III: A Feasibility Study of MEL Usage, Forecasting, and Methodologies | **Budget:** $468,750<br>Phase I**:** $75,386<br>Phase II**:** $100,000<br>Phase III**:** $293,364 |
|---|---|
| **Expected Completion Date:** Phases I and II completed, Phase III on hold | **Study Manager:** Southern California Edison |
| **Description:**<br>Phase II is a follow up to the Miscellaneous Energy Loads (MELs) in Residential Buildings Phase I (hereafter, Phase I), which was an extensive review of existing literature on MELs. Phase I examined the best available estimates of individual MELs, identified gaps in the literature, and developed a series of recommendations for Phase II. Phase II will provide a methodological review and feasibility assessment of existing MEL studies, with an emphasis on the feasibility of disaggregating, predicting, and analyzing how MELs are used in individual homes. The study will examine existing data, and the | |

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| **Expected Completion Date:** Phases I and II completed, Phase III on hold | **Study Manager:** Southern California Edison |

metering devices and techniques used to collect MEL data, identifying strengths and weakness and potential improvements. Next, the study will examine if individual MEL disaggregation is reasonable (by each individual plug load including TVs, set top boxes, game consuls, etc.) or if an aggregate MEL (i.e. all plug loads aggregated together or into categories such as computing devises, entertainment devices, etc. approach is best. Then, current models will be explored that analyze the relationship between explanatory variables such as demographic and home attributes and MEL usage. The final objective will be to assess the feasibility of a predictive analytic model, and make recommendations for future data collection, as well as the feasibility of collecting the necessary data for use in a predictive model, potentially in Phase III. Phase III will seek to execute the methodologies, data collection recommendations, and forecasting models studied in Phase II to further develop, train, and deploy a predictive model for plug load usage.

**Objectives:**

- Identify current data sources that may be used to analyze relationships between home attributes and demographic characteristics, and MEL usage.
- Identify current demographic models in the literature and further develop a model to analyze the
- relationship between demographics and MEL usage.
- Identify monitoring techniques, time frame, sample, and data granularity of data with the most promise (promise influenced by the level of granularity identified as necessary and reasonable)
- Discuss predictive modeling, and current applications in MEL analysis, or discuss why such a model may not be possible.

**Key Research Questions:**

- What are the current tools available for monitoring and collecting MEL data? What are the potential strengths and weakness of each? What level of disaggregation is currently available?
- What data is currently available? And what data is being collected now and in the near future by 3rd parties and IOUs?
- What are the advantages and disadvantages of aggregating MELs (i.e. subtracting HVAC, lighting, and major appliances from total load)?
- What model (given available data) might best account for the relationship between household demographics and attributes, and MEL usage?
- What is the ideal sample size and time frame for a future predictive model?
- What is the most viable predicative analytic model that currently is used for estimating MEL usage among the customer segment most likely to purchase new homes in the CA IOU service territories?
- Can one year of monitored MEL usage data for a small number of homes be used to train the model to estimate MEL usage for the targeted customer segment and climate zone group?
- What level of data granularity (individual MELs or an aggregate MEL measure) is necessary to support the model?
- Given constant technological and rate change, how might the predictive power of a model be affected, and are there mitigating approaches that can be used to successfully adapt a model?

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|---|---|
| **Expected Completion Date:** Phases I and II completed, Phase III on hold | **Study Manager:** Southern California Edison |

**Potential EM&V Methods:**

- Secondary research
- Plug load metering
- Analytic/statistical modeling
- Exploration of AMI disaggregation opportunities

**Findings:**

*Phase I:*

- MEL energy usage has a high degree of uncertainty, which is primarily due to the distributed nature of the MEL end use category, and the significant time and expense required to collect comprehensive data on all MELs.
- A major source of uncertainty is usage hours, which are typically more variable than power or installed base estimates and have the greatest impact on Unit Energy Consumption (UEC) and Aggregate Energy Consumption (AEC). This uncertainty has especially significant implications for large end-use categories, such as computers and televisions, which had a significant variance in the usage hours (a 1.5 and 1.8 factor difference, respectively).
- UEC is dominated by TVs and Desktop Computers, with significant clustering of UEC from 60-105 kWh/yr. However, AEC is much more concentrated—televisions, set top boxes, and desktop computers dominate AEC, representing 65% of combined AEC of the twelve end uses.
- Over time, as energy use within the MEL category grows and the major end uses decrease in AEC, it will become even more distributed than it currently is today. Successfully reducing device energy consumption across these highly distributed loads will require innovative policy and program approaches.

*Phase II:*

- Delivery of program savings estimates, CASE reports, and CCTRs has improved but there are still significant gaps in the documentation available to evaluators.
- Verification of compliance is becoming more challenging.
- Grouping of multiple product types / standards in a single CASE report or CCTR tends to limit the evaluators' ability to assign attribution scores to each standard.

**Recommendations:**

*Phase I*

- Update the HERS model to incorporate large MEL end-uses.
- Develop a Stock-Flow model to inform ZNE modeling efforts.
- Improve existing data for MELs with low levels of confidence.
- Work with ENERGY STAR and other stakeholders to improve energy information for non-ENERGY STAR products.
- Support a Market Transformation (MT) approach to address MEL energy consumption.
- Consider conducting a large-scale, multi-year comprehensive metering study to improve plug load energy data within California.
- Encourage policies to promote the measurement of power data for CE devices through minimum

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|---|---|
| **Expected Completion Date:** Phases I and II completed, Phase III on hold | **Study Manager:** Southern California Edison |
| efficiency standards and labeling.<br>*Phase II*<br>• The statewide program administrators and CPUC should resolve data gap issues before starting the next impact evaluation.<br>• The CPUC and evaluators should consider collaboration with the CEC to make efficient use of resources used to determine compliance.<br>• Request that unlike technologies not be grouped together. | |

| **Study Title:** ZNE Evaluation Methodology Study, Phase II | **Budget:** $112,500 |
|---|---|
| **Expected Completion Date:** Q3 2017 | **Study Manager:** Pacific Gas & Electric Co. |
| **Description:**<br>This study will continue the Phase 1 efforts to develop and finalize the ZNE Evaluation Methodologies as monitoring data for other building types becomes available from Emerging Technology projects and other data sources. | |
| **Objectives:**<br>• Test and finalize new construction and retrofit evaluation methodologies on building types not covered in Phase 1, in particular non-residential new construction and retrofit projects.<br>• Use and improve the catalog of energy performances developed in the Res ZNE MC.<br>• Collect performance data from occupied ZNE-type homes and collaborate with the CEC to: (1) understand how occupant behavior can affect energy use; (2) develop ranges of energy use based on actual ZNE-type homes; and (3) improve energy modeling<br>• Track operational issues with high-performance and ZNE-type homes. | |
| **Key Research Questions:**<br>Develop ZNE modeling standards and criteria to enable consistent, market- driven development of integrated tools for ZNE residential projects. | |
| **Potential EM&V Methods:**<br>To be determined | |

| **Study Title:** ZNE Compliance Options for Distributed Energy Resources, Phase I | **Budget:** $112,500 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** Pacific Gas & Electric Co. |

| **Study Title:** ZNE Compliance Options for Distributed Energy Resources, Phase I | **Budget:** $112,500 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** Pacific Gas & Electric Co. |

**Description:**
The finding from the Residential ZNE Market Characterization that market actors have generally not pursued community-scale Distributed Energy Resources (DER) installations in ZNE-type housing developments suggests a need to investigate barriers and opportunities for such arrangements to achieve ZNE goals.

**Objectives:**
Explore the potential for DERs in ZNE-type homes and buildings including issues related to community scale DERs such as permitting, tariff frameworks, grid impacts, as well as how proposals such as PG&E's "Green Option" Community Solar Program could further the ZNE goals.

**Key Research Questions:**
Research efforts into community-scale DERs for residential and commercial customers should explore issues such as:

- Permitting requirements associated with siting and sizing the systems;
- Tariff frameworks that equitably allocate costs and generation to individual units;
- Least cost options that ensure grid reliability and safety;
- Potential DER voltage, frequency, and other impacts on the grid;
- Case studies of federal (e.g. Army and General Services Administration) approaches, and
- How the above variables interact and can be leveraged to forward ZNE goals;
- For example, research should explore whether community-scale DER installations sited close to the substation of the development's feeder could help to mitigate the grid impacts of the development's new load, while alleviating the need for locating DERs onsite to offset consumption;
- Research should also investigate how PG&E's "Green Option" Community Solar program and/or other IOU community solar tariffs could support achievement of the ZNE residential and commercial goals; and
- The study should coordinate with utility distribution, transmission, and interconnection planning groups and any relevant activities in the Integrated Demand Side Resource OIR.

**Potential EM&V Methods:**
Including but not limited to: literature review, in-depth interviews with technical advisory group, program managers, and market actors.

| **Study Title:** K-12 and Community College ZNE Retrofit Readiness Market Characterization Study | **Budget:** $293,699 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** Energy Division |

| **Study Title:** K-12 and Community College ZNE Retrofit Readiness Market Characterization Study | **Budget:** $293,699 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** Energy Division |

**Description:**
Achieving a ZNE building involves the mastering of many factors. These critical factors include the commitment of the owner, advocacy and diligence of the design team, iterations of the energy modeler to the selection of equipment, installation, commissioning, and finally, to the ongoing operations and occupancy. Attributes of successful ZNE building include the use of passive energy strategies that include efficient envelopes with increased insulation, natural ventilation and night flush ventilation, daylighting and controls, exterior window shading and operable windows that not only reduce the energy loads of these buildings but also creates comfortable indoor environments full of natural daylight, fresh air, thermal comfort and enhanced views.
A challenge remains that the landscape of opportunities and barriers to ZNE retrofits for educational institutions is not well understood. This understanding is needed for both a successful pilot and a successful subsequent program.

**Objectives:**
Characterize the K-14 ZNE retrofit readiness and challenges, including:

- Identify key market actors, drivers (economic, leadership, technology, other market), budgets, funding sources and levels, common business plans and patterns of interactions;
- Identify barriers, challenges and opportunities;
- Identify leading and lagging geographic regions and market actors;
- Identify key supply chains (technologies and professionals) and opportunities to incorporate (when can ZNE happen? Bonding, seismic, expansion etc.); and
- Identify high priority strategies and partners to advance ZNE retrofits in K-14.

**Key Research Questions:**

- Where are the key opportunities to develop ZNE retrofits in educational institutions?
- What are key market actor drivers, and how can these be harnessed to advance ZNE retrofit goals?
- What are key barriers, and how can these be overcome, via: program design; regulatory framework updates; market actor engagement, etc.?
- What is the range of potential savings available, on a sector level and average per building?
- What is the range of educational institution and IOU costs for ZNE retrofits?
- What are the best strategies and partners to advance ZNE retrofits in K-14?
- What lessons can be leveraged to accelerate adoption of ZNE in schools?

**Potential EM&V Methods:**
To be determined

| **Study Title:** State Building Decision Maker Study | **Budget:** $354,060 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** Energy Division |

| **Study Title:** State Building Decision Maker Study | **Budget:** $354,060 |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** Energy Division |

**Description:**
This study seeks to provide information to guide an intervention strategy that could help move building decision makers to ZNE as they retrofit buildings. Several recent studies have provided information on commercial ZNE. However, there is still no program design, engagement strategy or the internal coordination needed to effectively and consistently advance ZNE commercial newly constructed buildings or deep retrofits. At the same time, Executive Orders mandate that state buildings move towards ZNE, yet little progress has occurred to date for various reasons. This study will deepen understanding of intervention strategies and/or complementary regulatory updates needed. Through understanding and overcoming current barriers and 'leading by example', state buildings can support California's ZNE Commercial 2030 goals and help advance ZNE outside of state buildings. This study focuses on achieving ZNE through the retrofit of existing facilities.

**Objectives:**
- To characterize the current set of state buildings, with a particular focus on identifying potential ZNE retrofits; and
- To determine technical and organizational barriers to reaching ZNE in existing state buildings, as well as identifying paths forward toward increases in ZNE retrofit demonstrations.

**Key Research Questions:**
- What are the end-use profiles of state buildings?
- Which buildings include distributed generation, and how much does it offset building energy use?[61]
- How do the buildings rank in terms of performance (which are the best candidate, from a performance perspective, for ZNE)?
- What are barriers to ZNE, according to state building facility managers, state agency decision-makers, and relevant stakeholders such as regulatory and IOU staff? Which agencies/other stakeholder groups could help reduce the barriers?
- What are useful interventions to help move state facilities toward ZNE?
- What are the project approval pathways for the state agencies? How does this structure facilitate or impede moving toward ZNE?
- What level of financing is required for state buildings to perform ZNE-type retrofits? What are the financing options? Which of these options are accessible to state facilities?

**Potential EM&V Methods:**
Mixed methods study, including qualitative data gathered through in-depth interviews as well as quantitative data from surveys and databases of building characteristics. Data collection activities could include collation and datamining of Energy Star Portfolio Manager information, the State Agency Real Estate Inventory, depth interviews with state department decision makers, regulatory and IOU staff, and owners/facility managers of existing ZNE facilities within California.

[61] Understanding the current availability of distributed generation will provide an additional data point in identifying the best targets for ZNE demonstrations (with the underlying hypothesis that they are more ZNE ready). Similarly, a building that is highly efficient, but that does not have onsite distributed generation may also be a good target for demonstration insofar as assessing whether the addition of distributed generation would bring the facility towards ZNE readiness as well.

### 2.10.4. 2016 and Beyond EM&V Studies

**Proposed 2016-2017 Energy Division Budget: $1,257,458**
**Proposed 2016-17 Program Administration Budget for C&S, ZNE/RNC: $950,000**

The proposed 2016-2017 Energy Division Budget is $1,257,458. While studies are presently in the planning process, no specifics are yet available. However, Energy Division is considering a New Construction impact evaluation for this budget.

Currently, one IOU effort is underway using 2016 budgets, as shown below in Table 39. This effort is a web-hosting tool that is expected to be "live" as of the date shown below. Web hosting is under a 12-month contract after that. A second phase of the ZNE Compliance Options for Distributed Energy Resources study, of which the first phase is expected to complete in the second quarter of 2017, is tentatively included for 2017 budgeting, but few detail about this study are determined. In addition the IOUs have set aside $500,000 for combined efforts in C&S, New Construction and ZNE.

***Table 39. 2016 and Beyond ZNE Studies, Budgets, and Timing***

| Study Title | PSR ID | Manager | Evaluator | Estimated Budget | Expected Completion |
|---|---|---|---|---|---|
| ZNE Scenario Analysis Tool Hosting | 2137 | IOU | ARUP | $80,000 | Q4 2016 |

Other IOU proposals for 2016 and beyond are in the early stages. As such, there are no specific descriptions, objectives, or firm budgets. However, these ideas are bulleted next while budget available for these studies will be determined in the near future. The next update to the EM&V roadmap will describe future EM&V studies more fully.

- **ZNE Commercial New Construction** - A thorough ZNE Commercial New Construction Market Characterization study, to mirror the Residential New Construction study that was completed in 2015. The goal is to characterize the commercial new construction market and its key ZNE-opportunity segments to understand the drivers/barriers to reaching commercial market ZNE goals, possibly including but not limited to a review of local/regional/statewide policies, programs, regulatory frameworks, available incremental cost data for new buildings, financing opportunities, and building operator/energy manager experiences. Additionally, this study may investigate the impacts on ultimate ZNE performance of contract methodologies—design/bid/build vs. design/build, use of designers vs. design by contractors, etc.—and real estate management considerations regarding building owner-tenant relationships. We currently have about $100,000 of 2016 money set aside for this but that will be insufficient for a good characterization and require an additional $300,000-$400,000.
- **Effectiveness of ZNE Market Interventions** - PG&E wants to explore the market effects of pilot market interventions including but not limited to Architecture to Zero, Builder Demos, and Savings by Operation. This would focus on the persistence of desired ZNE project building, design, and operation practices, and could be done as one larger study of PG&E's piloted ZNE market interventions that together have holistically targeted all stages of the ZNE project lifecycle. We estimate this effort to cost about $200,000 and would likely be PG&E-only funded.

- **Assessment of Best Practices in ZNE New Construction Incremental Cost Reduction** - Recent case studies of new construction ZNE buildings and homes have indicated that keeping ZNE new construction $/ft$^2$ costs low or comparable to non-ZNE projects is linked to highly involved and innovation-minded designers and builders. It would be valuable to understand how these builders are reducing incremental costs for ZNE projects, and how these practices by builders/designers on the cutting edge of new construction can be applied to other sectors and adopted by a broader builder/designer group. This study would also seek to understand how these practices are driving innovation in design/building markets. This study is estimated to cost about $150k.

**Ideas for additional topics in planned studies or additional separate studies that may be funded by the IOUs or ED in 2017 and beyond (budget allowing) are as follows:**

- **ZNE Commercial Real Estate Management** – This study would evaluate the common property management setups and owner-tenant relationships, and how they impact ZNE implementation and performance.
- **ZNE Credentials Program and Career Development Pathways** – This study would evaluate existing and potential third-party credentialing programs to help foster career pathways for individuals interested in specializing in design, execution, operations, and maintenance of ZNE facilities. The goal is to propose methods by which these vital functions for the proliferation of ZNE can be promoted at the state-wide level, through credential programs or other market-driving techniques as determined in the course of the study.
- **ZNE Retrofit Timelines and Costs** – Most successful ZNE projects at this time are either new construction or involved invasive gut rehabilitation, but future projects will need to offer minimal impact on building use, possibly by performing incremental work over extended timelines. This study would analyze the cost premiums associated with extending project timelines for retrofitting existing, occupied buildings, emphasizing commercial and industrial customers. It would propose an objective function which would account for inconvenience to tenants as well as financial costs of extending a project timeline which can be used to minimize the total impact on tenant while maintaining cost effectiveness.
- **Energy Storage Applications for ZNE** – This study would assess the viability and impacts of a variety of currently available and anticipated energy storage solutions, including electrical, thermal, kinetic, etc., in bringing a building, campus, or community to ZNE. Consider lifecycle environmental impacts of, e.g., battery storage, including manufacture and disposal. Compare grid-scale versus customer-owned storage options, accounting for transmission losses and economies of scale.
- **Impacts of Electric Vehicle Charging on ZNE Facilities** – This study would analyze how an increasing number of electric vehicles will impact ZNE results among residential and commercial facilities. Modified load shapes would be considered, with an emphasis on the vehicles' total lifecycle carbon emissions compared to conventional vehicles.
- **ZNE Compliance Options for Distributed Energy Resources, Phase II** – This study would follow-up on the ZNE Compliance Options for Distributed Energy Resources, Phase I study, and focus on addressing research questions which arise in Phase I and benchmark compliance results against other states. This study will further explore the potential for DERs in ZNE-type homes and

buildings, including issues related to community-scale DERs and follow-up on new questions posed in Phase I study.

- **ZNE Building EUI Target Study** – This study would assess the value and viability of applying building Energy Use Intensity (EUI) as a metric for rating ZNE projects. It would aim to build upon related studies published by New Buildings Institute and the US Department of Energy. Where deemed appropriate, this study would propose baseline EUI values as targets for ZNE projects.

Prior to further planning and scoping upcoming studies, the statewide EM&V group will review on-going studies conducted by other industry stakeholders in order to leverage and build upon available data and findings, and to avoid duplication of effort.

Other study concepts that may be worth considering are listed below:
The key research questions and objectives for current and planned ZNE/New Construction EM&V studies are listed below:

- Commercial ZNE Market Characterization that builds on research priorities from Navigant's study titled "Measure, Application, Segment, Industry (MASI): Integrated Design for New Construction Buildings."
- Market Characterization research for K-12 schools and Community Colleges to support the ZNE Prop 39 pilot and subsequent program objectives.
- Market Characterization research on major renovations in the commercial sector. How can Savings-By-Design better identify these renovation activities early enough in the value chain to move some portion of them to ZNE building /deep energy savings renovations? What type of program design is needed to support this?
- [Res ZNE MC] Develop an evaluation research plan to support the State's ZNE goals
- [Res ZNE Action Plan – Strategy 3.1] Complete a needs assessment of existing software tools that identifies gaps, weaknesses and potential solutions to address ZNE needs.
- Conduct and integrate research on plug loads and MELs data that is California specific.
- [Res ZNE Action Plan – Strategy 5.2] Research and build data on the impact of energy production and demand response related to ZNE buildings on electric grid and gas distribution systems' stability and effectiveness.
- Incorporate impacts of MELS, electric vehicles and other existing and emerging ZNE system technologies in research.
- Evaluate policy needs related to distributed energy storage.
- Assess existing micro-grid and community-scale ZNE projects.
- Analyze expanded community-scale ZNE programs and projects, e.g., ZNE districts, campuses, etc.
- Update Grid Analysis annually and ensure ongoing coordination with other complimentary grid/distributed generation research efforts.
- Grid analysis impacts and recommendations are consistently incorporated into EPIC, CSI and IEPR planning. Grid impact analysis of ZNE in future multifamily and infill projects is included in distributed energy resources plans developed by 2015 pursuant to AB327. Targeted completion in 2016.
- Support CEC's short- and long-term ZNE forecasting methodology.

## Collaboration Considerations

Going forward, due to its highly cross-cutting nature, ZNE/New Construction EM&V will need to coordinate with the Codes & Standards, Workforce Education & Training, Emerging Technologies, Residential, and Commercial portfolio EM&V efforts—specifically with the Project Coordination Groups managing the Plug Load and Appliance, Statewide Program for Residential Energy Efficiency, Residential New Construction, and Savings by Design efforts–to optimize information sharing for research planning.

### 2.10.5. 2016 and Beyond Study Descriptions

The following table describes the only current effort underway funded through the 2016 budget.

***Table 40. ZNE Scenario Analysis Tool Hosting Project Description***

| **Study Title:** ZNE Scenario Analysis Tool Hosting | **Budget:** $80,000 |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** Pacific Gas & Electric Co. |
| **Description:**<br>The Scenario Analysis Tool that was developed using 2013 - 2014 funds is now being hosted publicly by the IOUs for stakeholder use. | |
| **Objectives:**<br>This contract includes the following:<br>• Hosted website creation and maintenance to provide the Scenario Analysis tool to the public;<br>• User management and training materials and resources; and<br>• Development of a long-term hosting plan for the web-based tool. | |
| **Key Research Questions:**<br>Not applicable for this effort | |
| **Potential EM&V Methods:**<br>Not applicable for this effort | |

# 2.11. Emerging Technologies Program

## 2.11.1. Background

### Sector or Program Area Description

Emerging Technologies Program (ETP) is a non-resource program aimed at increasing supply and demand for new/unproven and/or emerging/underutilized technologies. For 2013-15, the program has three overarching goals:

- Goal 1 – Support the Increase in Technology Supply
- Goal 2 – Increase number of Measures Offered by EE Programs
- Goal 3 – Support Technology Introduction

As a non-resource program, ETP's progress is measured and monitored via applying the ETP California EM&V protocols to assess key metrics and outputs of program activity. The 2013-2014 program has three sub-programs:

1. Sub-program 1 – Technology Development Support (TDS), which encompass the following program tactics (formally referred to as program elements):
   - Technology Development Support
   - TRIO
   - Market and Behavioral Studies
2. Sup-program 2 – Technology Assessments (TA), which encompass the following program tactics:
   - Technology Assessments
   - Demonstration Showcases
   - Market and Behavioral Studies
   - Technology Test Center (SCE only)
3. Sub-program 3 - Technology Introduction Support (TIS), which encompass the following program tactics:
   - Scaled Field Placements
   - Demonstration Showcases
   - TRIP solicitations (new element) – competitive bidding process to fund third party programs that leverage innovative EE and/or IDSM technologies and approaches. These candidates will be transferred and administered by utilities' third party programs.
   - Market and Behavioral Studies

In addition, in compliance with D.12-05-015, ETP will include HVAC Technology and System Diagnostics Advocacy activities under ETP.

### Programs included in the Research Scope

***Table 41. 2015 ETP Budget Summary***

| IOU | Program Name | kWh | kW | therms | 2015 Budget |
|---|---|---|---|---|---|
| SCE | SCE-13-SW-009ATechnology Development Support | N/A | N/A | N/A | $1,873,259 |
| SCE | SCE-13-SW-009BTechnology Assessments | N/A | N/A | N/A | $4,210,158 |

| IOU | Program Name | kWh | kW | therms | 2015 Budget |
|---|---|---|---|---|---|
| SCE | SCE-13-SW-009CTechnology Introduction Support | N/A | N/A | N/A | $4,684,763 |
| PG&E | PGE21061Technology Development Support | N/A | N/A | N/A | $1,417,703 |
| PG&E | PGE21062Technology Assessments | N/A | N/A | N/A | $3,799,773 |
| PG&E | PGE21063Technology Introduction Support | N/A | N/A | N/A | $741,821 |
| SDG&E | SDGE3246SW-ET-Technology Introduction Support | N/A | N/A | N/A | $746,00 |
| SDG&E | SDGE3247SW-ET-Technology Assessment Support | N/A | N/A | N/A | $543,000 |
| SDG&E | SDGE3248SW-ET-Technology Deployment Support | N/A | N/A | N/A | $68,000 |
| SCG | SCG3721SW-ET-Technology Development Support | N/A | N/A | N/A | $63,575 |
| SCG | SCG3722SW-ET-Technology Assessment Support | N/A | N/A | N/A | $508,588 |
| SCG | SCG3723SW-ET-Technology Introduction Support | N/A | N/A | N/A | $700,172 |
| | **Total Statewide ETP** | | | | **$19,356,812** |
| | % of Statewide Portfolio | | | | 2% |

The IOU 2015 ETP program budget is $19,356,812; slightly less than 2% of the entire energy efficiency portfolio budget across all utilities. The ETP is a non-resource program and therefore there is no accounting for savings directly attributable to this program.

**Table 62b: 2016 ETP Budget Summary**

| IOU | Program ID | Program Name | 2016 Budget |
|---|---|---|---|
| SCE | SCE-16-SW-009A | Technology Development Support | $1,873,259 |
| SCE | SCE-16-SW-009B | Technology Assessments | $4,210,158 |
| SCE | SCE-16-SW-009C | Technology Introduction Support | $4,684,762 |
| PG&E | PGE21061 | Technology Development Support | $452,119 |
| PG&E | PGE21062 | Technology Assessments | $3,073,632 |
| PG&E | PGE21063 | Technology Introduction Support | $2,766,325 |
| SDG&E | SDGE3246 | SW-ET-Technology Introduction Support | $432,832 |
| SDG&E | SDGE3247 | SW-ET-Technology Assessment Support | $737,262 |

| | | | |
|---|---|---|---|
| SDG&E | SDGE3248 | SW-ET-Technology Deployment Support | $199,976 |
| SCG | SCG3721 | SW-ET-Technology Development Support | $63,575 |
| SCG | SCG3722 | SW-ET-Technology Assessment Support | $508,588 |
| SCG | SCG3723 | SW-ET-Technology Introduction Support | $700,172 |
| | | **Total Statewide ETP** | **$19,702,660** |
| | | % of Statewide Portfolio | **1.7%** |

The ETP began in the late 1990s. Until 2009, the program's design was focused primarily on assessing emerging technologies. Over the history of the program, implementation efforts became more focused on moving technologies directly into the IOU portfolio. With the advent of the CPUC's adoption of the California Long Term Energy Efficiency Strategic Plan (CEESP), which recognized a role for ETP in supporting not only IOU EE programs but also the broader market, ETP staff expanded program design by incorporating five new program elements: Scaled Field Placements, Demonstration Showcases, Market & Behavioral Studies, Technology Development Support, and Business Incubation (TRIO).

The change from six program elements to three subprograms for 2013-2014 and 2015 was made to re-characterize the ETP in terms of its three major programmatic goals: 1) supporting technology development, 2) conducting technology assessments, and 3) supporting technology introduction. It is the program managers' understanding that the redesign will allow for a more holistic approach and enable the programs' accomplishments to be more easily followed and documented. The previous six program elements will now be considered "tools" in ETP's toolkit to be used to achieve the three ETP goals.

## Uncertainties and Challenges to Successful Implementation

The greatest challenge being addressed by ETP is the general misunderstanding of ETP's role in the technology development lifecycle. ETP is primarily a technology testing and demonstration program, and must rely upon technology developers (manufacturers) to produce the technologies that are then assessed by ETP. While ETP does play a role in providing feedback and suggestions to technology developers, ultimately the decision to create a new technology is not under ETP's direct influence. The biggest uncertainty is in understanding what unique value an utility emerging technology program should offer, in the overall landscape of technology development: When should ETP's efforts duplicate efforts by technology manufacturers or federal programs, and when should ETP's efforts differ?

### 2.11.2. Evaluation Studies for 2013-2014

The table below summarizes the 2013-2015 EM&V Studies that have been budgeted, some of which are in the process of being implemented and others are still in the planning stage. The table provides the study manager, work order under which the study is being conducted, the corresponding budget, implementation status and expected completion date for each study.

Research Plans for the scoped studies are available at www.energydataweb.com/cpuc/.

***Table 42. 2013-2015 ETP EM&V Studies, Budgets, and Timing***

| 2013-2015 Study Title | Study Manager | WO Number | Budget | Status | Completion Date |
|---|---|---|---|---|---|
| **Impact** | | | | | |
| N/A | | | | | |
| **Process** | | | | | |
| PY2013-2014 ETP Targeted Effectiveness Study | ED | ED_O_ETP_1<br>ED_O_ETP_2 | $391,222 | Complete | November 30, 2015 |
| 2013-2014 Study of the California Utility Internal Measure Development Process | IOUs | N/A | $185,000 | Complete | August 31, 2015 |
| 2013-2014 Statewide Emerging Technologies Program (ETP) Third Party Introduction Tactic Process Evaluation | IOUs | N/A | $80,000 | Complete | December 17, 2015 |
| **Total (2013-14) (ED & IOUs)** | | | **$656,222** | | |
| PY2015 Technology Development Support Process Evaluation | IOU | N/A | 120,000 | In Planning | June 2017 |
| **Total (2015) (ED & IOUs)** | | | **$120,000** | | |

### 2.11.3. 2013-2014 Study Descriptions

Below are descriptions for each of the 2013-2014 studies, which include the key research questions that will be addressed, and the potential EM&V methods that will be utilized.

| | |
|---|---|
| **Study Title:** 2013-2014 Targeted Effectiveness Study (CALMAC ID: CPU0112.01) | **Budget:** $391,222 |
| **Completion Date:** November 30, 2015 | **Study Manager:** (ED) |
| **Description:** The scope of this study will build on findings from the 2010-2012 ETP evaluation study to avoid duplication of study areas that are covered in the current study | |
| **Objective:** Assess program effectiveness and implementation to meet its mission, goals and objectives as designed (reflected in the PIPs), as a follow-up study to 2010-2012 evaluation study. | |
| **Key Research Questions:**<br>• How does ETP choose and plan specific activities for a given technology?<br>• To what extent do activities supplement existing industry and market knowledge for particular technologies? Are there redundancies or possible synergies to consider?<br>• Is ETP effectively utilizing the available program sub-activities to support the decision for measure transfer or not?<br>• Is ETP evaluating the aspects of a technology where their efforts can bring the most value? Are there missed opportunities?<br>• What is the ETCC website reach? How easy is the website to use?<br>• Does the ETCC website increase awareness of ETP activities?<br>• Are ETCC website visitors engaging with the material (i.e., access reports, use as source for information about ET?) | |

| **Study Title:** 2013-2014 Targeted Effectiveness Study (CALMAC ID: CPU0112.01) | **Budget:** $391,222 |
|---|---|
| • What effect does the ETP information have on subscribers?<br>• How many projects were initiated, are in progress, or were completed in 2013? How many projects were recommended for transfer to the EE portfolio?<br>• What are the end-use types of each project? Do they align with ETP program performance metrics? Do projects align with the California Energy Efficiency Strategic Plan end-use areas?<br>• What is the technical potential of projects recommended for adoption?<br>• What are the claimed savings for ETP adopted measures in the 2013 database?<br>• Which measures garnered the largest and smallest claimed savings?<br>• Are there any trends in terms of measures and their associated savings? | |
| **Potential EM&V Methods:** ETP Evaluation Protocols | |
| **High-Level Findings:**<br>• The IOUs have met their Program Implementation Plan (PIP) objectives and are contributing to both the EE portfolio and the broader California Energy Efficiency Strategic Plan (CEESP) goals in alignment with the PIP Program Performance Metrics (PPM). However, the current PPMs are insufficient for the CPUC Energy Division to assess achievement of regulatory objectives (such as the California Energy Efficiency Strategic Plan and AB 32), as well as progress towards achieving these objectives.<br>• Overall, ETP is a looked-to leader in its approach to assessing emerging technologies. However, given ETP's focus on technical readiness activities (as well as achievement of program objectives), additional effort is needed to align objectives and metrics with ETP's regulatory and legislative guidance (e.g., market readiness efforts). ETP currently has a suite of tactics in support of accelerating both technical readiness and market readiness for its technologies, but the current data tracking and metrics do not enable comprehensive assessment of long-term policy achievements. | |

| **Study Title: 2013-2014 Study of the California Utility Internal Measure Development Process (CALMAC ID: SCE0380.01)** | **Budget:** $185,000 |
|---|---|
| **Completion Date:** August 31, 2015 | **Study Manager:** SCE |
| **Description:** A process evaluation to improve program design | |
| **Objective:** To meet Program Manager's need to better understand EE program portfolio needs and constraints, with an emphasis on gaining an in-depth understanding the technology transfer process and identifying processes that facilitate successful transfer of measures into EE programs. | |
| **Key Research Questions:**<br>• Who are the IOU decision-makers and what are their roles?<br>• Where besides ETP to EE Program Managers find new measures?<br>• What is the internal EE-program decision-making process used to develop new measures?<br>• What is the decision-making of ETP Program Managers around creating a balanced portfolio? What factors are considered? What outside pressures influence these decisions?<br>• What are the roles of customer research and marketing departments? How does ETP determine customers' needs?<br>• What is the internal technology transfer process? (What are the differences across IOUs? What | |

| **Study Title: 2013-2014 Study of the California Utility Internal Measure Development Process (CALMAC ID: SCE0380.01)** | **Budget:** $185,000 |
|---|---|
| are the pros/cons of different processes?)<br>• What criteria are used for offering deemed measures?<br>• What criteria are used for custom measures?<br>• What are the criteria for sun-setting measures?<br>• What is ETP's role and how are technology assessments used or not used by EE in their adoption decision-making? What else would EE programs like from ETP? | |
| **EM&V Methods:** Qualitative methods. | |
| **High-Level Findings:**<br>• The utilities are utilizing a broad range of information sources to find potential new measures (e.g., academic institutions, peer utilities, industry organizations and publications, manufacturers and governmental organizations).<br>• The Emerging Technologies Program plays an important role in developing information about potential new measures, however many other utility staff are involved in measure development and approvals (e.g., engineering, product/technology managers, program managers, utility executive staff, marketing, strategy and compliance, processing operations).<br>• ETP staff do not independently decide whether a technology is ultimately adopted into the IOU portfolio; rather, a range of IOU staff (using a variety of scoring tools) contributes to a collective final decision whether or not to approve and adopt technologies.<br>• Measure development is not a linear process. Depending on factors such as the stage of technology maturity and the availability of external information about a technology, ETP may or may not play a role in measure development.<br>• The utilities are collectively considering a wide range of quantitative and qualitative factors in their measure adoption decisions. | |

| **Study Title:** 2013-2014 Statewide Emerging Technologies Program (ETP) Third Party Introduction Tactic Process Evaluation (CALMAC ID: SDG0294.01) | **Budget:** $80,000 |
|---|---|
| **Completion Date:** December 17, 2015 | **Study Manager:** (IOU) |
| **Description:** A process evaluation for the Technology Introduction Sub-program, including TRIP and other Technology Introduction Tactics | |
| **Objective:** Evaluate how TRIP is operating, selection criteria and decision making process, and identify barriers to its meeting the primary objective of "seeding" market interest. Evaluate how the other Technology Introduction sub-program tactics are operating in terms of reaching and creating demand among their target audiences. | |
| **Key Research Questions:**<br>• What are the program designer's objectives for the third party solicitation project?<br>• What was the utility's process for ensuring that outcome, either during or after the third party implementation of the project? (This function may reside in the Third Party Program)<br>• Why did each utility choose to use the solicitation process that they ultimately implemented (i.e. why did they choose TRIP vs IDEEA365)? | |

| **Study Title:** 2013-2014 Statewide Emerging Technologies Program (ETP) Third Party Introduction Tactic Process Evaluation (CALMAC ID: SDG0294.01) | **Budget:** $80,000 |
|---|---|
| • Over what channels are the marketing and outreach efforts being conducted? What types of 3Ps do these channels typically reach?<br>• How understandable are the outreach materials and efforts in conveying ETP's desire to introduce emerging technologies to the market, on a limited scale?<br>• How easy is the process of submitting a proposal?<br>• How well do the criteria align with ETP's objectives for supporting technology introduction on a limited scale?<br>• What are the characteristics of the emerging technologies in the proposal<br>• What are the characteristics of the bidding companies?<br>• What is the expected impact of these proposed projects? | |
| **EM&V Methods:** Qualitative methods | |
| **High-Level Findings:**<br>• SCE and SCG chose to use a new solicitation specially designed for ETP, the Technology Resource Innovation Program (TRIP), while PG&E and SDG&E chose to use an existing solicitation, the Innovative Designs for Energy Efficiency Approaches (IDEEA365). The ETP TIS subprogram has an objective to conduct TRIP, which solicits proposals from third party implementers to conduct early introduction of emerging technologies, on a limited scale. After awarding contracts, ETP then transfers winning projects and funding to the IOUs' Third Party (3P) Programs for the remainder of each project's contract.<br>• There are a number of differences between TRIP and IDEEA365: The new TRIP solicitations are intended to be issued periodically and focuses on emerging and underutilized technologies. The long-established IDEEA365 accepts proposals year round (until funding is exhausted), and is more broadly scoped to emphasize innovative program delivery methods.<br>• The TRIP solicitation did attract bidders that IDEEA365 did not: new vendors are more enticed by the new TRIP solicitation approach and were more likely to be selected for an award through TRIP. However, TRIP's requirement for cost effectiveness was found to be in conflict with the objective of innovation.<br>• Implementation experience was a larger factor in bid selection than perceived by vendors, and that losing bidders lack understanding of the reasons they were rejected, which may prevent them from improving on future bids. | |

Below are descriptions for each of the 2015 studies, which include the preliminary research questions that will be addressed, and the potential EM&V methods that may be utilized.

*The Emerging Technology Program will be moving to a statewide approach and administration, to be outlined in more detail in the Program Administrators' Business Plans, due January 17, 2017. Energy Division is deferring further research planning until that time.

| **Study Title:** PY2015 Technology Development Support Process Evaluation | **Budget: $**120,000 |
|---|---|
| **Expected Completion Date:** December 2017 | **Study Manager:** (SCE) |
| **Description:** We propose a process evaluation of the Technology Development Support (TDS) subprogram to help streamline its activities. TDS is a subprogram that has not yet been evaluated. | |

| **Study Title:** PY2015 Technology Development Support Process Evaluation | **Budget:** **$**120,000 |
|---|---|

ETP engages in a variety of activities with technology developers, manufacturers, and entrepreneurs early in a product's development lifecycle. This upstream area of ETP is not customer-facing, but has important implications for overcoming market barriers and making technologies available to customers down-the line.

- Key Research Issue 1: We will categorize and document the need for current TDS activities as viewed by the technology developers, and make recommendations as to which activities should be de-emphasized or discontinued, and which activities should be added or increased. This would benefit the program by allowing ETP to streamline its activities and adapt it to the needs of technology developers. This study will look at technology developers focused around "integrated solutions" that provide systems-level solutions beyond just "widgets."

- Key Research Issue 2: We will conduct a needs assessment of technology entrepreneurs. The community that supports technology entrepreneurship strives to provide innovative young companies with mentoring and resources to develop new technologies. ETP has provided support to these organizations in the past, including the Cleantech Open, and DOE's First Look West (FLoW). However, this support has been mainly financial, and ETP would like to understand areas in which utility knowledge of customer needs, technology use, and regulatory context can be transferred to young companies that are interested in serving utility customers. One growth area of utility and regulatory interest, that may not be well understood by technology developers, is integrated distributed energy resources (IDER) which is "distribution-connected distributed generation resources, energy efficiency, energy storage, electric vehicles, and demand response technologies.[162]".

- Key Research Issue 3: We will identify barriers to supporting long-term market transformation (MT) with Technology Development Support and make recommendations on how to remove these barriers.

**Objective:**

- To provide ETP program managers with a better understanding of the effectiveness and level of need for current Technology Development Support activities.
- To provide the SW ETP team with more information about the needs and wants of technology developers with regards to California's regulations and mandates for integrated solutions.
- To provide the SW ETP with an understanding of how to better coordinate TDS activities across the state.
- To provide a list of barriers to TDS support of long-term MT with accompanying solutions.
- To develop metrics for TDS program outcomes.

**Key Research Questions:**

- What are the categories of current ETP TDS activities, and how necessary are these activities as viewed by the technology developers? What follow-up or mentoring is necessary for new

[62] Draft Distributed Energy Resources Action Plan, CPUC, 2016, available at http://www.cpuc.ca.gov/General.aspx?id=10710

| **Study Title:** PY2015 Technology Development Support Process Evaluation | **Budget:** $120,000 |
|---|---|
| entrepreneurs to incorporate IOU and regulatory concerns into their technology development process? How did past ETP support contribute to the development of their technology?<br>• What are the barriers to TDS support of long-term market transformation?<br>  ○ What communication channels could be utilized to facilitate MT?<br>  ○ What policies prevent or support TDS support of long-term MT?<br>  ○ How can cost-effectiveness requirements be restructured to allow TDS to support long-term MT?<br>• How can TDS best support IDSM efforts?<br>  ○ What technologies are involved in IDSM programs?<br>  ○ What are the key drivers and barriers to the implementation of IDSM?<br>  ○ How can utilities best support IDSM technology development? | |
| **Potential EM&V Methods:** Evaluators will leverage ETP's existing relationships with technology developers, universities and young technology entrepreneurs to conduct the needs and wants assessment. Evaluators may use in-depth interviews, focus groups, program reports, and/or surveys with standardized scales to assess perceived needs and satisfaction. | |

### 2.11.4. 2016 and beyond EM&V Studies

| 2016-2017 Budgets | 2016 Budget | 2017 Budget | Total (2016-2017) |
|---|---|---|---|
| **Process Evaluations** | | | |
| Energy Division | $104,792 | $104,792 | $209,584 |
| IOUs/PAs | $0 | $0 | $0 |
| Total (2016-2017) | $104,792 | $104,792 | $209,584 |

Energy Division has conducted a significant number of studies in the Emerging Technologies sector in the past few years and will assess needs for new ETP studies following the submittal and approval of Program Administrator Business Plans in 2017.

# 2.12. Finance

## 2.12.1. Background

### Sector or Program Area Description

The Statewide Financing Program consists of a portfolio of financing efforts, including continuation of the On-Bill Financing (OBF) program, continuation of the American Recovery and Reinvestment Act (ARRA)-originated financing programs, and a set of new financing pilots for single-family and multi-family residential customers as well as for small business and broader non-residential customers. OBF and the new financing pilots are statewide efforts through the investor owned utilities, whereas the ARRA originated programs are implemented regionally. These financing offerings are intended to eventually support all types of demand-side investments, including energy efficiency, demand response, distributed generation and storage. The IOUs portion of the Financing Program totals to $154 million in budgeted costs, which represents slightly less than 10% of the total program costs proposed by the IOUs for the 2013-14 Program Cycle and a total of $34 million in budgeted costs for the 2015 Program Cycle. Additional portfolio funds have been allocated to the RENs' and MCE's finance pilots in the amount of $ 62 million for 2013-2014, and $ 47 million for 2015. The proposed savings for this Financing Program are not yet defined.

Southern California Gas (SCG) and San Diego Gas & Electric (SDG&E), collectively Sempra Utilities or SEU, lead the development of the On-Bill Financing concept in California. SEU staff designed the program by researching what other utilities had done to make OBF successful, obtaining feedback from public advisory groups, and reviewing lessons learned from similar programs SEU had tried in the past. The OBF staff worked with SEU's legal department to understand lending law requirements, and then worked with the information technology and billing departments to arrange for loan payments to appear on customer bills. SEU and SCE initiated OBF as pilot programs in 2006. These pilot program designs have since been expanded to include all types of nonresidential customers. PG&E began offering a temporary "off-bill" loan program in July 2010 before the utility had functional "on-bill" loan servicing, and launched OBF in the third quarter of 2011.

### Ex Ante Coordination

Programs and activities in this sector use ex ante savings estimates and implementers should be aware of updates to these estimates and studies needed to improve the savings estimates. However, a section on ex ante updates is not included in this chapter. The studies planned in this sector will not likely be designed to directly inform updates to ex ante savings estimates. Please see the customer specific research plans for discussion of updates to ex ante savings estimates.

### Programs included in the Research Scope

This research roadmap currently covers the Investor-Owned Utility (IOU)-administered Statewide On-Bill Finance Program, new Statewide Finance Pilots, and local-government American Recovery and Reinvestment (ARRA)-initiated finance programs. It also includes regional finance pilots administered by Regional Energy Networks (RENs) and Community Choice Aggregator (CCA). All of the program administrators will continue their existing OBF and ARRA-originated financing programs. The financing program budgets for the IOUs total $154,671,384 of the 2013-2014 energy efficiency program budget across all utilities and a total of $34,411,948 million in budgeted costs for the 2015 Program Cycle.

***Table 43. 2013, 2014 and 2015 IOU Savings Goal and Budget Summary for Financing Programs***

| IOU | Program Name | kWh | kW | therms | Budget 2013-2015 |
|---|---|---|---|---|---|
| SCE | SCE-13-SW-007A On-Bill Financing | * | * | * | $69,980,337 |
| SCE | SCE-13-SW-007B ARRA-Originated Financing | * | * | * | $5,639,432 |
| SCE | SCE-13-SW-007C New Finance Pilots | * | * | * | $21,900,000 |
| PG&E | PGE21091 On-Bill Financing (actual – 2014) | * | * | * | $39,288,425 |
| PG&E | PGE21092 Third-Party Financing | * | * | * | $4,031,703 |
| PG&E | PGE21093 New Financing Pilots | * | * | * | $15,500,000 |
| SDG&E | SDGE3262 On-Bill Financing | * | * | * | $981,576 |
| SDG&E | SDGE3263 ARRA-Originated Financing | * | * | * | $2,225,224 |
| SDG&E | SDGE3264 New Finance Pilots | * | * | * | $12,077,309 |
| SCG | SCG3735 On-Bill Financing | * | * | * | $2,605,957 |
| SCG | SCG3736 ARRA-Originated Financing | * | * | * | $4,585,745 |
| SCG | SCG3737 New Finance Pilots | * | * | * | $10,467,622 |
| | **Total Statewide Financing** | | | | **$189,083,332** |
| PG&E | Bay Area Regional Energy Network (BayREN) | 5,621,775 | 7,987 | 740,456 | $39,748,822 |
| PG&E | Marin Clean Energy (MCE) | 15,232,088 | 3,786 | 1,139,754 | $5,235,472 |
| SCE/SCG | Southern California Regional Energy Network (SoCalREN) | 54,321,228 | 25,403 | 0 | $64,951,330 |
| | **REN and MCE Sub Total** | | | | **$109,935,624** |
| ALL | **Grand Total** | | | | **$299,018,956** |

*No savings goals for 2013-2014 have been adopted due to this being the first cycle in which financing programs have been considered resource acquisition programs.
The budgets for the RENs finance programs may be listed in a separate roadmap but are shown here for informational purposes

In September 2013, Decision 13-09-044 was adopted to pave the way for the Statewide Finance Pilots. In November and December 2013, the IOUs filed the, identified above as "New Financing Options Program". The following Program Implementation Plans (PIPs) are further defined in this Decision:

1. CA Hub for Energy Efficiency Financing (CHEEF) PIP,
2. Single Family Sector
    a. Residential Energy Efficiency Loan (REEL)
    b. Energy Finance Line Item Charge (EFLIC) – PG&E Only,
3. Multi-Family Sector
    a. Master Metered Multifamily Financing Program (MMMFP)
4. Non-Residential Sector
    a. On-Bill Financing (OBF)
    b. Small Businesses
        i. On-Bill Repayment Small Business Loan Program ),
        ii. On-Bill Repayment Small Business Lease Providers,
        iii. Off-Bill Small Business Lease Providers,
    c. Medium Business, Large Business, and Institutional
        i. Non-Residential On-Bill-Repayment without Credit Enhancement.

The funding for these Statewide Pilot Programs was delayed until July 2014 as the ability of the implementer, the California Alternative Energy and Advanced Transportation Finance Authority, to use the funds had to be authorized through the annual state budgeting cycle. Additionally, key systems will have to be established and inter-connected before program implementation can begin. The Residential Energy Efficiency Loan (REEL) pilot started enrolling loans in July 2016. Other pilots are still under development and plan to launch in 2017 or beyond. Decision 13-09-044 extended the program cycle for the pilots.[63]

The ARRA-originated programs include:

1. PG&E ARRA-originated Pilots
    a. Golden State Financing Authority (Formerly the California Homebuyers Fund) (LLR (loan loss reserves) for Single Family)
    b. emPower Central Coast (LLR for Single Family)
2. SCE ARRA-originated Pilots
    a. emPower Central Coast (LLR for Single Family)
    b. SDG&E ARRA-Originate Pilots
    c. CCSE marketing
3. SoCalGas
    a. emPower Central Coast (LLR for Single Family)

The regional finance pilots administered by RENs and CCA include the following. An asterisk indicates it if the pilot was ARRA-originated:

[63] EM&V budgets for finance programs are currently for the 2013-2015 cycle even though the program cycle for the statewide pilots have been updated so that each pilot will run for two years from the time the first loan is enrolled, per CPUC Decision D. 15-06-008.

1. SoCalREN
    a. Energy Upgrade California Residential Loan Loss Reserve (Single Family LLR)*
    b. Non-Residential PACE: Promotion and administration for already established PACE program that uses private funding backed by LA County bonds*
    c. Promotion and management of master lease program (Public Building LLR)[64]*
    d. Promotion of public agencies of finance programs and assistance setting up revolving loan fund (Public Agency Loan Fund)*
2. BayREN
    a. Multi-Family Capital Advance Program Pilot in support of EUC
    b. Commercial PACE: Support commercial PACE in the Bay Area
    c. Pay as you Save*
3. Marin Clean Energy (MCE)
    a. On-Bill Repayment for Single Family (LLR)
    b. On Bill Repayment for Multi-Family and Small Commercial (LLR)
    c. Standard Offer Finance Program (designed for the Commercial and Agricultural sectors, but TBD)

Beginning in 2013, the Commission will count all savings generated by the finance programs as resource savings. This contrasts with the OBF program offered prior to 2013 that was treated as a non-resource program.

## Uncertainties and Challenges to Successful Implementation

The major issues and challenges faced by the Financing Programs are:

- Increasing sales of energy efficient products and services;
- Encouraging customers to invest in projects that will achieve deeper energy savings;
- Overcoming the "first cost" barrier of energy efficiency upgrades;
- Leveraging ratepayer funds while bringing in private capital;
- How to best position financing against other offerings in the marketplace such as PACE; and
- Reaching a broader set of customers and market segments.

### 2.12.2. 2013-2015 EM&V Studies

The table below summarizes the EM&V studies funded from 2013-15 budget, some of which have been completed, some are in the process of being implemented and others are still in the planning stage pending the full implementation of the Statewide Pilots. The table provides the study manager, work order under which the study is being conducted, the corresponding budget, implementation status and expected completion date for each study.

[64] The Public Building LLR and Public Agency Revolving Loan Fund (c and d) were not implemented as outlined in SoCalRen's PIP. They essentially combined into one marketing and promotional program to help public agencies find financing for energy efficiency financing.

***Table 44. 2013-2015 EM&V Financing Studies***

| 2013-2015 Study Area/Title | Study Lead (ED/IOU) | Work Order # | Budget 2013-2015 | Completion Date |
|---|---|---|---|---|
| **Process** | | | | |
| Process Evaluation #1– On-Bill Financing– SMB & Institutional/NR | IOU | 2011 | $50,000 | Hold |
| Process Evaluation #2 A - HERO Loan Program – | IOU | 2009a | $291,479 | Report expected Q4, 2016 |
| Process Evaluation #2 B – Special Project TBD | IOU | 2010 | 0 | Completed (funds combined with #2A) |
| Process Evaluation #3 A– Market Research, Process Evaluation, Baseline, Development of Program Theory & Logic Models | IOU | 2011 | $507,461 | Completed 2014 |
| Process Evaluation #4– Development of Evaluation Plans for Financing Pilot Programs | IOU | 2011 | $113,505 | Completed 2015 |
| Process Evaluation #5– Single Family Loan Program | IOU | 2011 | $300,000 | Hold |
| Process Evaluation #6–Small Business-OBR w/CE; Lease Providers w/CE On-Bill; Lease Providers with CE – Off-Bill | IOU | 2011 | $300,000 | Hold |
| Process Evaluation #7– Master Meter Multifamily | IOU | 2011 | $342,500 | Hold |
| Process Evaluation #8 – Medium, Large Business – OBR w/out CE | IOU | 2011 | $325,000 | Hold |
| Early EM&V and Market Research | IOU | 2084 | $300,000 | 2017 |
| Partner Network Best Practices | ED | ED_0_FIN7 | $100,000 | Report Expected Q4, 2016 |
| **Impacts** | | | | |
| Market Study #1: Residential | ED | ED_0_FIN3 | $900,000 | Completed 2016 |
| Impact Evaluation #1: Cross-Cutting and Attribution Research | ED | ED_0_FIN2 | $350,000 | Completed 2016 |
| Impact Evaluation #2: Multi-Phase On-Bill Financing Study | ED | ED_0_FIN4 | $350,000 | Report Expected Q4, 2016 |

| 2013-2015 Study Area/Title | Study Lead (ED/IOU) | Work Order # | Budget 2013-2015 | Completion Date |
|---|---|---|---|---|
| **Process** | | | | |
| Impact Evaluation #3: Regional Financing Study | ED | ED_0_FIN8 | $200,000 | 2017 |
| Impact Evaluation #4: Statewide Financing Pilot Study | ED | ED_0_FIN10 | $404,095 | 2017 |
| Non-Residential Market Study | ED | ED_0_FIN9 | $300,000 | 2017 |
| Other 2015 studies* | ED | n/a | n/a | n/a |
| **Additional Finance Studies Funded by Other Areas** | | | | |
| Process Evaluation - Finance Marketing, Education and Outreach. **This study is funded through the ME&O roadmap** and a description can also be found in the ME&O roadmap. | ED | ED_O_ME&O_7 | See ME&O roadmap | 2017 |

*Table Note: More impact studies for the SW Finance Pilots were planned for 2013-2015 as noted in the V6 roadmap however these studies did not and will not occur as part of 2013-2015 Finance EM&V funding due to the delay in implementing the Pilots.

### 2.12.3. 2013-15 Study Descriptions

Below are descriptions for each of the financing studies funded from 2013-15 budget, which include the key research questions that will be addressed, and the potential EM&V methods that will be utilized.

| | |
|---|---|
| **Study Title:** Process Evaluation #1 – On-Bill Financing SMB & Government/Institutional Non-Residential | **Budget: $50,000** |
| **Expected Completion Date:** TBD once finance pilots launch | **Study Manager:** IOU |
| **Description:** Review program design, effectiveness, marketing, ease of application process | |
| **Objective:** Confirm increase in customer investments achieving deeper energy savings; evaluate criteria of lighting measures limited to </= 20% of total project cost (G & I exempt from this lighting maximum) | |
| **Key Research Questions**:<br>• What are the program participant characteristics? Who are participating in these programs and how are they using the loan funds? What measures are they deploying? Are they achieving comprehensive retrofit goals?<br>• Are these programs effectively implemented as planned? If not, what are the necessary improvements? If yes, what are the bright spots for these programs?<br>  ○ Is this program evaluable?<br>  ○ Can the program report both rebate/loan and loan-only project results and energy | |

| **Study Title:** Process Evaluation #1 – On-Bill Financing SMB & Government/Institutional Non-Residential | **Budget: $50,000** |
|---|---|
| savings?<br>○ Is the QA/QC process for this program adequate to ensure quality of energy savings reporting?<br>• Are these financing programs interacting with other rebate programs? If yes, how?<br>• What are the process evaluation recommendations to date? Can these recommendations be implemented? If no, why not?<br>• What are the feedbacks from the implementers, contractors and customers? How can the program improve? | |
| **Potential EM&V Methods:** Focus groups, 1-on-1 interviews, surveys, billing analyses, segmentation | |

| **Study Title:** Process Evaluation #2 A – HERO Loan Program | **Budget:** $291,479 |
|---|---|
| **Expected Completion Date:** Expected Q4, 2016 | **Study Manager:** IOU |
| **Description:** Research evaluation of the residential HERO PACE program to understand the factors underlying its success in California, and to identify how those factors could be incorporated into IOU finance pilots and programs to maximize uptake of clean energy upgrades by addressing the barrier of upfront cost of the upgrades. | |
| **Objective:** The primary goal is to better understand what accounts for the success of the HERO program and how those learnings might be applicable to the IOU residential financing pilots and incentive programs. Secondary goals include testing various methods of attributing energy savings between overlapping finance and incentive programs, and identifying gaps in terms of market segments and unmet needs. Budget may be added to the evaluation to accommodate further work on attribution. | |
| **Key Research Questions:** To what extent is the HERO Program's success due to PACE financing, to contractor recruitment, training, and support, to making the process easy and fast for the homeowner, to policy decisions, and to other factors? How is the program marketed? Are there market segments that HERO is not addressing? Is there a statistical analysis method that can reasonably estimate the relative importance of financing and rebates in homeowners' decision-making process? | |
| **Potential EM&V Methods:** 1-on-1 interviews with sponsoring local governments, the program administrator, and contractors; surveys of HERO participants, IOU rebate participants, and the general population; attribution research and analysis; and a marketing review. | |

| **Study Title: Process Evaluation #2 B– IOU Special Evaluation Project – to-be-determined** | **Study Title: Process Evaluation #2 B– IOU Special Evaluation Project – to-be-determined** |
|---|---|

| **Study Title: Process Evaluation #2 B– IOU Special Evaluation Project – to-be-determined** | **Study Title: Process Evaluation #2 B– IOU Special Evaluation Project – to-be-determined** |
|---|---|
| Expected Completion Date: Completed—see #2A | Expected Completion Date: Completed—see #2A |
| Description: Budget transferred to supplement expanded scope for allocation method in Process Evaluation #2 A – HERO Loan Program study. | |
| Objective: Though not affiliated with the IOUs in any way, HERO provides an early opportunity to test different allocation methods for evaluating the relative impact of rebates and financing. Various methodologies will be tested on a survey of participants/non-participants for the most likely approaches for the IOUs to apply in future evaluations. | |
| Key Research Questions: What are some of the better methodologies the IOUs can use to allocate the decision making process for rebates and financing. | |
| Potential EM&V Methods: Expanded self-report, Discrete choice model, questionnaire, selection of participant and non-participants. | |

| **Study Title:** Process Evaluation #3 A – Cadmus Early EM&V and Market Research | **Budget:** $507,461 |
|---|---|
| **Expected Completion Date:** Completed 2014 | **Study Manager:** IOU |
| **Description:** Market Research; Process Evaluation; Baseline Study; Development of Program Theory and Logic Models; Literature Review and special Evaluation of HERO loan program to 1.) assess program design and marketing approaches; and 2.) assess overlap with other loan programs – per direction of LAO (CA's Legislative Analyst's Office)to CPUC, CEC and CAEATFA. | |
| **Objective:** Assess customer, partner and stakeholder responses to Pilot Programs; baseline study of residential customers; interviews with Financial Institution partners; develop the program theory and logic models; definition of PPMs; literature review; evaluability assessment; evaluate process of HERO program, and overlap with other loan programs. | |
| **Key Research Questions:**<br>• Reaction to pilot marketing, application process, test elements of the logic models, awareness of the pilots. Preferences for financing relative to other EE attributes, reaction to pilot marketing, application process.<br>• Awareness and promotion of financing, finance selling process, reaction to program offerings, pilot materials and requirements.<br>• Barriers to financing<br>• Customer segment value/trade-off of various loan attributes.<br>• Per PG&E Changes | |
| **Potential EM&V Methods:** Focus groups, 1-on-1 interviews, surveys, billing analyses, segmentation, ride-alongs with contractors, review of marketing materials, analysis of program appeals vs. rebate programs incentives to define key marketing drivers. | |

| **Study Title**: Process Evaluation #3B - Early EM&V and Market Research | **Budget:** $300,000 |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** IOU |
| **Description:** Process evaluation tasks to support the California Finance Pilots during the pre-launch and early launch periods | |
| **Objective:** The objective of the Finance Early EM&V study is to define perspectives in the marketplace prior to the launch of program pilots in order to: 1.) Define current market conditions in which EE financing is launching; 2.) Understand current limits to expansion of financing for EE projects; and 3.) Describe opportunities where pilot programs can generate the biggest impact. | |
| **Key Research Questions:**<br>IOU & State Agencies:<br>• What are the constraints and challenges that program staff face in the pre-launch and early launch periods?<br>• How the IOUs, the CPUC, state's EE marketing agency, and CAEATFA (California Alternative Energy and Advanced Transportation Financing Authority) are working together to implement the pilot.<br>• Document the program implementation processes including outreach collaterals, delivery, and QA/QC of program tracking databases.<br>Contractors:<br>• How do contractors promote financing to customers? At what point during the discussions do they bring financing up? How do they tell which customers might be interested in financing?<br>• What (if any) barriers exist to contractors' promoting EE financing to their customers?<br>• Contractor perception on how EE finance programs could help increase EE sales (both # of projects and size of projects)<br>• Contractor opinions on the major barriers to selling comprehensive EE projects to customers, and how EE finance (and programs) provide opportunities to address those barriers and expand the EE retrofit market<br>• Contractor opinions on what types of projects would most benefit from financing and why<br>• Contractor feedback on pilot program offerings, whether they will market them to their customers and why | |
| **Potential EM&V Methods:** Interviews with IOU program managers and state agency staff, contractor panel and financial institutions. Reporting. | |

| **Study Title:** Process Evaluation #4 – Freeman Sullivan/Nexant Development of Evaluation Plans | **Budget:** $113,505 |
|---|---|
| **Completed Date:** Completed in 04/2015 | **Study Manager:** IOU |
| **Description:** Assess the potential for Experimental Design to be applied in the evaluation of the new Financing Pilot programs. | |
| **Objective:** Review the designs proposed for the Financing Pilots and then – applying the concepts and | |

| **Study Title:** Process Evaluation #4 – Freeman Sullivan/Nexant Development of Evaluation Plans | **Budget:** $113,505 |
|---|---|
| requirements of Experimental Design, attempt to design an evaluation approach that could define the incremental energy savings attributable to Financing, when supporting the existing EE programs. | |
| **Key Research Questions:** Can Experimental Design be applied to successfully measure the impact of the Financing Pilots? | |
| **Potential EM&V Methods:** Working sessions including ED and IOU staff, ED Advisors, and ED and IOU evaluation consultants. | |

| **Study Title:** Process Evaluation #5– Single Family Loan Program | **Budget:** $300,000 |
|---|---|
| **Expected Completion Date:** TBD once finance pilots launch | **Study Manager:** IOU |
| **Description:** Assess Loan Loss Reserve 20% CE; support for low & moderate income; </=70% EEMs and </= 30% non-EEMs; loan application process; contractor marketing; loan-only; data collection; QA process; effective marketing; deeper retrofit | |
| **Objective:** Determine effectiveness of program design relative to other financing options, obtain feedback on program marketing; Characterize program participants and projects; Elicit participant feedback; Evaluate consumer preferences for financing and different types of financing vehicles/program designs; Characterize contractor role in program participation; Determine success of program in making financing available to more consumers and whether more and larger energy efficiency projects are conducted as a result of the program. | |
| **Key Research Questions:**<br>• Finance Pilot Program design and implementation:<br>○ Is this program effective as planned and implemented?<br>○ What are the characteristics of program participants and drop-outs?<br>○ How do the program participants use their loans to investment in their homes (i.e., what measures)?<br>○ Are the program marketing activities effective? If not, what improvements are needed for program participants and non-participants?<br>○ Is the program's end-to-end processing effective? Is the duration for this processing acceptable? What kinds of improvements are necessary?<br>○ Is the program education, training and outreach effective for the intended targets (i.e., financial institutions, contractors, homeowners, etc.)? If not, what improvements are needed?<br>○ How is the loan program interfacing with IOUs/RENs rebate programs? How is the loan program interfacing with contractor and financial institutions? What are the bright spots? What are the areas for improvements? | |

| **Study Title:** Process Evaluation #5– Single Family Loan Program | **Budget:** $300,000 |
|---|---|
| • Program contractors:<br>  ○ What is the program contractors' feedback about this loan pilot?<br>  ○ Are they getting more projects as a result of the single-family loans?<br>  ○ Do they have sufficient information to market and sell these loan packages?<br>  ○ What improvements are necessary to improve the situation for the contractors?<br>• Program participants (i.e., homeowners):<br>  ○ What are the feedbacks from the homeowner participants and non-participants?<br>  ○ Are they getting sufficient information for these loan packages to help them make a financial decision?<br>  ○ Are they investing in more and deeper energy retrofit options?<br>  ○ Are they satisfied with the finance pilot program design and delivery?<br>  ○ What improvements are necessary to improve the program outcome?<br>• Other Rebate Program/s Interface:<br>  ○ For the other complementary rebate programs, are they receiving sufficient information to help market and promote the loan products?<br>  ○ What is their feedback? What are the needed improvements?<br>• What improvements are necessary to improve program outcome? | |
| Potential EM&V Methods: Participant surveys, participant focus groups, conjoint analysis, contractor focus groups, contractor surveys, financial institutions surveys | |

| **Study Title:** Process Evaluation #6– Small Business-OBR w/CE; Lease Providers w/CE On-Bill; Lease Providers with CE-Off-Bill | **Budget:** $300,000 |
|---|---|
| **Expected Completion Date:** TBD once finance pilots launch | **Study Manager**: IOU |
| **Description:** Assess Loan Loss Reserve 20% cap $200k per project; >/=70% EEMs and </= 30% non-EEMs; loan application process; contractor marketing; loan-only; data collection; QA process; effective marketing; deeper retrofit; with Credit Enhancement; without Credit Enhancement; Interest %>0; OBR shut-off on non-payment; transferability with customer consent | |
| **Objective:** Determine effectiveness of program design relative to other financing options, obtain feedback on marketing materials; Characterize program participants and projects; Elicit participant feedback; Evaluate consumer preferences for financing and different types of financing vehicles/program design; Characterize contractor role in program participation; Determine success of program in making financing available to more consumers and whether more and larger energy efficiency projects are conducted as a result of the program; determine the effect of credit enhancement and the on-bill repayment option on loan activity. | |
| **Key Research Questions:** For Small Business Financing Program, please consider all researchable | |

| **Study Title:** Process Evaluation #6– Small Business-OBR w/CE; Lease Providers w/CE On-Bill; Lease Providers with CE-Off-Bill | **Budget:** $300,000 |
|---|---|
| questions identified above in the MMMFP REEL and EFLIC.<br><br>For small businesses, there are three different loan options. Much like the Multi-family sector, these small businesses also face the split-incentive barrier. Please consider these researchable questions, on top of the relevant researchable questions identified in both the single family and multi-family sectors:<br><br>• Has credit enhancement increased loan activities?<br>• Has either On-Bill Repayment increased loan demand?<br>• What are the customer feedbacks for this loan program?<br>• What improvements are necessary to improve program outcome? | |
| **Potential EM&V Methods:** Participant surveys, participant focus groups, conjoint analysis, contractor focus groups, contractor surveys, financial institutions surveys | |

| **Study Title:** Process Evaluation #7– Master Meter Multifamily | **Budget:** $342,500 |
|---|---|
| **Expected Completion Date:** TBD once finance pilots launch | **Study Manager**: IOU |
| **Description:** Define demand & interest in financing/loan programs across MF customer sectors; debt service coverage reserve </=10% loan value; >/=70% EEMs and </= 30% non-EEMs; loan application process; contractor marketing; loan-only; data collection; QA process; effective marketing; deeper retrofit; without shut-off for non-payment | |
| **Objective:** Determine effectiveness of program design, marketing materials; Characterize program participants and projects; Elicit participant feedback; Evaluate consumer preferences for financing; Characterize contractor role in program participation; Determine success of program in making financing available to more consumers and whether more and larger energy efficiency projects are conducted as a result of the program; determine how well the program is working within the context of the single-point-of-contact strategy used in the multifamily sector; determine whether the program has helped minimize the property owner versus tenant split-incentive barrier. | |
| **Key Research Questions:** For Master Metered Multi-Family Financing Program, please consider all researchable questions identified above in the single family sector.<br><br>Since the MMMFP must interface with either income-qualified and lower-income qualified property owners, please consider the additional researchable questions below:<br><br>• What are the characteristics of the program participants and drop-outs? Why are they participating or not participating?<br>• For program participants, how are they investing in their property using the loan amount (i.e., what gas and electrical measures)? Are the property owners making deeper and broader scoped energy retrofit as a result of the loan program? | |

| **Study Title:** Process Evaluation #7– Master Meter Multifamily | **Budget:** $342,500 |
|---|---|
| • Is the single-point-of contact strategy working in the context of the loan program? Can the property owners successfully leverage all rebate resources and financing options by leveraging the single-point of contact?<br>• Has the loan program helped to overcome the property-owner versus tenant's standing split-incentive barriers? Are they making improvements inside the tenant units?<br>• How is this finance program interfacing with IOUs and RENs rebate programs?<br>• In additional to contractors, the multi-family programs may also engage utility consultants and/or Raters for these projects. We need to collect program response from these utility consultants and/or Raters.<br>• What improvements are necessary to improve program outcome? | |
| **Potential EM&V Methods:** Participant surveys/interviews, contractor focus groups, contractor surveys, financial institutions surveys. | |

| **Study Title**: Process Evaluation #8– Medium, Large Business – OBR w/out CE | **Budget:** $325,000 |
|---|---|
| **Expected Completion Date:** TBD once finance pilots launch | **Study Manager:** IOU |
| **Description:** Define demand & interest in financing/loan programs across customer sectors; >/=70% EEMs including DR and DG; and </= 30% non-EEMs; loan application process; contractor marketing; loan-only; data collection; QA process; effective marketing; deeper retrofit; without Credit Enhancement; Interest %>0; OBR shut-off on non-payment; transferability with customer consent | |
| **Objective:** Determine effectiveness of program design relative to other financing options, obtain feedback on marketing materials; Characterize program participants and projects; Elicit participant feedback; Evaluate consumer preferences/need for financing; Characterize contractor role in program participation; Determine success of program in making financing available to more consumers and whether more and larger energy efficiency projects are conducted as a result of the program; determine whether the program can meet/is meeting objectives without credit enhancement. | |
| **Key Research Questions:** For Medium/Large businesses and Institutions, please consider all relevant researchable questions identified in Multi-family and Small Business sectors above.<br>• Can this loan program meet its deal flow objective without credit enhancement? | |
| **Potential EM&V Methods:** Participant surveys/interviews, participant focus groups, conjoint analysis, contractor focus groups, contractor surveys, financial institutions surveys. | |

| **Study Title:** Market Study #1: Residential | **Budget:** $900,000 |
|---|---|
| **Completion Date:** Completed, May 2016 | **Study Manager:** ED |
| **Description:** Develop a baseline for the residential market for energy efficiency finance products in CA including both supply and demand. | |
| **Objective:** To understand the market conditions prior to the start of the finance programs, and to Inform the development of market changes over time. | |
| **Key Research Questions:**<br>• What are the characteristics of the supply-side market for energy efficiency financing?<br>• What are the characteristics of the demand-side market for energy efficiency financing?<br>• What is the financial institutions' understanding of the risk related to energy efficiency financing opportunities?<br>• What financial products and services are available for energy efficiency financing?<br>• Do lenders offer specialized energy efficiency finance products and if so, what types of financial institutions offer them and how are they marketed?<br>• At what rates and terms is energy efficiency financing available to different market segments of customers (residential and non-residential)? To mid-stream contractors?<br>• Are contractors using financing to close sales (importance of financing to the sale of various kinds of jobs)?<br>• What is the number and depth of energy efficiency projects prior to offering these energy efficiency finance programs?<br>• What percentage of the population has taken an energy efficiency action?<br>• What percentage of that population has used energy efficiency financing?<br>• How much of the project cost was financed?<br>• How accessible (in terms of products available and cost) is financing for energy efficiency projects? How accessible is financing among different customer segments?<br>• How aware are customers (by sector and segment) of financing options available to them? | |
| **Potential EM&V Methods**: Interviews with financial institutions and market actors, mystery consumer research, secondary data. Potential EM&V Methods: general population residential survey, potential questions from 2010-2012 evaluation research, leveraging other survey efforts for 2013-2014, secondary data. | |

| **Study Title:** Impact Evaluation #1 – Cross-Cutting Background and Attribution Research | **Budget:** $350,000 |
|---|---|
| **Expected Completion Date**: Completed September 2016 | **Study Manager:** ED |
| **Description:** Cross-cutting cost-effectiveness and attribution research for the statewide pilots and | |

| **Study Title:** Impact Evaluation #1 – Cross-Cutting Background and Attribution Research | **Budget:** $350,000 |
|---|---|
| regional programs/pilots | |
| **Objective:** conduct cross-cutting research as well as consulting and coordination activities in support of the statewide pilot and regional program/pilot evaluations. | |
| **Key Research Questions:**<br>• What data is available to evaluate the projects?<br>• How should the savings for finance programs be attributed to program administrators?<br>• How should the cost-effectiveness of the portfolio of finance programs be calculated? | |
| **Potential EM&V Methods:** Review of programs, available data and program materials; review of program logic models; prioritization of key local programs/pilots; key informant interviews, review of attribution methods; review of evaluability of programs/pilots and (if needed) discussion of alternative cost-effective methodologies. | |

| **Study Title:** Impact Evaluation #2 – Multiphase On-Bill Finance Study | **Budget:** $350,000 |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |
| **Description:** Impact assessment and lessons learned of the On-Bill Finance Program in two phases. | |
| **Objective:** Determine gross and net energy impacts of the OBF pilots and report on how the program affected the finance market and demand for energy efficiency financing; develop lessons learned for future efforts. | |
| **Key Research Questions:**<br>• What data is available for OBF Programs?<br>  ○ How much information is available on customers, contractors, programs, measures installed, and measure incentives and costs on OBF projects. This will help us to understand the potential impact analysis approaches.<br>• Has the OBF program changed beginning in 2013 from the prior program?<br>  ○ How is the OBF program progressing over time in terms of design, delivery and participation by segment? Which segments have been impacted?<br>• What are the energy efficient measures being financed through OBF and what are the ex-ante savings associated with these projects?<br>• What are the best attribution methods to address the OBF program?<br>  ○ Does enough information exist to assess incremental energy savings attributable to the OBF program?<br>  ○ What factors contributed to non-residential customers' decision to participate in the OBF program?<br>• How do the participating OBF customers perceive their program participation experience? | |

| **Study Title:** Impact Evaluation #2 – Multiphase On-Bill Finance Study | **Budget:** $350,000 |
|---|---|
| • What is the incremental impact of the OBF program on IOU energy savings?<br>  ○ What is the incremental impact of OBF on OBF program energy savings? | |
| **Potential EM&V Methods:** Estimate incremental savings using participant surveys and program tracking data; financial institution and market actor interviews | |

| **Study Title:** Impact Evaluation #3 – Regional Pilot/Program Study | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** Q1, 2017 | **Study Manager:** ED |
| **Description:** Gross and net savings evaluation for the regional finance programs/pilots | |
| **Objective:** Quantify the gross and net savings from three different 2015 active regional financing programs/pilots. | |
| **Key Research Questions:**<br>• What data is available for these Programs?<br>  ○ How much information is available on customers, contractors, programs, measures installed, and measure incentives and costs on projects. This will help us to understand the potential impact analysis approaches.<br>• How is each program designed?<br>  ○ What are the requirements for participation? What measures qualify? What customers qualify? How is the loan repaid? What is the selection criteria? What rebate programs are they associated with, if any?<br>• What are the energy efficient measures being financed and what are the ex-ante savings associated with these projects?<br>• What are the net savings?<br>  ○ Does enough information exist to assess incremental energy savings attributable to finance?<br>  ○ What factors contributed the customers' decision to participate in the finance program?<br>  ○ How influential was the finance program on the customers' decision to do a project?<br>• How do the participating customers perceive their finance program participation experience?<br>• What is the incremental impact of the finance pilot on any CPUC claimed energy savings?<br>• What is the cost-effectiveness of these programs? | |
| **Potential EM&V Methods:** Est. Increased savings using participant surveys and program tracking data; financial institution and market actor interviews; database reviews and analysis, depth interviews with program staff, program material review | |

| **Study Title:** Impact Evaluation #4: Statewide Residential Financing Pilot Study | **Budget:** $404,095 |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** ED |
| **Description:** Assess the evaluability of the Statewide REEL and EFLIC Pilots and determine the energy savings and cost-effectiveness of each. | |
| **Objective:**<br>• Understand what data is available for evaluation from each pilot and recommend improvements<br>• Develop an impact evaluation plan for each pilot that is feasible and grounded in the information available<br>• Calculate gross and net energy savings from each pilot; estimation of incremental energy savings where possible, and the cost-effectiveness of each. | |
| **Key Research Questions:**<br>• What data is available for these Pilots?<br>  ○ How much information is available on customers, contractors, programs, measures installed, and measure incentives and costs on projects. This will help us to understand the potential impact analysis approaches.<br>• How is each pilot designed?<br>  ○ What are the requirements for participation? What measures qualify? What customers qualify? How is the loan repaid? What is the selection criteria? What rebate programs are they associated with, if any?<br>• What are the energy efficient measures being financed and what are the ex-ante savings associated with these projects?<br>• What are the net savings from the pilots?<br>  ○ Does enough information exist to assess incremental energy savings attributable to the finance pilot?<br>  ○ What factors contributed the customers' decision to participate in the finance program?<br>  ○ How influential was the finance program on the customers' decision to do a project?<br>• How do the participating customers perceive their finance program participation experience?<br>• What is the incremental impact of the finance pilot on any CPUC claimed energy savings? | |
| **Potential EM&V Methods:** Estimate incremental savings using participant surveys and program tracking data; financial institution and market actor interviews; database reviews and analysis, depth interviews with program staff, program material review | |

| Study Title: Financial Institution Partner Network Best Practices | Budget: $100,000 |
|---|---|
| **Expected Completion Date:** Q4, 2016 | **Study Manager:** ED |
| **Description:** This study would explore best practices when soliciting potential finance program partners such as financial institutions and contractors. It will also explore best practices for | |

| Study Title: Financial Institution Partner Network Best Practices | Budget: $100,000 |
|---|---|
| developing and identifying selection criteria for potential partners. These include – understanding the characteristics of transactions preferred to fund projects; the nature of energy efficiency projects in partner portfolio, the relative importance of cash flow, interest rates, and loan duration in financing EE projects versus renewables, etc. | |
| **Objective:** The objective of the study is to understand strategies that have successfully enabled other similar Energy Efficiency finance initiatives to solicit, recruit and onboard critical program partners such as private lenders and contractors considering the following: | |
| **Key Research Questions:**<br>• Identify the successful strategies and approaches to getting private lenders and contractors to participate in Energy Efficiency Finance Initiatives.<br>• Identify the criteria that have successfully enabled Energy Efficiency Financing Initiatives to select private lenders and contractors for program support.<br>• Recommend recruitment and selection criteria for the Pilots moving forward. | |
| **Potential EM&V Methods:** Literature review, semi-structured in-depth interviews with program managers, lenders and contractors | |

| **Study Title: Non-Residential Market Study** | **Budget: $300,000** |
|---|---|
| **Expected Completion Date**: 2017 | **Study Manager:** ED |
| **Description:** The purpose of this study is to assess key metrics related to energy efficiency financing for small business (SB) customers in California. The results of this study will serve as a market baseline of energy efficiency financing prior to the introduction of the Small Business Statewide Finance Pilots ("the Pilots") expected in 2017. By providing baseline estimates of several key metrics for the period prior to the introduction of the Pilots, the results of this study will offer points of comparison against which future research can assess the impact of the Pilots. | |
| **Objective:** The goal of this study is to establish baselines for a number of key metrics related to energy efficient financing, prior to the launch of the SB Pilots. | |
| **Key Research Questions:**<br>• What proportion of SBs implemented energy efficient upgrades in the past two years?<br>• What proportion of SB energy efficient upgrades were financed?<br>  ○ What is the average size/depth of the energy efficient upgrades?<br>  ○ What type of financing was used for energy efficient upgrades?<br>• What proportion plan to conduct energy efficient upgrades in the next two years?<br>• What is the awareness level of energy-efficiency financing products?<br>• What is the nature of the decision-making process for financing?<br>• What are the barriers to energy efficient upgrades and/or financing? | |

| **Study Title: Non-Residential Market Study** | **Budget: $300,000** |
|---|---|
| • What is the current loan volume for energy-efficiency financing? | |
| **Potential EM&V Methods:** Customer quantitative surveys, in-depth interviews and web-based verification of self-report data. | |

## Additional 2013-2016 Finance-Related Studies Funded by Other Roadmaps

| **(8) Study Title:** Finance ME&O Study | **Budget:** Funded by ME&O roadmap |
|---|---|
| **Expected Completion Date:** Q4 2017 | **Study Manager:** ED |
| **Description:** This study will focus on research surrounding the marketing efforts of the Statewide Financing pilots that will roll out in 2016. Specifically, this study will look both at process issues across all stakeholders, as well as the effectiveness of the marketing efforts. We anticipate that this study would focus on marketing efforts across all parties including marketing by the state's EE marketing agency, IOUs/RENs, CAEATFA and the strategic partners. | |
| **Objective:** To gather insights that will: help improve messaging related to the finance programs; assess the "market facilitation" approach; help refine the processes, channels and tactics used for marketing Statewide finance efforts; and ultimately help improve ME&O efforts overall so that they better support increased uptake of financing of energy efficiency projects. | |
| **Key Research Questions:**<br>*The evaluation team will work with the CPUC to develop the key research questions as the marketing efforts develop, but they may revolve around the following:*<br>**Documentation and Verification:**<br>• Document and assess the implementation process, program structure, program goals and program tracking records.<br>• How much money was spent on marketing finance programs? Was it well spent? Were the tools and tactics used the right ones? Were the marketing efforts directed towards the appropriate stakeholders?<br>• *Do the marketing activities align with the finance program objectives? Do they consider the full range of market actors including contractors, real estate professionals, lenders, retailers and CBO's to evaluate which can best support the pilots?<br>• Which channels best support the pilots?<br>• Which mediums best support the pilots? (CBOs, website, video marketing, etc.)?<br>**Coordination/Roles:**<br>• How did the various parties coordinate the marketing of the finance programs? How could this coordination be improved?<br>• What role do the IOUs play and how well are they fulfilling that role? If and how are the IOUs duplicating, complementing or competing efforts?<br>**Strategic Partners/Contractors:**<br>• *Did strategic partner awareness and understanding of financing pilot opportunities increase?<br>• *Did strategic partners communications with target customers (aka potential borrowers) increase?<br>• How many contractors were touched through the marketing? Do they understand the | |

| **(8) Study Title:** Finance ME&O Study | **Budget:** Funded by ME&O roadmap |
|---|---|
| efforts? Do they feel that the marketing support was valuable?<br>• Is the training of contractors effective? How can it be improved?<br>• Did the contractors change their messaging? Do contractors believe that the marketing helped to increase the number of jobs or the size of jobs?<br>• What is working to engage partners/contractors? What is not working? (as close to real-time feedback as possible)<br>• Is the market facilitation approach, i.e. focus on partners and contractors, an effective approach to marketing finance options to customers?<br>**Strategic Partners/Financial Institutions:**<br>• *Did strategic partner awareness and understanding of financing pilot opportunities increase?<br>• *Did strategic partners communications with target customers (aka potential borrowers) increase?<br>• Are Financial Institutions able to use the marketing materials to promote their loan products?<br>**Consumers (residential):**<br>• Was the messaging on point for the audience?<br>• How effective is the marketing in addressing the first cost barrier?<br>• How do consumers respond to the marketing materials? How receptive are they to the messaging? Does the messaging address / help decrease consumers specific barriers?<br>• *Did target customer awareness of the availability of financing and the key differentiating benefits of the financing pilots increase? Where did it increase or amongst whom?<br>• Did customers move beyond awareness to early action?<br>• Is there any evidence of increased program participation/uptake due to the marketing efforts? Which groups or segments? (indicators: % of participants that heard about financing from various channels, motivations to participate in financing)<br>• *Did the volume of target customers taking initial action to seek financing increase?<br>• Is the concierge system needed? If so, for whom and why?<br>*Indicates that this is a measurement of one of the three stated objectives for the finance ME&O efforts (per the January 2015 plan). | |
| **Potential EM&V Methods:** Focus groups, 1-on-1 interviews, training observations, surveys, contractor interviews, web survey, panel, marketing collateral review/content analysis, web statistics, best practice research. All survey efforts will be coordinated with other surveys where possible. | |

## Other Important Considerations

The Financing Program is designed to provide a strategy by which the PAs can deploy more comprehensive measures and deeper energy efficiency savings to a diverse array of customers. EM&V studies for existing programs should include questions and analysis about the processes and synergy with the Financing Program. These programs would include (but are not limited to):

- Residential: Whole House Upgrade Program; (SF and MF) Multifamily Whole Building Retrofit; Multifamily (MFEER); Plug Load and Appliances (PLA). and Residential HVAC .
- Non-Residential: Commercial; New Construction; Industrial; Agricultural; non-residential customers in Primary Lighting program; Statewide Institutional, Local Government Partnership Programs and Non-Residential HVAC.

As financing programs develop across the state, future research needs could include market studies of:

- The landscape of multifamily buildings. An analysis of existing data could yield key information for program planning such as the location and condition of multifamily buildings, and measures that would be most cost-effective to install in them
- Customer response to rebates and/or financing: this type of study could examine which customer segments are most likely to respond to rebates, and which to financing
- IALC customer decision-making with regard to financing: research questions could include whether and how customers decide to complete projects with on-bill financing or repayment
- Contractor decision-making: this type of study could explore how contractors determine which, if any, financing programs to offer directly to customers.

### 2.12.4. Key Research Questions for 2016 and beyond

**Proposed 2016 -2017 Energy Division Budget: $838,332**
Given the back log of analysis that is intended, the budget allocated from 2016 and 2017 is limited. The key programs are still not going in full force. These funds will allow for a couple of additional studies and activity can be scaled as the programs get greater traction.

**Proposed 2016-2017 PA budget: $0 (carry over funding is being used to manage any studies)**

Program administrator-led research in 2017 will focus on previously-planned studies of the SW financing pilots. Due to the delayed launch of the pilots and the carry over of funds for studies of those pilots, additional funds have not been allocated for PA-led studies for the upcoming program cycle.

# 2.13. Marketing, Education and Outreach

## 2.13.1. Background

The purpose of this research roadmap is to provide a comprehensive evaluation research plan for the Marketing, Education and Outreach ("ME&O") activities that will be conducted for statewide, investor owned utility (IOU) and Regional Energy Network (REN) activities using PY13-15 cycle funds. This roadmap identifies recent and current research, describes known research needs, and proposes new research to meet those needs.

This roadmap is being developed under guidance from Decision D.13-12-038, which states that "…we direct all stakeholders to engage in a collaborative process to create a road map for EM&V of statewide and [IOU/REN] marketing activities. Commission staff … will take the lead in this process. The roadmap should include the types of information that is needed, the types of evaluations that should be conducted, and a timeline for conducting them."

This long-term research roadmap is a living document that will be maintained by the Program Coordination Group (PCG) responsible for ME&O. Updates to this document will be based on a clear understanding and knowledge of the scope and timing of research projects relevant to ME&O. Updates will reflect evolving research needs and coordination with other sector/topic area PCGs to minimize duplication of efforts and to leverage research opportunities where practical. This document and future updates will facilitate planning and coordination efforts and guide future program/policy design, implementation, and evaluation.

## 2.13.2. Sector or Program Area Description

In California, ME&O is used both as a strategy within each of the IOU and REN energy efficiency portfolios and as an overarching Statewide ME&O Program. The ME&O roadmap covers the following:

- Statewide ME&O: The statewide umbrella brand effort implemented by the Center for Sustainable Energy (CSE) between 2013-September 2016, and by DDB from October 2016-2019.
- IOU/REN ME&O: The funds used for marketing the IOU and REN energy efficiency programs as approved in D.12-11-015 and D.16-09-020.

### Statewide ME&O Overview

A 2009 decision (D.09-09-047) laid out the overall goals of the statewide ME&O effort, specifically saying that: "The goal of the Statewide Marketing & Outreach Program is to motivate ratepayers to take action on energy efficiency/conservation measures and behavior change. The program should aim to both increase ratepayer awareness and facilitate the ability to act and incorporate technology advances or behavior changes, using all available resources to reduce energy use and choose clean energy options. The program should increase the percentage of ratepayers reducing energy consumption. Furthermore, the program should have the flexibility to include discussion of renewable self-generation options as deemed appropriate. The program should also motivate those who are taking energy efficiency action to do more and move along a continuum to become clean energy advocates."

In 2011-2012, it was determined that Energy Upgrade California would become the new statewide brand. The statewide brand was intended to complement utility and other local marketing efforts. As

clarified in D.12-05-015, the creation of a new Energy Upgrade California brand is not intended to "prevent utilities from continuing to conduct local and targeted marketing that is service territory and/or program-specific. In fact, local ME&O campaigns undertaken by utilities will coordinate with, and complement, the Energy Upgrade California umbrella brand. However statewide marketing and local marketing should still be coordinated, and the strategies for each should be designed to complement each other."

Starting in 2014, CSE began implementing and coordinating the statewide ME&O Program under the Energy Upgrade California umbrella brand with the general goal of motivating "residential and small business energy consumers to take continued action over time to better manage their energy use."[65] More specifically, as described in D. 13-12-038, Statewide ME&O, as a stand-alone program, is charged with providing "California residents and small business owners with information about energy concepts, programs, services, rates and benefits of taking action so that Californians (1) begin to understand their energy use, the opportunities available for them to act, and the benefits of their action, and (2) begin to take well informed action to better manage energy."

Objectives for statewide ME&O were laid out in D.13-12-038, and reiterated in D.16-03-029. They include the following:

1. Use the Energy Upgrade California brand to educate consumers about the Home Upgrade programs, why energy use matters, how California homes and businesses use energy, as well as energy efficiency, demand response, distributed generation, and energy management actions available.
2. Encourage consumers to engage with resources and tools to learn more about their energy use.
3. Inform consumers about the benefits of participating in local program opportunities, seasonal opportunities, or no/low cost actions.
4. Provide direction about how consumers can learn more about and enroll in local program opportunities and time sensitive opportunities, or how to take no/low cost actions.
5. Identify and pilot messaging and message delivery for partners that complements existing utility partnerships, including, local governments, CBOs, retailers, and realtors.
6. Identify and pilot methods to provide information to small business owners.[66]
7. Work with a marketing firm, and use behavior research to develop a social marketing campaign.
8. Coordinate local, regional, and statewide marketing efforts, messaging, and tactics.
9. Develop an EM&V roadmap for utility local marketing, and statewide marketing to understand the impacts of local, utility- led marketing, and how local and statewide efforts can best be coordinated and complementary.[67]

[65] Energy Upgrade California 2013-2014 Marketing Plan

[66] Per D.16-09-020, p. 45: "Objective number 6 should be eliminated, because it is encompassed within other objectives."

[67] Note that while this objective was included as part of the list of objectives for Statewide ME&O, per D. 12-05-015 the development of this roadmap is the responsibility of Commission staff, not the Statewide ME&O implementer.

## IOU/REN ME&O Overview

In general, the goal of ME&O is to educate and motivate consumers to take action on energy efficiency/conservation measures and change their behavior. For the IOU and REN efforts, the "behavior" that ME&O seeks to encourage is largely participation in the existing portfolio of demand side programs. Program administrator ME&O activities are comprised of targeted, program-specific, and action-driven marketing activities, managed by the IOUs, Local Government Partnerships (LGPs), RENs, or Community Choice Aggregators. For some utilities, the "local" ME&O leverages customer analytics to personalize messaging and offer relevant demand-side management solutions directed at customers within each utility's service territory, or for the RENs, local geographic area. Activities are often tied to key engagement opportunities that are unique to the customer and IOU/REN, and could include items such as service turn-on or program enrollment.

The IOUs and RENs conduct ME&O within their territories to deliver specific messages which are targeted toward their customers. Objectives for IOU and REN ME&O activities vary by individual campaign, program, or effort, but generally focus on raising awareness of and participation in specific programs. These interactions were evaluated in the Cross Cutting ME&O study completed in November 2016, and available at http://www.calmac.org/publications/PY2013-2015_MEO_Cross-Cutting_Process_Evaluation_Report_FINAL_2016-11-11.pdf..

### 2.13.3. Summary of the Programs included in the Research Scope

This roadmap is intended to guide the evaluation of the statewide ME&O program, as well as the more localized IOU and REN efforts. The budgets allocated for the implementation of the marketing efforts are shown in the table below. Note that while the IOU and REN budgets are specific to energy efficiency funding, the statewide funds are broader, covering topics such as demand response, distributed generation, and education for water-energy savings to combat the drought.

***Table 45. 2013-2017 ME&O Program Budget Summary***

| Program Administrator | Program/ Campaign | Budget | Source |
|---|---|---|---|
| CSE | Energy Upgrade California | $40,492,265* | A.12-08-007 et. al., Service of letter Reporting Updated Budget Information in Compliance with OP 16 in D.13-12-038 |
| DDB | Energy Upgrade California | $23,000,000 | D.16-09-020 authorizing implementer for Statewide ME&O post 2016 |
| IOUs | | $58,937,509 | Individual IOU Budget Files (see below) |
| PG&E | Various | $30,924,186 | "EE 2013-14 PGE Portfolio Budget" |
| SCE | Various | $19,193,591 | " SCE EE Budget Placemat 2013-2014" |
| SDG&E | Various | $8,858,166[a] | SDG&E April 23, 2013 Advice Letter 2448-E-A/2167-G-A[b] |
| SoCalGas | Various | $8,819,732 | "SCG 2013-2014 EE Program Budget" |
| | Aliso Canyon | $11,000,000 | Proposed Decision A.12-08-007 (4/21/16) |
| RENs | | $7,631,998 | REN Revised PIPs (see below) |
| SoCalREN | Various | $4,232,418 | 2/24/14 SoCalREN Revised PIP |
| BayREN | Various | $3,399,580 | BayREN Communications |

[a] SDG&E (only) Budget is $7,311,096 which excludes Local Government Marketing ($1,019,682) and Third Party Program Marketing ($527,388).

[b] "Attachment C - SDG&E Al 2448-E-A/2167-G-A Revised Placemats – Budget & Savings (one with and one without lighting scenario)", which was approved by the letter dated June 12, 2013 by Ed Randolph of the Energy Division , which approved Advice Letter SDG&E 2448-E/2167-G, 2448-E-A/3267-G-A, 2448-E-B/2167-G-B.
* This budget covers the 2013-2015 period.

## Uncertainties and Challenges to Successful Implementation

There are several uncertainties and challenges to successful implementation of ME&O efforts that affect both implementation and EM&V. Some of the key challenges include:

- **Crowded Media Space**: Energy efficiency marketing and outreach takes place in a crowded information environment in which consumers are bombarded with messages from numerous sources. This can make it more challenging to achieve increased awareness or recognition of any one particular message because consumers' attention is compromised with all of the other messages and sources in the market. In this environment, it is challenging to determine the effectiveness of a particular ME&O campaign. With consumers exposed to multiple messages through many channels, it is difficult to determine which had the greatest impact.
- **Narrowcasting**: The market is characterized by "narrowcasting" in which consumers can pick and choose information sources that are of most interest. As a result, multiple channels and approaches are needed to effectively reach California consumers. Thus, ME&O campaigns must be multifaceted and utilize many different strategies to reach the target audience.
- **Complex "Asks"**: Unlike social marketing campaigns that ask consumers to take a single action (e.g., anti-smoking campaigns), many, but not all energy efficiency ME&O efforts inform consumers about a wide range of actions that they could take to reduce usage. This list of asks will grow even further over time as water, solar and demand response related-messaging is added to the statewide and IOU/REN campaigns. The complexity of what ME&O asks consumers to do makes the task of spurring action all the more challenging.
- **Multiple Transactions**: Unlike campaigns that include a single transaction, energy efficiency ME&O efforts are a targeted, sequential strategy involving multiple touches and stages and are thus more challenging because they involve building an ongoing relationship with consumers.
- **Business Plans –** The 10 year Business Plans filed by the program administrators will change and should enhance coordination.

The research studies outlined in this roadmap will consider these challenges and provide information that will help IOUs, RENs, CSE and CPUC staff to address them. The specific methods will be determined during the planning process for each study. However, a critical goal is to accurately measure ME&O exposure and establish a connection between exposure and customer awareness of and attitudes towards energy efficient actions. Many past studies measured attitudes but relied on self-reported exposure, which is fraught with measurement error. The team will draw upon the latest methods that can be used to refine existing and future ME&O messages and strategies.

### 2.13.4. Recent Evaluations

No process or indirect impact evaluations were conducted specifically for the 09-11 Statewide ME&O program (Engage 360) since the program was terminated prior to the end of the cycle. However, there are likely lessons learned from the planning of this program that can be of use moving forward.

Moreover, there was a considerable amount of research conducted on the 06-08 Statewide ME&O program in preparation for 2009 program planning. Some of the findings and recommendations from this research remain relevant and have influenced the program planning for the 2013-15 program.

In addition, some research conducted on behalf of other residential programs is also directly relevant to the Statewide ME&O efforts. These projects are noted below:

***Table 46. Summary of Relevant Past ME&O Studies***

| Study Title | Study Manager | Evaluator | Approximate Budget | Data Collection Date | Publication Date |
|---|---|---|---|---|---|
| 2006 - 2008 Statewide Marketing and Outreach Process Evaluation | ED | Opinion Dynamics | $600K | April – May 2008 | October 2008 |
| PY2006-2008 Indirect Impact Evaluation of the Statewide Marketing and Outreach Programs | ED | Opinion Dynamics | $1.2M | May and October 2008; February 2009 | February 2010 |
| Market Segmentation Findings | ED | Opinion Dynamics | $250K | July – August 2009 | December 2009 |
| Ethnographic Research Findings | ED | Opinion Dynamics | $150K | May - July 2009 | August 2009 |
| 2009 Brand Assessment Report | ED | Interbrand | Unknown | August 2009 | November 2009 |
| 2010 Energy Conservation and Efficiency Marketing, Education and Outreach Study – California Oversample | ED, SCE, SCG, PG&E and SDG&E | Abt SBRI and Research Into Action, Inc. | Unknown | August – September 2010 | June 2012 |
| Reconsidering What We Measure: A White Paper--Residential Decision Making and Proposed Questionnaire Items | SCE and PG&E | Opinion Dynamics and Research Into Action, Inc. | $233K | N/A | August 2011 |
| 2011-2012 General Households Population Study in California | SCE and PG&E | Research Into Action, Inc. and Opinion Dynamics | Unknown | January – February 2012 | September 2012 |
| 2010–2012 PG&E Whole House Retrofit Program Phase II Process Evaluation Study | PG&E | SBW Consulting, Inc. | $250K | May – August 2013 | December 2013 |
| Energy Upgrade California Brand Assessment | CSE | Opinion Dynamics and Shelton Group | $425K | December 2012 – January 2014 | February 2014 |

| Study Title | Study Manager | Evaluator | Approximate Budget | Data Collection Date | Publication Date |
|---|---|---|---|---|---|
| 2013–2015 California Statewide Marketing, Education, and Outreach Program: Verification and Integrated Effectiveness Study | CPUC | Opinion Dynamics | $650K | January 2014 – December 2015 | May 2016 |
| 2013–2015 California Statewide Marketing, Education, and Outreach Program: Cross-Cutting Process Study | CPUC | Opinion Dynamics | $900K | January 2014 – September 2016 | November 2016 |

Each of the studies above addressed a number of key research objectives as outlined in the following table.

***Table 47. Summary of Research Objectives Addressed through Prior ME&O Evaluation***

| Study Name | Objectives |
|---|---|
| 2006 - 2008 Statewide Marketing and Outreach Process Evaluation | • Improve statewide marketing and outreach efforts in the future<br>• Identify where program improvements can be made to increase the value of mass media and non-mass media efforts |
| PY2006-2008 Indirect Impact Evaluation of the Statewide Marketing and Outreach Programs | • Identify changes in attitudes, awareness, and knowledge of energy efficiency<br>• Quantify net energy savings for key components of the Statewide ME&O program (Flex Your Power) |
| Market Segmentation Findings | • Identify unique segments for statewide outreach efforts. |
| Ethnographic Research Findings | • To inform 2009-2010 Marketing Strategy.<br>• Understand residential customer decision making, interactions with, and language around energy efficiency, demand response, and solar. |
| 2009 Brand Assessment | • Assess the brand equity and potential of Flex Your Power to meet new marketing and savings goals set forth in the California Energy Efficiency Strategic Plan (CEESP) and recent CPUC Decisions, including the opportunity to evolve the brand to represent other demand-side energy solutions such as demand response, low income energy efficiency, and distribution generation such as solar.<br>• Determine an optimal branding approach informed by the perceptions of a representative sample of California residents |
| 2010 Energy Conservation and Efficiency Marketing, Education and Outreach Study – California Oversample | • Assess importance of energy issues<br>• Assess attitudes and motivations regarding energy efficiency and conservation<br>• Assess behaviors related to energy efficiency and conservation<br>• Assess awareness and knowledge of energy-efficient products and services<br>• Assess barriers to implementing energy efficiency practices |
| Reconsidering What We Measure: A White Paper--Residential Decision Making and Proposed Questionnaire Items | • Understand whether the AKAB framework facilitates thinking about and measuring how customers are influenced by energy efficiency programs<br>• Understand whether the AKAB framework provides adequate guidance to program planners who want to influence customers to engage in more energy-efficient behaviors, including practices and purchases |

| Study Name | Objectives |
|---|---|
| 2010- 2012 General Population Survey | • Validate the AKAB theoretical model for single-family/renters<br>• Measure A/K, concern and personal responsibility toward energy efficiency based on general, as opposed to program-specific concepts<br>• Segment residential customers and identify marketing and outreach opportunities for current and future PG&E and SCE energy efficiency programs and campaigns;<br>• Examine recent appliance and electronic product purchasing behavior to support Home Energy Efficiency Rebate (HEER) and Business and Consumer Electronics (BCE) program evaluations<br>• Assess appliance recycling and retrofit behaviors |
| 2010- 2012 PG&E Whole House Process Evaluation | • Assess customer attitudes, motivation, and experience with the program<br>• Assess participation barriers<br>• Assess contractor attitudes, motivation, and experience with the program<br>• Assess energy rater attitudes, motivation, and experience with the program<br>• Assess the effectiveness of contractor training |
| 2013 Energy Upgrade California Brand Assessment | • Measure awareness and elasticity of Energy Upgrade California Brand |
| 2013–2015 California Statewide Marketing, Education, and Outreach Program: Verification and Integrated Effectiveness Study | • Document ME&O activities in comparison to the program's objectives and metrics<br>• Assess the effectiveness of statewide ME&O efforts including identification of changes in attitudes, awareness, and knowledge of promoted topics |
| 2013–2015 California Statewide Marketing, Education, and Outreach Program: Cross-Cutting Process Study | • Provide recommendations and feedback for ME&O efforts conducted by the SW implementer, the IOUs and RENs.<br>• Develop a program theory and logic model.<br>• Assess how ME&O activities are designed and implemented, how well efforts are going on a tactical level, and consumer perspectives, and coordination across statewide and IOU/REN efforts |

## Ex Ante Updates

ME&O programs are non-resource and therefore do not have ex ante savings estimates. As a result, there are no ex ante updates planned for this research area.

### 2.13.5. 2013-2015 EM&V Studies

The table below summarizes the 2013-15 EM&V Studies that have been budgeted, some of which are complete while others are in the process of being implemented. The table provides the study manager, work order under which the study is being conducted, the corresponding budget, implementation status and expected completion date for each study.

It is important to note that two of the completed ME&O study areas were for ad hoc consulting activities, which are listed here so that the full budget under this roadmap is accounted for. In addition, as shown below, a Finance ME&O study is funded out of the ME&O roadmap budget.

***Table 48. Summary of 2013-2015 ME&O EM&V Studies, Budgets and Timelines***

| Study Area/Title | Study Manager | Work Order | Budget | Status | Completion Date |
|---|---|---|---|---|---|
| **Statewide Verification and Integrated Effectiveness** | | | | | |
| Early Coordination and Consulting on PPMs and Measurement Designs | ED | ED_O_ME&O_1 | $49,000 | Complete | February 2014 |
| Baseline and Initial Data Collection | ED | ED_O_ME&O_2<br>ED_O_ME&O_3 | $175,000 | Complete | September 2014 |
| Verification and Integrated Effectiveness Study<br>• Audit & Verification<br>• Ongoing Effectiveness Tracking<br>• Causality Research | ED | ED_O_ME&O_6 | $650,000 | Complete | April 2016 |
| ***Statewide V&E Subtotal*** | | | ***$874,000*** | | |
| **Cross-Cutting Process** | | | | | |
| Cross-Cutting Process Study | | | | | |
| • Upfront Review of Past SW Research | ED | ED_O_ME&O_4<br>ED_O_ME&O_5 | $50,000 | Complete | January 2015 |
| • Start-Up Background Research and Scoping | | | $50,000 | Complete | July 2015 |
| • Cross-Cutting Process Assessment | | | $800,000 | Underway | November 2016 |
| ***Cross-Cutting Sub-Total*** | | | ***$900,000*** | | |
| **Climate Credit** | | | | | |
| Climate Credit Study | ED | ED_O_ME&O_3 | $100,000 | Complete | September 2014 |
| ***Climate Credit Sub-Total*** | | | ***$100,000*** | | |
| **Finance ME&O** | | | | | |
| Finance ME&O | ED | ED_O_ME&O_7 | $402,000 | Underway | 2017 |
| ***Finance Sub-Total*** | | | ***$402,000*** | | |
| **Coordination** | | | | | |
| Ongoing Coordination and Consulting | ED | ED_O_ME&O_3 | $75,000 | Complete | September 2014 |

| Study Area/Title | Study Manager | Work Order | Budget | Status | Completion Date |
|---|---|---|---|---|---|
| ***Coordination Sub-Total*** | | | ***$75,000*** | | |
| ***Total ME&O Budget**** | | | ***$2,400,000*** | | |
| **ME&O Studies Funded by Other Roadmaps** | | | | | |
| Aliso Canyon ME&O | ED | ED_D_Mkt_8 | $310,000 | Underway | Q1 2017 |

*Note that some funding (<10%) is also being held back for general administration, support and consulting services.

### 2.13.6. 2013-2015 Study Descriptions

Below are descriptions for each of the 2013-15 studies, which include the key research questions that were addressed, and thel EM&V methods that were utilized.

| | |
|---|---|
| **Study Title:** Early Coordination and Consulting on PPMs and Measurement Designs | **Budget:** $49,000 |
| **Completion Date:** February 2014 | **Study Manager:** (ED) |
| **Description:** This budget was used by the CPUC for early start-up and planning, as well as coordination with CSE and Lowe-Campbell Ewald. | |
| **Objective:** Build a strong foundation for evaluation by ensuring that the evaluation team is included early in the process of Statewide program development. | |
| **Key Research Questions:**<br>• What are the key research questions of interest to the CPUC?<br>• Who are the key staff members at CSE and their partner agencies responsible for implementing the ME&O efforts?<br>• What ME&O activities are planned for the first six months of the 2014 campaign?<br>• What are the challenges for evaluating the proposed Program Performance Metrics (PPMs) for Statewide ME&O? | |
| **EM&V Methods:** N/A | |

| | |
|---|---|
| **Study Title:** Baseline Study and Initial Data Collection | **Budget:** $175,000 |
| **Completion Date:** September 2014 | **Study Manager:** (ED) |
| **Description:** This research was conducted in two phases. There was an initial study (2a) to determine if Energy Upgrade CA awareness had changed prior to the March 2014 launch of the Climate Credit campaign, which used Energy Upgrade CA visuals and messaging. The second phase of the study (2b) will involve additional data collection to get early measurements of the final Statewide ME&O PPMs. | |

| **Study Title:** Baseline Study and Initial Data Collection | **Budget:** $175,000 |
|---|---|
| Phase 2b would occur after finalization of the metrics. | |
| **Objective:** To gather initial information related to the statewide campaign metrics. | |
| **Key Research Questions:**<br>Phase 2a:<br>• What is awareness of Energy Upgrade CA?<br>• What do customers associate with Energy Upgrade CA?<br>• Are CA residents aware of the state's policies to combat climate change?<br>• What are the barriers to taking energy efficient actions?<br>• What websites or sources of information are customers utilizing?<br>Phase 2b:<br>• What are the initial measurements for the final PPMs? | |
| **EM&V Methods:** Internet and telephone surveys, secondary research, collaborative efforts with implementers (e.g., web analytics collected by implementers, tapping into implementer-collected data) | |
| **High Level Findings:** See the Climate Credit Study description below. | |

| **Study Title:** SW ME&O Verification and Integrated Effectiveness<br>(CALMAC Study ID: CPU0110.02 ) | **Budget:** $650,000 |
|---|---|
| **Completion Date:** April 2016 | **Study Manager:** (ED) |
| **Description:** This is a multi-phase study that includes verification, as well as ongoing tracking of effectiveness across statewide ME&O efforts. The early phase (3a) provides a descriptive snapshot of program activities compared to objectives described in the marketing plans, as well as Decision (D. 13-12-038), and will primarily serve as a documentation effort. The later phases (3b and 3c) will include measurement of performance against the finalized PPMs and the nine objectives listed in D. 13-12-038. This will also include an assessment of the causal link between the statewide efforts and key ME&O metrics to the extent possible. | |
| **Objective:** Phase 3a: To document ME&O activities in comparison to the program's objectives and metrics. Phase 3b and 3c: To monitor the effectiveness of statewide ME&O efforts. | |
| **Key Research Questions:**<br>Phase 3A:<br>• What ME&O activities have been carried out for residential and small business customers? What messages and channels were used to reach California residents? | |

| **Study Title:** SW ME&O Verification and Integrated Effectiveness<br><br>(CALMAC Study ID: CPU0110.02 ) | **Budget:** $650,000 |
|---|---|

- How are key audiences identified and targeted?
- Do the marketing activities and plans align with the program objectives?
- What are the resources and tools promoted through SW ME&O?
- What benefits to program participation is SW ME&O communicating to customers?
- What did SW ME&O efforts tell customers about how to get information about programs, and how to participate?
- How were the marketing tactics (messages and channels) selected?
- What has the SW ME&O campaign messaging and approach offered that is unique or "differentiating" in this crowded space?
- SW ME&O is just one source of energy information for California residents. They also receive information from brands like Energy Star, as well as retailers, manufacturers, contractors, other service providers, and other ME&O. Does this confluence or duplication of messengers confuse or motivate Californians? Which audiences are more likely to act due to SW ME&O messaging? Or due to multiple messengers (ex. IOU and SW ME&O)?

What is the reach of statewide ME&O activities? Phases 3B and 3C:

- Do we see change in the key ME&O metrics over time? What effect does SW ME&O have on the target market in terms of customer awareness or attitudes about marketed issues?
- Are customers using the resources and tools promoted through SW ME&O?
- What do consumers perceive as the benefits of taking actions promoted through SW ME&O?
- Do consumers understand where to get additional information about energy management actions and behaviors?
- Do consumers find the information provided through SW ME&O useful and actionable?
- Among customers who are aware of Energy Upgrade California, to what extent do they view the brand as trusted "voice" about energy and energy usage in the marketplace? Do these customers think of Energy Upgrade California as a "go to" source of information?
- Are customers who are exposed different in terms of key metrics such as awareness, intent to take action, etc.?

**EM&V Methods:** Internet panel survey and telephone surveys (across languages and res/small commercial), focus groups, observations, secondary data analysis.

**High Level Results:** Overall, the findings from this study provide a mixed picture of SW ME&O effectiveness. In terms of the formal program performance metrics established for the 2014-2015 period, the program administrator, the Center for Sustainable Energy (CSE), achieved four of the five metrics for which they are directly responsible. These metrics include both quantifiable targets and process outcomes designed to ensure a collaborative SW ME&O process. Beyond the performance metrics, Opinion Dynamics found low levels of unaided brand awareness, increasing knowledge and familiarity with the brand, and moderate levels of energy self-efficacy. Additionally, a deeper analysis of consumer engagement with and actions taken due to the program suggests that its effects on behavior are limited. In particular, Opinion Dynamics found that consumers had greater recall of retail and mobile outreach events compared with Community-Based Organization (CBO) events and took a

| **Study Title:** SW ME&O Verification and Integrated Effectiveness<br><br>(CALMAC Study ID: CPU0110.02 ) | **Budget:** $650,000 |
|---|---|
| greater number of actions because of those engagements than those who engaged with CBOs. Collectively, these findings suggest that the retail and mobile channels have been more effective than CBOs in catalyzing changes in behavior. | |

| **Study Title:** Cross-Cutting Process Evaluation | **Budget: $**900,000 |
|---|---|
| **Expected Completion Date:** November 2016 | **Study Manager:** (ED) |
| **Description:** This is a multi-phase study effort designed to provide recommendations and feedback for ME&O efforts conducted by CSE, the IOUs and RENs. The initial phases involve the review of past research on statewide marketing to understand lessons learned and past recommendations for improvement, including development of a program theory and logic model. Later phases will focus on documenting how ME&O activities are designed and implemented, how well efforts are going on a tactical level, the review of brand positioning and program pathways, an assessment of consumer perspectives, and an assessment of coordination across statewide and IOU/REN efforts. | |
| **Objective:** To document processes, understand customer engagement, and look at issues around coordination of ME&O implementation between various groups. | |
| **Key Research Questions:** Examples of the detailed research questions for this study include the following. Note that unless otherwise noted all questions will be asked about SW, IOU and REN efforts.<br><br>• What past research has been done on or is relevant to SW ME&O? What lessons can be learned from these studies for ME&O design and implementation?<br>• What recommendations have been made and how have they been addressed by the current SW ME&O implementer?<br>• What is the program theory behind SW ME&O? What are the activities and outcomes envisioned by the program?<br>• How is the SW program designed? What is the governance structure? Who is involved with program implementation?<br>• What ME&O activities have been carried out for target audiences? What was their purpose and strategy? What tactics/tools were utilized?<br>• How well is coordination occurring between CSE, and its sub-contractors and tactical partners (i.e., marketing agencies, retail partners, grant recipients, CBOs etc.)?<br>• How well is coordination occurring between SW, IOUs and RENs on a tactical level where applicable?<br>• What do CSE, the IOUs and RENs track to assess the effectiveness of their activities?<br>• How do consumers engage with ME&O activities?<br>• Does the campaign resonate with consumers?<br>• Does their experience with statewide, IOUs or RENs increase their likelihood to take no-cost, low-cost actions? Does their experience with statewide, IOUs or RENs increase their | |

| **Study Title:** Cross-Cutting Process Evaluation | **Budget: $**900,000 |
|---|---|
| likelihood to participate in programs?<br>• Have the ME&O efforts been implemented as planned? If not, how has it differed and why? | |
| **EM&V Methods:** Meetings with CSE and IOUs, focus groups, customer surveys or in-depth interviews, program material review, customer observations. | |
| **High Level Results:** The evaluation team found that coordination has improved over time, including increased two-way communication, more collaborative quarterly stakeholder meetings, and earlier opportunities to provide feedback on creative materials. Stakeholders, however, continue to identify challenges that need to be overcome moving forward. The PAs develop and track a variety of program- and channel-specific metrics to assess the effectiveness of their activities. However, while all PAs indicate that they develop marketing plans as a key step in determining what ME&O activities to conduct, we found that their availability, the timing of their development, and their content varies across PAs, programs, and program cycles. Overall, our assessment indicates that the PA marketing campaigns appear to be achieving or on track to achieve their campaign objectives, such as increasing awareness of programs, providing clear messaging, and motivating energy savings actions. | |

| **Study Title:** Climate Credit Study<br><br>(CALMAC Study ID: CPU0110.01) | **Budget:** $100,000 |
|---|---|
| **Completion Date:** September 2014 | **Study Manager:** (ED) |
| **Description:** Follow up study to assess awareness of the Climate Credit initiative | |
| **Objective:** To assess the effectiveness of early ME&O efforts related to the California Climate Credit | |
| **Key Research Questions:**<br><br>What percentage of the target population is aware of the Climate Credit?<br><br>• What percentage of the target population recalls receiving the Climate Credit?<br>• What percentage of the target population understands why they received the credit?<br>• What percentage of the target population knows that the State is providing the credit?<br>• Did receiving the climate credit motivate the target population to take actions to save energy in their homes? Did it motivate them to seek additional information about it? | |
| **EM&V Methods:** Internet surveys in English and telephone surveys for non-English speakers. | |
| **High Level Findings:** Opinion Dynamics conducted a survey with 1,083 California residents who were eligible to receive the Climate Credit between April 30 and June 19, 2014. Approximately two out of five California residents recalled receiving a credit on their April electric bill (43%). Most of these residents did not know why they received a credit (74%). When asked directly, approximately one-quarter of Californians had heard about the Climate Credit (27%). Just over one-quarter of those who had heard of the Climate Credit knew that the state of California provided the credit (28%). Slightly | |

| **Study Title:** Climate Credit Study<br><br>(CALMAC Study ID: CPU0110.01) | **Budget:** $100,000 |
|---|---|
| under one in five correctly identified the purpose of the Climate Credit as encouraging Californians to save energy (17%). Nearly half of those who were aware of the Credit said that it motivated them to save energy (49%). Nearly two-thirds of Californians are aware that the state has policies to fight climate change, but few can name a specific policy. | |

| **Study Title:** Finance ME&O Study | **Budget:** $402,000 |
|---|---|
| **Expected Completion Date:** Q4 2017 | **Study Manager:** ED |
| **Description:** This study will focus on research surrounding the marketing efforts of the Statewide Financing pilots that will roll out in 2016. Specifically, this study will look both at process issues across all stakeholders, as well as the effectiveness of the marketing efforts. We anticipate that this study would focus on marketing efforts across all parties including marketing by CSE, IOUs/RENs, CAEATFA and the strategic partners. | |
| **Objective:** To gather insights that will: help improve messaging related to the finance programs; assess the "market facilitation" approach; help refine the processes, channels and tactics used for marketing Statewide finance efforts; and ultimately help improve ME&O efforts overall so that they better support increased uptake of financing of energy efficiency projects. | |
| **Key Research Questions:**<br>*The evaluation team will work with the CPUC to develop the key research questions as the marketing efforts develop, but they may revolve around the following:*<br>**Documentation and Verification:**<br>• Document and assess the implementation process, program structure, program goals and program tracking records.<br>• How much money was spent on marketing finance programs? Was it well spent? Were the tools and tactics used the right ones? Were the marketing efforts directed towards the appropriate stakeholders?<br>• *Do the marketing activities align with the finance program objectives? Do they consider the full range of market actors including contractors, real estate professionals, lenders, retailers and CBO's to evaluate which can best support the pilots?<br>• Which channels best support the pilots?<br>• Which mediums best support the pilots? (CBOs, website, video marketing, etc.)?<br>**Coordination/Roles:**<br>• How did the various parties coordinate the marketing of the finance programs? How could this coordination be improved?<br>• What role do the IOUs play and how well are they fulfilling that role? If and how are the IOUs duplicating, complementing or competing efforts?<br>**Strategic Partners/Contractors:**<br>• *Did strategic partner awareness and understanding of financing pilot opportunities increase?<br>• *Did strategic partners communications with target customers (aka potential borrowers) increase?<br>• How many contractors were touched through the marketing? Do they understand the efforts? Do they feel that the marketing support was valuable? | |

| **Study Title:** Finance ME&O Study | **Budget:** $402,000 |
|---|---|
| • Is the training of contractors effective? How can it be improved?<br>• Did the contractors change their messaging? Do contractors believe that the marketing helped to increase the number of jobs or the size of jobs?<br>• What is working to engage partners/contractors? What is not working? (as close to real-time feedback as possible)<br>• Is the market facilitation approach, i.e. focus on partners and contractors, an effective approach to marketing finance options to customers?<br>**Strategic Partners/Financial Institutions:**<br>• *Did strategic partner awareness and understanding of financing pilot opportunities increase?<br>• *Did strategic partners communications with target customers (aka potential borrowers) increase?<br>• Are Financial Institutions able to use the marketing materials to promote their loan products?<br>**Consumers (residential):**<br>• Was the messaging on point for the audience?<br>• How effective is the marketing in addressing the first cost barrier?<br>• How do consumers respond to the marketing materials? How receptive are they to the messaging? Does the messaging address / help decrease consumers specific barriers?<br>• *Did target customer awareness of the availability of financing and the key differentiating benefits of the financing pilots increase? Where did it increase or amongst whom?<br>• Did customers move beyond awareness to early action?<br>• Is there any evidence of increased program participation/uptake due to the marketing efforts? Which groups or segments? (indicators: % of participants that heard about financing from various channels, motivations to participate in financing)<br>• *Did the volume of target customers taking initial action to seek financing increase?<br>• Is the concierge system needed? If so, for whom and why?<br>*Indicates that this is a measurement of one of the three stated objectives for the finance ME&O efforts (per the January 2015 plan). | |
| **Potential EM&V Methods:** Focus groups, 1-on-1 interviews, training observations, surveys, contractor interviews, web survey, panel, marketing collateral review/content analysis, web statistics, best practice research. All survey efforts will be coordinated with other surveys where possible. | |

| **Study Title:** Ongoing Coordination and Consulting | **Budget:** $75,000 |
|---|---|
| **Completion Date:** September 2014 | **Study Manager:** (ED) |
| **Description:** Ensure ongoing communications through the PCG. Ad hoc consulting as needed. Monitoring of Statewide and IOU/REN program efforts. | |
| **Objective:** Coordination and consulting. | |
| **Key Research Questions:** N/A | |
| **Potential EM&V Methods:** N/A | |
| **Study Title:** Aliso Canyon Effectiveness Study | **Budget: $**310,000 |

| **Study Title:** Ongoing Coordination and Consulting | **Budget:** $75,000 |
|---|---|
| **Expected Completion Date:** Q1 2017 | **Study Manager:** (ED) |
| **Description:** This study is designed to verify Southern California Gas Company (SoCalGas) ME&O efforts, as well as Flex Alerts, and to assess the effectiveness of these activities in terms of catalyzing energy usage reductions in the Los Angeles Basin. | |
| **Objective:** This study has two main objectives: (1) to audit and verify Aliso Canyon ME&O activities and (2) to asses Aliso Canyon ME&O effectiveness. | |
| **Key Research Questions:** Research questions for this study include the following:<br>• What Aliso Canyon ME&O activities were implemented?<br>• What audiences were identified and targeted with Aliso Canyon ME&O activities?<br>• What channels were utilized to reach the Aliso Canyon target market?<br>• What messages and calls to action were utilized in the campaign?<br>• Do the ME&O activities and plans align with the CPUC's direction?<br>• Can users effectively navigate the microsite www.ConserveEnergySoCal.com?<br>• How effective is each channel in reaching the target audience(s)?<br>• How effective were the messaging and calls to action in engaging customers?<br>• What are the demand reduction impacts associated with Flex Alerts?<br>• Overall, was the investment in additional ME&O and Flex Alerts successful in increasing consumer conservation of both gas and electricity? | |
| **EM&V Methods:** Secondary research, stakeholder in-depth interviews, a web usability study, a split panel survey, billing analysis, and participation in Advisory Group meetings. | |

### 2.13.7. Key Research Questions for 2016 and Beyond

Proposed 2016 Energy Division Budget: **$920,000(D.15-08-033)**
**Proposed 2017 – 2016 Energy Division budget – $2,760,000 (D.16-03-039)**
*Program administrators do not have any proposed studies or budgets for this sector.*

The next round of funding of evaluations for ME&O have not yet been authorized by the Commission. When these funds are approved this evaluation roadmap will be updated.

Research issues that may be considered include:

| Study Title: **Process Evaluation for Post-2016 Transition and Planning** | **Budget:** TBD |
|---|---|
| **Expected Completion Date:** Q4 2017 | **Study Manager:** ED |
| **Description:** In October, 2015, the Commission issued a scoping memo for Phase 3 of R.13-11-005 regarding the future of ME&O after the end of its 2016 year of bridge funding. The memo calls for a competitive RFP to be issued in order to solicit a program implementer for 2017 and beyond. The | |

| Study Title: **Process Evaluation for Post-2016 Transition and Planning** | **Budget:** TBD |
|---|---|

scoping memo asks stakeholders to respond to questions regarding the future vision, purpose, strategy, and budget for ME&O, among other things.

In April, 2016, the Commission outlined a competitive process to select an ME&O implementer for 2017 and beyond. The Commission also spelled out a planning process which includes a 5 year integrated ME&O roadmap, "To improve longer term planning and coordination, after the utilities file their energy efficiency business plans in R.13-11-005, all stakeholders in this proceeding should collaborate in a process to develop a five-year 'ME&O Strategic Roadmap' that will outline long-term goals, metrics, and strategies, with consideration of what contribution ME&O will play in complying with Senate Bill (SB) 350. Commission staff shall lead this process. The roadmap should incorporate demand response ME&O objectives from R.13-09-011 as well as the strategic action plan for residential rate reform ME&O developed in R.12-06-013."

The Commission also outlined additional 1-year joint consumer engagement action plans to carry out the vision spelled out in the 5 year roadmap.

**Objective:**

The RFP process is now complete, and the new vendor, DDB, is on contract as of October 1, 2016. Energy Division proposes a process evaluation for this transition and planning period, from the RFP process to the transition from the current direction of EUC to whatever new direction is decided by the Commission in 2017.

**Key Research Questions:**
*The evaluation team will work with the CPUC to develop the key research questions as the marketing efforts develop, but they may revolve around the following:*

- The RFP process as a case study in bringing a diverse group of stakeholders into an RFP process.
- The transition of Energy Upgrade California from CSE to DDB as a case study in future transitions.
- The 5-year and 1-year planning process: The CPUC has ordered DDB to work with stakeholders to develop a 5-year integrated ME&O roadmap, and a 1-year consumer engagement action plan. The CPUC ordered this process to be informed by the cross cutting ME&O evaluation. This evaluation would examine that process.
- The level and quality of integration and leveraging of resources between Energy Upgrade California and the program administrators. The CPUC has ordered integration of statewide marketing with PA marketing, and the leveraging of all ME&O resources for both. What are the lessons learned from this process?
- How are the 10-year business plans for energy efficiency addressing integration with statewide ME&O?

| Study Title: **Process Evaluation for Post-2016 Transition and Planning** | **Budget:** TBD |
|---|---|
| **Potential EM&V Methods:** TBD | |

| Study Title: **Interaction of Energy Efficiency and Demand Side Marketing with Recent Residential Rate Reform Decision (D.15-07-001)** | **Budget:** TBD |
|---|---|
| **Expected Completion Date:** Q4 2019 | **Study Manager:** ED |

**Description:** In July, 2015, the CPUC adopted D.15-07-001 in the residential rate reform proceeding that requires the IOUs to increase customer understanding of their bills generally, the changes to retail rates made by the decision, as well as the customer's specific rate plan and plan options. The decision also called for co-marketing to be employed in order to leverage existing IOU ME&O programs for the benefit of rate reform education.

Per Commission direction, the IOUs are transitioning to new energy rate tiers which are having the biggest impact on low-income users as well as on "super-users", or those who use greater than 400 percent of average baseline consumption in a month. In addition, the utilities are offering a greater selection of Time of Use rate packages, which will expand in coming years. The utilities, as well as CSE, are currently marketing these rate changes to ratepayers, and will continue to in 2016

Energy Division hired Greenberg to produce an extensive report with recommendations on how to communicate these changes to Californians as well as how to align and integrate the various ME&O efforts.

**Objective:** Improved customer understanding of retail rates and the rate plans that determine a customer's final bill can be a critical element in increasing voluntary uptake of energy efficiency measures. Therefore, the rate reform effort is inextricably connected to energy efficiency. The rate reform decision made changes to the structure of retail rates that makes average bills higher for low energy users even if they do not increase their usage. In effect, the recent decision automatically lowered – in some cases substantially – the payback period for energy efficient technology. For these reasons, it is appropriate to include residential rate reform messaging in residential EE ME&O and measure the effectiveness of the same.

**Key Research Questions:**
Explicit co-marketing of rate reform with residential EE ME&O should be pursued to increase customer awareness of the new avoided cost incentives for EE technology. Therefore, key areas of research include: 1) measuring the extent to which co-marketing is occurring, 2) whether such co-marketing has the effect of increasing awareness and understanding of rate reform, and 3) whether that improved awareness and understanding increases voluntary take-up of EE technology.

The call to action for much of this marketing is both to change behavior and to take measures and install equipment in homes and businesses to use energy more efficiently. Energy Division proposes an additional study that will examine the effectiveness of the marketing, and measure the utilities progress in meeting the approved metrics.

| Study Title: **Interaction of Energy Efficiency and Demand Side Marketing with Recent Residential Rate Reform Decision (D.15-07-001)** | **Budget:** TBD |
|---|---|
| **Potential EM&V Methods:** TBD | |

| Study Title: **Cross Cutting Marketing Effectiveness Study** | **Budget:** TBD |
|---|---|
| **Expected Completion Date:** Q4 2019 | **Study Manager:** ED |

**Description:** In September 2016, the CPUC selected a new SW ME&O implementer, DDB. While it is not yet clear how DDB will approach design and implementation of the SW ME&O Program, it is critical that the CPUC understand the impact that ratepayer funding for this program is having on California residents and their knowledge of, as well as likelihood to take energy saving actions.

**Objective:** To evaluate the interaction of statewide and PA marketing and their effectiveness in leading consumers to take actions. In particular, this study may include the following components:

1. Effectiveness Assessment: This component is intended to assess the effectiveness of the SW ME&O Program in meeting its stated objectives and program performance metrics. This study would provide information on how the program is performing, as well as whether and how performance changes over time. In addition, if of interest to the CPUC, this study could go beyond the current objectives of the program to assess its energy savings impacts.
2. Collaborative Process Assessment: The CPUC's proposed ME&O Strategic Roadmap and Joint Consumer Action Plan will require significant ongoing coordination between key ME&O stakeholders. While coordination increased over the 2014-2016 program period, it is unclear how the collaborative process will be structured going forward. Given the importance of coordination to the successful implementation of SW ME&O and the potential changes to this process based on lessons learned, as well as evaluation results, we suggest a study to assess the effectiveness of the collaborative process instituted in the next program cycle to determine whether stakeholders have been able to move beyond holding meetings to truly collaborating on the next phase of this program.
3. ME&O Delphi Study: The 2013-2015 ME&O evaluations revealed that the SW ME&O implementer and IOU/REN program administrators (PAs) used a wide range of different strategies to measure the performance of their marketing efforts. In particular, as documented in the most recent evaluation studies, there were differences in the type of metrics and success criteria used to assess ME&O effectiveness. The evaluation studies also revealed a lack of established benchmarks in the energy efficiency industry for marketing effectiveness (i.e., what is a good click-through-rate for email communications or what level of program awareness should be considered low, medium or high). As a result, we suggest a Delphi study to establish consensus around benchmarks related to ME&O metrics and success criteria in the energy efficiency industry. By developing and deploying an expert panel of marketing experts from utilities, as well as other industries, this study can help to create a

| Study Title: **Cross Cutting Marketing Effectiveness Study** | **Budget:** TBD |
|---|---|
| framework for assessment of ME&O efforts in California going forward. | |
| Key Research Questions:<br><br>Interaction with Recent Legislation: The California legislature continues to pass legislation for new programs and technologies that are reliant on ME&O for their success. For instance, AB 793 requires the utilities to market energy monitoring devices to customers.<br><br>How did stakeholders identify a workable lead generation process? How are leads transferred, tracked etc.?<br><br>How many leads have been generated? How many adopted DSM actions and/or enrolled in programs/services?<br><br>Do we see changes in key ME&O metrics over time? What effect does SW ME&O have on the target audience in terms of awareness, recall and actions taken? | |
| **Potential EM&V Methods:** TBD, but may include customer surveys, Delphi panel, in-depth interviews | |

# 2.14. Workforce Education and Training

## 2.14.1. Background

### Sector or Program Area Description

The Statewide IOU Workforce Education and Training (WE&T) Program represents a portfolio of education, training, and workforce development planning and implementation activities. Education and training are integral in supporting the achievement of IOU energy savings targets and the workforce objectives set forth in the California Long-Term Energy Efficiency Strategic Plan (Strategic Plan). Workforce Education and Training has become an important crosscutting activity for the IOUs in an effort to not only educate and train current workers, but to prepare future workers to be better able to successfully perform the jobs needed to help achieve increased energy savings targets for the IOUs and California's clean energy goals.

The Strategic Plan, Workforce Education and Training Chapter has outlined the following goals:

1. Establish energy efficiency (EE) education and training at all levels of California's educational systems
2. Ensure that minority, low income and disadvantaged communities fully participate in training and education programs at all levels of the DSM and energy efficiency industry.

#### *WE&T Program Overview*

The Statewide IOU WE&T Program includes three pivotal Sub-Programs that form an integrated and cohesive structure for implementing WE&T curriculum and related activities in support of IOU energy savings targets and the long-term strategic goals.

The WE&T program consists of three Sub-Programs:

- WE&T Centergies Sub-Program
- WE&T Connections Sub-Program
- WE&T Planning Sub-Program

1. ***The WE&T Centergies Sub-Program*** consists of seven Energy Centers through the IOUs' service territories and is generally organized around market sectors and cross-cutting segments to facilitate workforce education and training appropriate for achieving the energy savings, demand reductions and related energy initiatives required of the IOUs through the Energy Centers. Through this program, IOUs offer classes, seminars, building performance measurement equipment and displays to educate and promote awareness of Demand Side Management (DSM) to facilitate development of a skilled workforce knowledgeable about saving energy. The Energy Centers serve as a "public face" and conduit to California utilities' local and statewide energy efficiency programs. The centers leverage IOU and industry resources to address gaps in the workforce landscape and identify new or successful local and regional workforce training models that can be migrated across the state and to underserved areas via IOU implementation or IOU administration of third-party sponsored implementation. The centers target building professionals, offer general knowledge courses and are expanding their offering of sector-specific courses and training aimed at improving energy efficient practices with key industry sectors (e.g. Building Owner Certification (BOC), LEED, and others). The Energy Centers also draw from the educational sector for resources and training to help achieve

market transformation toward a green workforce. The Energy Centers represent the largest component of this Sub-Program and provide WE&T curriculum and related deliverables—training courses, seminars, workshops, clean energy technology demonstrations, equipment efficiency testing, interactive training exhibits and lectures—to promote industry trends and developments for advancing energy efficiency as a professional discipline.

2. ***The WE&T Connections Sub-Program*** is organized around downstream and upstream relationships between the IOUs and the educational sector, entry and intro-level community-based training efforts that support workforce development in energy efficiency, energy management, and new emerging green careers. The Connections programs are curriculum- and education-driven programs offered to K-12 and post-secondary school agencies to facilitate interest in green careers. According to the program theory offered by the IOUs, WE&T Connections addresses lost opportunities in the school market by implementing a comprehensive, innovative approach that involves incorporating some of the nation's leading energy education programs. These programs are designed to:
    i. Promote green careers through energy and environmental curriculum,
    ii. Educate students on energy, water, renewable energy, demand response, distributed generation as well as greenhouse gases and impact to the environment with the goal of influencing day-to-day decisions of students and their households, and,
    iii. Educate schools/facilities on the benefits of implementing energy efficiency policies and demand response programs at their sites to impact energy use in schools and universities and to project energy and environmental leadership by example.

3. ***The WE&T Planning Sub-Program*** involves the management and execution of several strategic statewide planning tasks and resulting project implementation actions initiated by the Strategic Plan and CPUC guidance.

The WE&T program structure essentially remains the same for the 2013-2014 program cycle. However, the program focuses have evolved due to implementation of the California Workforce Education & Training Needs Assessment (WE&T Need Assessment) findings, sector strategies and additional CPUC requirements.

In 2013, at the direction of the CPUC, the statewide WE&T program team hired the Donald Vial Center for Labor in the Green Economy (DVC) to develop a comprehensive approach to WE&T for the EE programs, in line with the goals in the Strategic Plan and the Needs Assessment recommendations.[68] On May 2, 2014, DVC finalized its recommendations in the document *Workforce Issues and Energy Efficiency Programs: A Plan for California's Utilities* (Guidance Plan). In June 2015, the CPUC approved a joint IOU compliance advice letter and Program Implementation Plan (PIP) Addendum, describing which of the Guidance Plan recommendations would be initiated in 2015.[69]

[68] D.12-11-015, Ordering Paragraph 34.

[69] PG&E 3567-G/4592-E, SDG&E 2705-E/2361-G, SCE 3179-E, SCG 4765 G

## Programs included in the Research Scope

***Table 49. 2013-2014 WE&T Savings and Budget Summary***

| IOU | Program Name | kWh | kW | Therms | Budget |
|---|---|---|---|---|---|
| SCE | WE&T | 163,763 35* | 35 | | $18,438,000 |
| PG&E | WE&T | 0 | | | $23,600,214 |
| SDG&E | WE&T | 0 | | | $11,071,742 |
| SCG | WE&T | 0 | | | $6,154,553 |
| | **Total Statewide** | **7,493,281** | **3,048** | | **$63,491,355** |
| | % of Statewide Portfolio | 0.5% | 0.2% | | 3% |

***Table 50. 2015 WE&T Savings and Budget Summary***

| IOU | Program Name | kWh | kW | Therms | Budget |
|---|---|---|---|---|---|
| SCE | WE&T | 964,345 | 162 | 0 | $9,164,656 |
| PG&E | WE&T | 0 | 0 | 0 | $12,561,342 |
| SDG&E | WE&T | 0 | 0 | 0 | $5,494,244 |
| SCG | WE&T | 0 | 0 | 0 | $3,128,997 |
| | **Total Statewide** | **964,345** | **162** | **0** | **$30,349,245** |

For 2016, the WE&T program budgets are authorized at the 2015 levels[70], and the statewide program will be primarily non-resource for all IOUs. *SCE WE&T claimed some savings for the LivingWise program in the past, however, this program was discontinued in June 2016.

***Table 51. 2015 WE&T Budget Breakdown by Sub-Programs***

| | 2015 Program Cycle | Budget | Budget% |
|---|---|---|---|
| **SCE** | | | |
| | WE&T Centergies | $5,614,128 | 61% |
| | WE&T Connections | $3,426,167 | 38% |
| | WE&T Planning | $124,361 | 1% |
| **SCE Total** | | **$9,164,656** | **100%** |
| % of Statewide WE&T Program Total | | 30% | |
| **PG&E** | | | |
| | WE&T Centergies | $ 9,721,801 | 77% |
| | WE&T Connections | $ 2,150,604 | 17% |
| | WE&T Planning | $ 688,937 | 5% |
| **PG&E Total** | | **$12,561,342** | **100%** |
| % of Statewide WE&T Program Total | | 41% | |
| **SDG&E** | | | |
| | WE&T Centergies | $4,672,808 | 85% |
| | WE&T Connections | $774,065 | 14% |

[70] D.14-10-046, pp. 31-32

| | 2015 Program Cycle | Budget | Budget% |
|---|---|---|---|
| | WE&T Planning | $48,371 | 1% |
| **SDG&E Total** | | **$5,494,244** | **100%** |
| % of Statewide WE&T Program Total | | 18% | |
| **SCG** | | | |
| | WE&T Centergies | $2,548,697 | 81% |
| | WE&T Connections | $429,952 | 14% |
| | WE&T Planning | $150,348 | 5% |
| **SCG Total** | | **$3,128,997** | **100%** |
| % of Statewide WE&T Program Total | | 10% | |

***Table 75. 2016 WE&T Savings and Budget Summary***

| IOU | Program Name | kWh | kW | Therms | Budget |
|---|---|---|---|---|---|
| SCE | WE&T | 160,839 | 33 | 0 | $9,164,656 |
| PG&E | WE&T | 0 | 0 | 0 | $12,561,342 |
| SDG&E | WE&T | 0 | 0 | 0 | $4,929,864 |
| SCG | WE&T | 0 | 0 | 0 | $3,128,997 |
| | **Total Statewide** | **160,839** | **33** | **0** | **$29,784,859** |

For 2016, the WE&T program budgets are authorized at the 2015 levels[71], and the statewide program will be primarily non-resource for all IOUs. SCE WE&T claims savings for the LivingWise program.

***Table 76. 2016 WE&T Budget Breakdown by Sub-Programs***

| | 2016 Program Cycle | Budget | Budget% |
|---|---|---|---|
| **SCE** | | | |
| | WE&T Centergies | $5,614,128 | 61% |
| | WE&T Connections | $3,426,167 | 38% |
| | WE&T Planning | $124,361 | 1% |
| **SCE Total** | | **$9,164,656** | **100%** |
| % of Statewide WE&T Program Total | | 31% | |
| **PG&E** | | | |
| | WE&T Centergies | $ 9,721,801 | 77% |
| | WE&T Connections | $ 2,150,604 | 17% |
| | WE&T Planning | $ 688,937 | 5% |
| **PG&E Total** | | **$12,561,342** | **100%** |
| % of Statewide WE&T Program Total | | 42% | |
| **SDG&E** | | | |
| | WE&T Centergies | $4,066,030 | 85% |

[71] D.14-10-046, pp. 31-32

| | 2016 Program Cycle | Budget | Budget% |
|---|---|---|---|
| | WE&T Connections | $834,000 | 14% |
| | WE&T Planning | $29,834 | 1% |
| **SDG&E Total** | | **$4,929,864** | **100%** |
| % of Statewide WE&T Program Total | | 17% | |
| **SCG** | | | |
| | WE&T Centergies | $2,548,697 | 81% |
| | WE&T Connections | $429,952 | 14% |
| | WE&T Planning | $150,348 | 5% |
| **SCG Total** | | **$3,128,997** | **100%** |
| % of Statewide WE&T Program Total | | 11% | |

## Uncertainties and Challenges to Successful Implementation

Prefacing the '13-'14 studies areas, there were three essential data needs to support the WE&T initiatives:

1. Data needs to support implementation of findings from the "WE&T Needs Assessment" ordered in CPUC Decision 09-09-047, especially in the area of sector strategies (i.e., Lighting, HVAC, Whole House, etc.),
2. Data needs to support requirements specified by CPUC Decision 12-05-015 (i.e., EE programs) and 12-08-044 (i.e., Low-Income and Energy Savings Assistance (ESA) programs) to support workforce policy and program formulation strategy,
3. Data needs to support implementation of WE&T programs, especially in the area of energy savings realization and claims.

## WE&T Needs Assessment Study Findings Implementation Data Needs

The Strategic Plan directed the utilities to fund a WE&T Needs Assessment to study "critical workforce needs" and to pinpoint "opportunities to help identify and fulfill those needs through collaboration and fund sharing." The Needs Assessment was completed in March 2011 and examined these key areas:

- The impact of state and federal energy efficiency policies and programs on jobs and the labor market
- The need to improve the quality of the installation of energy efficiency equipment and materials in some sectors by developing and supporting a stable and professionalized workforce
- The need to coordinate and refocus the many pieces of the training system to incorporate new energy efficiency knowledge and skills, build on the strengths of state-certified apprenticeship programs, and build pipelines into good jobs for workers from disadvantaged communities

Following the Needs Assessment, the utilities filed an advice letter with the CPUC describing program changes that would be implemented to address the needs identified in the report. In October 2011, the CPUC approved the joint IOU advice letter, which included the following proposed program changes and activities:

***Table 52. WE&T Program Proposed Changes and Activities***

| | Needs Assessment Topic | IOU Proposal |
|---|---|---|

| | Needs Assessment Topic | IOU Proposal |
|---|---|---|
| 1. | Support Sector Strategies | Develop and initiate Sector Strategies, test some proven concepts and refine as needed |
| 2. | Collaborate with Construction Trades | Engage with workforce organizations |
| 3. | Support Credentials and Certifications | Seek best comprehension and retention strategy |
| 4. | Restructure Classes | Assess feasibility of longer courses and series |
| 5. | Support Curricula Development | IOUs have an advisory role; can advise on how best to make curricula accessible |
| 6. | Inclusion of Disadvantaged Workers | Facilitate relationships with Disadvantaged groups |
| 7. | Evaluation of Workforce Outcomes | Seek feasible metrics |
| 8. | Collaborate with Education | This is an existing aspect of the program's strategy |
| 9. | Career Education | Incorporate career exploration into programs |
| 10. | Evaluation of K-12 Programs | Collect non-specific student data from schools |

## CPUC Decision Data Needs

In May 2012, CPUC Decision 12-05-015 was published. In this Decision, the CPUC provided guidance on the needs of the Workforce Education and Training activities. More specifically, the IOUs were asked to implement specific program design and implementation activities to address sector-specific concerns for lighting, HVAC and other industries. Subsequent to this Decision, in the low-income proceeding, the ESAP Decision 12-08-0444 separately outlined the need to collect program contractor-specific information.

To support the data needs of both Decisions 12-05-015 and 12-08-0444, the statewide WE&T study roadmap needs to consider a few very specific and complex data collection and analysis needs. As outlined in the Decision—for HVAC quality installation, CALCTP-certified installations, and any other sector strategy-induced skill standards identified, the IOUs should pursue—

1. Data or estimation of the incremental customer cost, if any, of requiring skill standards;
2. Data or estimation of the average and range of permitting/compliance costs across permitting jurisdictions in the IOUs' service territories;
3. Data or estimation of impacts, if any, mandatory skill standards would have on program participation rates;
4. Data or estimates of the incremental energy savings and customer cost savings over the life of the equipment; and
5. Any other potential benefits associated with higher standards, such as fewer call-backs, lower frequency of customers over-riding control systems, lower life-cycle costs, and increased consumer uptake of measures based on higher quality and certainty."

The above needs are further summarized by the UC Berkeley Donald Vial Center. The WE&T study plan needs to include—

- Research on the costs and benefits of contractor qualification and worker skill standards; (i.e., work-quality and job-quality data),
- Research on the labor market characteristics and business environment of contractors participating in IOU resource programs, including wages, working conditions (including health and safety conditions), employee turnover rates and other factors.

## Senate Bill 350

SB350 also has some implications for the WE&T area. SB350 states that "The commission shall adopt, implement, and enforce a responsible contractor policy for use across all ratepayer-funded energy efficiency programs that involve installation or maintenance, or both installation and maintenance, by building contractors to ensure that retrofits meet high-quality performance standards and reduce energy savings lost or foregone due to poor-quality workmanship." The concept of a Responsible Contractor Policy was also addressed in the February 23, 2015 IOU Tier 2 Advice letter in compliance with Commission Decision (D.) 14-10-046.

## 2015-2016 WE&T Inclusion Research*

For 2015-2016, the statewide WE&T team sought to explore ways in which the program may further support "disadvantaged" workers in response to facilitating inclusion efforts.

The IOUs have knowledge and experience related to implementing a wide range of energy efficiency programs. To better align this expertise with support for disadvantaged workers, the IOUs examined the inclusion landscape as it relates to workforce development in the EE and low income energy efficiency sector. The work was expected to provide additional information on the implications of some of the recommendations from the Don Vial Center's May 2014 Guidance Plan in order to enable the IOUs to make more informed decisions related to implementing specific Guidance Plan recommendations.

The IOUs are exploring and researching the following:

(1) Examining the relationship between existing federal and state job classifications and the job descriptions of workers implementing the Energy Savings Assistance Program (i.e., Installation Technician/Specialists; Natural Gas Appliance Test (NGAT) Technicians; Energy Specialist/Program Representative/Residential Outreach Specialists; Inspectors)

(2) Identifying promising EE career pathways for disadvantaged workers which provide entry-level employment onramps as well as ongoing opportunities for advancement.

(3) Identifying viable inclusion implementers working in the IOUs' service territories who may be appropriate partners for inclusion work.

(4) Examining the functionality, reporting features, security and privacy features of two electronic certified payroll reporting and labor compliance systems (LCP Tracker and Elation) that may be considered as a resource to collect job and workforce data relevant to the implementation of select EE programs administered by the IOUs.

*This work was funded out of program budgets (not EM&V). The total budget for this work was $171,613. The results of this work were published in two different reports (1) "*Survey of Inclusion Workforce Landscape*" June 2016; (2) "*Online Data Reporting Systems Evaluation Report*", July 2016.

## 2.14.2. 2013-2015 WE&T EM&V Studies

The table below summarizes the 2013-2015 EM&V Studies that have been budgeted, some of which are in the process of being implemented and others are still in the planning stage. The table provides the study manager, work order under which the study is being conducted, the corresponding budget, implementation status and expected completion date for each study.

***Table 53. 2013-2015 WE&T EM&V Studies, Budgets, and Timing***

| 2013-2015 Study Area/Title | Study Manager (ED/IOU) | Work Order Number | 2013-2015 Budget | Completion Date |
|---|---|---|---|---|
| **Process** | | | | |
| 2013-2014 Statewide WE&T Program Theory | IOU | n/a | $110,000 | Completed in 2014 |
| Lighting Controls Training Assessment** | IOU | n/a | $127,008 | 2016 |
| WE&T Course Outcomes Study | IOU | n/a | $200,000 | 2017 |
| **Market and Impact/Indirect Impact** | | | | |
| 2013-2014 Workforce Market and Impact Evaluation Study, Phase 1-4* | ED | ED_0_WET_2 and ED_D_Res_19 | $550,000 | 2017 |
| Building Operator Certification in Multifamily Residential Market: Impact and Outcome Study | ED | ED_0_WET_3 | $250,000 | 2017 |
| Tool Lending Library Impact Study | ED | ED_0_WET_4 | $141,222 | 2017 |

*The 2013-2015, the total budget for market and impact includes the balance of WE&T funds (i.e., $100,000) also found in the Residential Study Roadmap.
**Study is co-funded through Lighting Innovation ($106,054) and WE&T ($20,954). This study was formerly named "Assessment of CALCTP and Lighting Contractor Training".

### 2.14.3. 2013-2015 Study Descriptions

Below are descriptions for each of the 2013-2015 studies, which include the key research questions that will be addressed, and the potential EM&V methods that will be utilized. Note that the CPUC has re-prioritized the research objectives in the 2013-2015 Workforce Market and Impact Evaluation Study. Phase 3 of that study has been re-scoped to explore gaps in the marketplace in light of developing a Responsible Contractor Policy, per SB350 guidance, instead of pursuing a study that captures the cost and benefit data specified in Decisions 12-05-015 and 12-08-0444. This study area was of stronger interest to the CPUC and IOUs due to methodology issues involved in attempting to quantify the costs and benefits of a specific training requirement or skill and the emergence of SB350. Note that the IOUs have re-prioritized their research needs and as a result have removed the two 2015 studies from the EM&V Plan. The IOU-led 2015 Job Task Analysis, Mapping, and Gap Identification Study was removed because it overlapped with a related project already underway by the WE&T program team. The IOU-led 2015 Centergies Job Quality Outcome Study was removed because studying how WE&T students are using course content, skills and information is of stronger interest to the IOUs than studying the workforce related outcomes of WE&T. The 2015 and 2016 statewide IOU EM&V budget of $200,000 will be utilized to conduct a new study titled, "WE&T Course Outcomes Study".

| **Study Title:** 2013-2014 Statewide WE&T Program Theory and Logic Model | **Budget:** $110,000 |
|---|---|
| **Expected Completion Date:** Completed in 2014 | **Study Manager:** IOU |
| **Description:** Focused study to update program theory and logic to reflect program changes in light of the Strategic Plan and Needs Assessment. The study reviewed all program data collection thus far and recommended improvements to ensure consistency across all Centers and to ensure data collection aligns with the program's theory and logic. | |
| **Objective:** To modify program theory and logic model to better align with the program's activities and goals. To improve data collection so that Centergies can show evidence of their program theory and goal achievement. | |
| **Key Research Questions:**<br>• What modifications are required to the WE&T Centergies' program theory to support the Strategic Plan and Needs Assessment?<br>• Is the data tracking system adequate to support the theory?<br>• What are the data tracking requirements? | |
| **Potential EM&V Methods:** Interviews, Analysis, Group Discussions. | |

| **Study Title**: Lighting Controls Training Assessment* | **Budget:** $127,008 |
|---|---|
| **Expected Completion Date:** 2016 | **Study Manager:** IOU |
| **Description:** This assessment aims to characterize CALCTP training in context with other lighting controls training options, with a focus on manufacturer-provided training. CALCTP training will be compared and contrasted with that of top manufacturers, resulting in findings and recommendations that will help determine the likelihood that CALCTP training supports increased energy savings in lighting projects compared to nonresidential lighting system installers who are not certified. | |
| Objective: Characterize and evaluate the CALCTP training; Characterize and evaluate manufacturer-offered controls training; Characterize general certification programs that include lighting controls training; Define "work quality" and "installation quality; Compare training experiences/outcomes between CALCTP and manufacturer-trained contractors | |
| **Key Researchable Questions:** See project scope for detailed research questions. | |
| **Potential EM&V Methods:** Training material review, depth interviews, analysis. | |

| **Study Title:** 2013-2015 WE&T Skill Standards for IOU Resource Programs Study | **Budget:** $550,000 |
|---|---|
| **Expected Completion Date:** Phase 1 and 2 are complete, Phase 3 is expected in 2017 | **Study Manager:** ED |
| **Description:** The research will take place in three phases. The first phase will focus on if and how to collect job quality data from programs in an indirect contracting relationship with customers. The second phase will focus a contractor skill/training market characterization. The third phase will explore market intelligence gaps as they relate to Contractor Policy. | |
| **Objective:** Gather further market intelligence regarding contractor skill and workforce condition requirements as they related to resource program participation requirements. | |
| **Key Researchable Questions:** Please refer to the detailed research plan for the comprehensive list of researchable questions by project phase. | |
| **Potential EM&V Methods:** Secondary research, depth interviews, Delphi panel. | |

| **Study Title:** WE&T Course Outcomes Study | **Budget:** $200,000 |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** IOU |
| **Description:**<br>Currently, most statewide WE&T Centergies courses gather post course evaluation information in the form of brief surveys that gather information about how students perceived the quality of the class, materials, and instructor(s). WE&T has historic studies showing the impact of their educational offerings, yet those studies are outdated. The IOUs are interested in updating these studies to better understand how the material or course impacted or were relevant to jobs following WE&T coursework, and aligning the results in concert with the Business Plans. This study will examine more about if and how course participation impacts and relates to participants jobs. It is anticipated that this study will provide insights on outcomes, that may include if and how students apply the skills and use the information they receive in WE&T courses. Knowing if students are applying the skills and/or using the information they received would be very useful in assessing the course content and in designing or redesigning future courses.<br><br>The IOUs will consider the WE&T program direction as outlined in the Business Plans in conjunction with the 2013-2014 WE&T Statewide Program Theory and Logic Model Study to provide insights into the design of this study. Multiple other potentially relevant studies including the SCE 2006-2008 Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program and 2009-2010 Education and Training and Outreach M&E study, and the 2000 PG&E Report on the Market Effects of the Energy Training Center Stockton, and some of the more recent 2013-15 studies will serve as resources for the development of the specific direction and potential key questions for this study.<br><br>In addition, the details of the methodology or approach for this study (e.g., level of courses considered; multiple sectors or types of courses examined, method for collecting the information etc.) have not been determined and will be based on a combination of factors including budgets, timing, and relevance to overall business plans and statewide needs. | |
| **Objective:** This study is intended to provide statewide WE&T program managers with information for understanding the nature and relevance of the courses offered and/or the relevance of current course | |

| **Study Title:** WE&T Course Outcomes Study | **Budget:** $200,000 |
|---|---|
| content, in order to better understand the benefits or potential benefits the courses can offer and/or to improve content of future courses, or for prioritizing types of courses and delivery methods. | |
| **Key Research Questions:**<br>• Why do students take the trainings?<br>• How are trainings relevant to their jobs?<br>• What specific information learned is translated into the workplace?<br>• Why was information not translated into the workplace?<br>• What role, if any, did the course have on their immediate role/job or their career opportunities?<br>• How are students using the information they receive in WE&T courses in their jobs?<br>• If students are not using course information, why not?<br>• What skills should WE&T be teaching to fill the gap? | |
| **Potential EM&V Methods:** Interviews, Analysis | |

| **Study Title:** Building Operator and BPI Certification in Multifamily Residential Market: Impact and Outcome Study | **Budget:** $250,000 |
|---|---|
| Expected Completion Date: 2017 | **Study Manager:** ED |
| Description: This study explores the outcomes of BOC and BPI training on residential multifamily properties. This study will build from the '10-'12 BOC impact evaluation by focusing on participants who manage residential multifamily properties. The previous study looked at all BOC participants together and was not able to explore the nuances across the varying sectors that receive training including, but not limited to, schools, universities, military, office space and multifamily residential. This study will explore the multifamily market and may identify another sector for the deeper dive. To produce a large enough study group, we will focus the study on MF property manager participants who received BOC training in CA in 2013, 2014 and 2015. This study will also include all participants who received BPI Multifamily training in CA in 2013-2015. | |
| **Objective:**<br>• Quantify the savings potential in multifamily properties from the training.<br>• Explore the issues involved in Operations and Maintenance in the multifamily market | |

| **Study Title:** Tool Lending Library Impact Study | **Budget:** $141,222 |
|---|---|
| **Expected Completion Date:** 2017 | **Study Manager:** ED |
| **Description:** This study will quantify the savings from tool lending to customers from one PG&E Energy Center. This study will focus on the tool lending library that has the most energy saving potential, residential or non-residential. It will also focus on 1-3 specific tools that have the most energy saving potential. | |
| **Objective:**<br>• Identify the 3 tools that have the most energy saving potential<br>• Quantify the saving potential per tool<br>• Explore if and how the tool lending can claim savings in the future | |
| **Key Research Questions:** | |

| **Study Title:** Tool Lending Library Impact Study | **Budget:** $141,222 |
|---|---|
| • Which tools have the most savings potential?<br>• How do participants typically use the tools?<br>• How do the tools enable savings that would otherwise not be captured?<br>• What are the savings per tool? Per square footage?<br>• What evidence is needed to claim savings in the future? | |
| **Potential EM&V Methods:** Interviews, secondary research, engineering analysis, on-site visits. | |

## Other Important Considerations

The WE&T study roadmap is cross-cutting in nature. To accomplish the above study goals and data collection needs, this study team would need to coordinate with the following programs and study areas, at minimum:

- All residential programs with contractor skill standards and study roadmaps
- All Non-residential programs with contractor skill standards and study roadmaps
- Low-income and ESAP program and study roadmap

It is also possible that various program tracking systems may require enhancement to support the detailed contractor data collection needs, as specified by the CPUC decisions. The appropriate PCG will be formed to facilitate this coordination and discussion.

## 2.14.4. 2016 and Beyond Study Needs

The IOUs are interested in better understanding the impacts of WE&T. The Statewide IOU-led "WE&T Course Outcomes Study" will contribute to the foundation needed to determine WE&T impacts. The study can begin to identify patterns in the types of courses, student profiles, or learning methods utilized in courses where course content is being implemented as part of the student's job. This study will provide WE&T program managers key information for understanding how WE&T students are using, or not using, the course content they receive. The study can also potentially lead to metrics for WE&T beyond counting classes and number of students. The IOUs may utilize 2017 IOUs EM&V budget to expand on these efforts further.

Two reports were released addressing ways to support the "disadvantaged" workers in response to facilitating the 2015-2016 WE&T Inclusion Research. The IOUs need to determine whether the results of these studies should be incorporated in their programs and whether any unallocated funds should be applied towards further exploring findings and conclusions of these studies.

During the 2016 – 2017 evaluation period there is also interest in building on the previous research to determine the broader cost-benefits of WE&T efforts in order to develop an understanding of whether these strategies actually lead to quantifiable energy efficiency savings and non-energy benefits on a broader more general scale.

**Proposed 2016 & 2017 Energy Division Budget**: $204,584

Energy Division has conducted a significant number of studies in the WE&T sector in the past few years and does not intend to commence new studies in 2016. We will continue to review and support oversight of IOU-led evaluation. Based on comments from the public meeting and comments provided Energy Division will be considering the following projects for future work. They will be subject to review and prioritization when contractors come on board.

| Issue | Potential Research Need |
|---|---|
| WE&T and the linkage with improved installation practices | Understand whether and to what extent there is a causal link between IOU workforce training programs and improved installation practices. The goal of this study would be to contribute to an assessment of the effectiveness of WE&T training programs and evidence to consider whether and to what extent they drive greater savings. |
| Role and value of subcontractor training to improve savings. | Study whether and to what extent subcontractor training contributes to higher quality energy efficiency installations and ultimately greater energy savings. |
| WE&T Connections Programs have not been evaluated for several program cycles. Several program changes have been made since the last process evaluation that explored alignment with the WE&T Strategic Plan and identified several gaps and areas of improvement. The last evaluation uncovered gaps in "establishing energy efficiency education at all levels" per the Strategic Plan's goals for WE&T. Several new programs were developed to fill the market gap by targeting high school, trade school, and community college levels. | It may be helpful to conduct a process evaluation on the Connections programs (specifically those targeting high school levels and up) to explore evaluability, effectiveness, workforce outcomes, and alignment with Strategic Plan goals. This process evaluation could also explore the transition to a statewide program as ordered in the Proposed Decision Providing Guidance for Initial Energy Efficiency Rolling Portfolio Business Plans Filings. |
| It is uncertain how much of the contractor workforce is supporting energy efficiency as part of their standard sales tactics. As a key conduit to customer energy efficiency opportunities, CA needs the contractor workforce to support energy efficient sales tactics and help educate the customer with the correct information regarding their equipment options including the energy efficiency costs and benefits. Research studies that ask the contractor what they typically do in the field may not give an accurate picture of what happens with a typical customer. | A large-scale, representative and generalizable, mystery customer study of contractors may be able to address this gap in knowledge. This study would explore how contractors are selling equipment, if and how they explain the energy efficiency options, if and how they discuss permitting requirements, and the accuracy of the information they provide to customers. This study would develop customer scenarios (e.g., HVAC system broken in need of replacement, HVAC system not broken but starting to fail/underperform, and home has no insulation/single- paned windows and wants to install solar. This study would involve a mystery shopper approach with many contractors in the vicinity of various sizes, credentials, years of experience, service offerings, etc.). |
| SB 350 directs the Commission to adopt, implement, and enforce a Responsible Contractor Policy across all ratepayer-funded energy efficiency programs that addresses high-quality performance standards and workmanship. A policy around performance requires that a contractor's performance on a job can be measured. To measure performance, we must start with defining performance, or the quality of the contractor work, and then determine a way to measure | A study that selects a few key measures or programs and helps to define what work quality means and how it could be measured may help address this need. |

| | |
|---|---|
| that work quality. The definition of work quality will vary by measure and program. Some examples of measures or programs that attempt to define work quality and how to quantify it are Non-Residential Lighting Control Design and Installation, the Residential HVAC Quality Installation Program, and the Commercial HVAC Quality Maintenance Program. | |
| It is uncertain how the WE&T Centergies Program participants are linked to IOU Resource Programs; specifically how many of the Center trainees end up supporting IOU Resource Program projects? We know from surveying the Center trainees in the past that the overwhelming majority are aware of IOU Resource Programs and say they support them and market them to their customers. But no research has been done to try to link the Center trainees to the actual projects being incentivized. | We suggest a secondary research study analyzing the Center's history of training participant databases along with the IOU Resource Program tracking databases to find linkages. The study would identify how much channeling is happening overall and which programs are receiving more or less support from Center participants. The study may leverage additional data sources to help link databases such as the Contractors State Licensing board. The study may also uncover what would be needed in the future to better enhance this analysis and allow for ongoing tracking of this channeling by the Centers and IOU Resource Programs themselves. |
| With the passage of AB 802, training implementers, contractors, technicians, and contractor laborers to identify meter-based savings at program intervention points is needed to increase the level of quality of installation, service, and maintenance in the retrofit market as well as better inform the customer of the benefits of energy efficiency. While there are some training providers, such as the National Comfort Institute and Association of Energy Engineers, already doing aspects of this, the practice and expertise may be limited. There is little research to understand what learning objectives need to be addressed to meet this immediate need. | We suggest a study to identify the knowledge, skills, and abilities needed to train implementers, contractors, technicians, and contractor laborers to measure project savings at the point of project intervention. Using the ADDIE Model as a framework, this study would address the Analysis Phase and Design Phases. |
| Robert Friedman of the ZNE verified J Craig Venter Institute described their ZNE smart building as "smart like babies are smart...." While there has been a fair amount of research on getting California buildings to ZNE, little research exists on ensuring these buildings continue to run effectively and efficiently. This will require more highly skilled performance contractors in many trades who are trained in energy efficiency, renewables, building systems, and building automation. As has been called for many times in the last ten years, developing a career lattice with multiple entry points, opportunities for continuous career development, and a range of career targets that can be reached through multiple pathways in the building trades needs to be addressed. One of these pathways must support the acquisition of knowledge, skills, and abilities to operate and maintain ZNE buildings | Using related third party credentials as a foundation (such as the High Performance Building Operation Certification and the Building Operator Certification), we suggest a needs assessment to inform the definition and development of a specific career pathway for operating and maintaining ZNE buildings. |

**Proposed 2016 & 2017 Program Administrator Budget**: $200,000

The specific studies have not yet been defined. Once the IOU Business Plans are completed in January 2017, the IOUs will have a better sense of what research is needed. The budgets will be used to support evaluations for this sector.

In October 2016, the public submitted WE&T study suggestions via the Public Documents Area in response to the Draft Evaluation Plan WE&T EM&V Roadmap document. One stakeholder recommended two studies – one that would explore the relationship between IOU workforce training programs and the quality of installation practices, and another aimed at understanding if and how subcontractor training contributes to quality installations and energy savings. Another stakeholder provided several study suggestions including evaluation of the WE&T Connections Programs, exploring the extent to which the contractor workforce is supporting energy efficiency as part of their standard sales tactics, a study that defines what work quality means and how it could be measured, and secondary research analyzing the WE&T Centers' history of training participant databases along with the IOUs Resource Program tracking databases to find linkages. The study suggestion to do secondary research to find linkages between the WE&T Centers' training participant databases and the IOUs Resource Program tracking databases may be an element of the upcoming IOU-led WE&T Course Outcomes Study, which currently resides in the WE&T Roadmap.

While many of these study suggestions have merit, the IOUs are holding off on allocating their 2017 WE&T EM&V budget of $100,000 to new research until current ED-led and IOU-led WE&T research is completed and/or the IOUs Business Plans are completed. At that time, the IOUs will have a better sense of what additional research is needed in order to improve WE&T programs statewide.

# 3. Study Type Long Term Research Roadmaps

## 3.1. Impact Analysis

### 3.1.1. Background for the Impact Evaluation

Energy Division is responsible for quantifying the impacts and cost-effectiveness of the energy efficiency portfolio investments, tracking progress against savings goals, and providing information in order to improve savings estimates. This is accomplished through strategic review of the utilities' savings claims starting with the largest areas of impact or savings estimates with the greatest uncertainties. Energy Division uses engineering review, bill analysis, lab testing and field based monitoring to assess the savings impacts.

Impact evaluations were prioritized in the past years to focus on measures and program areas projected to have the greatest impact on the portfolio savings with the greatest uncertainties (either because they are new or because measures have uncertain parameters). This information has allowed for robust portfolio level analysis of the savings impacts as well as disaggregated reporting of program and measure level impacts.

Impact evaluations improve the accuracy of the savings assumptions and close the gap between IOU savings projections and CPUC verified savings estimates. The proposed impact evaluations will again target measures and programs that have the greatest impact on the portfolio but also demonstrate the greatest uncertainty in the savings (or cost) estimates in order to maximize the benefit of the research dollars spent.

In the upcoming years, we will continue to explore more opportunities to embed M&V and evaluation into program design and with the advent of more "meter based" program designs and evaluation impacts can be more quickly determined.

#### Impact Analysis included in this plan

Energy Division evaluation staff, in collaboration with the program administrators, developed long term research roadmaps by sector. Each of these roadmaps also considered an appropriate amount of funding for impact evaluation. Energy Division will further develop impact evaluation plans consistent with D.12-05-015 and in response to D.16-08-019 after the program administrators' file business plans. Further refinement will happen on an annual basis, per the rolling portfolio guidance, to adapt to Once reported savings claims, and Energy Division's annual uncertainty analysis. Funds may be re-distributed or combined as appropriate to execute the work in the most efficient fashion, but results will be reported for each of the relevant sectors. The proposed budgets are based on experience in prior cycles regarding the costs of field data collection and analysis. Please see the respective sector research plans for planned impact analysis and anticipated ex ante updates.

#### Uncertainty Analysis and Prioritization

In accordance with the rolling portfolio schedule, the Energy Division is conducting an uncertainty analysis on the program planning data and reported claims submitted by the program administrators. This information is used to generate an "uncertain measure list" which is presented each year via the

Energy Savings Performance Incentive process. The uncertainty analysis identifies and quantifies the uncertainty in the program planning estimates, and helps in assessing where EM&V resources can be applied to reduce the uncertainty in a cost effective manner. This analysis was conducted across the portfolio and by sector, and is reflected in impact plans.

# 3.2. Market Studies

## 3.2.1. Background

## Program Area Description

### *Market Studies Overview*

Market studies in previous evaluation cycles have largely been designed to meet program planning needs. Market effects studies assess the effects that programs have on the structure and functioning of energy efficiency markets, including changes in the behavior of contractors, suppliers and customers. Market characterization studies describe current market conditions in order to help inform program planning and the development of public policies. Market share tracking studies monitor changes over time in equipment sales patterns.

In addition to the above market studies, the Commission has given specific direction to measure market transformation regarding non-participant spillover[72] and to utilize market transformation indicators.[73] This direction has been slightly modified to allow program administrators' to devise market transformation indicators, and further policy development will be included in Phase III of the energy efficiency proceedings.

Finally, market saturation surveys have been conducted to determine the current baseline of equipment in the commercial and residential buildings and, in some cases, develop building Energy Use Intensities (EUIs). Under Title 20, there is a state mandate requiring statewide saturation surveys with specific design characteristics. These Title 20-compliant studies have primarily been used in the CEC demand forecast and LTPP process at the CPUC. While these studies have historically been funded through the EM&V budget, given resource constraints, Commission Decision (D.) 12-11-015, approving the IOUs' 2013-2014 programs and budgets, recommends a preference for alternative funding of the Title 20 surveys. In D.16-08-019 these studies were cited again as necessary and one of them (Commercial End Use Survey) has been picked up by the EPIC research activities.

### *Commission Direction on Market Transformation, Spillover and Market Effects*

In October 2007, the Commission approved D.07-10- 032 which directed that "a key element of the [Long-term Energy Efficiency] Strategic Plan would be that it articulates how energy efficiency programs are or will be designed with the goal of transitioning to either the marketplace without ratepayer subsidies, or codes and standards."[74] The CPUC also stated that the Strategic Plan would incorporate the market transformation goal described above and "develop milestones to measure progress towards that goal," including the development of a "targeted timeframe for such market transition and the process

[72] See, for example, D.12-11-015 which states that: "We lack recent program-specific data and analysis on spillover within California," (FOF 21) and "Commission staff should commit evaluation funding in 2013 and 2014 to study these [spillover] market effects further." (COL 47)

[73] See, for example, D.09-09-047.

[74] D.01-10-032, p.33.

for tracking progress so that it is clear at what point a program has made a successful transition or conversely, is having problems."[75]

In September 2008, the Commission adopted the California Energy Efficiency Strategic Plan (CEESP) in D.08-09-040. While the Plan represents a significant advance towards the market transformation goal articulated in D.07-10-032, it did not identify the process to track progress towards market transformation. Therefore, D.08-09-040 further directed the Commission to take action on the remaining issues that need to be addressed in market transformations. Per the decision, this includes, "at a minimum, identifying the process to track progress towards defined end points for program efforts and progress metrics."[76]

In September 2009, the Commission approved the IOUs' 2010-2012 energy efficiency portfolios and budgets in D. 09-09-047. This Decision also set forth principles and a process for developing and implementing market tracking systems. Specifically, D. 09-09-047 states that:

- The IOUs shall file an Advice Letter requesting approval of program performance metrics (PPMs) for each statewide program and associated subprogram and include "key data sources and indicators for which to begin collecting market transformation baseline data."
- ED should develop detailed recommendations for market transformation indicators and measurement and present their recommendations in a workshop followed by a public comment period.
- Market transformation data and metrics should not only serve to define end points for programs and measures but also to improve existing programs.

Subsequently D.15-10-028 called on the program administrators to define new metrics to comport with their Business Plan objectives.

Furthermore, D.09-09-047 modified the existing Commission definition of market transformation to state (changes noted in italics):

Market transformation is long-lasting, sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point here continuation of the same publicly-funded intervention is no longer appropriate in that specific market. *Market transformation includes promoting one set of efficient technologies, processes or building design approaches until they are adopted into codes and standards (or otherwise substantially adopted by the market), while also moving forward to bring the next generation of even more efficient technologies, processes or design solutions to the market.*[77]

In May 2010, the IOUs filed a joint Advice Letter with PPMs for the 2010-2012 statewide EE programs and an initial set of long-term MTIs. D.15-10-028 called on the program administrators to define new metrics to comport with their Business Plan objectives.

In December 2010, the Commission issued Resolution E-4385 which approves PPMs for the 2010-2012 program cycle, identifies an initial set of long-term market transformation indicators, and directs further

[75] Ibid, p.33.

[76] D.08-09-040, p.10.

[77] D.09-09-047, p.88-89.

efforts to integrate these into EM&V activities. Pursuant to the Resolution, the Joint Utilities are directed to track and report progress against the approved PPMs on an annual basis and to work with Commission staff to finalize a subset of MTIs for subsequent data collection, tracking and reporting.

On November 7, 2011, Energy Division hosted a workshop on Market Transformation Metrics. The workshop was used to frame the topic of market transformation in the CPUC regulatory context, share and review the subset of metrics that have been identified per Resolution E-4385, and discuss revisions proposed by other stakeholders. This workshop also met the requirements in Decision 10-10-033 to further refine the market transformation logic of the portfolio, develop, vet and add new indicators where gaps have been identified, and adapt to portfolio guidance or the orientation of the next program cycle programmatic objectives.

To support Commission direction on market transformation, in December 2014 the Energy Division released two White Papers on market transformation (Building a Policy Framework to Support Energy Efficiency Market Transformation in California and Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiative, both available on the CPUC website, http://www.energydataweb.com/cpuc/search.aspx). Additionally, the IOUs contracted to create a report on market transformation (A Review of Effective Practices for the Planning, Design, Implementation, and Evaluation of Market Transformation Efforts) which was published on November 2013 and is available at www.calmac.org.

The Commission subsequently has taken up the issue of policy questions around Market Transformation in the November 2, 2016 scoping memo to comply with legislation in SB 350, in creating Public Utilities Code § 399.4(d), provides that:

> The commission, in a new or existing proceeding, shall review and update its policies governing energy efficiency programs funded by utility customers to facilitate achieving the targets established pursuant to subdivision (c) of Section 25310 of the Public Resources Code [requiring the setting of goals to achieve a doubling of energy efficiency savings by 2030]. In updating its policies, the commission shall, at a minimum, do all of the following:
> Authorize market transformation programs with appropriate levels of funding to achieve deeper energy efficiency savings. [Emphasis added.]

### *Programs included in the Research Scope*

The Market Studies Research Roadmap evaluates EE programs in at a meta-level that considers many if not all of the utilities' programs. There are no savings associated with the research roadmap so the "Savings and Budget Summary" table provided in other roadmaps is not applicable and not shown.

### *Uncertainties and Challenges to Successful Implementation*

Market studies span multiple program areas. In the past, market studies have been completed in discrete program sectors. Going forward, most sector- or market-specific market studies are planned and executed in the sector- level roadmaps. Challenges will remain around coordination across-sectors to ensure consistency in market research, including measurement of market transformation indicators. Additionally, various market studies can consider the same sets of market actors, leading to data collection fatigue among the market actors. To help address these challenges, the CPUC plans to work collaboratively with the IOUs to pilot panel surveys for specific market actors. Also, in the 2013-2014 research, the CPUC created Excel-based tools to help roadmap leads understand what data is already available and where targeting sector-specific market studies may be beneficial. Commission staff have

made these tools available to stakeholders on the CPUC's Public Documents Area. Through assuring that others have access to knowledgeable consultants around market studies, the CPUC plans to support internal ED staff and other roadmaps as they consider sector-specific market studies.

The future market transformation policies and metrics are still uncertain, but will likely drive future evaluation needs. In addition evaluation budgets for the program administrators will represent a larger proportion of the total to more adequately cover market study needs (see D.16-08-019).

### 3.2.2. 2013-2015 EM&V Studies

The existing PCGs for market studies are oriented to coordinating studies intended to support specific programs or sets of programs. After holding meetings during 2014, the CPUC determined that, while coordination for market studies may be difficult, it would be beneficial to move back to the sector specific PCGs planning for and managing sector-specific market studies. However, the CPUC plans to slowly transition back to sector specific market study planning and assist the sector PCGs through Excel-based tools created during 2014. At present, we are planning to disband the current Market Studies PCG after the two spillover studies currently underway are completed.

In the interim, we will continue to fund market studies and some additional studies from the 2013-2014 Market Studies budget. The budget details are below. There were two primary rationales for funding some additional studies under the 2013-2014 Market Studies Budget**:** 1) the original allocation of 2013-2014 EM&V funds failed to account for some administrative costs; to address this, budget was removed from the Strategic Plan and Policy Support budget (see section below). Doing this curtailed Strategic Plan Action Plan activities for 2013-2014 however, so we provide $200,000 for this from 2013-2014 Market Studies budget in this roadmap update; and, 2) in completing the Market Studies Needs Assessment study in late 2014, it became clear that Energy Division staff bandwidth was extremely limited to consider market studies developed outside of the sector PCGs. To be successful, each EM&V study needs a strong champion, and this bi-furcation of effort was dampening attention to market studies. To address this tension, we assessed immediate ED staff recommendations for 2013-2014 EM&V studies against market studies recommended in the draft Market Studies Needs Assessment and allocated funds for two additional studies not recommended in the Needs Assessments: A finance study required by the Legislative Analysts Office (LAO) and an inventory of IDSM programs and opportunities, a priority suggested by the opening of a Customer Solutions Rulemaking (R. 14-10-003). These studies are described below. In addition, we agreed to the IOUs proposal to undertake a more thorough whole house market characterization study to support transition of the Energy Upgrade California Home Upgrade program to a full market transformation program.

## Key Research Questions to Be Addressed in 2013-2015 EM&V

The Market Studies PCG was designed to address both coordination and specific market study gaps that are not addressed in other PCGs. Below is a summary of the original coordinating functions of the Market Studies PCG. As noted above, CPUC is currently planning on disbanding the Market Studies PCG following the completion of two spillover studies. However, before doing so we will review the identified priorities below and determine which functions may necessitate retaining a skeletal Market Studies PCG to retain the minimum needed central coordinating functions.

The original coordinating functions of the Market Studies PCG are divided into five categories, and will likely continue to be relevant for the future:

1. *Coordinating the performance of market studies that, by their nature, span multiple program-oriented PCGs*. A good example would be a saturation study. Because saturation studies are intended to systematically inventory all of the equipment holdings within a particular population of end-users, and because different types of equipment are often targeted by different programs, saturation studies by their nature support a wide range of programs, and are thus not easily covered by program-oriented PCGs. A specific activity under this function could be to develop a matrix which links objectives of market analysis in various programs together so that data collection efforts can be streamlined and prioritized accordingly.
2. *Coordinating the performance of market studies that are viewed as being particularly important to perform consistently*, and/or systematically prioritize, across program areas. In the 2013-2014 program cycle, one good example of such a study is research into non-participant spillover. Other examples include systematically tracking MTIs and the performance of market effects studies. Such research is challenging and fairly expensive to perform, and the available funds are limited, so systematic prioritization will be important. Research into non-participant spillover is also a relatively new activity in California, so it will be important to ensure that consistent methodological standards are applied.
3. *Coordinating the performance of market studies touching the same sets of market actors*, in order to limit over-contacting and enhance efficiency. An example would be studies intended to collect data from the general population of residential HVAC contractors. In the 2010-2012 program cycle, there have been numerous different studies, supporting different programs and cross-cutting functions, that have all sought to collect data from these contractors. While these studies have been coordinated as the need arose, with more systematic coordination it may be possible to increase the quality of the data collected in such studies while decreasing total costs and ensuring that individual contractors are not contacted repeatedly.
4. *Ensuring that needed market studies do not fall through the cracks.* Lastly, an important function of the Market Studies PCG will be simply to ensure that needed market studies are not overlooked entirely. Because of the incomplete alignment between programs and markets, there may be studies that are of significant value but are not initiated by any of the individual program-oriented PCGs.
5. *Planning market studies through 2020.* Market transformation is more than measure adoption in codes and standards. It is also persisting market change and is not measured in a one-off, impact or measure-based assessment. Rather, market transformation evaluation transcends programs and evaluates the changes in markets targeted by energy efficiency initiatives. In this regard, time-series and trend analysis is necessary to effectively measure market transformation. While specific market studies for the 2013-2014 cycle and future EM&V cycles will be detailed through the PCG process, this roadmap outlines a plan for which market studies will be strategic and necessary in future EM&V funding cycles.

***Table 54. Potential Strategic Market Studies in Future EM&V Cycles***

| EE Program Cycle | Study name | Previously Completed |
|---|---|---|

| EE Program Cycle | Study name | Previously Completed |
|---|---|---|
| 2013-2015 | Residential, non-participant spillover<br>Non-residential, non-participant spillover<br>MTI Tracking and Development (Dropped from plan)<br>Market Effects Studies (Dropped from Plan)<br>Commercial End-Use Survey (CEUS)[1] | ---<br>---<br>---<br>2010-2012<br>2006 |
| 2016-2017 | Follow-up Market Effects Studies<br>Market Share Tracking<br>Additional Spillover Studies | 2010-2012<br>2013-2014<br>2013-2014 |

[1] Currently, not included in 2013-2015 EM&V budget as will be implemented by the CEC.

## A Summary of 2013-2015 EM&V Studies, Budgets, and Timing

***Table 55. 2013-2015 Market Studies EM&V Activities, Budgets, and Timing***

| 2013-2015 Study | Study Manager (ED/IOU) | Estimated Budget | Completion Date |
|---|---|---|---|
| PCG coordination | ED/IOU | 60,000 | Ongoing |
| Market Studies Needs Assessment | ED | 74,260 | Final report due Q2 2015 |
| Residential Non-Participant Spillover Study | ED | $1,100,000 | Q4 2016 |
| Non-Residential Non-Participant Spillover Study | ED | $1,100,000 | Q4 2016 |
| Whole House Market Characterization Study | ED | $400,000 | TBD |
| Behavioral Market Characterization | ED | $80,000 | April 2015 |
| Market Studies Support and Coordination (2015) | ED | $100,000 | Ongoing |
| **Total 2013-2015 Allocated Budget** | | **$2,914,260** | |
| IDSM Inventory Study- See IDSM Chapter for study description | ED-IDSM PCG | $305,000 | TBD |
| Comparative Finance Study for Legislative Analysts Office- See Finance Chapter for study description | ED-Finance PCG | $350,000 | TBD |
| Strategic Plan Action Plans- (See Policy Support Chapter for activity description) | ED-Strategic Plan Support | $200,000 | TBD |
| **Total MS funds transferred to other studies** (see relevant chapters for study or activity description). | | **$855,000** | |
| **Total Remaining 2013-2014 Budget** | | **$330,740** | |
| **New 2015 Budget** – will be placed in contingency funds due to ED staff limitations | | **$978,054** | |

## 3.2.3. 2013-2015 Study Descriptions

| **Study Title:** Market Studies Needs Assessment | **Budget:** $74,260 |
|---|---|

| **Study Title:** Market Studies Needs Assessment | **Budget:** $74,260 |
|---|---|
| **Expected Completion Date:** Q2 2015 | **Study Manager:** ED |
| **Description:** Determine the current and future needs for market studies | |
| **Objective:** Create a framework for determining California Public Utilities Commission (CPUC) and investor-owned utility (IOU) energy efficiency market study needs and priorities for the next five-to-10 years | |
| **Key Research Questions:**<br>• Within which markets does the CPUC already have good data?<br>• Which market studies are worthwhile for the CPUC to undertake, and what is their relative priority?<br>• What is an appropriate framework for conducting market study research, and what are the structural and communication requirements of such a framework? | |
| **Potential EM&V Methods:** Depth interviews, secondary research | |

| **Study Title:** Residential Spillover Study | **Budget:** 1,100,000 |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |
| **Description:** Assess the extent to which California's Investor Owned Utilities (IOUs) programs have resulted in program-induced participant and nonparticipant spillover in the residential market. | |
| **Objectives:**<br>• To determine what energy efficient measures are being installed without use of program incentives,<br>• To estimate the amount of savings that results from these measures, and<br>• To estimate the percent of those savings that can be attributed to program interventions (i.e., the spillover from the program).<br>• Additionally, to the extent possible, the study seeks to understand why customers install/purchase energy efficient measures without program incentive or rebate support. | |
| **Key Research Questions:** How much spillover is occurring in the residential market? | |
| **Potential EM&V Methods:** primary data collection through participant and nonparticipant surveys; secondary data analysis of CLASS data; trade ally depth interviews | |

| **Study Title:** Overarching Residential Non-Participant Spillover Study | **Budget:** 1,100,000 |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |
| **Description:** Assess the extent to which California's Investor Owned Utilities (IOUs) programs have resulted in program-induced participant and nonparticipant spillover in the nonresidential market. | |
| **Objectives:**<br>• To determine what energy efficient measures are being installed without use of program incentives and determine the role of the program in their adoption (i.e., attribution);<br>• To estimate the amount of savings that results from the program-attributed high-efficiency measures;<br>• Estimate the spillover savings rate; and<br>• Characterize why customers install energy efficient measures without program incentive or rebate support. | |

| **Study Title:** Overarching Residential Non-Participant Spillover Study | **Budget:** 1,100,000 |
|---|---|
| **Key Research Questions:** What is the amount of non-participant spillover is happening in the non-residential sector? | |
| **Potential EM&V Methods:** primary data collection through participant and nonparticipant surveys; secondary data analysis of CMST/CSS data | |

| **Study Title:** Behavior Market Characterization | **Budget:** $80,000 from Market Studies Roadmap; $150,000 from the Residential Roadmap; $230,000 overall |
|---|---|
| **Expected Completion Date:** Q2 2015 | **Study Manager:** ED |
| **Description:** This study is partially funded from the Market Studies roadmap (for the $80,000 shown here) and partially funded from the Residential roadmap (for $150,000) document. The study documents IOU implementation of Smart Meter policy decisions and seeks to better understand and characterize the residential behavioral market to inform future possible policy. | |
| **Objective:**<br>• To document the cost and benefit assumptions within the Smart Meter Business Case Decisions and IOU progress in achieving these benefits to date<br>• To characterize the markets beyond IOUs<br>• To identify gaps in California programs found through the market characterization and provide options for the CPUC to provide guidance to or collaborate with the IOUs to develop improved interventions | |
| **Key Research Questions:**<br>• What IOU Smart Meter/AMI projects have been approved by the CPUC?<br>• What IOU EE, DR, HAN, and Emerging Technology Program (ETP) behavioral pilots exist in the California residential market?<br>• Are the IOUs on track with Smart Meter implementation and seeing the projected results?<br>• What third party (non-IOU) EE, DR, HAN, ET, and Smart Appliances behavioral pilots/programs (“Third Party Behavioral Programs”) exist in the California residential market?<br>• How are the IOU Third Party Programs performing to date?<br>• Are there similar non-California pilots/programs that could be used to project behavior savings potential in California?<br>• From the viewpoint of third-party implementers, what are the barriers and trends in the residential behavioral program market?<br>• What are the barriers, gaps and opportunities for the known third party and IOU EE/ DR behavior pilots?<br>• Considering these gaps and opportunities, how can the CPUC guide IOUs and third party program implementers? Options are needed to help the CPUC: | |
| **Potential EM&V Methods:** Depth interviews, secondary research | |

| **Study Title:** Whole House Market Characterization and Market Indicator Measurement | **Budget:** $400,000 |
|---|---|
| **Expected Completion Date:** Q4 2016 | **Study Manager:** ED |

| **Study Title:** Whole House Market Characterization and Market Indicator Measurement | **Budget:** $400,000 |
|---|---|
| **Description:** The IOUs have proposed a market characterization study to determine whether the whole house retrofit market is an ideal Market transformation (MT) candidate. As a part of this effort, the Program Administrators (PA) and Energy Division (ED) have jointly agreed to explore three target customer segments: (1) home renovation, (2) HVAC replacement, (3) whole house retrofit. The PAs have proposed that the market characterization study be conducted by ODC and include the following **Objectives:** 1) Complete market characterization work, 2) Analyze the Home Upgrade logic model from the Navigant project 3) Operationalize the Home Upgrade recommended market indicators, and 4) Perform baseline measurement and/or counter-factual baseline. | |
| **Objective:**<br>Complete market characterization work<br>Analyze the Home Upgrade logic model from the Navigant project<br>Operationalize the Home Upgrade recommended market indicators<br>Perform baseline measurement and/or counter-factual baseline | |
| **Key Research Questions:**<br>• Is whole house retrofit market and ideal Market Transformation candidate?<br>• Which is preferred?<br>• A prescriptive and/or one-off measure rebate approach?<br>• The current Advanced Home Upgrade performance based approach?<br>• Are there additional alternate program delivery options?<br>• Is gas saving the future of the performance approach?<br>• Can electric savings still be obtained somehow?<br>• If so, how?<br>• What are current data pointing towards? | |
| **Potential EM&V Methods:** Compare NTG ratios across customers in participating in each program design, interviews with program staff and program implementers, interviews with contractors, participant surveys, comparative data analysis using program tracking databases across each program, review and comparison of program theory/logic models, review and comparison of program implementation plans, secondary materials and data review. | |

| **Study Title:** Market Studies Support and Coordination | **Budget:** $100,000 |
|---|---|
| **Expected Completion Date:** Ongoing | **Study Manager:** ED |
| **Description:** This budget will allow the ED to support the needs of the various PCGs as they discuss and implement market studies. Additionally, this budget will support internal ED staff as they consider and review market studies put forward by the IOUs. | |
| **Objective:**<br>• Assure that market studies are considered within the sector specific PCGs<br>• Provide quick review of IOU market study plans as needed<br>• Train in the use of the market studies tools and maintain the tools | |
| **Key Research Questions:** No specific research questions are included for this budget | |
| **Potential EM&V Methods:** Not applicable | |

### 3.2.4. 2016 and Beyond EM&V Market Studies

As stated above, the CPUC plans to support internal ED staff and other roadmaps as they consider sector-specific market studies. This will be a flexible support to best meet the needs of the other roadmaps and internal ED staff. As such, specific tasks are unknown. For 2016 and 2017, the ED has a budget for this support to assure that the various PCGs discuss market studies and that market studies are included across the portfolio as needed. The ED will use the budget on a task-by-task basis and augments the previous 2013-2015 budget for PCG support. For 2016 and 2017 budgets, a small amount will be maintained to ensure market studies are supported within the roadmaps.

***Table 56. 2015 Market Studies EM&V Activities, Budgets and Timing***

| Study | Study Manager (ED/IOU) | Budget | Completion Date |
|---|---|---|---|
| Market Studies Support and Coordination (2016) | ED | $104,792 | Ongoing |
| Market Studies Support and Coordination (2017) | ED | $104,792 | Ongoing |

The following studies were identified in public comments, but lead is not yet defined.

- Market effects from long-term programs (and any needed follow-up on spillover studies) may be useful to Improve global savings estimates to account for all program effects attributable to PA interventions.
- Broad and specific market assessments (e.g. MF assessment, end-use specific studies) may help to support improved program administrators program design and targeting as well as POE for deemed programs.

### 3.2.5. 2016 and Beyond Study Descriptions

| **Study Title:** Market Studies Support and Coordination | **Budget:** $209,584 |
|---|---|
| **Expected Completion Date:** Ongoing | **Study Manager:** ED |
| **Description:** This budget will allow the ED to support the needs of the various PCGs as they discuss and implement market studies. Additionally, this budget will support internal ED staff as they consider and review market studies put forward by the IOUs. | |
| **Objective:**<br>• Assure that market studies are considered within the sector specific PCGs<br>• Provide quick review of IOU market study plans as needed<br>• Train in the use of the market studies tools and maintain the tools | |
| **Key Research Questions:** No specific research questions are included for this budget | |
| **Potential EM&V Methods:** Not applicable | |

# 4. Policy Planning Long Term Research Roadmaps

## 4.1. Goals and Potential Analysis

### 4.1.1. Background

#### Sector Description

The Potential & Goals (PG) study assesses the energy savings potential of all sectors in order to establish goals and targets for future portfolios and to incorporate energy efficiency impacts into the demand forecast. The 2013-2014 cycle funding kicked off the 2015 and Beyond Goals Study and the 2015 cycle funding completed the rest of the budget.

The 2015 and Beyond Goals study completed Phase 1 of the existing contract with a budget of $1,260,000. Phase 2 of the contract will inform the goals for 2018 and beyond with an allocated budget of $2,740,000. This amount includes $660,000 for a technical analysis to inform data needs and preliminary impacts of the Assembly Bill 802 (Williams) mandate. As the technical analysis was work already carried out but is in fact an input to Phase 2, the budget for this activity is included in the Phase 2 general scope. Certain tasks in the original scope were de-prioritized or cancelled and funding added to Phase 2 tasks:

| Task | Status |
|---|---|
| **GHG goals** | Cancelled |
| **Metrics to Support the Strategic Plan Update** | On hold |
| **Locational Targeting** | Cancelled |
| **Savings Potential from Existing Conditions Technical Analysis** | Added |

This roadmap also includes the approved funding for 2017 of $2,000,000. These funds are earmarked to the next update to the Potential and Goals study. The next update will inform goals for 2020 and beyond and will account for updates in programmatic delivery, codes and standards and any other policies and legislative mandates. At this time, this roadmap adds only a placeholder for the funds. Activities are planned to start in 2018.

#### Programs included in the Research Scope

The Potential and Goals Study uses data from all EE programs and produces a product that is relevant to all of the utilities' programs. In addition, with the adoption of Assembly Bill 802 (Williams) and Senate Bill 350 (De León), the current update will be considering data beyond the current EE programs.

## Uncertainties and Challenges to Successful Implementation

This section is not applicable, since this is not a program specific study.

## Recent Evaluations

### *A Summary Research Questions, Budgets, and Timing*

The scope of the 2018 and beyond Potential and Goals study will be expanded to accommodate emerging policy needs and previously identified methods and data updates. AB 802 directed the Commission to authorize programs to and through code, consider normalized meter energy consumption as a measurement of savings and performance and savings from behavior, retrocommissioing and operational interventions.

SB 350 mandated the doubling of the energy efficiency targets by 2030, a task that will be led by the Energy Commission, but which the PG study will be one of the main inputs. The bill proposes several sources of savings, some of which are in scope of Commission authorized funding. Finally the bill directs the study to consider efficiency potential that is not restricted by previous levels of utility savings.

The Phase 2 potential and goals outputs need to be finalized in Q2 of 2017 to be used in the inter-agency demand forecast. The current study scope also included a technical analysis to model preliminary magnitude of opportunities and risks resulting from AB802 as well as to inform additional methodological and data needs. The 2018 and beyond update will build on this technical analysis.

### *Key Research Questions Addressed*

**2018 and Beyond Potential and Goals Study**: The Potential Study will assess net energy savings potential in the four IOUs' territories for 2018 and beyond. This study quantifies all cost-effective savings at the DEER and non-DEER measure group level for deemed measure groups, and then identifies the level of savings expected to be adopted by the market based on the market adoption curve. In past studies, custom measure groups (largely those savings from the Industrial and Agriculture sectors) were modeled using a top down approach. This update will estimate potential from such measures using a bottom up approach similarly to deemed measures. The Phase 2 PG Study will expand and refine the model to assess the potential of various delivery mechanisms impacted by statewide initiatives, the legislative policies mentioned above and new codes. The study will build and evaluate numerous scenarios in order to inform the most cost effective portfolio of delivery mechanisms. The draft study is anticipated to be completed in Q2 2017 and the final study is anticipated to be completed in Q3 2017.

**Purpose of Study**: The utilities will be using the details of the potential study to plan their 2018 and beyond portfolios. The study will also inform the CEC's demand forecast for the purposes of long term procurement planning, the CAISO's transmission planning for the purpose of maintaining grid reliability and will inform the process to implement the mandate of SB 350 to double energy efficiency by 2030.

## Emerging Analysis and Information Needs

### *Past & Current Needs:*

- The Potential and Goals Study will provide forecasted energy savings on an annual and cumulative.
- The study will expand and refine the estimate of commercial "operating efficiency potential," or usage based behavioral potential to include building commissioning and retro-commissioning.
- The study will refine behavior savings attributed to energy efficiency.

- The study will expand and refine the emerging technology framework, to consider a larger number of technologies, based on the ETP database, PIER program, etc.
- Refine previous estimates of potential for the industrial and agricultural markets. Potential will also be expanded to include:
  - Mining
  - Street lighting
- The study will identify the impact of financing on market potential

### *Emerging Needs:*

- The study will inform the adoption of net energy efficiency goals for the territory covered by the utilities. D.16-08-019 directed the goals for utility energy efficiency programs to set on a net basis.
- DEER/Potential Study update: The study will need to be refreshed with updated 2017 and 2018 DEER values from the previous DEER C&S Updates and DEER non-C&S Updates. Impactful results from 13-14 evaluation will also be incorporated into the study.
- The study will identify additional potential to be captured by utilities due to opportunities to bring buildings and equipment to and through code that would have not otherwise happened.
- The study will quantify savings at risk of double counting due to a broader application of to-code incentives.
- The study will produce cost-effectiveness scenarios based on the recently adopted new Avoided Cost Calculator considering alternative policy options.
- The study will model bundles of measures to determine the addition economic potential of whole house retrofits that could be supported by the use of normalized meter energy consumption in determining savings.
- The study will align savings for C&S that do not overlap with incentive programs.

### *Stakeholder Needs*

- CPUC: The Commission needs the completed study by mid-2017 to be adopted by August 2017 in order to inform the 2018 budget requests bus stop. The parties are likely to want to evaluate the scenarios before adopting the post 2018 goals.
- IOUs: The IOUs need the completed model outputs by early 2017 for their portfolio planning for the 2018 budget applications and possible Business Plans and/or Implementation Plans adjustments.
- CEC and CAISO: Need the adopted goals and overall results of the study as an input to the demand forecast in August 2017.

## Key Research Questions to Be Addressed in 2016 EM&V

- How much additional potential can be captured from AB802 mandate?
- What is the risk that the identified additional savings due to bringing buildings to code would have happened anyway as a function of normal market activity?
- What is the most appropriate method to define C&S savings goals that are net of to-code savings to be captured by incentive programs?
- How much additional potential can be captured by programs based on normalized metered energy consumption?
- How does the 2017-18 DEER updates, C&S and EM&V updates affect the future potential?

- How does the new adopted Avoided Cost Calculator impacts future potential?
- What are alternatives to the existing cost-effectiveness framework and how they could affect future potential?

## Key Research Questions to Be Addressed in 2017 EM&V

TBD.

***Table 57. 2013-2016 and 2017 Potential and Goals EM&V Studies, Budgets, and Timing***

| Study | Estimated Budget | Study Lead (Ed/IOU) | Status |
|---|---|---|---|
| Potential and Goals Update for 2015 (Phase 1) | $1,260,000 | ED | Complete |
| Potential and Goals Update for 2018 and Beyond (Phase 2) | $2,740,000 | ED | Ongoing |
| Potential and Goals update for 2020 and beyond (2016 + 2017 Funding) | $4,000,000 | ED | Not started |
| **Total Budget** | **$8,000,000** | **ED** | |

### 4.1.2. Study Descriptions and Objectives

| **Study Title:** Potential and Goals Study Phase 2 | **Budget: $2,740,000** |
|---|---|
| **Expected Completion Date:** Q2 2017 | **Study Manager:** ED |
| **Description:** The Potential Study will assess net energy savings potential in the four IOUs' territories for 2018 and beyond. This study quantifies all cost-effective savings at the DEER and non-DEER measure group level for deemed measures groups, and then identifies the level of savings expected to be adopted by the market based on the market adoption curve. In past studies, custom measure groups were modeled using a top down approach. This update will adopt the same methods from deemed measures to custom. The Goals Study will expand and refine the model to assess the potential of various delivery mechanisms impacted by statewide initiative, the legislative policies mentioned above and new codes. The study will build and evaluate numerous scenarios in order to inform the most cost effective portfolio of delivery mechanisms. The draft study is anticipated to be completed in Q2 2017 and the final study is anticipated to be completed in Q3 2017. | |
| **Objective:**<br>• The study will inform utility goals for 2018 and beyond.<br>• The study will inform the CEC and CAISO forecasting needs as well as serve as an input to implementation of SB350 interim targets | |
| **Key Research Questions:** see above | |
| **Potential EM&V Methods:**<br>• Modeling approach based on adoption algorithms at a measure level.<br>• Data sources: 2017-18 DEER, non-DEER workpapers, saturation studies, the C&S Integrated Standards and Savings Model. | |

| **Study Title:** Potential and Goals Study 2020 and Beyond | **Budget: $4,000,000** |
|---|---|
| **Expected Completion Date:** Q2 2019 | **Study Manager:** ED |
| **Description:** The Potential Study will assess net energy savings potential in the four IOUs' territories for 2020 and beyond. The study will account for policies, legislative mandates and updates to programmatic delivery and codes and standards. | |
| **Objective:**<br>• The study will inform utility goals for 2020 and beyond.<br>• The study will inform the CEC and CAISO forecasting needs as well as other policy and legislative mandates | |
| **Key Research Questions:** TBD | |
| **Potential EM&V Methods:**<br>• Modeling approach based on adoption algorithms at a measure level.<br>• Data sources: TBD. | |

# 4.2. Policy Studies

## 4.2.1. Background

The policy studies roadmap includes studies on high-priority topics that will help to inform future Commission decisions and inform broader policy discussions not directly covered by the evaluation measurement and verification goals. Some policy studies have been specifically ordered by past Commission decisions while others are scoped to provide input on topics likely to inform decision-makers on future policy questions.

The studies that form the policy studies roadmap are heterogeneous and vary depending on the policy priorities identified by the Commission and staff. Depending on the need identified, they can include studies that:

- Evaluate high priority programs and pilots not included in the sector roadmaps
- Develop and test new evaluation methods and procedures
- Survey, compile, and compare the existing literature on policies in other jurisdictions
- Tackle questions of the effectiveness of specific policies for the energy efficiency portfolio

The list above is not exhaustive; the policy studies roadmap has considerable flexibility in scope in order to be able to respond to Commission and staff needs in a timely fashion.

### 2013-2015 Policy Studies

The table below summarizes the 2013-2015 policy studies that have been budgeted, some of which are in the process of being implemented and others are still in the design phase. The table provides the study manager, work order under which the study is being conducted, the corresponding budget, implementation status and expected completion date for each study.

***Table 58. 2013-2015 Policy Studies EM&V Activities, Budgets, and Timing***

| 2013-2015 Study Title | Study Manager | Budget | Status | Completion Date |
|---|---|---|---|---|
| Incorporating Experimental Design Techniques into Energy Efficiency Program Evaluations | ED | $296,454 | Merged with To Code Pilot | Q2 2018 |
| Evaluation of Energy Efficiency Upgrades to K-12 Public Schools in IOU Territories | ED | $262,788 | Discontinued | Q4 2016 |
| 2015 Experimental Evaluation of Baseline Pilots (extension) | ED | $499,724 | Pre-pilot / Design | Q2 2018 |
| **Total** | | **$1,058,966** | | |

## 4.2.2. 2013-2015 Study Descriptions

Below are descriptions for each of the 2013-2015 funded studies, which include the key research questions that will be addressed, and the potential EM&V methods that will be utilized.

| | |
|---|---|
| **Study Title:** 2013-2014 Incorporating Experimental Design Technique into Energy Efficiency Program Evaluations | **Budget:** $296,454 |

| **Study Title:** 2013-2014 Incorporating Experimental Design Technique into Energy Efficiency Program Evaluations | **Budget:** $296,454 |
|---|---|
| **Expected Completion Date:** Q3 2016 | **Study Manager:** ED with UC Haas-E2e |
| **Description:** This study will develop recommendations for greater incorporation of experimental design techniques into program administrator program design and evaluation. It will also identify and implement high policy priority programs that may benefit from evaluation using experimental designs, including novel approaches that may not yet have been used in the California IOU territories. *[This project was directed toward the To Code Pilots with the IOUs]* | |
| **Objective:**<br>• Recommend programs or suites of programs that could benefit from experimental design evaluations in the future in order to inform future Commission policy.<br>• Design and implement field experiment evaluations for 1-2 current IOU programs or pilots. | |
| **Key Research Questions:**<br>• What kinds of programs and policy processes would benefit most from greater experimental evaluation? *A technical memo was generated summarizing criteria for*<br>• What are the ex post net savings attributable to selected programs or pilots? | |
| **Potential EM&V Methods:** Randomized control trials, randomized encouragement trials, recruit-and-deny trials | |

| **Study Title:** 2013-2014 Evaluation of Energy Efficiency Upgrades to K-12 Public Schools in IOU Territories | **Budget:** $262,788 |
|---|---|
| **Expected Completion Date:** Q1 2017 | Study Manager: ED with UC Haas-E2e |
| **Description:** This study will develop ex post savings estimates of gross and net savings attributable to IOU programs in K-12 schools in IOU territories in California in the context of the substantial increase in energy efficiency activity from Proposition 39 funding. The study will utilize interval data to estimate the total savings in the K-12 public schools sector as well as estimates of the savings attributable to Prop 39 and IOU funding. | |
| **Objective:** Estimate ex post gross and net savings in K-12 public schools in the 2013-2014 period. Identify methods for and estimate attribution of savings to Prop 39 and to IOU programs. | |
| **Key Research Questions:**<br>• What are total ex post savings in K-12 public schools?<br>• What are the net savings attributable to different funding sources?<br>• What is the incremental impact of IOU programs on the savings generated by school projects in IOU territories? | |
| **Potential EM&V Methods:** Quasi-experimental design; billing analysis. | |

| **Study Title:** 2015 Experimental Evaluation of Baseline Pilots (extension) | **Budget:** $500,000 |
|---|---|
| **Expected Completion Date:** Q1 2018 | **Study Manager:** ED with UC Haas-E2e |
| **Description:** This study, along with resources from the 2013-2014 incorporating experimental design evaluation, will evaluate the uptake, net savings, and cost-effectiveness of the IOUs baseline or 'to-code' pilots. D.14-10-046 ordered the IOUs to run pilots that would be evaluated by experimental | |

| **Study Title:** 2015 Experimental Evaluation of Baseline Pilots (extension) | **Budget:** $500,000 |
|---|---|
| design and required third-party evaluation. Each IOU must run a pilot budgeted at up to $1 million. | |
| **Objective:** Estimate the increased uptake, net savings, and cost-effectiveness of offering incentives based on existing conditions versus a standard code baseline. | |
| **Key Research Questions:**<br>• How much additional activity or uptake do incentives based on existing conditions produce when compared to a code baseline?<br>• What are ex post net savings attributable to increased incentives?<br>• What is the cost-effectiveness of offering increased incentives based on existing conditions? | |
| **Potential EM&V Methods:** Randomized control trials, randomized encouragement designs. | |

### 4.2.3. 2016 and Beyond Policy Studies

**Energy Division Proposed Budget for 2016-2017: $1,000,000**

**IOU 2016 Budget : $115,000**

The table below summarizes the 2016 and 2017 EM&V Studies that may be pursued. These are largely informed by stakeholder input at public workshops and Commission direction. The table provides the study manager, corresponding budget and expected completion date for each study. The budgets are very high level distributions that will need to be re-considered with further scoping of the activity and completion dates will be dependent on contracting processes.

***Table 59. 2016 – 2017 Policy Studies EM&V Activities, Budgets, and Timing***

| Study Title | Study Manager | Budget | Completion Date |
|---|---|---|---|
| Methods and field results on equipment turnover, effective useful life and savings decay | ED | $100,000 | TBD |
| Update inputs/methods for cost effectiveness, including load shapes, locational value, and societal cost (depending on outcomes of IDER, DRP and EE proceedings) | ED | $200,000 | TBD |
| Process and best practice review of competitive solicitation structure for third party and statewide programs | ED | $100,000 | TBD |
| Define and track energy efficiency industry indicators to understand effects of third party and statewide policy changes | ED | $100,000 | TBD |
| Overview of High Opportunity Programs and Projects outcomes (including effectiveness of embedded M&V best practices) | ED | $50,000 | TBD |
| EM&V Framework Needs Assessment | IOU | $115,000 | 2017 |
| Update California EM&V Framework based on scoping review and Commission direction | ED | $350,000 | TBD |
| Market Transformation evaluation needs and best | ED | $100,000 | TBD |

| Study Title | Study Manager | Budget | Completion Date |
|---|---|---|---|
| practice for leveraging public dollars | | | |
| | | $1,115,000 | TBD |

Other recommendations for staff or stakeholder analysis included:

| Whitepaper Topic | Justification |
|---|---|
| Upstream/midstream consolidation and reorganization opportunities | Support staff and PA implementation of D.16-08-019 direction on statewide programs and upcoming proceeding activity on market transformation |
| Value of EE as a grid resource and strategies to bundle EE with other demand-side resources (coordinated effort with IDER and DRP proceedings as well as CEC's IEPR forecast) | Inform future PA program offerings and staff and PA coordination of EE programs with other demand-side resources |
| Aligning program goals and performance to maximize net lifecycle benefits of EE | Support staff implementation of SB 350 and D.16-08-019 direction on net lifecycle goals |

### 4.2.4. 2016 and Beyond Study Descriptions

Detailed descriptions for each of the proposed 2016 and beyond studies are not yet available. A working group for this chapter can be convened to further define the study needs and discuss prioritization in the upcoming year and prior to the next plan update.

Scoping of the EM&V Framework update is underway utilizing 2016 funds.

| **Study Title**: EM&V Framework Needs Assessment | **Budget:** $115,000 |
|---|---|
| **Expected Completion Date:** December 31, 2017 | **Study Manager:** IOU |
| **Description**: The California Evaluation Framework (Framework) was published in 2004 with the objective of providing a consistent, systemized, approach for planning and conducting evaluations of California's energy efficiency and resource acquisition programs. The reason for a needs assessment of the Framework is grounded in changes in needs for energy efficiency evaluation that were identified first in the 2010-2012 cycle and recently resulting from several new policy decisions and legislation, specifically AB 802 and SB 350. | |
| **Objective**: The goal of the needs assessment is to identify whether there are ways to improve the usefulness and usability of the Framework and ensure its relevancy for evaluation of energy efficiency in the policy environment of 2016 going forward. This needs assessment will identify gaps in the Framework, but will not develop the solutions. Those solutions will be addressed in a second phase of the project. A boundary for the needs assessment is generally energy efficiency evaluation, but in the current and future context, energy efficiency evaluation must include other distributed energy resources and integrated demand side management. Further, programs of the future may have different definitions than that used by the Framework. Thus, the needs assessment seeks to be inclusive of the | |

| **Study Title**: EM&V Framework Needs Assessment | **Budget:** $115,000 |
|---|---|
| issues that affect energy efficiency program evaluation, without being overly expansive. | |
| **Key Research Questions:** There are three focus areas for the needs assessment and several key research questions that emerge for each focus area.<br><br>1. Uses of the Framework: How is it used, who uses it, why it is and is not used, who should use it? Can it be more useful, more relevant, more available, more user friendly for existing and new users?<br><br>2. Policy Changes that Affect Evaluation Need: What are the effects of recent policy changes on evaluation (specifically, SB 350; AB 802; AB 758, default baselines, the rolling portfolio, and the presence of varying types of programs administrators and implementers (RENs, POUs, third parties, etc.))? What are the challenges for doing embedded evaluation given the Framework and what guidance need to be provided for programs and processes? Does the Framework have sufficient flexibility for other types of evaluations? Is the Framework sufficiently flexible to allow for changes to cost effectiveness provisions?<br><br>3. New and Emerging Methods and Data: Are there methods that are not in the Framework (specifically, M&V 2.0, greenhouse gas (GHG) estimation, Uniform Methods Project (UMP) evaluation protocols (UMP), default baselines, big data predictive modelling, and experimental design)? Are there technologies that are not addressed in the Framework but affect evaluation of EE/demand-side management/integrated demand-side management (DSM/IDSM) (specifically, AMI data, distributed generation, storage, ancillary services, and communicating devices (thermostats, lighting, controls, etc.))? | |

## 4.3. Strategic Plan Updates and Support

In 2015 and 2016, activities to update the Energy Efficiency Strategic Plan were put on hiatus due to staffing constraints and due to a parallel process occurring with the IOU Business plans for the Rolling Portfolio Cycle. An update to the Strategic Plan may be initiated, pending direction from the Commission. Activities on Strategic Plan implementation will continue per Table 79. The greyed-out language below remains in the Research Plan for archival reason.

Energy Division has set aside $500,000 in each of 2016 and 2017 EM&V budgets (for a total of $1M) to support updates to the Strategic Plan at such time it is appropriate to initiate this activity.

Published in 2008, The Energy Efficiency Strategic Plan (Plan) has provided the Energy Efficiency market and California's regulatory agencies a vision and roadmap for programs that reduce the state's energy usage. Some examples of the Plan's outcomes include:

- Zero Net Energy (ZNE) is widely recognized as a statewide goal, with the Governor's office ordering all new state buildings to be ZNE.
- Per the "zero net energy" vision in the Plan, California's building codes and standards are increasingly changing to where ZNE will be the norm for new buildings in California via Title 24.
- Per the Energy Efficiency financing strategies outlined in the Plan, the CPUC now has pilots for financing major energy efficiency retrofits.
- The Plan called for an active stakeholder group to grapple with the many challenges facing the state's HVAC industry. As a result, the Western HVAC Performance Alliance was formed, and is actively working to improve the effectiveness of HVAC programs.
- Per legislation that came about because of the Plan, there is now a goal of 100 percent of low income residents in California to participate in the Energy Savings program.
- Continuous Energy Improvement is being implemented on a pilot basis, and is recognized by some as a viable energy management tool.
- The state now has a statewide marketing platform "Energy Upgrade California," as the Plan recognized the importance of statewide marketing, education, and outreach.
- The Plan continues to be used as a guidance document for energy efficiency policy direction and programs.

Since the Plan was published, however, much in the demand-side energy sector has changed. Many of the goals and strategies are no longer relevant as they have been accomplished, were unrealistic to begin with, were overly ambitious, or need an update. In addition, the market for energy efficiency and other demand side programs has changed. For instance, nearly all California homes now have Smart Meters, which can potentially give both ratepayers and utilities granular information about energy usage, while rooftop solar, demand response, energy storage and electric vehicles are poised to reinvent the way energy is managed for ratepayers.

The update described below is currently underway with budgets available from 2013-2015 EM&V allocations. A budget of $500,000 from the 2016 budget has been set aside in Energy Division funds to address future updates which have not yet been defined.

### 4.3.1. The 2015 Strategic Plan Update – Vision and Purpose

**Plan Vision:** The draft vision (per staff proposal, May 2014) for the 2015 Plan update:

Californians highly value energy, water and other resources, and are inspired to undertake sustainable consumption reduction activities as the state builds a thriving, low-carbon energy market that dramatically reduces greenhouse gas emissions.

The 2015 Plan update will emphasize a whole-building approach and continue to pursue ZNE buildings as a guiding vision. The 2015 Plan update will include vetting and synthesizing of data to produce measurable short, mid, and long-term goals, including market characterization data and the Potential and Goals study. (Whether or not the 2015 Plan update will include a cost effectiveness screen is yet to be determined).

**Plan Purpose**: The plan should inform post-2015 energy efficiency and other IDSM guidance documents, including a re-evaluation of the big bold goals, and should inform the IDSM proceeding. The Plan should also serve as a vision document for how to deliver seamless program offerings for energy efficiency and other demand side programs that are currently siloed. It should greatly influence R.13-11-005, the Energy Efficiency proceeding.

**Proposed Factors:** The 2015 Plan updating process began in 2013 with internal staff interviews and meetings, which led to the findings of this work plan. In 2012 and 2013, Commission lead staff and their consultants were interviewed regarding the need for an appropriate scope and focus of a Plan update. Recommendations identified in these interviews are summarized below.

- **Goal Setting and Metrics**: The goals will be more metrics based. The steps to establish new goals are:
  - Define metric;
  - Determine baseline;
  - Set goals for 2020 and 2025; and
  - Establish interim targets.

This work should be in tandem with the next iteration of the Potential and Goals study. When possible, the metrics should be tied to actual energy savings. Goals should be plotted over time, rather than having one goal for an endpoint (for example, energy usage will decrease 5 percent per year leading to a total reduction of 50 percent by 2024). The planning process should also consider how to leverage the areas with the greatest potential in order to maximize what is prescribed in the Potential and Goals study, while considering the impact of more stringent building codes beginning in 2019. Navigant has been hired to do this work.

- **Plan Format**: The update will have reduced prose and expanded goals. Chapter formats will be decided in meetings and discussions with staff. While the Plan update will include some implementation steps, the details of how to achieve goals will be in the action plans. Chapters will be broken down by building types, and cross cutting issues will be incorporated into those chapters. There should be a universal approach to writing each chapter and calculating and reporting metrics.
- **Coordination of On-going or Existing Work**: Chapters will leverage existing work with stakeholder groups, consultants, and Commission staff. For example, the Plan update will build upon and complement the AB 758 Action Plan and the Commission will work with the CEC on to ensure consistency. Commission staff will contribute to the creation of the AB 758 Action Plan, and will incorporate the final actions of the AB 758 Plan into the Plan update, where appropriate and as a result, the stakeholder process will be reduced. In addition, there are several Action Plans which will provide the basis for the new buildings and cross cutting areas.

- **Integrated Demand Side Management**: To continue the ZNE vision, The Plan update will include analysis and goals of non-energy efficiency factors such as distributed generation, demand response, EVs, water savings, and Smart Meter-enabled technologies. The Plan may not treat these with the same rigor as the energy efficiency technologies, but rather will ascribe "soft" goals to them extrapolated from their related proceedings and state initiatives. The Plan needs to take into account the shift of moving demand response from IOUs to third party implementers (aggregators). The Plan should develop a vision for some ideal combination of customer-owned generation, low energy devices, energy storage, and energy efficiency. It could consider how best to design a rate structure and incentives that are best for the customer. EVs should be considered as both a load factor and as a source of energy storage. The Plan may consider exceeding the goals in the Governor's Electric Vehicle Action Plan.

The non-EE proceedings that may be used for background include:

- Alternative Fueled Vehicles (R.13-11-007)
- Demand Response (R.13-09-011)
- Distributed Generation (R.12-11-005)
- Energy Storage (R.10-12-007)
- Smart Grid (R.08-12-009)
- Water-Energy Nexus (R.13-12-011)
- Net Energy Metering Successor Tariff (R.14-07-002)
- Energy Upgrade California Marketing Education & Outreach (currently without an open proceeding)
- Residential Rate Reform (R.12-06-013)

**Chapters:** The 2015 Plan update, as currently envisioned, will be divided into four main chapters, with one other under consideration:

1. Commercial Buildings
    a. Existing
    b. New
2. Residential Buildings
    a. Existing
    b. New
3. Industrial (including water treatment and food processing)
4. Local Government (this could possibly be considered cross cutting).
5. Agriculture (under consideration)

These cross-cutting technologies, initiatives, and programs may be included in these chapters as appropriate:

- Lighting
- HVAC
- Workforce Education and Training
- Marketing Education and Outreach
- Low income programs
- Codes and Standards
- Customer-owned generation
- Research and Technology

- Electric vehicles
- Rates
- Behavior
- Water
- Electric vehicles
- Demand response
- Financing

In 2015, Energy Division requests a total of $600,000 for activities around the updating and the implementation of the Energy Efficiency Strategic Plan. These funds break down as follows:

**Covered with 2013-2014 Funds**

- **Strategic Plan Adviser ($225,000) –** These funds have already been allocated. This will fund a single advising consultant to the Strategic Plan, who will work as a project manager and analyst to assist in the 2015 update to the Plan. Herter Energy has been selected as the consultant for this, and will begin in late April or May of 2015.
- **Lighting Action Plan ($50,000) –** A continuation of the work being done by DMV Kema to continue stakeholder outreach and appropriate updates to the Lighting Action Plan.
- **Research and Technology Action Plan ($50,000) -** A continuation of the work being done by Itron to continue stakeholder outreach and appropriate updates to the Research and Technology Action Plan.
- **Residential ZNE Action Plan ($50,000) -** A continuation of the work being done by Bluepoint Planning to continue stakeholder outreach and appropriate updates to the Residential ZNE Action Plan.
- **ZNE Commercial Education and Outreach ($50,000) –** A continuation of the work being done by New Buildings Institute to continue ZNE education and outreach., namely ZNE Early Adopter activities, ZNE Commercial Stakeholder Strategic Plan update and meeting support, ZNE Bulletin, ZNE Bldg Recognition program technical support.

**Continued Strategic Plan Activities through 2017 ($125,000) –** This funding, will be used as needed for additional tasks. These could include (but are not limited to) additional work on the Local Government Action Plan; Production costs for the Strategic Plan (such as editing, design, and printing); Additional tasks needed for the Industrial Action Plan not covered by the current budget.

***Table 60. Strategic Plan Activities and Budgets***

| Project | Vendor | Amount | Funding Source |
|---|---|---|---|
| Strategic Plan Adviser | Karen Herter | $225,000 | 2013-2014 (Advisory Funds) |
| Lighting Action Plan | DNV – Kema | $50,000 | From Market Studies 2013-2014 budget |
| Research and Tech AP | Itron | $50,000 | From Market Studies 2013-2014 budget |
| Residential ZNE AP | Bluepoint | $50,000; (2013-2014 $25,000 (2015) | 2015 (other funding for this in Market Studies 2013-2014 budget) |
| ZNE Commercial | New Buildings | $50,000 (2013-2014) | 2015 (other funding for |

| Project | Vendor | Amount | Funding Source |
|---|---|---|---|
| Education and Outreach | Institute | $25,000 (2015) | this in Market Studies 2013-2014 budget) |
| Additional tasks and research projects | TBD | $100,000,000 | 2016 and 2017 |
| **Total** | | **$975,000** | **2013-2015** |

### 4.3.2. Action Plans

In addition to the Strategic Plan, there will be on-going work to publish and implement Action Plans on specific topics. These Action Plans are designed to (a) identify the key actions required to achieve Plan milestones; (b) secure leaders ("champions") to achieve these actions; (c)track and report on progress; and (d)feed into the development of the Strategic Action Plan Progress Reports. The Action Plans are designed to achieve milestones identified in the Strategic Plan by working with Strategic Plan champions. They are listed below.

#### Codes and Standards

Currently the Commission is collaborating with the California Energy Commission and other stakeholders from the IOUS on a Codes and Standards (CS) Action Plan. This will cover both buildings (Title 24) and appliances (Title 20). The Codes and Standards Action Plan is expected to be published by the end of 2012, and its implementation will continue into 2013. Work includes:

- Work with CPUC staff on the planning and management of CS Action Plan-related activities.
- Strategize with CPUC staff on implementation adaptations needed due to changed conditions between now and the time when Strategic Plan activities were originally conceived.
- Help CPUC staff address implementation overlaps and assist with coordination of the different chapters/topics in the Strategic Plan as they relate to CS.
- Support the Action Plan Champions for CS plans.
- Work with CPUC staff in helping coordinate with other state agencies, such as California Energy Commission and the Air Resources Board.
- Provide technical and policy work supporting investor-owned utility activity on Zero Net Energy (ZNE) roadmaps and ZNE activities as they relate to CS action plans.
- Coordinate with Residential and Commercial ZNE Activities
- Other topics as may be requested by the CPUC Project Manager and related to CS action plan.

#### Residential Zero Net Energy New and Existing Buildings

This project supports Energy Division to develop and launch a Residential Zero Net Energy (ZNE) Building Action Plan and associated ZNE residential stakeholder engagement activities. It will also support ongoing stakeholder engagement on the residential chapter of the Strategic Plan, particularly in the area of whole house energy upgrades. The CPUC and the Energy Commission have endorsed the goal that all new residential buildings shall be zero net energy buildings by 2020. The Strategic Plan also includes ambitious milestones for upgrades of existing California homes to reduce demand from the grid by 40% by 2020. Work in this area shall include:

- Drafting, launching and maintaining the Residential Zero Net Energy Action Plan (currently underway).

- Conducting stakeholder engagement activities in the area of ZNE residential buildings, including: periodic ZNE Action Group and subgroup meetings, calls and other outreach activities; management of a ZNE Residential inter-agency Coordinating Committee, stakeholder Advisory Group, and ZNE Action Group working group leaders and champions; coordination between the ZNE Residential and other Action Plans, particularly the Research and Technology, Codes and Standards and HVAC Action Plans; and other related activities as deemed appropriate.
- Research and technical support for the creation of improved public information on ZNE residential buildings including an online database, and printed formats.
- Support for stakeholder engagement activities in the area of whole house energy upgrades
- Support for research, stakeholder engagement and other activities in the area of whole house energy upgrades; the AB758 process; AB758 Action Plans; and related comprehensive whole home upgrade programs and activities.

## Industrial

To address the Strategic Plan's industrial sector goals, Energy Division (ED) is drafting the Industrial Action Plan. Based on the milestones and goals outlined in the industrial chapter of the Strategic Plan, the Industrial Action Plan identifies champions and the intermediary steps necessary to achieve maximum energy efficiency in the industrial sector. The Industrial Action Plan is the first step towards meeting the industrial sector goals. The Industrial Action Plan may be rolled into the 2013 update to the EE Strategic Plan. Planning will include working with industrial stakeholders, as well as ensuring that the Action Plan is consistent with state goals detailed in the AB32 Scoping Plan.

## Research and Technology

This project supports Energy Division work related to the Strategic Plan. The contractor, Itron, is providing technical assistance to CPUC staff on the Strategic Plan Support for developing the Action Plan related to Research and Technology (RT) chapter of the Strategic Plan. In addition, this work supports the implementation of the Market Intelligence and Integrated Building Design chapters of the RT Action Plan.

CPUC support work will include:

- Working with CPUC staff on the planning and management of RT Action Plan-related activities.
- Strategizing with CPUC staff on implementation adaptations needed due to changed conditions between now and the time when Strategic Plan activities were originally conceived.
- Helping CPUC staff address implementation overlaps and assist with coordination of the different chapters/topics in the Strategic Plan as they relate to RT.
- Support the Action Plan Champions for RT plans.
- Work with CPUC staff in helping coordinate with other state agencies, such as California Energy Commission and the Air Resources Board.
- Provide technical and policy work supporting investor-owned utility activity on Zero Net Energy (ZNE) roadmaps and ZNE activities as they relate to RT action plans

Implementation support work will include:

- Appoint a part time person to coordinate the activities of the group and to keep parties engaged. This activity has been already funded with existing funds of WO 73 – estimated $ 48,000/year (20 hours/month) each chapter.

- Provide initial funding for implementation activities. These may include but not limited to:
  - Staff to carry out administrative activities of the collaborative such as invoicing, logistics, activity logs, etc.
  - Travel and per diem when necessary for parties to attend meetings and related implementation events.
  - Venue booking and other necessary costs to support meetings.

Requested implementation funding: $200,000 /year for the first year for each chapter, total $400,000/year for the first year.

The implementation activities were expected to have been funded in partnership with CIEE. As this option is no longer available, ED proposes to have this activity funded out of the Strategic Plan funds or a new WO if necessary.

Other topics may be requested by the CPUC Project Manager related to the RT action plan.

This work will be performed under the overall supervision of Energy Division. In performing these tasks, Itron will follow an administrative and coordination process developed by ED. All work performed under this work order will be subject to pre-approval by the ED Project Manager and shall be done at the ED Project Manager's discretion. These tasks are expected to be carried out throughout 2013 and target the first year of implementation of the plan.

## Commercial Zero Net Energy (ZNE)

The purpose of this work is to support the CPUC with strategic planning and implementation of the ZNE Commercial Action Plan, including assisting with management and coordination of a network of key leaders in industry, nonprofits and government.

This includes consulting to the CPUC on the ongoing implementation of the ZNE Action Plan for Commercial Buildings. Support includes strategy development for market acceptance and participation in ZNE goals, providing specific technical input on critical topics and ongoing planning and coordination functions. Tasks may include:

- Participation in bi-weekly coordination meetings with CPUC to set priorities, plan quarterly meetings and workshops, and track critical policy, program and technical issues related to implementation of the Commercial Action Plan and coordination of the Champion Network
- Supporting the CPUC with planning and coordination of quarterly ZNE workshops, meetings and webinars including assistance with agenda development, event planning, development of meeting presentations and materials, facilitation of meetings and breakout sessions, and note taking and distribution to ZNE stakeholders.
- Updating the 2010-2012 ZNE Action Plan for Commercial Buildings
- Ensuring coordination amongst Action Plans
- Convening ZNE Early Adopters to share best practices
- Continuation of ZNE Bulletin

Other topics may be requested by the CPUC Project Manager related to the Commercial ZNE action plan. This work will be performed under the overall supervision of Energy Division. In performing these tasks, consultant will follow an administrative and coordination process developed by ED. All work performed under this work order will be subject to pre-approval by the ED Project Manager and shall be done at the ED Project Manager's discretion.

## Energy Efficiency Financing

The 2008 Action Plans included a sprinkling of goals and strategies that touched on energy financing across all sectors; there was not a dedicated Energy Finance Action Plan.

Given that there is a yawning gap between the forecasted annual investment needed to meet the past Strategic Plan statewide goals (~$4B)[78] and the amount of (predominantly ratepayer subsidized) capital that is currently invested in energy efficiency in the state (~$2B)[79], we anticipate that bold long-term plans for energy finance will be woven into the 2013 Strategic Plan Update. We also anticipate that a contractor will be hired to support this work.

## Lighting

To date, this work assigned staff from KEMA to support the Energy Division with its strategic planning efforts related to lighting and the lighting action plan as well as strategic support and advice regarding the IOU's 2010 – 2012 LMT Program.

Specifically, this work involves quantifying the baseline energy use for lighting, drawing on the work from Navigant's potential and goals study and the CEC's demand forecast team. The baseline energy use must also undergo peer review from internal Energy Division consultants as well as through collaboration with the CLTC. Additionally, there may be more peer review teams formed to aid in the review process (utilities, EMV folks, stakeholders, etc.)

Once the baseline energy use is quantified, this work involves identifying what actions, through the lighting action plan, can actually drive lighting consumption down to the target levels identified in the Strategic Plan and the Lighting Chapter, as adopted by the Commission. This will involve meetings with experts and key stakeholders to define and quantify the actions that will lead to quantifiable progress towards meeting this goal.

After identifying the action that will lead to quantifiable progress, implementation of these actions must happen, and the implementation must be tracked and reported on to ensure successful completion of the actions and thus successful accomplishment of the visionary goals set forth by the Commission. This will involve developing a proper framework for project management of the implementation and scheduling routine check-ins with stakeholders to report on progress.

In order for the implementation of the actions to influence Commission proceeding, the actions must feed into the regulatory decision making cycle. This will involve assisting Energy Division write position statements that will be used to influence the eventual design of the IOU EE programs, or policy documents that may be used to influence other activity outside of the CPUC's jurisdiction.

Finally, as progress is tracked and goals eventually met or not met, this task will require multiple reporting requirements, as defined by the Energy Division Strategic Plan lead.

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[78] 2011. Harcourt Brown and Carey: Energy Efficiency Financing in California: Needs and Gaps. Prepared for the California Public Utilities Commission. Page 4.

[79] Ibid.

## 4.4. Ex Ante Review and Database for Energy Efficiency Resources (DEER)

### 4.4.1. Background

#### Program Area Description

Ex ante estimates stemming from the Database for Energy Efficient Resources (DEER), along with non-DEER work papers and custom projects, serve as a starting point in the planning and forecasting of the impacts and cost-effectiveness analyses of energy efficiency programs in California. The DEER provides ex ante estimates for "deemed" energy efficiency measures which are commonly installed in the residential and non-residential market sectors. Non-DEER work papers provide ex ante estimates for deemed measures that are used or located (e.g., varied hours of use and/or climate zone) in a way that differs from the DEER. Custom projects refer to site-specific ex ante estimates that are calculated on a project-by-project basis. Custom projects usually, but not always, involve a combination of measures.

The DEER contains estimates of a measure's natural gas and electrical typical gross impacts net-to-gross (the number of program participants who would have implemented the measure without the utility program), and effective useful life. The estimates are based on previous evaluation studies, pilot tests, engineering calculations, building simulations, measurement studies and surveys, econometric regressions, or a combination of approaches; ex ante estimates are not based on the real-time results of the current program cycle.

#### Programs included in the Research Scope

The DEER and ex ante estimates are used in all EE programs for cost-effectiveness analysis. As such, all programs are potentially included within the DEER and ex ante research scope. No additional budget is needed from the 2016 or 2017 EM&V allocation to complete ex ante and DEER scope in the next year since each individual roadmap budgeted for this work.

#### Uncertainties and Challenges to Successful Implementation

One challenge facing ex ante estimates is that, to date, limited field work has been performed to study very specific and precise data points that feed into building modeling parameters (e.g., effective useful life). Additionally, market transformation and economies of scale create price volatility for many energy efficiency measures, thereby requiring updates to cost data for measures that constantly change their relative contributions to the energy efficiency portfolio. Efforts are being made to improve communication and coordination between the ex ante and evaluation teams to collect data to better inform ex ante estimates in a timely manner.

Another challenge facing ex ante estimates is the projection of EM&V results reflecting what happened during a historical program year into forecasted energy savings estimates of what will happen in a future program year. This can be particularly challenging for measures with quickly-changing markets such as LEDs. Data from EM&V studies and surveys improve the accuracy of engineering calculations and building simulations by updating changes in hours of use, energy savings baselines, measure costs, effective useful lives, and net-to-gross ratios related to equipment performance, technology advancements, and economies of scale. Historically, however, EM&V studies were not scoped to predict how past performance should be interpreted for future application. The Rolling Portfolio Cycle schedule sets firm milestones for when EM&V data must be completed in order to feed into the next DEER

update. Energy Division is coordinating and collaborating internally to ensure that the EM&V results finalized by March of each year are developed and communicated in a way that facilitates a straightforward ex ante update.

## Emerging Evaluation and Information Needs

Ex ante research needs can be divided into two areas: (1) improving the DEER values for existing measures, and (2) data validation support for ex ante estimates for new measures (i.e., non-DEER work papers). EM&V can be used for improving the DEER and non-DEER work paper values for in-cycle measures through impact evaluation studies.

In discussions regarding funding for ex ante research needs, the utilities identified which work papers require supporting research. This includes light emitting diode effective useful life, unit energy savings, and adoption; display cases; ovens, fryers, and cookers; exhaust hoods; and power management for networked computers. Many of the identified research needs will be address by EM&V activities planned in the appropriate sectors For example, the technology assessment research proposed in the residential sector will broaden the software options available for developing ex ante estimates of whole house retrofits. Additionally, LED lab testing and lighting market assessment activities will supplement EM&V activities in the lighting sector. These research activities will improve DEER and ex ante estimates for unit energy savings, baseline technologies, and effective useful lives for the targeted measures.

Ex ante estimates for new measures, including technologies originating in the utilities' Emerging Technologies Programs, will need additional research. Ex ante estimates for new measures are commonly developed by utilities and vetted by Commission staff through the work paper development collaboration process and custom project review process. Development of ex ante values for new technologies originating in the Emerging Technologies Program should come through the work paper development collaboration process as directed by the Commission. Coordination between staff overseeing emerging technology studies team and the portfolio forecasting team (at the utilities and Commission) is needed to ensure that development of ex ante estimates is as streamlined and efficient as possible.

### 4.4.2. 2013-2014 EM&V Studies, Budgets, and Timing

The following activities are close to being completed for the 2013-2014 program funded period.

***Table 61. 2013-2014 Ex Ante Review and Database for DEER EM&V Studies, Budgets, and Timing***

| 2013-2014 Study Area/Title | Study Manager (ED/IOU) | Budget | Completion Date |
|---|---|---|---|
| **Impact** | | | |
| DEER and All Ex Ante Regulatory Support | ED | $8,000,000* | October 2013- October 2016 |
| Ex Ante Development and Tracking Support | ED | $3,100,000 | TBD |

*Funding was sourced ½ from 2010-2012 and ½ from 2013-2014 EM&V authorization

### 4.4.3. Key Research Questions for in 2016 and beyond

Draft DEER updates are released June 1 of each year, with finalization by September 1. Research needs include:

- Update load shapes
- Updates to the peak period
- Effective Useful Life/Remaining Useful Life updates (particularly for LEDs)
- Exhaust hoods demand-controlled ventilation
- Power Management for networked computers
- Commercial and residential saturation studies to determine baseline technologies
- Baseline study for refrigerated food display cases
- Operating hours, food production rates, baseline efficiency data for target population for convection ovens, conveyer ovens, fryers, and steam cookers

EM&V studies proposed in other sectors will address some DEER and ex ante research needs. Please refer to the sector-specific chapters of this plan for additional information.

# 5. Processes and Procedures Supporting the Evaluation

## 5.1. Management of Energy Division EM&V Effort

Oversight of the energy efficiency EM&V is the responsibility of Energy Division's Demand Side Management Evaluation Section. The supervisor and staff in this section are responsible for the development and execution of this plan in coordination with the EM&V staff at the investor owned utilities or IOUs.

Energy Division has designated staff lead roles in 12 sector/program specific areas, as reflected in the PCGs, and three study type lead roles.

- The **sector/program area leads** are responsible for tracking all studies (IOU or ED-led) in their assigned sector or program area. They are responsible for convening the project coordination group with the IOUs to coordinate research and to ensure open lines of communication for vetting plans and results from all studies. Staff frequently lead the ED studies in their sector area but may share this responsibility with other ED staff.
- **Study type coordinators** are responsible for understanding the breadth of a specific type of study being conducted to identify needs for consistency in methodology or outputs. The best example of this is the Impact Study lead. This individual is responsible for ensuring that the impact methods are consistent where appropriate and that studies are completed on time to feed portfolio wide analysis.
- **Support leads** also exist for Data management, reporting, contracting, and other areas that are necessary for keeping the EM&V activities moving forward.

Energy Division hires contractors to support the EM&V effort in two primary ways:

- Advisory Consultants provide assistance to Energy Division in overseeing the implementation of program evaluation projects and related studies conducted by various evaluation contractors. Advisory Consultants provide expert analysis and advice to Energy Division staff for on-call advice and consulting; special research projects at the request of the Energy Division contract manager and on an ad-hoc basis. Advisory Consultants are also paired with Energy Division staff that are serving as sector or study area coordinators to support them in coordinating work across the sector or study area, ensure that deliverables are on schedule and meeting expectations, and ongoing prioritization of work within the sector or study area.
- Prime Evaluation Contractors are hired by the Energy Division to lead the execution of that evaluation plan. Prime Evaluation Contractors and their subcontractors perform evaluation, measurement and verification activities with respect to energy efficiency programs implemented by the California lOUs and under the supervision of Energy Division staff.

More detailed management and organizational diagrams can be provided upon request.

### 5.1.1. Data Management

## Background

This document provides an update on 2013-2015 activities in the area of data management and reporting, and proposed new activities for 2016 and beyond.

Since Energy Division assumed responsibility for energy efficiency evaluation (post 2005 EM&V) we have developed a standardized dataset of savings information, which allows for review of savings values and informs incentive payment awards. This dataset also forms the foundation for impact evaluation and public tracking of savings, costs, goals and emissions reductions.

The foundation for all EM&V activity is program tracking data, and data standardization has been a core effort of the evaluation data team in collaboration with the IOUs over the past several years. The reporting framework is designed to enable frequent updates on the progress of savings and highlight evaluation findings. This framework ensures the timeliness and relevance of evaluation expenditures as well as summarizes accomplishments at the end of a program cycle. Together these support activities are essential to executing and realizing value from this proposed EM&V plan.

The Energy Division maintains the California Energy Efficiency Statistics website (EEStats.cpuc.ca.gov), containing the full set of IOU program tracking data and evaluation updates from the 2010-2012 program cycle, as well as program tracking data for the current 2013-15 cycle and the first two quarters of 2016. The dynamic format of EEStats allows users to filter data for savings, expenditures and other types of data mining.[80]

In 2015, the Energy Division took the data standardization a step further with an automated claims processing engine that validates and performs quality control checks on quarterly program tracking data submissions. The California Energy Data And Reporting System (CEDARS) encodes and enforces all of the rules governing the ex-ante data, providing feedback to program filing staff about the quality of their submissions, including cost effectiveness checks. This automated platform has reduced manual processing tasks nearly two-thirds. Once processed and confirmed, the data is stored in the Energy Division Central Server, where numerous end-users may access files based on their unique roles.

Efficiencies gained with CEDARS led to the development of a filing module (CEDARS-FM) that similarly processes cost effectiveness inputs, stores program definitions, and enables the upload of budget request tables and other application documents for annual budget filings. As part of this work, developers will link the two modules (claims and filing data) to enable the quarterly tracking data to feedback as reports against the inputs filed the prior year.

## Data Management Accomplishments

Significant progress has been made in data management, and the systems, approaches, and knowledge gains have improved and continue to build on progress made in earlier cycles. The key accomplishments in the 2013-2015 program cycle, and the building blocks for the next program cycle, include:

[80] California Energy Efficiency Statistics – http://eestats.cpuc.ca.gov/

- A single data repository of Program Administrator energy efficiency tracking data created for centralized access by multiple users.
    - Specialized expertise in integrating the standardized dataset with other critical data systems, such as the ex-ante data set and cost effectiveness calculations.
    - The standardized dataset better meets the needs of the multiple uses such as:
        - *Direct application for updating goals and potential model*
        - *Source data for evaluation planning and sampling*
        - *Accessing monthly, quarterly and annual reporting (or interim queries)*
        - *Adaptable to incentive mechanism variations*
    - This standardized data set and framework serves as a resource for staff and external parties and provides a consistent, centralized source of information about the expenditures, savings and cost effectiveness of the energy efficiency portfolio investments.
- Regular working meetings with the IOUs, RENs and CCAs, including an in-person reporting PCG with full PA attendance, to improve communication and understanding of data sets and processes used in meeting the CPUC's reporting requirements. These meetings resolved several short term issues in order to meet, and incrementally improve, reporting each quarter and conform with policy direction on reporting requirements.
- Completion of an automated validation/QC platform for quarterly program tracking called the California energy Data And Reporting System (CEDARS) which has led to a two-thirds reduction in post-processing time.
- Completion of a filing module within CEDARS to store program definitions, cost effectiveness inputs and other files related to annual budget request applications, leading to efficiencies and transparency in staff budget review.
- Completion of the Cost Effectiveness Tool (CET) desktop application through Version 17.2; integration of the CET SQL code into the CEDARS claims and filing modules.
- Development of a Standard Impact Evaluation Report to supplement the ESPI reports.
- Full data sets for 10-12 program cycle of reported claims and evaluation results in graphical format on the EEStats data portal; full *reported* claims data for 2013-2015; processed claims for Q1 and Q2 2016.
- Migration to a more secure and efficient server environment that grants users role-based access to necessary data resources.
- Coordinated with the Ex Ante team to implement a change management process that ensures synchronicity between data resources such as the DEER and program tracking databases, and provides transparency regarding scheduled structural changes to any of the databases.

## Data Management and Reporting Project List for 2013-2015

The table below summarizes the 2013-15 EM&V Projects that have been budgeted. The table provides the Project manager, the work order under which the Project is being conducted, the corresponding budget, and the implementation status.

***Table 2013-2015 Data Management Studies Summary***

| Work Order | Title | Total Contract Amt | Task # | Task Name |
|---|---|---|---|---|
| Dta_1* | Data Management, Integration & Coordination<br>*Part of original 2013-14 budget | $1,650,000 | 1.1 | Mgt & Coordination |
| | | | 2.1 | Road Map Plan |
| | | | 3.1 | Data Needs Assessmnt |
| | | | 4.1 | Data Requests |
| | | | 5.1 | Trk Data Spec |
| | | | 5.2 | Trk Data Processing |
| | | | 5.3 | Trk Data Summaries |
| | | | 5.4 | DR DG Dta Processing |
| | | | 6.1 | CIS Bill Dta Process |
| | | | 6.2 | Intv Data Processing |
| | | | 7.1 | Database Integration |
| | | | 8.1 | Coord with Roadmaps |
| | | | 8.2 | Coord w ExAnte Team |
| | | | 9.1 | Public Data Request |
| | | | 10.1 | IT Related |
| | | | 10.2 | IT Expenses 2014 |
| | | | 10.3 | IT Expenses 2015 |
| | | | 11.1 | EE Stats |
| | | | 12.1 | Cost Effectiveness |
| | | | 12.2 | Cost Effect Tool |
| | | | 13.1 | Reporting Data |
| | | | 14.1 | Data Library Specs |
| | | | 15.1 | Contingency |
| | | | 16.1 | 1012 Follow Up |
| Dta_2* | 13-14 ED Reporting – ESPI<br>**Part of original 2013-14 budget | $185,000 | | |
| Dta_3 | EEStats Website<br>Added in 2015 Budget | $100,000 | 1.1 | Project Management |
| | | | 2.1 | Data Portal |
| | | | 3.1 | Website Features |
| | | | 4.1 | Tech Support & Maint |
| Dta_4* | 13-14 Automated Data Submissions Platform (CEDARS Claims)<br>*Part of original 2013-14 budget | $350,000 | 1.1 | Project Management |
| | | | 2.1 | Systems Development |
| | | | 3.1 | Systems Testing |
| | | | 4.1 | Documentation |

| Work Order | Title | Total Contract Amt | Task # | Task Name |
|---|---|---|---|---|
| | | | 5.1 | Training |
| | | | 6.1 | User Support |
| | | | 7.1 | Application Support |
| Dta_5 | 13-14 CEDARS-PIP/Application Module (CEDARS-FM)<br>Added in 2015 Budget | $300,000 | 1.1 | Project Management |
| | | | 1.2 | Coord w Stakehlders |
| | | | 1.3 | Systems Design |
| | | | 1.4 | Rqrmnts Rev Approval |
| | | | 2.1 | Mgmt of Development |
| | | | 2.2 | Systems Development |
| | | | 2.3 | Systems Testing |
| | | | 2.4 | Documentation |
| | | | 2.5 | Training |
| | | | 3.1 | Planning |
| Dta_6 | 13-14 CEDARS CET<br>Added in 2015 Budget | $65,000 | 1.1 | Management |
| | | | 2.1 | CET/CEDARS Integratn |
| | | | 3.1 | CET Optimization |
| | | | 4.1 | EDCS Migration |
| Dta_7* | 13-14 Data Requests<br>*Part of original 2013-14 budget | $150,000 | 1.1 | Project Management |
| | | | 1.2 | Fulfill Previous DR |
| | | | 2.1 | DR Submission Portal |
| | | | 3.1 | CPUC DR Coordination |
| | | | 3.2 | CPUC DR Processing |
| | | | 4.1 | External DR Coord |
| | | | 4.2 | External DR Process |
| | | | 4.3 | External DR TechAsst |
| Dta_8 | Data Management 2015 – Processing<br>Added in 2015 Budget | $600,000 | 1.1 | Management |
| | | | 4.1 | Data Requests |
| | | | 5.1 | Trcking Data Specs |
| | | | 5.2 | Trcking Data Process |
| | | | 5.4 | DR/DG Data Process |
| | | | 6.1 | CIS/Bill Dta Process |
| | | | 6.2 | Interval Dta Process |
| | | | 8.1 | Coord w Roadmaps |
| | | | 8.2 | Coord w ExAnte |
| | | | 10.1 | IT Related |

| Work Order | Title | Total Contract Amt | Task # | Task Name |
|---|---|---|---|---|
| | | | 10.3 | IT Expenses |
| | | | 13.1 | Reporting Data |
| | | | 13.2 | Reporting ExPost Dta |
| | | | 14.1 | Contingency |
| Dta_9 | 13-14 Cost Effectiveness tool (CET) Added in 2015 Budget | $50,000 | 1.1 | Management |
| | | | 2.1 | CET Landing Page |
| | | | 3.1 | Versioning |
| | | | 4.1 | Combustion Type |
| | | | 4.2 | RIM Test |
| | | | 4.3 | Sav Levelized Costs |
| | | | 5.1 | Quality Control |
| | | | 6.1 | Deployment Package |
| | | | 7.1 | Support and Maint |
| | | | 8.1 | Policy Coordination |

## Data and Reporting Project Descriptions for 2013-2015

The following section details tasks and objectives associated each of the above work orders. The total 2013-2015 budget for data management is $2.25 million. Numerous tasks have been completed or are near-completion, in which case the products— such as data submission platforms, calculators and websites—are being maintained, updated as appropriate, and supported.

| | |
|---|---|
| **Study Title:** Data Management – 2013-2015<br>**DTA_1(2013-14) and DTA 8 (2015)** | **Budget:** $1,650,000 (2013-2014)<br>**Budget: $600,000 (2015)** |
| **Expected Completion Date:** Continuous through end of the anticipated contract in 2017. | **Project Manager:** (ED) |
| **Description:** This project will continue the majority of the activities being conducted under the 2013-15 Data Management Project including: processing IOU tracking, CIS, billing, and interval data, working with evaluators to ensure they have everything needed for timely evaluations, having regular meetings with the program administrators to continue to increase data quality and coordination, responding to data requests from stakeholders, designing and managing systems to ensure efficient processing and appropriate access of data, coordinating with the DEER/ex-ante team, conducting needs assessment of several systems/sites including EE Stats. | |
| **Objective:**<br>• Process IOU data efficiently in order to ensure high quality data.<br>• Provide timely, high quality data to key parties including CPUC staff, EM&V contractors, IOUs, PAs, DEER/ExAnte team, and other stakeholders. This includes data at various levels including high level summaries, standardized and quality controlled detailed claim level data, measure level tables, and data required for EE Stats.<br>• Manage a system whose required inputs are not overly burdensome on any party. | |

| **Study Title:** Data Management – 2013-2015<br>**DTA_1(2013-14) and DTA 8 (2015)** | **Budget:** $1,650,000 (2013-2014)<br>**Budget: $600,000 (2015)** |
|---|---|
| • Manage a system that has well defined processes/procedures and appropriate change management protocols. | |
| **Key Project Questions:**<br>• Are the appropriate data being requested to adequately fulfill the data needs of CPUC staff, EM&V contractors, IOUs, PAs, DEER/ExAnte team, and other stakeholders?<br>• How should the data be made available to these groups to ensure that each has the appropriate level of access ensuring privacy?<br>• How should the availability of data be best communicated to the various groups?<br>• At what levels should data be available in pre-defined, downloadable dataset?<br>  • What should the process be for providing additional support when someone requests data that is more complicated than the pre-defined reports? | |

Additional detail regarding the activities conducted under the data management work order are:

- Continue the working group with the IOUs and non-utility implementers to improve the data submission and compliance with the reporting specifications.
  - Continue to improve data quality and data flow moving towards compliance with AB270.
  - Work directly with non-utility implementers (REN; CCA) to ensure they maintain systems that can meet the data specifications from their inception.
- Maintain a dataset of the customer specific data and monthly billing data from all IOUs. Compile data from associated data requests for evaluation sampling and other participant and non-participant evaluation inquiries from CPUC staff and contractors.
  - Develop a centralized repository for this data with appropriate security provisions and protocols for data retention.
  - Develop access protocols for evaluation contractors and Energy Division.
  - Develop user interfaces to enable queries by these parties.
  - Enable longitudinal (back to 2006) analysis of progress by linking the data sets from each program cycle.
- Improve integration of IOU tracking data with DEER and Ex Ante review tools and approval processes.
- Continue to improve on the power of the reported and evaluated tracking data.
  - Support CEC and CAISO and potential forecasting with better locational data (currently have zip code and address, but need to map to busbar or other relevant locational data).
  - Maintain the capability to link with publicly available Census data (including demographic data) as being added to the database under the 10-12 Macro Consumption Project to potentially improve program targeting and enable future macro-economic modeling.
  - Identify and leverage opportunities to integrate with smart grid data as it becomes available, and real time information with customers
- Continue to improve the flow of detailed tracking data through the cost effectiveness tool.
  - Create queries on the output of the cost effectiveness runs to be displayed on the CPUC's EE-Stats website and in preparation for the Energy Division's Annual Report.

  - Assist with the adoption of a SQL-based cost effectiveness calculator tool.
  - Collaborate with California Energy Commission (CEC), California Air Resources Board (CARB), U.S. Department of Energy (DOE – specifically the Building Performance Database) to ensure that regular reports required for these entities are defined in the data system and can be generated by staff automatically - and are presented in the public sphere.
    - CARB – Greenhouse gas cumulative impacts
    - CEC – Demand Forecasting – IEPR
    - DOE Building Performance Database
- Maintain and improve the data warehouse to meet the following high-level objectives:
  - Inform and require ALL evaluation contractors to meet the specifications as a requirement of their contract (IOU and ED contractors).
  - Develop security and access protocols that will:
    - Maintain only the essential data
    - Protect any customer-specific information with appropriate security protocols (TBD)
    - Define specific user cases that are appropriate for the data
- Per guidance provided in D.12-05-015 section 18.4, Energy Division and the IOUs will continue to collaborate on and improve the ease of reporting and access to program tracking data.

## Reporting

This project was originally intended to fund the consultant support required for two annual reports released by the CPUC. During the 2010-2012 cycle, consultants assisted in writing two rounds of the CPUC Annual Report. Their input included:

- The development of the Evaluation Project Summary Report (EPSR) template which highlighted the findings of each work order in a standardized briefing.
- Writing EPSRs for each of their Work Orders (WO)
- Assisting the CPUC with the design of the MS Word version and online version of the report
- Developing and producing the appendices.

At this time, the requirements for future summary CPUC Annual Reports are under discussion. In addition to possibly one or more summary reports, the 2013-14 cycle requires the development of the ESPI reports. It is assumed that two ESPI reports, one for each year, are required and that these reports will roll up the evaluation findings from the EM&V Studies covering Deemed ESPI Measures and Custom ESPI Measures.

At this time, the budget and scope below assume that one summary report and two years of ESPI reports will be delivered under this project. This Road Map Plan will be updated as the scope and deliverables are better defined.

| **Study Title:** Reporting – 2013-2015<br>**DTA_2** | **Budget:** $185,000 |
|---|---|
| **Expected Completion Date:** Continuous through end of the current contract in 2016. | **Project Manager:** (ED) |
| **Description:** This project provides consultant support for the development of one summary report and two ESPI reports. These funds will also be used to identify and improve the user interfaces for the report and an integrated user interface for energy efficiency including updated and live appendices of results. | |
| **Objective:**<br>• Assist CPUC Project Managers and Road Map Leads to produce a full portfolio report providing a summary of EE program activity including both reported and ex-post achievements.<br>• The summary report will be available online and easily navigated; provide summaries of results that are informative; and include downloadable tables of results.<br>• Coordinate with the CPUC ESPI lead to design tables of results that present the evaluation results accurately and in an easy to understand format.<br>• Use the system that efficiently processes ex post results (funded elsewhere) to produce tables required for reporting including scenario analysis. | |
| **Key Project Questions:**<br>• N/A | |

## EEStats Website

In addition to Energy Division's vision for a central, online resource for energy efficiency program achievements and resources, similar to other Energy Division resources such as the California Solar Statistics website, the California Energy Efficiency Statistics website, "EEStats," is intended to respond to a legislative mandate under AB270 (Bradford, 2013) that calls for energy efficiency program information displayed at the portfolio level (statewide and by IOU) as well as geographically, by end-use and measure group, market sector, building type, fuel type, expenditures and emissions reductions.

| **Study Title:** EEStats Website<br>**DTA_3** | **Budget:** $100,000 |
|---|---|
| **Expected Completion Date: December 2016** | **Project Manager:** (ED) |
| **Description:** The primary functionality for the EEStats website has been completed. Ongoing tasks associated with this work order include quarterly data updates to the Data View section, user and IT support, and minor updates to content. | |
| **Objective:**<br>• Establish a primary web portal that brings together all of the various online properties associated with energy efficiency programs and the EM&V work.<br>• Enable data request submissions and response tracking.<br>• Publish quarterly program tracking in both raw (Excel) and graphical (Tableau) formats.<br>• | |
| **Key Project Questions:** | |

## California Energy and Data Reporting System (CEDARS): Program Tracking Claims Processing Module

With the growth of the standardized data sets came increases in the amount of manual processing required to ensure that the appropriate parameters and rules were applied consistently in the tracking claims. To reduce this burden on staff resources and improve the timeliness of the data outputs, the Energy Division automated processing with the CEDARS platform.

| | |
|---|---|
| **Study Title:** CEDARS - Automated Data Submission Tool – Program Tracking Claims **Module DTA_4** | **Budget:** $350,000 |
| **Expected Completion Date:** Continuous release of functionality through December 2016. | **Project Manager:** (ED) |
| **Description:** This project was completed and tested throughout 2015 and placed into formal implementation beginning with Q1.2016. Functionality includes bulk submission of claims data, automated data quality control, claim submission status tracking, user account management, event notification, and data specification management. Still ongoing is the development of a feedback system so that as claims come in, they drive reports on the program detail pages, populated by the Program Definitions table in the CEDARS module. | |
| **Objective:**<br>• Automate data submission processing<br>• Document data table specifications and quality control rules<br>• Improve data quality and consistency<br>• Provide PAs actionable, real-time QC results<br>• Coordinate communication regarding data submission events<br>• Enforce change management for data specifications moving forward<br>• Reduce errors in data, gain efficiencies in processing time by reducing need for manual processing by roughly 75 percent.<br>• Build development and operations infrastructure, particularly enhanced reporting functionality.<br>• Release and fully adopt automated claims data submission tool by December 2015.<br>• Rigorously test ADST prior to launch specifically testing for data anomalies that would reduce data quality or processing time. | |
| **Key Project Questions:**<br>• What, if any, other business processes should the product team target to automate and integrate? | |

## CEDARS Filings Module

In 2016, another module in the CEDARS system was developed to ingest annual budget filing details like cost effectiveness input files, program-related documents and budget request templates, store them in the database, and display confirmed submissions at both the portfolio and individual program level. The

filing module relies on the program definitions table, which serves as a source of truth against which claims may be filed.

| **Study Title:** CEDARS - Automated Data Submission Tool – Filings Module<br>**DTA_5** | **Budget:** $300,000 |
|---|---|
| **Expected Completion Date: December 2016** | **Project Manager:** (ED) |
| **Description:** The filing module was envisioned as a way for PAs to file the cost effectiveness inputs and other filing documents systematically; similarly, to enable more efficient review of the annual budget filings. This project was scoped for user requirements in late 2015, and then coded in 2016. The testing phase required that the PAs interact with the system and complete filing milestones as functionality was built-out. Functionality includes submission cost effectiveness inputs, implementation plans, program-specific documesnt like logic models and program manuals. Data inputs follow the format of the claims specification when applicable. Tasks include a detailed needs assessment (focusing on the needs of the reviewers/approvers of the program plans), development of web pages that include the results of the needs assessment, programming, product team coordination, user acceptance testing, user training sessions, and developing product documentation. | |
| **Objective:**<br>• Automate program plan processing<br>• Document data table specifications and quality control rules<br>• Provide CPUC and other stakeholders a common platform that is easily available to review and compare program plans<br>• Provide CPUC and other stakeholders actionable, real-time detailed and aggregated summaries of anticipated participation<br>• Enforce change management for data specifications moving forward<br>• Reduce errors in data, data processing, and communication<br>• Build development and operations infrastructure | |
| **Key Project Questions:**<br>• What data do the PAs file in applications?<br>• What is the best way to present the information for staff and public review versus the needs for ex ante review?<br>• How does system handle program changes mid-season? | |

## CEDARS/CET Integration

To fully automate claims data processing, the CET code was integrated into the CEDARS claims and filing modules to allow seamless processing and QC feedback within the platform. With the integrated CET functionality, users receive real-time feedback on errors and/or warnings, which allows them to correct any issues and submit "clean" filings.

| **Study Title:** CEDARS CET integration<br>**DTA_6** | **Budget:** $65,000 |
|---|---|
| **Expected Completion Date: June 2016** | **Project Manager:** (ED) |
| **Description:** This project involves optimization and integration of the cost effectiveness processing code into the CEDARS claims submission and filing module functionality. This enables seamless | |

| **Study Title:** CEDARS CET integration<br>**DTA_6** | **Budget:** $65,000 |
|---|---|
| processing of the claims cost effectiveness tables. | |
| **Objective:**<br>• Enable PAs to view the cost effectiveness QC for quarterly claims and annual program application filings within the CEDARS processing platform. This allows PAs to address erros and/or "warnings" in real time so that they make the corrections to their filings in a timely and efficient manner.<br>• Reduce errors in data, data processing, and communication<br>• Build development and operations infrastructure | |
| **Key Project Questions:** | |

## Public Data Requests

While large amounts of public data have been made available online, we still receive requests for custom data queries for specific purposes, usually from other State agencies or members of the research community.

| **Study Title:** Public Data Requests<br>**DTA_7** | **Budget:** $150,000 |
|---|---|
| **Expected Completion Date: December 2016** | **Project Manager:** (ED) |
| **Description:** This work order was created in 2015 to allow the Energy Division to be more responsive to various data requests received from researchers and State agencies. Energy Division adheres to data privacy rules established by Commission decisions. | |
| **Objective:**<br>• Create a streamlined data request form to initiate the request with ED and the appropriate consulting teams.<br>• Enable adequate bandwidth for technical assistance both prior to and after the delivery of requested data. | |
| **Key Project Questions:**<br>• | |

## Cost Effectiveness Tool (CET)

Processing large (million+ rows) batches of data used to take days with the Excel-based calculators used in the past. This method not only put pressure on staff resources, but provided little transparency when Energy Division would re-run the claims and, potentially, get different results. To enhance the efficiency for our post processing efforts, the cost effectiveness calculator was reprogrammed into SQL. The effectiveness of this processing approach led to the development of a desktop version of the SQL-based code, complete with a simple user interface such that users didn't need SQL server or programming skills to benefit from the new approach. Thus, the CET was born.

| **Study Title:** Cost Effectiveness Tool<br>**DTA_9** | **Budget:** $50,000 |
|---|---|

| **Study Title:** Cost Effectiveness Tool<br>**DTA_9** | **Budget:** $50,000 |
|---|---|
| **Expected Completion Date: December 2016** | **Project Manager:** (ED) |
| **Description:** This project is a continuation of the CET, released in 2014 as a desktop application. As various cost effectiveness parameters change, the CET requires updating under a new version. | |
| **Objective:**<br>• Ensure that calculations match the E3 calculator.<br>• Update as-needed different cost effectiveness parameters.<br>• Provide an updated landing page on EEStats, where new versions can be downloaded.<br>• Update tool with new Avoided Cost tables.<br>• Provide user training and support as-needed. | |
| **Key Project Questions:**<br>• | |

## Proposed Data Management and Reporting Project List for 2016 and Beyond

The table below summarizes the 2016 Data Management and Reporting Projects that will be budgeted. All budgets shown in the table below are draft and will be revised during the planning phase. The table provides the project manager and corresponding budget. The total Data Management budget for 2016 and 2017 is $2,095,830 per year, for a total of $4,191,660.Feedback from stakeholders suggests a need for more IOU involvement in the standardization of EE data; specifically, the IOUs may consider holding a work order within this contract to link their tracking data to detailed program implementation data. An additional work order that stakeholders believe would be appropriate for the IOUs under this budget would be to process the AMI data in accordance with an agreed-upon protocol, and assist with streamlined data delivery options.

Data Management Studies Summary for 2016 and Beyond

| Proposed Project Title |
|---|
| Data Management |
| Standardize data for implementers and link implementation data to tracking data (IOUs) |
| AMI data processing (IOUs) |
| Implement additional standards such as BEDES and the Prop 39 XML schema, when relevant. |
| Support relevant CEC Existing buildings Energy Efficiency (EBEE) data initiatives. |
| Improve data transfer processes |
| Reporting |
| EE Stats |
| CEDARS - Automated Data Submission Tool – Tracking Module |
| CEDARS - Automated Data Submission Tool – Filings Module |
| CEDARS - Automated Data Submission Tool– Work Paper Module |
| Cost Effectiveness Tool – Cloud-based |
| Data Request Public Platform |
| Data Request – Custom Request Form |

## Data and Reporting Project Descriptions for 2016-2017

**Data Management:** Most of the core data management functions will continue throughout the years, such as those tasks associated with work orders DTA_1 and DTA_8. However, with years of progress in areas such as data standardization and processing automation, we are able to shift some of the focus and funding from manual processing tasks and related communications to meeting the needs of a more robust evaluation schedule (i.e. the "bus stop" schedule associated with the Rolling Portfolio Cycles) and internal/external reporting.

The data management category typically encompasses the majority of our data work, including Project Management, Data Requests for Evaluation Studies, Tracking Data Specification and Processing, DR/DG Data Processing, CIS/Bill Data Processing, Interval Data Processing, Coordination with Roadmaps and the Ex Ante team, IT Related discussions and IT Expenses, and reporting ex ante/ex post results.

**Standardize data for implementers and link implementation data to tracking data (IOUs)**: With an expected increase in the third party program implementer activities in coming years, it is reasonable to consider an IOU-led initiative to standardize the implementer data and link it to their own program tracking data. Energy Division will work with the IOUs to ensure that resources are provided for this type of activity.

**AMI data processing (IOUs):** Similar to the IOU management and standardization of implementer data, the IOUs are also in a good position to process their AMI data and provide standardized outputs according to the needs of EM&V studies.

**Implement additional standards such as BEDES and the Prop 39 XML schema, when relevant:** This promotes the goals of standardized data for an ever-wider range of uses.

**Improve data transfer processes:** As a matter of efficiency and security, some efforts to improve the transfer of large data sets will enhance data management and EM&V tasks.

**Reporting:** As with the data management task, the focus of reporting tasks will be on delivering results along a more robust schedule, and when possible offering online reports that correspond to the timeliness of this schedule. Additionally, CEDARS, discussed below, will enable reports for portfolios and programs derived from the filings and claims.

**EEStats:** With the effectiveness of the online approach to providing public information on EE and EM&V, evidenced by widespread use of EEStats and the new CEDARS platforms, the emphasis will shift from traditionally issued reports to the ability to generate reports from the databases at any point in time. We will continue to enhance the effectiveness and reliability of the online data reporting resources. We will evaluate the quality of the graphics currently generated with Tableau software, and consider the possibility of offering hard-coded graphical reports, which may better reflect program achievements and update automatically, replacing the manual process currently in use.

**CEDARS:**

With the claims processing engine complete, the focus will be on maintaining these systems and enhancing its reporting functionality.

With phase-1 of the filing module now complete, the next step is to build-out a system to process budget request tables, currently filed as Excel files, that can be validated/QC'd and reviewed more effectively year-over-year.

A modular platform with the capacity to support multiple processing functions, CEDARS may be an appropriate platform for a work paper validation and QC. The concept here is to enable PAs to input work paper files in a similar format to the current ex ante specification, process/validate/QC these inputs, then produce outputs at a level appropriate for ex ante review. Functionality could also include archiving and versioning strategies as well as synching to the DEER database, budget filings, and monthly and quarterly program tracking claims.

As time goes on and the data management's tasks evolve, the CEDARS platform can

**Cost Effectiveness Tool:** Greater use of the SQL-based CET have led to feedback about the potential to create an online or cloud-based tool, which may be more flexible and practical than the desktop version. Ideally, the cost effectiveness calculations could be performed by any type of user within the CEDARS platform.

**Data Access and Specialized Requests:** The outreach efforts made in past cycles to educate stakeholders on the ever-improving data resources have caused an increase in awareness of these useful resources and, as a result, an increase in requests for a variety of data. Abiding by the Commission's established privacy rules, we intend to increase our focus on serving the ever-growing demand for data by adding to

self-serve products, such as those found on EEStats, as well as a portal for specialized data requests made to the Energy Division.

**Data Request Public Platform and Custom Request Form:** An online form for parties to request either pre-processed or raw data.

## 5.2. Stakeholder Participation

In Decision 10-04-029 the Commission adopted a stakeholder input and review process to replace processes previously adopted in Decision 05-01-055. This process is summarized below and provides context to the Commission's delegation of responsibility to ED for weighing the value of public input versus the extra time such input would entail, as well as the addition of the Commission adopted dispute resolution process.

### 5.2.1. 2013-2017 EM&V Plan

This EM&V plan was developed jointly by the IOUs and ED, with a series of opportunities for stakeholder participation. Decision 12-05-11 requires ED and the IOUs to finalize and publish the plan as a report no later than 60 days after the adoption of the decision. Adoption of Decision 15.10.028 calls for an update to the plan each year as part of the rolling portfolio cycle.

There is no process for Commission adoption or for "finalizing" the plan. The plan is a project management tool and a means to provide full disclosure of this phase of the EM&V process to all interested parties. The plan is not intended to be static and will be updated annually.

Consistent with the Commission's concern that critical EM&V projects be completed on a timely basis, ED and the IOUs will continue to initiate EM&V projects as this work plan is reviewed and commented on by stakeholders.

### 5.2.2. Tools for Stakeholder Participation

Energy Division maintains several tools and processes to that allow stakeholders to provide input on research planning and dissemination and track progress of research projects. Quarterly Stakeholder Meetings: ED and the IOUs hold public meetings on the second Tuesday of each quarter to showcase the results of studies, answer questions, and discuss ongoing EM&V planning, spending and contracting.

- **Public Documents Area**: Energy Division and the IOUs use this site to share contracts and scopes of work for studies, research plans for studies, and interim and final deliverables. Energy Division also posts materials for the quarterly meetings on the site, see http://www.energydataweb.com/cpuc/home.aspx (also available via http://eestats.cpuc.ca.gov/)
- **Project Status Reporting (PSR)** database is where Energy Division maintains a list of all active evaluation projects. The site provides information on budgets for specific projects or study type and expected date of completion. Users can access the summary of budget expenditures to date for any Energy Division project and this information is updated on a bi-weekly basis. Site orientation is available upon request. http://www.emvpsr.com/Projects/ (also available via http://eestats.cpuc.ca.gov/)
- **IOU and ED staff:** Stakeholders can also contact IOU and ED staff with questions about particular studies or sectors. Contacts for studies and contracts are listed on the Project Status Report. ED Sector leads are listed in on page 302; "List and Contacts for 2013-2016 EM&V PCGs".

### 5.2.3. EM&V Project Scopes and Study Plans

Because ED's EM&V activities will be conducted through specific study plans, ED has set up a procedure for review of and comment on the scope included in those study plans and the underlying projects. As described in the following chapter, ED also requires the IOUs to post their approved EM&V project

scopes on the Public Documents Area website. Thus the process for IOU projects will follow similar procedures. The procedures below are adapted from the stakeholder input process adopted by the Commission in Decision 10-04-029.

All project scopes and study plans developed by Energy Division and the IOUs will be posted on the Energy Division public document website at www.energydataweb.com/cpuc/default.aspx. In some cases, draft study plans will be posted for public comment. Notice of posting of study plans will be sent to work order topic subscribers on the public document website (automatically)and to the applicable CPUC service list. Comments on draft study plans will be submitted to and will be publicly available on the public document website.

Energy Division and the IOUs may hold public meetings (in person, via webinar, or via webcast), separately or jointly as the case may be, to solicit input on draft study plans posted on the public document website. Parties may submit written comments on the study plans before and/or after the public meetings; these comments will be posted on the public document website. Notice of the public meetings will be sent to subscribers on the public document website automatically and to the applicable service list. Energy Division and the IOUs, working with their respective EM&V contractors, will finalize study plans, taking into consideration the parties' written comments and input during the public meetings.

The finalized study plans or project scopes will be posted on the public document website.

If a party or parties take(s) issue with a final study plan, the party or parties may file a motion with the Assigned ALJ and provide evidence for why the study plan should be changed and how. The ALJ will resolve the dispute and direct Energy Division and/or the IOUs to revise the plans accordingly via ruling.[81]

### 5.2.4. EM&V Project Implementation and On-going Feedback

Energy Division and the IOUs will convene a quarterly public stakeholder meeting among their staff and EM&V contractors to share key study plan ideas or methods, results and EM&V findings for portfolio improvements and identify best practices and possible improvements to evaluation methods. The meetings will take place on the second Tuesday of the first month in a quarter, from 10:00 a.m. to 2:00 p.m.

Informal public meetings to discuss EM&V work progress and results may be held by ED, the IOUs or both on an ad hoc basis if requested by ED, the IOUs, parties or members of the public.

When significant results are produced by the EM&V work, and a technical report is not immediately pending, the Energy Division and/or the IOUs will provide informal written summaries of the results to all stakeholders. These written summaries will be posted on the public document website.

[81] Decision 10-04-029 describes the dispute resolution process: "For Project-Specific EM&V Plans, if parties continue to take issue with the final work plans, a party or parties may file a motion with the assigned ALJ and provide a rationale for why the plans should be changed and how. The ALJ will resolve the dispute and direct ED and/or the IOUs to revise the plans accordingly via ruling." http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/116710.pdf.

### 5.2.5. Public Review of EM&V Technical Reports

Drafts[82] of any interim or final EM&V technical reports produced by Energy Division and the IOUs, working with their respective contractors, will be posted on the public document website. A notice will be distributed to the appropriate service list(s) and to subscribers (automatically) to the pertinent topic in the public document website. For this purpose, EM&V technical reports are defined as reports produced by the Energy Division and the IOUs, working with their respective contractors that document completed analysis and are identified as a milestone in the Evaluation Plan or in a study plan.

Energy Division and the IOUs will hold public meetings (in person, via webinar, or via webcast), separately or jointly as the case may be, to solicit input on the EM&V Technical Reports. Parties may submit written comments on these reports before and/or after the public meetings. Comments must be submitted to the public document website and will be publicly available. Energy Division will also review and reserves the right to provide written comments to the IOUs on their EM&V contractors' draft reports.

Energy Division and the IOUs, working with their respective EM&V contractors, will finalize the draft reports, taking into consideration the parties' written comments and/or input during the public meetings.

The final EM&V technical reports will be posted on the public document website. Responses to written comments on the draft reports will be prepared and posted at the same time or soon after the revised reports are posted. Notice of posting of final technical reports will be sent to subscribers to the relevant topics on the public document website and to the appropriate service list.

If parties continue to take issue with the final EM&V technical reports, a party or parties may file a motion with the Assigned ALJ and provide evidence for why the report is deficient and what changes to the report would be necessary to correct the deficiency. The ALJ will resolve the dispute and direct Energy Division and/or the IOUs, via ruling, to prepare an addendum to the report correcting the deficiency. The addendum will be posted on the same website where the draft reports are posted.

Within 60 days of public release of a final report, the program administrators will respond in writing to the final report findings and recommendations indicating what action, if any, will be taken as a result of study findings. The IOU responses will be posted on the public document website.

### 5.2.6. Public Review of Aggregate EM&V Reports

Energy Division's draft reports aggregating or summarizing the results of the EM&V technical reports, in any form, will be issued via ALJ Ruling for parties' comments and posted on the public document website..

Energy Division will hold public meetings (in person, via webinar, or via webcast), to discuss the draft report. Parties may file comments and reply comments on the draft aggregate EM&V report for a

[82] "Draft" in this context refers to a completed version of a technical report that is deemed ready for public posting by the project manager. In this case, a "draft" report is final in every sense except for the final step of allowing for stakeholder review, gathering stakeholder comments and making changes in response to stakeholder comments.

specified period following the public meetings. The comments must be posted on the public document website.

The assigned ALJ will issue a proposed decision on the draft aggregate EM&V report, revising it as needed based on parties' comments.

Parties may file comments and reply comments on the ALJ's proposed decision pursuant to Commission procedure.

The Commission will adopt a decision on the final aggregate EM&V report.

### 5.2.7. Dispute Resolution Process

In Decision 10-04-029, the Commission established dispute resolution methods for matters that cannot be resolved informally between ED and the IOUs. Under that process, a party may file a "Motion for EM&V Dispute Resolution" (EM&V Motion) with the assigned ALJ in R.09-11-014 or its successor for resolution of an EM&V matter. The EM&V Motion must include a statement from ED giving its side of the dispute. The ALJ may undertake any appropriate process to gather further information. The ALJ may issue a Ruling to resolve the dispute. Alternatively, in an EM&V Motion, the filing party or the ED may ask that the matter be resolved by the assigned Commission or the full Commission. In that case, the ALJ will consult with the assigned Commissioner to determine the appropriate course of action. This may include an ALJ Ruling, an assigned Commissioner Ruling, or a Commission Decision. If the ALJ and assigned Commission decide to bring the matter to the full Commission, the ALJ or assigned Commissioner will issue a PD and allow for comment under Rule 14 of the Commission's Rules of Practice and Procedure.

The EM&V Motion may be used for the following purposes only:

- Disputes over results of EM&V studies or reports;
- Dispute over selection of an EM&V contractor;
- Disputes about project-specific final EM&V work plans;
- Disputes regarding final EM&V technical reports; and
- Disputes concerning public vetting of EM&V projects.

## 5.3. Contracting – by Energy Division & IOUs

### 5.3.1. Energy Division Contracting Plan and Access Information

Energy Division will solicit technical assistance to execute this 2013-2014 evaluation plan. This includes outside support to assess progress, and evaluate, measure and verify savings from IOU energy efficiency programs and portfolios to inform savings estimates, program performance, and market status.

The solicitation will be issued from the CPUC contracts office in the upcoming months.

Multiple contracts will be needed to carry out the evaluation work for the upcoming program cycle (and likely future program cycles). For 2013-2014 we expect the contracts to be organized around a few major groupings of sectors. Likely, the two large customer segments (Residential and Non-Residential), groupings of the research roadmaps, and a third or fourth that will cover multiple cross-cutting areas. The contractors for the customer segments will be responsible for the full spectrum of evaluation needs in that segment (impact, process and market studies) as needed. Any cross-cutting areas will be more discretely defined, and may need to be contracted independently. The pending Requests for Proposals will provide detailed direction.

A new solicitation for Energy Division advisory consultants will also be made in the upcoming months. The role of the advisory consultant is to assist Energy Division staff with expert analysis and advice on research projects and evaluation, measurement and verification studies. Energy efficiency evaluation research spans a wide range of disciplines and activities, and therefore the solicitation for expertise should be likewise inclusive and with an expectation of collaboration with a wide array of consultants. The pending Requests for Proposals will provide detailed direction.

All contracts for the 2013-2014 program cycle will be handled through the CPUC Contracts Office according to state contracting rules. Solicitations will be posted on "Bidsync" http://www.bidsync.com the state contracting site managed by the California Department of General Services.

### 5.3.2. PG&E Contracting Plan and Access Information

The following information provides the basic process for identifying and being awarded contracting opportunities for evaluation activities with PG&E.

#### RFP Process

1. Submit company information to the CALMAC EM&V Contractor Contact List: http://www.calmac.org/contractorcontact.asp
2. Respond to the Request for Proposal (RFP): http://www.pge.com/b2b/purchasing/bidopportunities/
3. PG&E notifies the company of the RFP acceptance or rejection.
4. If the company is awarded the contract and already has a Master Service Agreement (MSA) in place with PG&E, then a Contract Work Authorization is issued.
5. If the company is awarded the contract and *does not* have a MSA in place, then a MSA must be signed with PG&E.

## Direct Award Process

At times, it is not necessary to implement the RFP process and instead PG&E directly awards a contract to a consultant. To become part of the notification list that PG&E is seeking to direct award a contract, submit your company's information to the CALMAC EM&V Contractor Contact List:

http://www.calmac.org/contractorcontact.asp

## Data Security

If the Scope of Work includes PG&E Confidential, Restricted, and/or Privileged data, then your company is required to pass a Third Party Security Review. Use only the Enterprise Secure File Transfer (ESFT) system to transmit confidential data to PG&E throughout your company's engagement.

## Supplier Diversity

PG&E values and aggressively seeks to extend its supplier relationships with diverse suppliers including Women, Minority and Service Disabled Veteran-Owned Businesses (WMDVBEs) through our Supplier Diversity Program. The first step to become a PG&E certified WMDVBE is to become certified through the California Public Utilities Commission's (CPUC) Clearinghouse at http://www.suppliernetwork.net/CPUC/. At the same time, complete a PG&E supplier profile at https://cvmas10.cvmsolutions.com/pge/.

### 5.3.3. SCE Contracting Plan and Access Information

The following information provides the basic process for identifying and being awarded contracting opportunities for evaluation activities with PG&E.

## Request for Proposal / Quote / Information (RFx)

1. Supplier Registration, submit supplier company information onto SCE supplier registration web-site.
   https://cvmas15.cvmsolutions.com/sce/
2. Request for proposal / quote / information notification sent to suppliers
3. Respond to the RFx on or before the due date both by mail or electronically.
4. Based on business needs a purchase or a master agreement may be used (see below).
5. Start the negotiation process and make award(s) to supplier(s) once negotiation is completed.

## Master Agreement (MA)

A Master agreement is a perpetual set of terms and conditions between Edison and a Supplier to govern the entire relationship between the two entities across all PO's that reference it. MA's are an evergreen set of terms and conditions that lay the ground rules and the context for all contractual transactions between Edison and the Supplier.

## Benefits of an MA

1. MAs make life easier for substantial and repetitive procurements by allowing common terms to be negotiated once instead for each individual PO.

2. MAs create certainty around each aspect of the relationship between Edison and the Supplier, thereby lowering risk and cost.
3. Providing efficiencies of scale: negotiating in-depth once instead of negotiating the same thing over multiple procurements.
4. Providing stability for the Supplier and SCE through long-term pricing.

## Purchase Order (POs)

Purchase Orders are transactional documents that Edison uses to obtain goods and services from a Supplier. They are comprised of four main parts: the general terms & conditions, the work schedule for services, the delivery date for goods, and the price.

## MAs vs. POs

Master Agreements are the preferred way of contracting at Edison. There are circumstances where the issuance of a standalone Purchase Order is appropriate. An example of this can be demonstrated if the goods or services to be procured are a onetime buy and the expectation is that no further procurements for a specific product or service are identified to continue with a given Supplier. For EM&V contracts, SCE typically uses purchase orders.

## Directed Award

At times based on business needs it is not necessary to implement a RFx process and instead SCE can directly award a contract to a supplier or consultant. Specific management approvals are required for a directed award.

## Customer Data Security and Privacy Compliance

If the Scope of Work includes confidential, restricted, or privileged data, then supplier is required to pass a third party security review and use only secured file transfer protocol to transmit any and all confidential data throughout supplier's engagement.

## Supplier Diversity and Inclusion

At Southern California Edison (SCE), we believe in continuous improvement and aim to build upon our long-standing commitment to supplier diversity. By building programs to enhance our tools, processes, and communications, we have made supplier diversity an integral and standard part of the way we do business. We value both strengthening existing programs and processes, as well as seeking new ways to be successful in helping diverse suppliers develop the capabilities to make them even more valuable to their customers, including SCE. SCE is committed to provide opportunities for diverse business enterprises (DBE) to participate in its purchasing and contracting activities on a competitive bidding basis. The Supplier Diversity Program has four main **Objectives:**

1. To increase opportunities for DBEs to compete for SCE's business, through both direct and indirect contracting.
2. To increase both the dollar amount and percentage of materials and services the company procures from DBEs.
3. To assist DBEs, ethnic chambers, and trade business associations to better understand SCE's vision, strategy, goals, and procurement practices.
4. To increase support for achieving supplier diversity goals throughout our company.

The first step to become certified DBE is to become certified through the California Public Utilities Commission's (CPUC) clearinghouse at www.suppliernetwork.net/CPUC and register with SCE at https://cvmas15.cvmsolutions.com/sce/ at the same time.

### 5.3.4. SDG&E and SCG Contracting Plan and Access Information

## Guidelines for Supplier Qualification

### *Sourcing Process*

1. SoCalGas and SDG&E's Supply Management, Diverse Business Enterprise group, and individual business units will review the qualifications of interested suppliers in various ways, including review of a vendor relations portal, PEPMA, and a variety of other internal and external tools.
2. Qualified suppliers may be added to a bidder's list for the opportunity to participate in targeted RFP's at various times throughout the year.
3. Invited bidders may respond to a Request for Proposal (RFP), a Request for Quote (RFQ) or a Request for Information (RFI) when they occur.
    a. Information will be communicated with qualified suppliers before an event (RFP, RFQ or RFI) opens, either via email, phone, or via a request to register in Power Advocate (our electronic sourcing tool).

### *Direct Award Process*

SoCalGas and SDG&E may choose to award a contract directly to a qualified supplier when requirements necessitate securing the services of a contractor with unique attributes for a specific engagement.

### *Supplier Diversity*

SoCalGas and SDG&E are always seeking to broaden its relationships with diverse suppliers including Women, Minority and Service Disabled Veteran-Owned Businesses (WMDVBEs) through our Supplier Diversity Program. The first step in becoming a certified WMDVBE is to certify through the California Public Utilities Commission's (CPUC) Clearinghouse at http://www.suppliernetwork.net/CPUC/. SoCalGas and SDG&E also recognize qualified suppliers that are certified by a Comparable Agency Verification (CAV). CAV includes WMBE certification in good standing with the National Minority Supplier Development Council (NMSDC) and/or the Women's Business Enterprise National Council (WBENC).

If your company is not a certified WMDVBE, SoCalGas and SDG&E actively assist its suppliers with broadening their WMDVBE sub-contractor relationships.

## 5.4. Energy Division - IOU Collaboration

### 5.4.1. Process for Periodically Updating EM&V Plans and Budgets

As stated throughout this document, this EM&V plan is not intended to be static. While the IOUs and ED will earnestly use this plan as a management tool, and while, at this time, we expect to implement the projects as planned - we retain the flexibility to shift funds and refine projects when needed, as granted by the Commission in Decision 10-04-029.

The IOUs and ED will reflect changes to the plan in annual updates, to align with the rolling portfolio schedule. The plan is housed at CPUC.CA.GOV under Energy, and Energy Efficiency. A complete list of on line resources that allow stakeholders to track progress, interim changes, spending, etc., is listed in Chapter 3 of this section.

### 5.4.2. Process for Commission Oversight of IOU EM&V Projects

The following text is a partial restatement of a document provided to IOU EM&V staff by ED in August 2010. The purpose of the original document was to lay out ED's procedures for implementing the Commission's oversight of IOU EM&V projects per Ordering Paragraph 4 and Attachment 2 of D.10-04-029.

Ordering Paragraph 4 of Decision 10-04-029 states the following:

> *"The process for Evaluation, Measurement and Verification for the 2010 through 2012 energy efficiency portfolios adopted in Decision 09-09-047 for Southern California Edison Company, Southern California Gas Company, San Diego Gas & Electric Company, and Pacific Gas and Electric Company (collectively, IOUs) shall supersede the process adopted in Decision 05-01-055 regarding the following processes:*
>
> - *An IOU shall seek approval from Energy Division before initiating Evaluation, Measurement & Verification (EM&V) ex-ante studies, or EM&V process or formative evaluations.*[83] *The IOU management role for developing ex-ante savings estimates or EM&V process or formative evaluations shall be under the oversight of Energy Division, who shall have the authority to deny approval of projects. This authority is limited to situations where there is a conflict of interest with a contractor the IOU wishes to hire, where there is duplication or significant overlap with studies already planned or carried out by Energy Division, or where Energy Division can specify why a study is unnecessary. Energy Division's approval process for IOU's ex-ante studies, or EM&V process or formative evaluations, is limited to no more than two weeks. Any Energy Division denial of approval shall be in writing to the IOU requesting approval.*
> - *Energy Division's role for approval and involvement in IOU EM&V projects shall be as set forth in Attachment 2 of this decision.*

[83] In practice Energy Division has permitted the IOUs to proceed with projects that are under $30,000 without the approval process, however the research still must be disclosed to Energy Division. We intend to continue this practice in the 2013-2014 period.

- *Energy Division may make case-by-case exceptions to the Commission-adopted firewall policy regarding program implementers in order to collect data needed for EM&V."*

Implementation of the seven-step process outlined in Attachment 2 of D. 10-04-029 is clarified below. The numbered and italicized bullets are the steps from Attachment 2.

*1. **Project Formation**: IOUs notify ED of their intention to conduct an EM&V project and solicit input from ED on the shaping of the project. ED may choose to waive this opportunity to participate if it chooses. The point of this step is to minimize potential delays in the following steps.*

- Projects should be notified to ED through the project management system (basecamp), maintained at https://energydivision.basecamphq.com/. This system will be used by ED to track IOU projects until further notice.
- All EM&V projects that are planned or underway should be logged into basecamp for tracking purposes. This is required even under the following conditions:
  - If there is a possibility that a planned project will be cancelled or significantly modified.
  - Regardless of size and scope of the EM&V project.
  - Regardless of the source of funding for the EM&V project.
  - If the project has already been started.
  - If the project has already been approved by an ED staff person.
- Hereafter, EM&V projects should be logged into basecamp prior to seeking official approval from Energy Division staff.
- The IOUs may skip step 1 if the project is included in ED's EM&V work plan and is the proposed project is not significantly modified from the project envisioned by the EM&V work plan.
- As each IOU EM&V project is logged into basecamp it will be assigned to an ED staff analyst. If needed, the assigned ED staff will follow-up with the EM&V project contact person for clarification.

*2. **Project Description:** Once the need for a project has been determined, the IOUs will prepare a project description (basically a high level scope of work, following the template developed in 2011).*

- When the IOU is ready to seek approval from ED for an EM&V project it will do so by uploading to basecamp a detailed project description following the format and standards specified by ED.

*3. **Project Tracking**: The project description will be uploaded to the Energy Division's project tracking system.*

- This step is subsumed under step 1 above

*4. **Project Review and Approval**: the project description will be available for review and approval by Energy Division for one calendar week.*

- ED will prioritize its review of projects and will reserve its review for projects of high importance (such as evaluations of strategic plan programs, "Big Bold Energy Efficiency Strategy" programs, and programs/measures with high forecasted savings) or projects that are clearly good candidates for coordination between IOUs and ED.
- Within two weeks, ED will notify the IOUs if they intend hold the project to conduct a more detailed review and/or if ED requires more information on the project from the IOUs before approval can proceed. A reason for holding the project will be provided.

- ED will provide the IOU with a letter of contractor rejection stating the specific conflict problem behind rejection of a proposed contractor, and provide an opportunity for discussion or conflict resolution before a final contractor decision is made. The IOU shall have two weeks from the date of receiving the letter of contractor rejection to discuss the issue, or file a "Motion for EM&V dispute resolution" or request for ADR. Otherwise, ED may finalize the selection of contractor.
- If two weeks pass and ED has not already indicated that the project is approved or ED has not already held the project for further review, then the project will be considered approved and Energy Division's opportunity to review the project will be considered waived.
- When a project is formally submitted for review and approval by ED via basecamp, the assigned ED staff person will review the submitted material to determine if it meets the expected standards for project approval cited under step 2 above.–hIf these standards are not met, the assigned ED staff person will notify the IOU staff person submitting the project approval request and may request clarification or additional information within the two week review period. –if the standards are met, the assigned ED staff will review the documentation and will either approve or deny the project.
- If the project is denied[84], ED will respond in writing.
- If the assigned ED staff determines that the EM&V project should be publically vetted, he/she will inform the IOU and the IOU will upload all pertinent project documentation, as directed by the assigned ED staff, to ED's EM&V public document website located at www.energydataweb.com/cpuc.
- Regardless of whether ED requires public vetting of the IOU EM&V project, the final, ED approved scope of work will be posted to the public document website after ED's approval.

*5. **Project Initiation:** Once the ED review and approval is completed (or waived) the IOUs may begin implementing the project in accordance with the project description.*

- If the assigned ED staff provides no comment, questions, denial or approval within two weeks, then the EM&V project will be considered approved by default.

*6. **Project RFP and Proposals:** If the project requires competitive bidding, the IOUs will upload the RFP to the Energy Division project tracking system. If the project involves consultant proposals, the proposals will be uploaded to the Energy Division project tracking system.*

- These documents may be uploaded to basecamp at the time that the IOU requests formal approval or the IOU can wait until receiving approval before drafting and uploading these documents.
- RFPs must be uploaded before they are issued, and proposals must be uploaded when they are received. Proposals will be subject to review by ED staff and their advisory consultants. Proposals will not be reviewed by Energy Division EM&V contractors. Proposals that contain proprietary and/or confidential information will be treated with the appropriate level of confidentiality.

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[84] Per D. 10-04-029, "ED shall have the authority to deny approval of projects. However, this authority is limited to situations where: 1) there is a conflict of interest with a contractor the IOU wishes to hire; or 2) There is duplication or significant overlap with studies already planned or carried out by ED; or 3) ED can specifically articulate why a study is unnecessary or inappropriately conducted by the IOUs." (p.17)

***7. Contractor Selection:*** *If the project involves hiring a contractor, whether by competitive or directed bid, the IOUs will notify ED of their preferred contractor and other contractors who were considered and/or who submitted bids. ED will make the final selection of all EM&V contractors.*

- The scope of the review of contractors will be focused on conflicts of interest per D.10-04-029
- ED will notify the IOU if the preferred contractor is accepted or if ED intends to select a different contractor.[85]

### 5.4.3. Forums for Energy Division and IOU Collaboration

In Decision 10-04-029, the Commission adopted policies with the intent of establishing a more collaborative relationship between the IOU and ED staff. Specifically, Decision 10-04-029 adopted the following policies that are pertinent to the process for ED and IOU collaboration:

- Requires ED and IOU staff to conduct EM&V projects in a transparent manner, including: open, truthful, and timely communication; regular meetings to provide updates on projects; inclusion of ED and IOUs in all stages of all projects; sharing of data as it becomes available; and tracking of all projects in an easily accessible tracking system.
- Requires ED and the IOUs to attempt to resolve disagreements informally, and collaborate where possible, before seeking formal dispute resolution.
- Requires ED and the IOUs to design EM&V projects to be streamlined, to comply with Commission mandated schedules, and to avoid duplication of effort.
- Requires ED and the IOUs to follow professional standards for ethics and technical best practices.
- Grants ED and the IOUs flexibility to plan and implement EM&V in phases while continuously optimizing the EM&V portfolio and emphasizing the flow of EM&V results to program managers for program improvements.
- Requires avoiding unnecessarily duplicative data collection and analysis and identifying ways in which EM&V can be organized and implemented to meet multiple needs in a cost-effective manner.
- Affirmation of ED's authority to review, approve and oversee IOU EM&V activities.
- Clarification that ED may conduct some formative evaluations within their portfolio of EM&V projects.
- A requirement that the IOUs collaborate with ED in the development of non-DEER savings work papers.
- A stakeholder input process that supersedes the process adopted in D.05-01-055.
- Delegation to ED to determine which projects should be subject to the stakeholder input process.
- A dispute resolution process that involves mediation by the ALJ Division.

[85] Energy Division has, to date, deferred selection of evaluation contractors to the IOUs for IOU-led 2010-2012 evaluations and research studies, unless the selected contractor has a clear conflict of interest.

- A requirement that all EM&V-related projects, regardless of funding source, adhere to the same policies and procedures as EM&V funded projects.
- Allows ED to use program implementers as a vehicle for collecting EM&V data.

In order to establish an administrative framework for effective collaboration between the IOUs and ED EM&V staff and ensure the greatest chance of realizing these Commission policy goals, ED has drafted administrative procedures, which are intended to supplement the Commission's EM&V policy goals with essential implementation detail.

### 5.4.4. Monthly ED/IOU Meetings

ED and the IOU EM&V staffs will meet during regular monthly meetings (Project Coordination Group Level 1) to coordinate the overall EM&V effort. These meetings have been a forum to manage high level administrative and policy issues, including creation of the 2013-2014 EM&V plan. Project level and sector level planning are handled in project coordination groups, described in the following section:

- The meeting will continue to be held on the second Tuesday of every month from 10 AM – 2 PM. The meeting can be extended to 5 PM, as needed.
- This meeting is held by ED and IOU staff that comprise the overall management of EM&V and is the first, of the three-levels of Project Coordination Groups (PCGs).

### 5.4.5. Project Coordination Groups

ED and IOU staff will convene in Project Coordination Groups (PCGs) to coordinate and plan EM&V activities. The structure and scope of PCGs for the IOU and ED staff is described in this section.

## Background and Overview of PCGs

### *What are Project Coordination Groups?*

Project Coordination Groups (PCGs) are a research collaboration structure between the Energy Division, IOUs, Program Administrators, and their respective representatives to develop credible, reliable, timely and actionable EM&V information and data. By working together on shared EM&V projects and following mutually agreed upon standards for transparency, respect, and communication, ED and the IOUs envision better research and program outcomes including greater cost-efficiencies, more reliable results, broader stakeholder buy-in, and fewer disputed issues. Where multiple Program Administrators (PAs) are relevant to a particular sector or study area, the PCG may include PA EM&V representatives to join the ED-IOU meetings. In other instances, PCGs may have non-administrator participants from the general public. Such instances should be allowed when it is necessary for the particular to the meeting agenda, does not detract from the group's ability to make timely decisions regarding EM&V, and does not raise a conflict of interest.

### *Why Do We Need PCGs?*

Decision 09-09-047 expressed the Commission's desire..."to make near-term improvements in order to streamline EM&V processes, and enhance timeliness, transparency and consistency across EM&V work products" (D.09-09-047 at 301) and "to take a fresh look at several aspects of our EM&V activity in California for the upcoming program cycle, to reduce unnecessary burden on staff and other resources, and streamline our EM&V processes." (D.09-09-047 at 294).

Furthermore, Decision 10-04-029 requires ED and IOU staff to,

> "…conduct EM&V projects in a transparent manner, including: open, truthful, and timely communication, regular meetings to provide updates on projects, inclusion of ED and IOUs in all stages of all projects, sharing of data as it becomes available, and tracking of all projects in an easily accessible tracking system….(p. 11-5)

### *How Are PCGs Organized and What Work Products Will They Deliver?*

The following three-level PCG structure is intended to strike a balance between topic area PCGs and more detailed-oriented project coordination through subgroups where necessary:

#### Level 1: Resources/Strategy/Planning Group

Level 1 PCG (or PCG-1) scope includes the full IOU-ED evaluation portfolio, and is currently the ED-IOU monthly administrative, planning, and policy issue-oriented PCG. This PCG-1 is responsible for:

- Cross-Portfolio Evaluation discussion and planning;
- Resolution of EM&V policy issues;
- Overarching and cross-cutting issues;
- Budget allocations and changes;
- Representation includes ED, Program Administrator (IOU and CCA) managers.

Work product: Joint EM&V Plan and annual updates to the plan

#### Level 2: Sector/Area-Level Study Management Groups

Level 2 PCG (or PCG-2) scope includes a general topic or sector of programmatic activity (e.g. Residential, HVAC, Financing, ETP, or Lighting) for which multiple EM&V projects inform savings estimates, program performance, and market status or trends.

The general responsibilities of the PCG-2 are to plan, implement and monitor a long term, cross cutting research roadmap for the defined topic or sector. General research planning for the sector or topic includes:

- Identify coverage of the sector or topic;
- Develop and maintain a long term EM&V roadmap;
- Understand scope and timing of the individual projects (e.g. research questions, key outputs, and dates) for projects within the defined sector/topic area;
- Monitor the research gaps and coordinate with other PCGs to minimize overlap and leverage field research opportunities.

Work product(s): Sector/Topic area Research Roadmap; summary of evaluation findings in brief Evaluation Project Summary Reports; Sector sections of the Energy Efficiency Progress Evaluation Report

#### Level 3: Research Project Teams

Level 3 PCG (or PCG-3)scope is limited to specific projects that ED and the IOUs agree need a detailed-level of input from both sides throughout the planning, execution and finalization process. PCG-3's are not relevant for every project and will be formed on an as-needed basis. The PCG-3 was initially envisioned in the 2010-2012 joint ED-IOU Plan and is mainly responsible for:

- Individual studies (identified to need Level 3 engagement);
- Project specific scoping;

- Vetting of instruments, deliverables;
- Function as a project advisory group.

Work product(s): Individual Research Plans; Final Research Reports

### *Guidelines for Effective PCGs*

Effective PCGs are determined by their composition, operation and communication protocols:

- PCG composition (e.g. the appropriate members/participants in the PCGs)
- PCG facilitation (led by ED lead with shared responsibility with the members as needed)
- PCG communication (set protocols for agendas, meeting notes and use of tools for inventory and tracking progress on research, reviewing ED Annual Report)
- PCG roles and responsibilities (understand scope of work, charter for the group)
- PCG work product (example: development and monitoring of a Long Term Research Roadmap, providing relevant evaluation results summary to the ED Annual Report (EPSR)

In addition, how the PCG delivers data and information will play a large role in its effectiveness. Key questions that the PCG must address include:

- Who needs what information from the PCG, including information needs of program staff as well as internal and external stakeholders?;
- When does the PCG need to provide the information?;
- How will the information be delivered by the PCG?;
- Where will the PCG house the information (for example: a disciplined use of Basecamp or similar communication tools)?

Regarding Basecamp (internal on-line platform for sharing documents), the PCGs will exercise discipline in the use of the Basecamp to facilitate communication, document shared understanding, and memorialize decisions made for the planning, design and execution of the studies. The implementation of the Basecamp protocols is expected to be self-policed by the PCG members and the ED -PCG Lead.

PCG effectiveness will be strengthened by managing PCG meeting and reporting consistency:

- PCGs will commit to regular meetings to provide updates. They will also commit to consistency while providing meaningful updates on a regular basis at an agreed-on schedule. This may vary given the nature of the sector and studies.
- PCGs will also commit to data sharing and all project tracking via Basecamp and the Project Status Reporting websites.

## List and Contacts for EM&V PCGs

The following table lists the sector and program area project coordination groups (level 2 PCGs) and their lead Energy Division contacts, as of the finalization of this plan.

***Table 62. Energy Division Program Sector Contacts***

| Program Sectors | Sector Contact | Contact |
|---|---|---|
| Code &Standards | Peter Biermayer | Peter.biermayer@cpuc.ca.gov |
| ZNE / New Construction | Maryam Ghadessi and Rob Hansen | Maryam.ghadessi@cpuc.ca.gov<br>And Robert.Hansen@cpuc.ca.gov |
| Emerging Technologies Programs (ETP) | Sasha (Alexander) Merrigan | Alexander.Merigan@cpuc.ca.gov |
| Residential, HER & RNC | Peter Franzese | peter.franzese@cpuc.ca.gov |
| Heating, Ventilation , Air Conditioning (HVAC) | Steve Rickert | Stephen.rickert@cpuc.ca.gov |
| Finance | Kevin Feizi and Sasha Merrigan | Kevin.feizi@cpuc.ca.gov<br>Alexander.Merigan@cpuc.ca.gov |
| Local Government Partnership, REN and CCA | Jeremy Battis | Jeremy.battis@cpuc.ca.gov |
| Small & Medium Commercial | Mona Dzvova | Mona.dzvova@cpuc.ca.gov |
| Lg. Commercial & NRNC | Kay Hardy and Maryam Ghadessi | Katherine.hardy@cpuc.ca.gov<br>Maryam.ghadessi@cpuc.ca.gov |
| Industrial and Agriculture, CEI | Kay Hardy | Katherine.hardy@cpuc.ca.gov |
| Integrated Demand-Side Management (IDSM) | Reese Rogers | Reese.rogers@cpuc.ca.gov |
| Lighting | Jeorge Tagnipes | Jeorge.tagnipes@cpuc.ca.gov |
| Marketing, Education &Outreach (ME&O) | Rory Cox | rory.cox@cpuc.ca.gov |
| Work, Education &Training (WE&T) | Reese Rogers | Reese.rogers@cpuc.ca.gov |
| Market Studies / Spillover | Nils Strindberg and Jeorge Tagnipes (Spillover) | Nils.strindberg@cpuc.ca.gov<br>Jeorge.Tagnipes@cpuc.ca.gov |

# APPENDIX A. SUMMARY OF EM&V STUDIES

To review high level summaries of the EM&V studies proposed details and how they build on past research - visit the Project Status Reporting website via the Energy Efficiency Stats website (eestats.cpuc.ca.gov). The site is available under the tab *Evaluation* and *Evaluation Status and Budget.* The Project Status Reporting interface provides access to project level information to track all EM&V projects (milestones, budgets and contacts) included in this plan.

# APPENDIX B. GUIDELINES FOR CPUC-ED AND CALIFORNIA IOU EM&V REPORTS

**Guidelines for CPUC-ED & California IOU**

**Evaluation Measurement & Verification Reports**

*Style Guidelines*

1. **Be clear.** People often overestimate their own writing abilities, including technical experts. Consider using a professional technical writer, or at a minimum have your draft reviewed by a professional copy editor. You may have done some great research, but unless it's well written, no one will ever know. A good rule of thumb is to read the first sentence of every paragraph and make sure the first sentence represents the main idea in the paragraph, and that the sequencing of the paragraphs flow. Achieving consistency in content, structure, and voice is extremely important when there are multiple contributors to a research project.
2. **Be concise.** Reports should be as short as possible, ideally 50-60 pages. Appendices can be as long as necessary. Executive Summaries should be a maximum of 4 pages.
3. **Use graphics appropriately.** Graphics are attention grabbing therefore reserve their use for clarity and/or impact. Label graphics carefully and always include the sample size "N". The best graphics don't require any explanation in the report to convey a clear message. Employ quality control: Text should match graphics and grammar and spelling should be checked.
4. **Avoid repetition.** We realize that you may have used content from other documents as a starting point. Carefully review those pasted items and ensure that when concepts are repeated, it is for the explicit purpose of clarifying or emphasizing a point. Otherwise, keep repetition to a minimum.

*Content Guidelines*

1. **Respect multiple audiences.** Main audiences for reports include EE program, CPUC, and IOU staffs. However, all final EM&V reports are publicly available. Do not assume everyone reading the report will be familiar with program details, measures, evaluation methods or terminology. Please explain briefly, while maintaining readability. Consider including a glossary of terms and acronyms.
2. **Explain study scope.** Clearly state the study scope, goals, and limitations and address how this research will add to the current understanding of the subject. Provide an executive summary that allows the reader to remember and recognize the key reasons, conclusions and recommendations of the research effort.

3. **Use trained researchers to report data.** Researchers should have appropriate training and experience to effectively review and report on qualitative data. Poor analysis of qualitative data can lead to inaccurate and misleading conclusions.

4. **Identify all sources of data.** Data need not be quantitative, but all sources need to be very well-identified. Qualitative data are fine, but need to be properly reported and analyzed. Ensure that data sources and reference materials are appropriate. Wikipedia and blogs are not appropriate citations or references for information included in evaluation reports.

5. **Indicate sample sizes and descriptive statistics.** When reporting results and summary statistics, whether in graphics or in the narrative, always include the sample size "N", standard deviation, min/max, and standard error. The questions on which data tables and data reporting are built need to be in the footnotes or in a table so the reader can properly interpret data in the context of what was originally asked.

6. **Differentiate between conclusions and recommendations.** Ensure that conclusions are (1) very tightly tied to data and (2) logical results emerge from the data and analysis. Recommendations are often helpful but it is important that they also be well-tied to data and data sources. When providing recommendations, identify caveats while distinguishing ideas, opinions, possibilities, and suggestions, from true data-driven recommendations. For example, use words such as "should" or "must" for a recommendation and words such as "can" or "may" for a suggestion.

7. **Explain clearly how the need for each recommendation is supported by your findings.** Specify the measurable benefit that should be the result of following a recommendation. If there are no data showing a need, and if you cannot state a measurable benefit or improvement, do not make that recommendation.

8. **Don't over utilize the "Other" category.** Too often fill-in-the-blank responses or pre-codes are poorly handled resulting in high percentages of responses falling into the "other" category. Too often these responses are ignored and/or not properly analyzed, and therefore represent wasted time and research dollars. Typically, these responses are the result of (1) poor interviewing (2) a bad coding system or (3) a researcher who does not take the time to investigate why a high incidence of "other" is occurring.

9. **Respect confidential data.** Ensure that the report protects all confidential customer information as appropriate.

# APPENDIX C. IMPACT EVALUATION STANDARD REPORTING GUIDELINES NOVEMBER 2015 - CPUC

The purpose of this memo is to inform parties to R.13-11-005 of the Impact Evaluation Standard Reporting (IESR) guidelines, which are proposed for inclusion as an appendix to current and future impact evaluation reports.

Many California energy efficiency (EE) stakeholder parties rely on impact evaluations for a variety of needs, including program, policy and procurement planning. The impact evaluation reports are the primary source of energy savings information upon which many of these groups can base decisions or gauge measure, program and portfolio performance. Representatives from the California Public Utilities Commission (CPUC) and the Investor Owned Utilities (IOUs) recently conducted a review of the 2010 – 2012 impact evaluation reports with the goal of identifying best practices and areas in which more consistency is needed to ensure that these reports achieve the following principal functions:

1. **Comprehensive evaluation results are documented**
2. **Ex Ante vs. Ex Post savings are comparable**
3. **Readers can easily access and identify important results**
4. **Results from different impact evaluations are comparable**

These goals are complicated by the many different savings domains and metrics by which the IOU portfolios are measured. The CPUC has established goals and incentives for IOU EE programs based on ex ante and ex post, gross and net, and first year, annualized[86] and lifecycle savings as well as average portfolio Effective Useful Life (EUL)[2][87]. Therefore, comprehensive impact evaluations must measure, organize, and report results in each of these categories. When multiple firms conduct the evaluations, using a variety of reporting methods, it becomes even more important that complete, comparable, and fundamental results can be readily found in every report.

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The following protocols were developed to ensure the above goals are met. *These guidelines, and the associated templates, are intended to supplement current styles and practices rather than replace them.*

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[86] Annualized savings = lifecycle savings/EUL. When a measure is installed as part of new construction, as natural replacement or as replace on burnout, annualized savings is equal to first year savings. In cases of early retirement, annualized savings reflects the impact of the remaining useful life (RUL) periods and associated baselines on lifecycle savings

[87] [2]In Decision 12-05-015, the CPUC adopted gross annual savings goals for 2013 – 2014 program cycle. The Decision Adopting Efficiency Savings and Performance Incentive Mechanism (ESPI; Decision 13-09-023) calls for the resource savings component of the ESPI to be determined based on a combination of locked down ex ante and verified ex post net lifecycle savings. The latter are based on annualized savings goals and portfolio average EUL. The Decision quotes a "business as usual" portfolio average EUL of 9 years for electric and 14 years for gas EE measures with target goals of 12 years for electric and 15 years for gas.

**Guideline 1**. Complete the Appendix A template for reporting of first year and lifecycle savings and associated metrics. This template includes two tables (gross and net) that report:

a.) Ex Ante and Ex Post Gross and Net savings

b.) Gross Realization Rate (GRR) and Net Realization Rate (NRR) for both total and evaluated savings

c.) Ex Ante and Ex Post Net-to-Gross Ratios (NTG) for both total and evaluated savings

d.) Percent of Each Measure Group Passed Through

These savings and metrics are to be broken out by:

i.) Evaluated Measure Groups

ii.) Other Passed Through Measure Groups.

The precise methodology to determine precision of the evaluated GRR may vary by evaluation. However, precision measurements are essential for complete results and should be included either in the Appendix A tables below or in separate tables/discussion also included in Appendix A of the evaluation. All evaluated savings3[88] should be included in Appendix A within a Measure Group4[89]. Within a Measure Group, a portion or all of the gross savings from certain individual measures may be passed through. The portion of a Measure Group's passed through gross savings should be reported as a percentage of ex ante savings as shown in the Appendix A example. The GRR for each measure group is reported based both on the total ex ante and ex post gross savings (including pass through) and the evaluated ex ante and ex post gross savings (excluding pass through). Similarly, the NTG ratio of a measure group should be reported based on both the total and evaluated savings. *Note that the sample of evaluated gross savings may not correspond to the sample of evaluated net savings.* Other passed through savings (from measures not included in Measure Groups) should be reported5[90] and may be broken out into multiple categories if appropriate and illustrative. The savings and associated realization rates and NTG ratios are rolled up to both the IOU level and statewide.

Custom measures may not lend themselves to well defined measure groups. Alternative appropriate strategies for the completion of the Appendix A tables for custom impact evaluations include a savings breakout by segmentation schemes, project types or measure types.

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[88] Evaluated savings have been updated by impact parameter measurements and/or NTG adjustments.

[89] 4Measure Groups should be chosen by the evaluator such that results from similar individual measures are summed together. Recent examples include High Impact Measure groups from the 2010 – 2012 impact evaluation cycle and measure categories identified as highly uncertain in the Decision Adopting Efficiency Savings and Performance Incentive Mechanism (ESPI; Decision 13-09-023).

[90] 5Inclusion and standard treatment of passed through savings is critical for both completeness and transparency as not all parties within the broader impact evaluation audience have access to program tracking data or familiarity with each measure assigned to an evaluation. Aggregated passed through measures often account for a significant fraction of total savings and their inclusion or exclusion can also have substantial impacts on realization rates, NTG values and decision making.

The Appendix A table should be repeated for each category of analyzed impacts (energy, peak load, and natural gas). Thus up to 12 Appendix A tables may be needed:

- First Year Gross Energy (kWh) Savings
- First Year Net Energy (kWh) Savings
- Lifecycle Gross Energy (kWh) Savings
- Lifecycle Net Energy (kWh) Savings
- First Year Gross Peak Load (MW) Savings
- First Year Net Peak Load (MW) Savings
- Lifecycle Gross Peak Load (MW) Savings
- Lifecycle Net Peak Load (MW) Savings
- First Year Gross Natural Gas (MMTherms) Savings
- First Year Net Natural Gas (MMTherms) Savings
- Lifecycle Gross Natural Gas (MMTherms) Savings
- Lifecycle Net Natural Gas (MMTherms) Savings

Finally, if applicable, interactive effects should be included in the savings reported for all measures.

**Guideline 2**. For Measure Groups or passed through measures in which early retirement (ER) is claimed or found in the evaluation, report an Appendix B table that gives ER and EUL metrics along with first year and annualized savings. These tables are designed to provide standardized information regarding ER and useful life. Early retirement can have a major impact over both first year and lifecycle savings. For a complete understanding of measure performance and to enable a comprehensive comparison of ex ante and ex post savings, stakeholders need metrics on ex ante ER claims and ex post ER findings along with the effect ER has on savings. Because of the emphasis on both annual and lifecycle savings and the definitive goals established for each, EULs should be reported for all evaluated Measure Groups. The Appendix B template standardizes reporting of ER, EUL and annualized savings by Measure Group and develops a weighted EUL. The appendix B table should be repeated for:

- Energy (kWh) Savings
- Peak Load (MW) Savings
- Natural Gas (MMTherms) Savings - when applicable

**Guideline 3.** Include a standardized Appendix C to catalog recommendations resulting from the evaluation research. This should take the form of a table or prepopulated Excel spreadsheet that would facilitate the Response to Recommendation (RTR) process. The target for each recommendation should be specified along with a brief description of the study findings upon which the recommendation is based and, if needed, where more detailed information that supports the recommendation can be found. This appendix would make the RTR process more transparent and help draw attention to recommendations that are aimed at coordinated/collaborative processes across multiple parties, such as Ex Ante Review or organization of program tracking data. Recommendations aimed at specific workpaper or DEER updates should be included and specified accordingly. An RTR template with illustrative example recommendations is included in Appendix C of this memo.

**Appendix A: Templates for reporting lifecycle savings (filled with example values)**

| Gross Energy Savings (kWh) | | A | B | C = B/A | D | E | F |
|---|---|---|---|---|---|---|---|
| | | Ex-Ante Gross* | Ex-Post Gross* | GRR* | % Ex Ante Gross Passed Through | Eval GRR‡ | Precision‡ |
| PG&E | Measure Group 1 | 40 | 30 | 0.75 | 10 | 0.72 | xx% |
| | Measure Group 2 | 60 | 40 | 0.67 | 15 | 0.61 | xx% |
| | Measure Group 3 | 50 | 30 | 0.60 | 0 | 0.60 | xx% |
| | Other Passed Through | 20 | 20 | 1.00 | 100 | - | - |
| | **Total** | **170** | **120** | **0.71** | **19.4** | **0.64** | **90/15** |
| SCE | Measure Group 1 | 80 | 100 | 1.25 | 27 | 1.34 | xx% |
| | Measure Group 2 | 70 | 50 | 0.71 | 1 | 0.71 | xx% |
| | Measure Group 3 | 80 | 60 | 0.75 | 16 | 0.70 | xx% |
| | Other Passed Through | 15 | 15 | 1.00 | 100 | - | - |
| | **Total** | **245** | **225** | **0.92** | **20.4** | **0.90** | **90/10** |
| SDG&E | Measure Group 1 | 30 | 20 | 0.67 | 4 | 0.65 | xx% |
| | Measure Group 2 | 40 | 30 | 0.75 | 0 | 0.75 | xx% |
| | Other Passed Through | 25 | 25 | 1.00 | 100 | - | - |
| | **Total** | **95** | **75** | **0.79** | **27.6** | **0.71** | **xx%** |
| | **Statewide** | **510** | **420** | **0.82** | **21.4** | **0.78** | **xx%** |

*Includes passed through savings

‡Does not include passed through savings

**Appendix A: Templates for reporting lifecycle savings (filled with example values)**

| Net Energy Savings (kWh) | | G | H | I = H/G | J = G/A | K = H/B | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Ex-Ante Net* | Ex-Post Net* | NRR* | Ex-Ante NTG | Ex-Post NTG | % Ex Ante NTG Passed Through | Eval Ex-Ante NTG‡ | Eval Ex-Post NTG‡ | Eval NTG Precision‡ |
| PG&E | Measure Group 1 | 10 | 10 | 1.00 | 0.25 | 0.33 | 50 | 0.20 | 0.37 | 8% |
| | Measure Group 2 | 40 | 35 | 0.88 | 0.67 | 0.88 | 4 | 0.66 | 0.88 | 12% |
| | Measure Group 3 | 40 | 20 | 0.50 | 0.80 | 0.67 | 0 | 0.80 | 0.67 | 7% |
| | Other Passed Through | 15 | 15 | 1.00 | 0.75 | 0.75 | 100 | - | - | - |
| | **Total** | **105** | **80** | **0.76** | **0.62** | **0.67** | **20.6** | **0.71** | **0.77** | **4%** |
| SCE | Measure Group 1 | 80 | 40 | 0.50 | 1.00 | 0.40 | 20 | 1.00 | 0.25 | 17% |
| | Measure Group 2 | 50 | 20 | 0.40 | 0.71 | 0.40 | 5 | 0.85 | 0.52 | 5% |
| | Measure Group 3 | 70 | 55 | 0.79 | 0.88 | 0.92 | 32 | 0.91 | 0.97 | 12% |
| | Other Passed Through | 10 | 10 | 1.00 | 0.67 | 0.67 | 100 | - | - | - |
| | **Total** | **210** | **125** | **0.60** | **0.86** | **0.56** | **24.2** | **0.90** | **0.50** | **6%** |
| SDG&E | Measure Group 1 | 30 | 10 | 0.33 | 1.00 | 0.50 | 12 | 1.00 | 0.43 | 21% |
| | Measure Group 2 | 30 | 20 | 0.67 | 0.75 | 0.67 | 25 | 0.75 | 0.64 | 9% |
| | Other Passed Through | 20 | 20 | 1.00 | 0.80 | 0.80 | 100 | - | - | - |
| | **Total** | **80** | **50** | **0.63** | **0.84** | **0.67** | **38.9** | **0.90** | **0.61** | **14%** |
| | **Statewide** | **395** | **255** | **0.65** | **0.77** | **0.61** | **26.2** | **0.79** | **0.56** | **3%** |

*Includes passed through savings

‡Does not include passed through savings

Columns labeled 'Eval' include results only on the portion of evaluated savings. Passed through savings are not included in these categories.

**Appendix B: Template for standardized reporting of Ex Post First Year, Annual and Lifecycle savings and Weighted EUL.**

| PG&E (Per Unit Ex Post kWh) | | | | | | | |
|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H = F/E |
| Measure | Passed Through | % ER Ex Ante | % ER Ex Post | Average EUL (yr) | Lifecycle | First Year | Annualized |
| Measure Group 1 | 0 | 85 | 36 | 7.2 | 55 | 15.0 | 7.6 |
| Measure Group 2 | 0 | 0 | 5 | 3.1 | 17 | 5.6 | 5.5 |
| Measure Group 3 | 0 | 20 | 41 | 12.5 | 98 | 9.1 | 7.8 |
| Measure Group 1 | 1 | 78 | 78 | 8.0 | 52 | 11.2 | 6.5 |
| Measure Group 2 | 1 | 0 | 0 | 2.7 | 19 | 7.0 | 7.0 |
| Measure Group 3 | 1 | 23 | 23 | 11.6 | 114 | 12.1 | 9.8 |
| Passed Through Group A | 1 | 0 | 0 | 6.4 | 27 | 4.2 | 4.2 |
| Passed Through Group B | 1 | 19 | 19 | 5.6 | 31 | 6.2 | 5.5 |
| | | | | | | Weighted EUL | 9.2 |

**Column C:** percent claimed as early retirement.

**Column D:** percent found to be early retirement in ex post evaluation.

**Columns F, G and H**: per unit lifecycle, first year and annualized savings associated with Column A.

**Appendix C: Proposed template for standardized recommendations (example entries are populated).**

| Study ID | Study Type | Study Title | Study Manager |
|---|---|---|---|
| 100.000 | Impact Evaluation | Downstream Lighting Impact Evaluation | CPUC |

| Recommendation | Program or Database | Summary of Findings | Additional Supporting Information | Best Practice / Recommendations | Recommendation Recipient | Affected Workpaper or DEER |
|---|---|---|---|---|---|---|
| 1 | Nonresidential Downstream Lighting | Early adopters drove down the net to gross ratio. This was evidenced by an Ex Post NTG among 2013 participants of 0.4 while the Ex Post NTG among 2015 participants was 0.8. | Detailed NTG survey results are presented in Appendix D, Pages 4 - 8. | Incorporate a 6 - 12 month "lull" period before offering rebates for new nonresidential lighting technologies. | All IOUs | |
| 2 | Nonresidential Downstream Lighting | Average Hours of Use for A-Lamp LEDs were found to be 2.5 hours/day. No major differences were found in the metering analysis for average HOU in the different IOU service territories | Detailed logger data and analysis is presented in Appendix B, Pages 24 - 37. | Adjust the HOU impact parameter from 3 hours/day to 2.5 hours/day in the relevant workpapers. | All IOUs and the ED | PGELTG1001 SCELTG1001 WPSDGELTG1001 |
| 3 | DEER | The percentage of efficient lamps (CFLs and LEDs) replacing halogens has increased since implementation of EISA. Enduser surveys indicate Halogens now represent 20% of bulbs replaced by efficient lamps. | Detailed survey results are presented in Appendix C, Pages 3 - 18. | Adjust the baseline from a 0.5/0.5 incandescent/CFL mix to a 0.3/0.5/0.2 incandescent/CFL/halogen mix. | CPUC-ED | DEER |

# APPENDIX D. 2017 EFFICIENCY SAVINGS AND PERFORMANCE INCENTIVE (ESPI) UNCERTAIN MEASURES LIST

[Released Publicly December 23, 2016]

Commission Staff has completed an assessment of current and projected measure savings uncertainty in order to produce the uncertain measures list, included as an attachment to this letter. The uncertain measures list is compiled on an annual basis in accordance to Commission Decision D.13-09-023.

The 2017 Uncertain Measures List in Appendix A provides a list of measure groups which are to be claimed through ex-post analysis, and are recommended for upcoming evaluation studies. Since program administrators define non-standard measure names, measures assignment to measure groups was performed by Energy Division. The list of measure groups varies slightly year-to-year, but in a given year of claims, each measure associated with one or more claims will be mapped to a measure group. Because the list of measures is extensive and varies across programs and years, a current version of the mapping is available from Energy Division upon request. In preparing the uncertain measures list in Appendix A, Energy Division performed a parameterized uncertainty analysis of all deemed energy savings claims from 2015, producing a sortable table, which shows the percent contributions to total uncertainty in kWh, kW, and Therm savings by measure group at the statewide level as well as at each program administrator's portfolio. The percent contributions to portfolio/statewide uncertainty are disaggregated into five parameters: installation rate, unit energy savings, gross realization rate, net-to-gross ratio, and expected useful life. The measure groups on the list contribute to 43%, 84%, and 51% of the uncertainty in statewide kWh, kW, and therm savings claimed in 2015.

The uncertainty analysis was published to Energy Division's Public Document Area on October 3 as a preliminary list of uncertain measures, followed by a public review period and a public webinar on October 12. Energy Division staff proceeded to refine the list based on evaluator comments and deeper analysis of the uncertainty calculations. The language in Decision D.13-09-023 is unclear regarding a threshold for including a measure, but contributions to portfolio variance show which measure groups are both substantially uncertain and are associated with significant savings. The uncertain measures list in Appendix A generally includes measure groups which contribute more than 0.1% of any program administrator's portfolio savings for any resource, i.e., kW, kWh, or therms. Additional measure groups are listed where staff expects substantial growth in savings claims, despit current less significant uncertainty, as is expected with newer measures such as outdoor LED lighting. Although measure groups will be applied statewide for the purposes of ex-post savings calculations, we will also provide a more detailed ranked list of measures to inform EM&V studies based on specific parameters identified by program administrator, market sector, and energy resource. Specific plans for studying measure groups on the uncertainty list will be determined through the public EM&V study vetting process.

Energy Division published the uncertainty calculations as a draft uncertain measures list on October 3, 2016, and conducted a public webinar to present both the tool and the list for review and comment on October 14. Written comments were made due on October 19, and Staff reviewed both written comments and those expressed during the webinar in preparing the final list.

During the webinar, it was noted that uncertainties attributed to the net-to-gross ratio largely arise from sampling errors generated in the evaluation process, rather than from the programs and measures

themselves. Staff and its advisors agreed that the different nature of the net-to-gross parameter warranted further consideration. In response, staff ran the uncertainty calculation tool on data where the uncertainty from net-to-gross ratio was set to zero. Staff observed that particular values of the total uncertainties and contributions to portfolio uncertainties changed in some cases considerably; however , the order of uncertain measures was generally unaffected. Furthermore, the tool displays the parameterized contributions to variance, so a user can easily see when net-to-gross ratio contributes disproportionately to the measure group uncertainty. Thus, Staff decided to keep net-to-gross ratio in the calculations.

Southern California Gas Company (SoCalGas) submitted two comments in response to the draft uncertainty list. First, SoCalGas recommends that "the most recent and complete claim data" be used in the uncertainty calculations. The most recent claim data at the time of this letter's writing would include the first two quarters of 2016 claims, with the most recent estimations of unit energy savings, however the 2016 data has not been fully processed and, e.g., new measures have not been assigned measure groups. SoCalGas continues to propose using the 2015 claim data with updated unit energy savings (UES). Staff agrees that this method potentially would yield a more accurate indication of both savings and uncertainties across portfolios, the process of incorporating and verifying updated UES values was determined to take more time than was available for the publication of this list, thus the uncertainty calculations were performed using 2015 claim data with its original UES values. Staff asserts that the updates would not yield substantial changes to the final uncertain measures list, but nevertheless will pursue improvements to the Uncertainty Analysis Tool according to SoCalGas' comment for future use.

SoCalGas' second comment references the definition of "sufficiently uncertain" presented in CPUC Decision D.13-09-023. Staff maintains that this definition is intended to be illustrative rather than serve as a fixed threshold for a measure's inclusion, as evinced in the Decision's language: "as much as 50% or more under- or over-estimated." This definition offers a guiding example and deference to Staff rather than a fixed threshold for the uncertain measures list. By comparing individual measure groups to portfolio or state-wide savings and uncertainty instead of evaluating each measure uncertainty in isolation, it is possible to identify highly uncertain measures efficiently while constraining the list to a practical length for the purpose of driving future evaluation studies.

The Commission appreciates SoCalGas' comments and those provided during the webinar, and trusts the final uncertainty list presented in Appendix A has satisfactorily addressed all.

Upcoming Decisions in early 2017 regarding baselines for energy use in calculating energy savings are expected to impact the uncertainty calculations, and may necessitate a re-evaluation of uncertain measures. For this reason, staff may update this list within the first quarter of 2017.

End of Document