Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan 2018- 2020 Version 9

CALIFORNIA PUBLIC UTILITIES COMMISSION, ENERGY DIVISION
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1 Overview and Research Summary

1.1 Introduction

The evaluation, measurement and verification (EM&V) plan details energy efficiency (EE) program studies conducted by the California Public Utilities Commission (CPUC) Energy Division (ED), investor owned utilities (IOUs) and non-IOU program administrators (PA) Regional Energy Networks (RENs). The purpose of this plan is to identify how the ED and the PAs will track, coordinate and prioritize research activities across sectors. This plan represents studies conducted in calendars years 2018 and 2019 and studies proposed to be conducted in 2020.

1.2 Scope

This scope of the EM&V Plan supports oversight of the PAs' portfolio of energy efficiency programs. The PAs file their Business Plans with the Commission September of each year as required as part of the rolling portfolio guidance. The core content of this EM&V Plan followed a disaggregated approach that focused on research needs grouped at the sector level chapters, which are aligned with the PAs business plans.

1.3 EM&V Chapters

The chapters in this EM&V Plan include the high-level descriptions of the impact, process and market studies for each sector. This planning effort was a collaborative process between CPUC ED, California IOUs, non-IOU PAs and CPUC consultants.

In developing the EM&V Plan, ED and PA 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
- Consider external stakeholder study needs
- Centralized planning and coordination for core functions (i.e., data) or research types (i.e., market studies)

1.4 Public Review

All studies developed by ED and the PAs will be posted on the ED public document area website (https://pda.energydataweb.com/#!/). In some cases, draft study plans will be posted for public comment. Please visit the public document area for detailed descriptions of the research activities described in this EM&V Plan.

1.5 Project Coordination Groups

ED and PA staff will convene Project Coordination Groups (PCGs) to coordinate and plan EM&V activities, and to collaborate on studies.

1.6 Resources

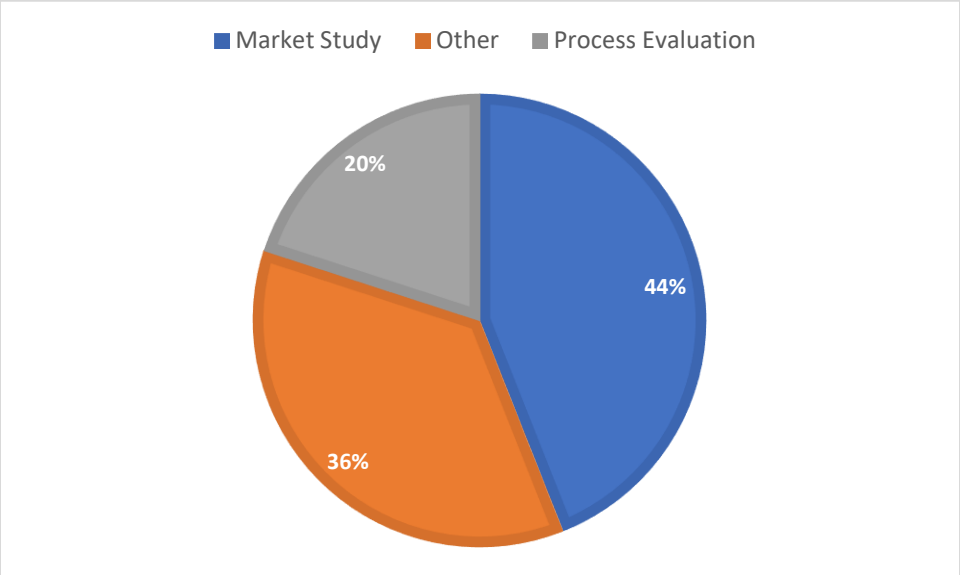
ED maintains several tools and processes that allow stakeholders to provide input on research planning and track progress of research projects.

- **Public Documents Area**: ED and the PAs use this site to share scopes of work for studies, research plans for studies and interim and final deliverables with the public. ED also posts materials for the quarterly meetings on the site. See https://pda.energydataweb.com.
- **California Energy Data and Reporting System (CEDARS):** CEDARS is the CPUC website for archiving and securely managing data associated with California's demand-side management (DSM) programs. See https://cedars.sound-data.com.
- **Project Status Reporting (PSR):** The 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, expected date of completion and study descriptions. Users can access the information and it is updated regularly by the study manager. See https://psr.energydataweb.com.

1.7 Plan Budget Summary

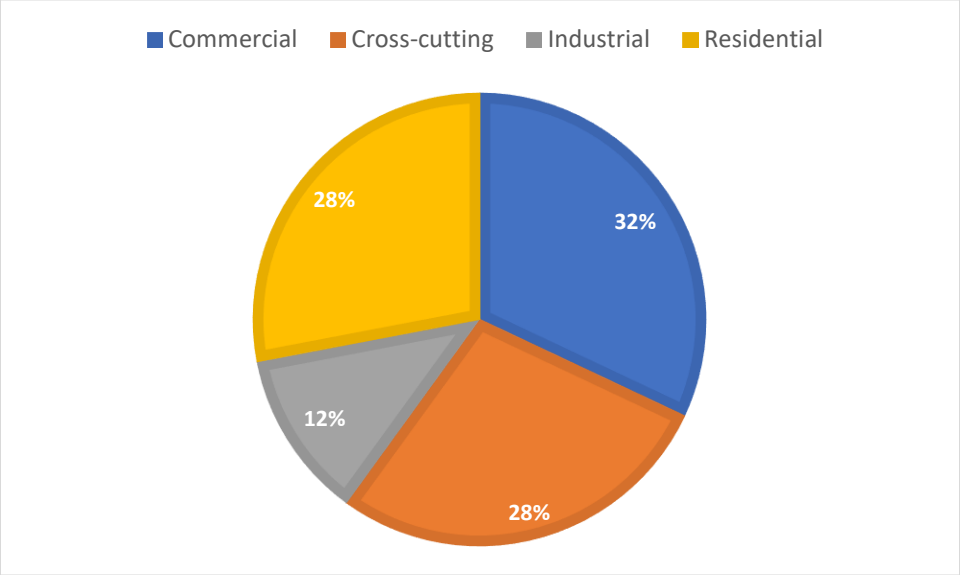
Below are summaries of the current EM&V budgets by activity area and sector. The data for these figures come from the Project Status Reporting (PSR) site,[1] which is updated frequently by project managers. The figures below were comprised of data from November 19, 2019. A download of this data is available in Appendix E. EM&V Studies Table.

Figure 1. Distribution of Planned 2020 EM&V Funds by Study Type - PAs Only



[1] https://psr.energydataweb.com/

Figure 2. Distribution of Planned 2020 EM&V Funds by Sector – PAs Only



1.8 Studies by Year

Below are tables showing the 2017-2018, 2019 and planned 2020 studies, respectively. This information is also included in Excel format in Appendix E. EM&V Studies Table. Further information on the individual studies can be found on the Project Status Reporting (PSR) site at https://psr.energydataweb.com/.

Table 1. 2018 EM&V Studies

Study Sector	Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
Public	2018-Pub-533	Assessment of Community Choice Aggregators (CCAs)	CPUC ED	Other	$137,500	Q4 2020
Public	2018-Pub-537	Assessment of Local Government Partnerships and RENs	CPUC ED	Other	$350,000	Q4 2019
Cross-cutting	2018-Cross-547	Career and Workforce Readiness Process Evaluation	CPUC ED	Process Evaluation	$120,000	Q4 2021
Cross-cutting	2018-Cross-530	Codes and Standards Cost Effectiveness	CPUC ED	Other	$125,000	Q1 2021
Cross-cutting	2018-Cross-531	Codes and Standards Harmonization Study	CPUC ED	Other	$125,000	Q4 2019
Cross-cutting	2018-Cross-541	Cross-Cutting Marketing Effectiveness Study	CPUC ED	Process Evaluation	$1,900,000	Q4 2019
Residential	2018-Res-495	Early M&V and Process Evaluation for the Residential Pay-for-Performance Program	PG&E	Process Evaluation	$320,000	Q1 2021

Study Sector	Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
Cross-cutting	2018-Cross-540	Emerging Technology Handoff Study	CPUC ED	Other	$150,000	Q1 2020
Cross-cutting	2018-Cross-539	Emerging Technology to Portfolio Evaluation Study	CPUC ED	Other	$270,000	Q2 2020
Residential	2018-Res-481	Energy Savings Distribution Analysis and Attrition Trends Study for the Home Energy Reports (HERs) Program	PG&E	Process Evaluation	$130,671	Q4 2018
Cross-cutting	2018-Cross-550	IOU and CCA Cross-Cutting Program Evaluation and Program Facilitation	CPUC ED	Other	$1,100,000	Q4 2021
Cross-cutting	2018-Cross-548	Knowledge Skills and Abilities Market Studies	CPUC ED	Other	$275,000	Q1 2020
Cross-cutting	2018-Cross-542	Marketing Education and Outreach Consensus Project	CPUC ED	Other	$375,000	Q4 2019
Cross-cutting	2018-Cross-543	ME&O Program Transition from IOUs to Third Parties and CCAs	CPUC ED	Other	$250,000	Q4 2021
Residential	2018-Res-508	Miscellaneous Energy Loads (MEL) Study: Phase 2	SCE	Market Study	$100,000	N/A
Residential	2018-Res-491	Mitigating Self-Selection Bias in Billing Analysis for Impact Evaluation	PG&E	Other	$100,000	Q3 2017
Public	2018-Pub-510	Model Assessment and Process Evaluation of SCE's Energy Leader Partnership Model	SCE	Impact Evaluation	$225,000	N/A
Residential	2018-Res-492	Observations on Chapter 8 of the Uniform Methods Project: A Discussion of Comparison Groups for Net and Gross Impacts	PG&E	Other	$58,181	Q3 2017
Cross-cutting	2018-Cross-545	Partnerships with Training Institutions Impact Evaluation - 2018	CPUC ED	Other	$455,000	Q3 2021
Residential	2018-Res-483	PG&E California Advanced Homes Program (CAHP) Billing Analysis	PG&E	Process Evaluation	$64,885	Q2 2019
Residential	2018-Res-482	PG&E Targeted HERs Study	PG&E	Process Evaluation	$49,460	Q4 2018
Cross-cutting	2018-Cross-526	REEL Pilot Financing Impact Evaluation	CPUC ED	Impact Evaluation	$400,000	Q4 2019
Residential	2018-Res-507	SCE and SCG Energy Upgrade California Multifamily Process Evaluation	SCE	Process Evaluation	$115,000	N/A
Residential	2018-Res-509	SCE Exploratory Comparative Assessment of New Homes for the CAHP	SCE	Other	$40,000	N/A

Study Sector	Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
Residential	2018-Res-488	Statewide Residential Lighting Customer Decision Study	PG&E	Market Study	$117,000	Q2 2018
Cross-cutting	2018-Cross-527	SW On Bill Financing Impact Evaluation - 2018	CPUC ED	Impact Evaluation	$400,000	Q4 2020
Residential	2018-Res-487	The Role of Community Distributed Energy in Zero Net Energy (ZNE) Compliance - Phase 1	PG&E	Market Study	$110,000	Q4 2017
Residential	2018-Res-480	Title 24 and Home Energy Score Comparison	PG&E	Process Evaluation	$41,000	Q4 2018
Cross-Cutting	2018-Cross-497	Updating California's Typical Meteorological Year Weather Files	PG&E	Other	$70,000	Q3 2019
Cross-cutting	2018-Cross-544	WE&T and Installation Improvement Evaluation Study - 2018	CPUC ED	Impact Evaluation	$470,000	Q4 2021
Cross-cutting	2018-Cross-546	WE&T Career Connections Process Evaluation - 2018	CPUC ED	Process Evaluation	$120,000	Q4 2021
Residential	2018-Res-490	ZNE Building Design and Performance Verification Methodologies: Phase 1	PG&E	Other	$109,484	Q3 2016
Residential	2018-Res-489	ZNE Architecture@Zero - Pilot Assessment	PG&E	Market Study	$104,700	Q3 2018
Cross-cutting	2018-Cross-549	ZNE Community Case Study - 2018	CPUC ED	Other	$485,000	Q4 2021
Cross-cutting	2018-Cross-551	ZNE Retrofit Timelines and Costs - 2018	CPUC ED	Other	$335,000	Q4 2021

Table 2. 2019 EM&V Studies

Study Sector	Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
Industrial	2019-Ind-583	2018 Industrial Strategic Energy Management (SEM) Evaluation	CPUC ED	Impact Evaluation	$1,357,000	Q2 2021
Cross-cutting	2019-Cross-582	2018-19 Custom Industrial Agricultural and Commercial (CIAC) Impact Evaluation	CPUC ED	Impact Evaluation	$5,045,000	Q2 2021
Public	2019-Pub-534	Assessment of CCAs	CPUC ED	Other	$150,000	Q4 2021
Public	2019-Pub-538	Assessment of Local Government Partnerships and RENs	CPUC ED	Other	$362,500	Q4 2020
Cross-cutting	2019-Cross-547	Career and Workforce Readiness Process Evaluation	CPUC ED	Process Evaluation	$120,000	Q4 2021
Commercial	2019-Com-525	Commercial Whole Building Demonstration Joint Study Report	PG&E	N/A	$80,868	Q2 2019
Cross-cutting	2019-Cross-541	Cross-Cutting Marketing Effectiveness Study	CPUC ED	Process Evaluation	$1,900,000	Q4 2019
Commercial	2019-Com-520	Deemed Measure Costs for Custom Projects & Programs	SDG&E	Market Study	$145,000	On Hold
Commercial	2019-Com-553	Group A 2017 and 2018 Nonresidential Downstream Program Performance Assessment	CPUC ED	Impact Evaluation	$600,000	Q4 2020
Commercial	2019-Com-553	Group A 2017 Small/Medium Commercial Sector Deemed ESPI Impact Evaluation	CPUC ED	Impact Evaluation	$1,156,602	Q4 2020
Commercial	2019-Com-551	Group A 2018 Small/Medium Commercial Sector Deemed ESPI Impact Evaluation	CPUC ED	Impact Evaluation	$1,156,000	Q1 2020
Commercial	2019-Com-584	Group A Impact Evaluation of HVAC ESPI Measures	CPUC ED	Impact Evaluation	$1,157,000	Q1 2020
Residential	2019-Res-554	Impact Evaluation of HERs Program (PY 2017)	CPUC ED	Impact Evaluation	$505,000	Q1 2020
Residential	2019-Res-587	Impact Evaluation of Hot Water Savings Fixtures	CPUC ED	Impact Evaluation	$100,000	Q1 2020
Commercial	2019-Com-555	Impact Evaluation of Lighting Non-Residential Midstream and Downstream	CPUC ED	Impact Evaluation	$426,000	Q4 2020
Residential	2019-Res-588	Impact Evaluation of Pool Pumps	CPUC ED	Impact Evaluation	$100,000	Q1 2020
Residential	2019-Res-586	Impact Evaluation of Smart Thermostats	CPUC ED	Impact Evaluation	$130,000	Q1 2020

Study Sector	Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
Residential	2019-Res-585	Impact Evaluation of Upstream and Residential Downstream Lighting	CPUC ED	Impact Evaluation	$727,000	Q1 2020
Cross-cutting	2019-Cross-550	IOU and CCA Cross-Cutting Program Evaluation and Program Facilitation	CPUC ED	Other	$1,100,000	Q4 2021
Cross-cutting	2019-Cross-548	Knowledge Skills and Abilities Market Studies	CPUC ED	Other	$275,000	Q1 2020
Cross-cutting	2019-Cross-542	Marketing Education and Outreach Consensus Project	CPUC ED	Other	$375,000	Q4 2019
Cross-cutting	2019-Cross-543	ME&O Program Transition from IOUs to Third Parties and CCAs	CPUC ED	Other	$250,000	Q4 2021
Cross-cutting	2019-Cross-545	Partnerships with Training Institutions Impact Evaluation - 2019	CPUC ED	Other	$455,000	Q3 2021
Cross-Cutting	2019-Cross-505	PG&E On-Bill Financing Alternative Pathway Early M&V	PG&E	Process Evaluation	$88,892	Q1 2020
Residential	2019-Res-511	SCE HERs Program Behavior Persistence Analysis	SCE	Market Study	$100,000	Q3 2020
Residential	2019-Res-518	SDG&E HERs Program Behavior Persistence Analysis	SDG&E	Market Study	$50,000	On Hold
Commercial	2019-Com-513	Statewide Commercial Market Characterization Study	SCE	Market Study	$150,000	N/A
Cross-Cutting	2019-Cross-521	Statewide Effectiveness of IDSM ME&O Efforts Study	SDG&E	Process Evaluation	$100,000	Combined
Cross-Cutting	2019-Cross-478	Statewide Energy Efficiency Program Composition Review	PG&E	Process Evaluation	$169,570	Q2 2019
Agriculture	2019-Ag-515	Statewide Horticulture Indoor Agriculture Market Study	SCE	Market Study	$150,000	N/A
Industrial	2019-Ind-514	Statewide Industrial Large Customer Wants and Needs	SCE	Market Study	$200,000	N/A
Cross-Cutting	2019-Cross-522	Statewide Interactive Effects of IDSM Projects Study	SDG&E	Process Evaluation	$105,000	Initiation
Commercial	2019-Com-535	Statewide Interior Lighting Study	SCE	Market Study	$82,725	Q3 2019
Commercial	2019-Com-512	Statewide Non-Residential Workpaper Support	SCE	Market Study	$75,000	N/A
Public	2019-Pub-503	Statewide Public Sector Market Study	PG&E	Market Study	$300,000	Q4 2020

Study Sector	Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
Residential	2019-Res-519	Statewide Residential Workpapers Update	SDG&E	Other	$100,000	On Hold
Cross-Cutting	2019-Cross-516	Statewide Revisit Attribution Methodology for Codes & Standards	SCE	Process Evaluation	$199,000	N/A
Public	2019-Pub-523	Statewide Study to Quantify Co-benefits and Local Economic Benefits of LGPs in HTR and DAC	PG&E	Market Study	$100,000	Q3 2020
Cross-Cutting	2019-Cross-527	SW On Bill Financing Impact Evaluation - 2019	CPUC ED	Impact Evaluation	$400,000	Q4 2020
Cross-Cutting	2019-Cross-528	SW Small Business & Multifamily Pilot Process Evaluation	CPUC ED	Process Evaluation	$400,000	Q4 2021
Cross-cutting	2019-Cross-544	WE&T and Installation Improvement Evaluation Study - 2019	CPUC ED	Impact Evaluation	$470,000	Q4 2021
Cross-cutting	2019-Cross-546	WE&T Career Connections Process Evaluation - 2019	CPUC ED	Process Evaluation	$120,000	Q4 2021
Cross-cutting	2019-Cross-549	ZNE Community Case Study - 2019	CPUC ED	Other	$485,000	Q4 2021
Cross-cutting	2019-Cross-551	ZNE Retrofit Timelines and Costs - 2019	CPUC ED	Other	$335,000	Q4 2021

Table 3. Planned 2020 EM&V Studies

Study Sector	Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
Cross-cutting	2020-Cross-577	Barriers to Efficiency Program Participation for Industrial Agriculture and Large Commercial Customers	PG&E	Process Evaluation	$95,000	Q4 2020
Residential	2020-Res-559	Bill Salience Customer Attention and Behavior Response Analysis	SCE	Market Study	$100,000	Q3 2021
Residential	2020-Res-563	California Multifamily Boiler Market Assessment Study - Phase II	SoCalGas	Market Study	$200,000	Q2 2021
Cross-cutting	2020-Cross-574	Calmac and CALEE2018 Maintenance	PG&E	Other	$85,000	Q4 2021
Commercial	2020-Com-576	Commercial Energy Efficiency Programs Ex Ante vs. Ex Post Gap Analysis	PG&E	Process Evaluation	$110,000	Q4 2020
Commercial	2020-Com-560	Commercial Whole Building Needs Assessment	SoCalGas	Market Study	$200,000	Q4 2020
Cross-cutting	2020-Cross-575	Comprehensive Logic Models for the Codes Standards and Crosscutting Programs	PG&E	Process Evaluation	$115,000	Q4 2020
Industrial	2020-Ind-556	Compressed Air Market Study	SCE	Market Study	$50,000	Q1 2021
Cross-cutting	2020-Cross-571	Costs and Processes of Secondary Service Upgrades in Electrification Retrofits	PG&E	Market Study	$100,000	Q4 2020
Residential	2020-Res-580	Early M&V to Inform PG&E's 2019 HERs Program Savings Claim	PG&E	Other	$50,000	Q2 2021
Residential	2020-Res-581	Early M&V to Inform PG&E's 2019 Savings Claims for Universal Audit Tool (UAT)	PG&E	Other	$125,000	Q2 2022
Commercial	2020-Com-565	EE Programs' Effectiveness in California Building Standards Code Compliance	SoCalGas	Market Study	$150,000	Q2 2021
Commercial	2020-Com-579	Evaluability and Process Evaluation of PG&E's Commercial Whole Building and Public Sector NMEC Program	PG&E	Process Evaluation	$120,000	Q3 2022
Industrial	2020-Ind-578	Evaluability and Process Evaluation of PG&E's SEM Program	PG&E	Process Evaluation	$110,000	Q2 2022
Cross-cutting	2020-Cross-569	Feasibility Study for the Electrification of Hot Water and Space Conditioning Systems in Residential and Small Commercial	PG&E	Market Study	$300,000	Q4 2020

Study Sector	Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
Cross-cutting	2020-Cross-570	IDSM & EE+DR Cost Effective Methodology	SDG&E or CPUC	Other	$150,000	Q4 2020
Cross-cutting	2020-Cross-568	IDSM & EE+DR Load Impact Methodology	SDG&E or CPUC	Other	$150,000	Q4 2020
Residential	2020-Res-572	IDSM & EE+DR Specific to control management	SDG&E	Other	$250,000	Q4 2020
Industrial	2020-Ind-558	Industrial Electrification Potential Study	SCE	Market Study	$150,000	Q3 2021
Residential	2020-Res-561	Market Study to Inform Future Whole House Retrofit Programs	PG&E	Market Study	$100,000	Q4 2020
Commercial	2020-Com-573	RCx HOPPs utilizing NMEC	SDG&E	Other	$75,000	Q4 2020
Commercial	2020-Com-557	Unitary HVAC Market Research	SCE	Market Study	$30,000	Q1 2021
Commercial	2020-Com-567	ZNE Commercial Greenhouse Gas (GHG) Emissions	SoCalGas	Market Study	$100,000	Q4 2020
Commercial	2020-Com-566	ZNE Non-Energy Benefits	SoCalGas	Other	$150,000	Q4 2021

2 Policy & Planning

2.1 Commission Decisions

The core objectives of EM&V were set out in D.09-09-047. These objectives were slightly modified in D.10-10-033, D.10-04-092 and R.09-11-014 and were recognized in D.12-11-015 to continue through 2015 activities per D.14-10-046. The core objectives are:

- Savings measurement and verification
- Program evaluation
- Market assessment
- Policy and planning support
- Financial and management audit

In 2015, D.15-10-028 changed the structure and budget cycles of energy efficiency programs and evaluation by moving to "Rolling Portfolios" that started in 2017. It provided guidance to energy efficiency PAs regarding:

- The general schedule and required contents of business plans
- Implementation plans
- An annual budget advice letter (ABAL) submission (September)
- The stakeholders (ED staff, IOUs and others) collaborative process for developing business and implementation plans through a stakeholder led coordinating committee
- Other details regarding the structure of this new process

D.16-08-019 described how the evaluation budgets for EM&V may shift after the IOUs' business plan submission and reinforced the need for continuing evaluation and provided further guidance on rolling portfolio elements and objectives. This decision also adopted the schedule and timing of EM&V activities, and updated the following due dates:

- Ex post evaluations that inform the Efficiency Savings and Performance Incentive (ESPI) and Database of Energy Efficiency Resources (DEER) updates released in draft form by March 1 every year
- Ex post evaluations that are custom and/or do not inform an ex ante update, but inform the ex post ESPI, would be released in draft form by April 1
- All reports for ESPI would be publicly vetted by May 1 to be used in the ESPI ex post deliberations

The Commission decided the IOUs' portion of the total evaluation budget may increase to 40% (maximum) from 27.5% because of an increased emphasis on 1) NMEC and Pay for Performance, and 2) up front planning for third party solicitations and market assessment associated with the market transformation and other programmatic emphasis in SB 350 and AB 802.

In D.17-09-025 the Commission set goals for energy efficiency from 2018 to 2030 and adopted aggressive but achievable goals and targets for the IOUs' programs. The goals were established using the assessment of energy potential in the state that included the updated avoided cost calculator and greenhouse gas adder that reflects the State's 2030 greenhouse gas reduction goals.

3 Residential

3.1 Residential Portfolio of Programs

The residential portfolio of programs includes the following:

- Direct Install
- Energy Advisor
- Energy Upgrade California
- Integrated Demand-Side Management
- Master-Metered Multifamily Financing Pilot
- Multifamily Energy Efficiency Rebates
- Plug Load and Appliances
- Residential New Construction
- Single Family Loan Program

Please note that some of these programs may be discontinued in the future. For questions, contact CPUC ED and PA staff. Refer to the CEDARS website for details regarding program budgets and anticipated energy savings and demand reductions for each PA.[2]

3.2 2018 and 2019 EM&V Studies

Table 4 summarizes the 2018 and 2019 Residential EM&V studies (including details regarding budgets and timing) for studies managed by the CPUC ED and PAs. These studies include impact evaluations of the 2018 and 2019 programs as well as process evaluations, market studies, and other research efforts active during 2018 and/or 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view. Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 4. 2018 and 2019 Residential EM&V Studies - PA-managed and CPUC-managed Studies

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Res-554	Impact Evaluation of HERs Program (PY 2017)	CPUC ED	Impact Evaluation	$505,000	Q1 2020
2019-Res-587	Impact Evaluation of Hot Water Savings Fixtures	CPUC ED	Impact Evaluation	$100,000	Q1 2020
2019-Res-588	Impact Evaluation of Pool Pumps	CPUC ED	Impact Evaluation	$100,000	Q1 2020
2019-Res-586	Impact Evaluation of Smart Thermostats	CPUC ED	Impact Evaluation	$130,000	Q1 2020
2019-Res-585	Impact Evaluation of Upstream and Residential Downstream Lighting	CPUC ED	Impact Evaluation	$727,000	Q1 2020
2018-Res-495	Early M&V and Process Evaluation for the Residential Pay-for-Performance Program	PG&E	Process Evaluation	$320,000	Q1 2021
2018-Res-481	Energy Savings Distribution Analysis and Attrition Trends Study for the HERs Program	PG&E	Process Evaluation	$130,671	Q4 2018
2018-Res-491	Mitigating Self-Selection Bias in Billing Analysis for Impact Evaluation	PG&E	Other	$100,000	Q3 2017

[2] CEDARS website: https://cedars.sound-data.com/

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2018-Res-492	Observations on Chapter 8 of the Uniform Methods Project: A Discussion of Comparison Groups for Net and Gross Impacts	PG&E	Other	$58,181	Q3 2017
2018-Res-483	PG&E CAHP Billing Analysis	PG&E	Process Evaluation	$64,885	Q2 2019
2018-Res-482	PG&E Targeted HERs Program Study	PG&E	Process Evaluation	$49,460	Q4 2018
2018-Res-488	Statewide Residential Lighting Customer Decision Study	PG&E	Market Study	$117,000	Q2 2018
2018-Res-487	The Role of Community Distributed Energy in Zero Net Energy Compliance - Phase 1	PG&E	Market Study	$110,000	Q4 2017
2018-Res-480	Title 24 and Home Energy Score Comparison	PG&E	Process Evaluation	$41,000	Q4 2018
2018-Res-490	Zero Net Energy (ZNE) Building Design and Performance Verification Methodologies: Phase 1	PG&E	Other	$109,484	Q3 2016
2018-Res-489	ZNE Architecture@Zero - Pilot Assessment	PG&E	Market Study	$104,700	Q3 2018
2018-Res-508	Miscellaneous Energy Loads (MEL) Study: Phase 2	SCE	Market Study	$100,000	N/A
2018-Res-507	SCE and SCG Energy Upgrade California Multifamily Process Evaluation	SCE	Process Evaluation	$115,000	N/A
2018-Res-509	SCE Exploratory Comparative Assessment of New Homes for CAHP	SCE	Other	$40,000	N/A
2019-Res-511	SCE HERs Program Behavior Persistence Analysis	SCE	Market Study	$100,000	Q3 2020
2019-Res-518	SDG&E HERs Program Behavior Persistence Analysis	SDG&E	Market Study	$50,000	On Hold
2019-Res-519	Statewide Residential Workpapers Update	SDG&E	Other	$100,000	On Hold

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

3.3 Planned 2020 EM&V Studies

Table 5 summarizes the residential sector EM&V studies planned for 2020. All the planned studies below will be PA-managed, the CPUC does not currently have any studies planned for 2020.

Table 5. Planned 2020 Residential Sector EM&V Studies- PA-managed only

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2020-Res-563	California Multifamily Boiler Market Assessment Study - Phase II	SoCalGas	Market Study	$200,000	Q2 2021
2020-Res-561	Market Study to Inform Future Whole House Retrofit Programs	PG&E	Market Study	$100,000	Q4 2020
2020-Res-559	Bill Salience Customer Attention and Behavior Response Analysis	SCE	Market Study	$100,000	Q3 2021
2020-Res-580	Early M&V to Inform PG&E's 2019 HERs Program Savings Claim	PG&E	Other	$50,000	Q2 2021
2020-Res-581	Early M&V to Inform PG&E's 2019 Savings Claims for Universal Audit Tool (UAT)	PG&E	Other	$125,000	Q2 2022
2020-Res-572	IDSM & EE+DR Specific to control management	SDG&E	Other	$250,000	Q4 2020

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

The tables below provide further detail regarding each of the studies in Table 5 above.

Table 6. Study description: California Multifamily Boiler Market Assessment Study - Phase II

Study Title: California Multifamily Boiler Market Assessment Study - Phase II	Budget: $200,000
Completion Date: Q2 2021	Study Manager: SoCalGas
Description: This study is the second phase of the 2019 MF Boiler Market Assessment study. Based on the findings we see the need to understand how we can bring customers into our programs offering gas boilers with circulation pump controller. We want to explore the opportunity to see what are effective and what are not in our current programs.	
Objective: To understand the MF building owner/operator decision-making processes customer needs assessment on replacement and retrofits with a focus on circulation pump controllers for the boiler on MF CHWH systems.	
Key Research Questions: 1. If we offer the customers the circulation pump controllers will our level of participation increase? 2. What we can offer that is better than current practice? 3. What are the decision-making processes by the building owner/operator? What factors in the decision that we can offer in our programs?	
Potential EM&V Methods: Customer survey and IOUs data analysis.	

Table 7. Study description: Market Study to Inform Future Whole House Retrofit Programs

Study Title: Market Study to Inform Future Whole House Retrofit Programs	Budget: $100,000
Completion Date: Q4 2020	Study Manager: PG&E
Description: This is a market study which will provide insights into future cost-effective residential whole-house programs.	
Objective: To provide market information to benefit third-party implementers in their design, implementation, and targeting of whole house retrofit programs.	
Key Research Questions: 1. What are the promising segments for cost-effective residential pay-for-performance and "whole house" programs? 2. What types of marketing messages have a high likelihood of resonating with the most promising customer segments? 3. What measures or measure bundles (such as lighting retrofits and/or smart thermostats) have strong potential to increase customer participation in whole house programs, should third-party implementers feature them in their program designs, marketing materials and/or sales prospecting processes?	
Potential EM&V Methods: Literature review data collection and analysis.	

Table 8. Study description: Bill Salience Customer Attention and Behavior Response Analysis

Study Title: Bill Salience Customer Attention and Behavior Response Analysis	Budget: $100,000
Completion Date: Q3 2021	Study Manager: SCE
Description: The objective of the study is to exploit AMI to examine dynamic customer behavior under intermittent expenditure signals monthly bills. Monthly bills are the most fundamental and trusted communication tool between customers and utilities. Energy usage decisions are made in real-time; however, receipt of that decision is received monthly in discrete intervals between which households may forget the (cost) information. The purpose of the research is to explore whether households respond their expenditure information or not: who and for how long (by saving or not) immediately following the receipt of the bill and when is the impact is more distinct the most. Identifying information-elastic customers can help to better targeting.	
Objective: To investigate energy usage changes immediately following exposure to the billing information. Leveraging AMI by understanding consumer responses may create opportunities to maximize the value of such information to drive energy efficiency. Additionally, this would help to optimize better communication tools to keep customers going with savings behavior. It could also help to mitigate information overload and create understanding when does the customer is prone to save energy.	
Key Research Questions: Do customers pay attention to their billing information in regard to changes in customers' electricity consumption? Using interval data can we determine the duration of the changes in usage behavior immediately following the receipt of the bill How does the response vary among the customer (type season automatic bill payer etc.)? What is the distributional effect of bills among the customers? If savings occurs on average how long the saving behavior last? Can we utilize the results of this research to optimize targeting of energy efficiency related information and mitigate information overload and make customers more attentive of our communication and help to make our programs more cost-effective?	
Potential EM&V Methods: The study will exercise primary and secondary research. This include regression analysis and machine learning (ML) techniques. Leveraging ML, we would like the study customer clusters by their usage profiles and optimum saving duration for each clusters	

Table 9. Study description: Early M&V to Inform PG&E's 2019 Home Energy Reports Savings Claim

Study Title: Early M&V to Inform PG&E's 2019 Home Energy Reports Savings Claim	Budget: $50,000
Completion Date: Q2 2021	Study Manager: PG&E
Description: PG&E's Home Energy Reports (HER) program launch in August 2011 and all 17 experiments launched since then are active. Over 2 million households have received HER reports and over 1 million households have served as controls. Given its size the HER program represents the majority of savings for PG&E's residential sector. This project will provide additional funds to complete a report with estimates for: savings for 2019; the sixth year of the persistence study (how HER savings endure following cessation of treatment) and demand savings using the new DEER definition for Peak Megawatt Load Reduction which is changing from afternoon to evening hours given the increase of electricity available on the grid in daylight hours.	
Objective: To provide estimates of savings for PG&E's 2019 Home Energy Reports program to inform its final savings for reporting purposes while ensuring that savings that are potentially reported by other energy efficiency programs have been removed from the savings claim to avoid double-counting of these savings.	
Key Research Questions: How much electricity (kWh) did customers in the treatment groups from PG&E's Home Energy Reports program save in the 2019 calendar year? Of these kWh savings what proportion may have been claimed by other PG&E upstream and downstream energy efficiency programs? How much demand savings (Peak Megawatt Demand Reduction or PTLM) did customers in the treatment groups from PG&E's Home Energy Reports program save in the 2019 calendar year? Of these PTLM savings what proportion was potentially was claimed by other PG&E upstream and downstream energy efficiency programs? How much natural gas (therms) did customers in the treatment groups from PG&E's Home Energy Reports program save in the 2019 calendar year? Of these therms savings what proportion of it potentially was claimed by other PG&E upstream and downstream energy efficiency programs? How should these therms values affect any adjustments to kWh reported values made to account for interactive effects?	
Potential EM&V Methods: Difference-of-differences calculation conducted on each experiment. Adjustments are made by observing whether uptake of downstream and upstream programs is different in treatment and control groups. If so then deductions are made from the HER claim.	

Table 10. Study description: Early M&V to Inform PG&E's 2019 Savings Claims for Universal Audit Tool (UAT)

Study Title: Early M&V to Inform PG&E's 2019 Savings Claims for Universal Audit Tool (UAT)	Budget: $125,000
Completion Date: Q2 2022	Study Manager: PG&E
Description: The residential Universal Audit Tool (UAT) is an online survey designed to identify no- and low-cost energy savings actions that renters and homeowners can undertake to save electricity and natural gas consumption in their homes. The UAT provides residential customers with advice on energy efficiency insight into areas of high energy use and tips and suggestions for saving both energy and money based on responses to an online survey regarding household appliances occupancy and other dwelling characteristics.	
Objective: Provide estimates of 2019 gross savings (electric and gas) from the residential audit (UAT) program for Pacific Gas and Electric Company. Second an assess savings potentially double-counted with other downstream and upstream programs so that deductions can be made from the savings estimate to avoid double-counting.	
Key Research Questions: How does taking the PG&E-sponsored "online audit" that is comprised of an online survey that presents customized no- and low-cost energy savings tips and actions to renters and homeowners affect electricity and natural gas consumption as compared to similar householders who do not take the online audit?	
Potential EM&V Methods: Quasi-experimental design using propensity score matching (based on similarities in interval data) to identify comparison groups. Once identified a difference-of-differences calculation will be used to compare energy usage of the two groups.	

Table 11. Study description: IDSM & EE+DR Specific to control management

Study Title: IDSM & EE+DR Specific to control management	Budget: $250,000
Completion Date: Q4 2020	Study Manager: SDG&E
Description: Propensity of behavior to participate in EE programs. As an example, in relation to AB793 this study would focus more on residential customers and the various "smart" appliances available to them. A study to Understanding Customer Behavior in response to programs offered by IOUs including what other factors influences the customer to purchase. EE programs have influenced and transformed the market but are there other factors to install these "smart" devices? Accounting for these other decision-making factors that will enable 3rd Parties to improve program design to encourage participation.	
Objective: 1. Determine if a "smart" home study has been produced that looks at the new DEER Peak Definition shift 2. Compare if demographics have behavior patterns 3. Determine if competing with different groups (family, friends, co-workers) have influences on behavior 4. Determine if other benefits beside bill savings influence decision making such as GHG climate change etc.	
Key Research Questions: 1. What research is available that distinguishes the behavior of a customer to create a "smart" home? Does it include influences from the local utilities rate structures? 2. Are there differences in demographics to pursuing the latest "smart" home device? Any socio-economic or cultural inferiority?" 3. Other than having a reduction in the customer's utility bill what other "bundled" offerings are influencing the customer to purchase "smart" appliances?	
Potential EM&V Methods: Survey Discrete Choice Analysis Factor Analysis Principal Component Analysis	

3.4 Ex Ante Coordination

Ex ante processes (including DEER updates, Uncertain Measures List updates and workpaper review) incorporate data and results from the latest EM&V studies. This section highlights the ex-ante values that are relevant to this sector.

3.4.1 Summary of DEER Updates

For the residential sector, 2018 DEER updates include:[3]

- Updated residential refrigerant charge adjustment measure parameters based on updated EM&V data and a new weighted refrigerant charge measure based on these updated measure results
- Revisions to standard practice for lighting measures to reflect more efficient baselines
- Consideration of updated definition of peak demand
- Updated residential refrigerant charge adjustment measure parameters based on updated EM&V data and a new weighted refrigerant charge measure based on these updated measure results

[3] Source: http://www.deeresources.com/index.php/deer-versions/deer2017

- The residential refrigerant charge measures previously published for DEER2018 have been corrected to properly deal with systems with and without a thermal expansion valve.
- A new federal code for top loading clothes washers goes into effect 1/1/2018

Residential sector DEER updates for 2019 include:[4]

- A limited number of NTG values are updated base on recent EM&V findings.
- LED lighting is established as the standard practice baseline for normal replacement, new construction and replace-on-burnout measures.
- Industry Standard Practice (ISP) baselines and new measure tiers for small residential storage and instantaneous water heaters have been established.
- Net-to-Gross methodology has been updated to include treatment of measure utilizing existing conditions baselines rather than code/standard practice baseline in the case of accelerated replacement (AR) measure application type or a normalized metered energy consumption (NMEC) savings estimation approach.
- The available measure application types, delivery types, and measure impact types were updated to reflect E 4818. The final lists and associated acronyms for the revised codes are shown in Resolution E-4952, Section 5.6
- EUL/RUL policy for add-on equipment and Behavioral, Operational and Retrocommissioning (BRO) measures. EUL update for screw-in LED A-lamps.
- The below-code NTG adjustment factor for accelerated replacement (AR) applications has been suspended, effective 2019-01-01 and lasting indefinitely

Residential sector DEER updates for 2020 include:[5]

- Peak demand savings and lighting HVAC interactive effects have been updated for all previous DEER measures with no expiration date, or with an expiration date after December 31, 2019.
- New measures have been added for electrically commutated motors (ECM) in residential and commercial furnace units.
- Miscellaneous corrections include an error in residential window area in DEER2017 and an error with fan power in residential two speed air handlers.
- Several residential shell updates in the 2019 Title-24 have been incorporated.
- Non-residential upstream packaged HVAC and maintenance measures NTG values are update based on recent evaluation results.
- The numerous building vintage classifications used in previous DEER versions have been consolidated into "Old," "Median," "Recent," and "New" classifications.
- As a result of the transition to 100% LED baseline, the existing screw-in lamp and screw-in fixture measures – both workpaper and DEER measures - will be expired 12/31/2019.
- All workpapers will be statewide for 2020 and beyond.
- Consolidate savings by climate zone to eliminate PA-specific records.
- Missing RCA measures added to DEER 2020.
- Removed DEER 2020 measures which had been previously expired but never removed.

[4] Source: http://www.deeresources.com/index.php/deer-versions/deer2018
[5] Source: http://www.deeresources.com/index.php/deer-versions/deer2020

Residential sector DEER updates for 2021 include:[6]

- Further review and assessment of lighting measures
- Smart controllable thermostats
- Update and correct water heater calculators
- Correct duct sealing measure EUL
- Review on-bill-finance NTGR

3.4.2 Summary of Uncertain Measure Updates

The tables below identify residential measures and parameters on the 2018 and 2019 Uncertain Measures lists. Note that while the 2018 list identifies not only the uncertain measure group but also the specific energy resource or resources (i.e., electric or gas) and parameters, the 2019 and 2020 lists identify the measure group only. This is consistent with the information provided in the uncertain measure lists for each year.

Table 12. 2018 Uncertain Measures Residential Sector

Market Sectors	Measure Group	Energy Resource	Parameter(s) of Interest
Res	Appliance Clothes Washer	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Res	HVAC Duct Sealing	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
RES	HVAC Furnace	Gas	Gross Realization Rate, Net-to-Gross Ratio
Res	HVAC Motor Replacement	Electric	Gross Realization Rate, Net-to-Gross Ratio
Com, Res	HVAC RCA	Electric	Gross Realization Rate, Net-to-Gross Ratio
Com, Res	Lighting Indoor LED Fixture	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Res	Lighting Indoor LED High Bay Fixture	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Res	Lighting Indoor LED Lamp	Electric, Gas	Gross Realization Rate, Net-to-Gross Ratio
Com, Res	Lighting Indoor LED Reflector Lamp	Electric, Gas	Gross Realization Rate, Net-to-Gross Ratio
Ag, Com, Ind, Res	Lighting Outdoor LED Fixture	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Res	Water Heating Boiler	Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Res	Water Heating Controls	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Res	Water Heating Showerhead	Gas	Installation Rate, Net-to-Gross Ratio
Res	Water Heating Storage Water Heater	Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life

[6] Source: http://deeresources.com/index.php/deer-versions

Market Sectors	Measure Group	Energy Resource	Parameter(s) of Interest
Com, Res	Water Heating Tankless Water Heater	Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life

Source: 2018 ESPI Uncertain Measures List Memo. https://pda.energydataweb.com/#!/documents/1947/view

Table 13. 2019 Uncertain Measures Residential Sector

Market Sectors	Measure Group
Ag, Com, Ind, Res	Lighting Outdoor LED Fixture
Com, Res	HVAC Maintenance
Com, Res	HVAC RCA
Com, Res	Lighting Indoor LED Fixture
Com, Res	Lighting Indoor LED Fixture
Com, Res	Lighting Indoor LED Lamp
Com, Res	Lighting Indoor LED Lamp
Com, Res	Lighting Indoor LED Reflector Lamp
Com, Res	Water Heating Tankless Water Heater
Res	HVAC Duct Sealing
Res	HVAC Motor Replacement
Res	Water Heating Controls
Res	Water Heating Storage Water Heater

Source: Final 2019 Uncertain Measure List Memo, https://pda.energydataweb.com/#!/documents/2100/view

Table 14. 2020 Uncertain Measures Residential Sector

Market Sectors	Measure Group
Res, Com	HVAC Coil Cleaning
Res	HVAC Controls Smart Thermostat
Res	HVAC Economizer Repair
Res	HVAC Maintenance
Res	HVAC RCA
Res	HVAC Rooftop HP System
Res	HVAC Split HP System
Res	Pool Pump
Res	Water Heating HPWH

Source: 2020 Uncertain Measures List Memo, https://pda.energydataweb.com/#!/documents/2305/view

3.4.3 Program Administrators' Workpaper Submissions

Planned workpapers, and updates to existing workpapers for the upcoming portfolio cycle are submitted to Commission staff and reviewed and logged. These workpapers often use DEER data and/or methodology to add technologies that are not in DEER to the energy efficiency portfolio. Table 15 and Table 16 summarize the quantity of annual residential workpaper submissions by end-use category and IOU. Appendix C provides the workpaper locations where more information and the papers themselves can be found.

Table 15. 2018 Residential Sector Workpaper Summary by End-Use Category and IOU

End-Use Category	IOU				
	PG&E	SCE	SCG	SDG&E	Statewide
Any	1	1			
Appliance or Plug Load	3	3		1	2
Building Envelope				1	
HVAC	1	2	1	3	
Lighting	7	6		2	2
Recreate	1				
Service	1			4	
Service and Domestic Hot Water	1	2	1	4	1
Whole Building	1				

Source: CPUC Workpaper and Disposition Archive, http://www.deeresources.net/workpapers

Table 16. 2019 Residential Sector Workpaper Submissions by End-Use Category and IOU

	IOU			
	PG&E	SCE	SCG	SDG&E
Appliance or Plug Load	2		1	
Commercial Refrigeration	1			
HVAC	5	6	3	
Lighting		5		
Pool and Spa Equipment		2		
Service	1		1	
Service and Domestic Hot Water	3	2	13	2
Whole Building				

Source: CPUC Workpaper and Disposition Archive, http://www.deeresources.net/workpapers

4 Commercial

4.1 Commercial Portfolio of Programs

The commercial portfolio of programs includes the following:

- Calculated Incentives
- Commercial HVAC
- Continuous Energy Improvement
- Customer Services
- Energy Advisor
- Marketing, Education, and Outreach (ME&O)
- New Financing Offerings
- On Bill Repayment (OBR) Small Business Lease Providers Pilot
- OBR Small Business Loan Pilot
- OBR for Medium and Large Business
- Lighting Innovation
- Savings by Design

Please note that some of these programs may be discontinued in the future. For questions, contact CPUC ED and PA staff. Please refer to the CEDARS website for details regarding program budgets and anticipated energy savings and demand reductions for each PA.[7]

4.2 2018 and 2019 EM&V Studies

Table 17 summarizes the 2018 and 2019 commercial sector EM&V studies including details regarding budgets and timing. These studies include impact evaluations of the 2018 and 2019 programs as well as process evaluations, market studies and other research efforts active during 2018 and/or 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

[7] CEDARS website: https://cedars.sound-data.com/

Table 17. 2018 and 2019 Commercial Sector EM&V Studies PA-managed and CPUC-managed studies

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Com-553	Group A 2017 and 2018 Nonresidential Downstream Program Performance Assessment	CPUC ED	Impact Evaluation	$600,000	Q4 2020
2019-Com-553	Group A 2017 Small/Medium Commercial Sector Deemed ESPI Impact Evaluation	CPUC ED	Impact Evaluation	$1,156,602	Q4 2020
2019-Com-551	Group A 2018 Small/Medium Commercial Sector Deemed ESPI Impact Evaluation	CPUC ED	Impact Evaluation	$1,156,000	Q1 2020
2019-Com-584	Group A Impact Evaluation of HVAC ESPI Measures	CPUC ED	Impact Evaluation	$1,157,000	Q1 2020
2019-Com-555	Impact Evaluation of Lighting Non-Residential Midstream and Downstream	CPUC ED	Impact Evaluation	$426,000	Q4 2020
2019-Com-525	Commercial Whole Building Demonstration Joint Study Report	PG&E	N/A	$80,868	Q2 2019
2019-Com-513	Statewide Commercial Market Characterization Study	SCE	Market Study	$150,000	N/A
2019-Com-535	Statewide Interior Lighting Study	SCE	Market Study	$82,725	Q3 2019
2019-Com-512	Statewide Non-Residential Workpaper Support	SCE	Market Study	$75,000	N/A
2019-Com-520	Deemed Measure Costs for Custom Projects & Programs	SDG&E	Market Study	$145,000	On Hold

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

4.3 Planned 2020 EM&V Studies

Table 18 summarizes the commercial sector EM&V studies planned for 2020. All the planned studies below will be PA-managed, the CPUC does not currently have any studies planned for 2019.

Table 18. Planned 2020 Commercial Sector EM&V Studies PA-managed and CPUC-managed studies

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2020-Com-567	ZNE Commercial GHG Emissions	SoCalGas	Market Study	$ 100,000	Q4 2020
2020-Com-565	EE Programs' Effectiveness in California Building Standards Code Compliance	SoCalGas	Market Study	$ 150,000	Q2 2021
2020-Com-560	Commercial Whole Building Needs Assessment	SoCalGas	Market Study	$ 200,000	Q4 2020
2020-Com-557	Unitary HVAC Market Research	SCE	Market Study	$ 30,000	Q1 2021
2020-Com-573	RCx HOPPs utilizing NMEC	SDG&E	Other	$ 75,000	Q4 2020
2020-Com-566	ZNE Non-Energy Benefits	SoCalGas	Other	$ 150,000	Q4 2021
2020-Com-576	Commercial Energy Efficiency Programs Ex Ante vs. Ex Post Gap Analysis	PG&E	Process Evaluation	$ 110,000	Q4 2020
2020-Com-579	Evaluability and Process Evaluation of PG&E's Commercial Whole Building and Public Sector NMEC Program	PG&E	Process Evaluation	$ 120,000	Q3 2022

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

The tables below provide further detail regarding each of the studies in ***Table*** 18 above.

Table 19. Study description: ZNE Commercial GHG Emissions

Study Title: ZNE Commercial GHG Emissions	Budget: $100,000
Completion Date: Q4 2020	Study Manager: SoCalGas
Description: To revisit ZNE to meet GHG emissions from a mixed fuel perspective. This is part of the recommendations from the ZNE Commercial Market Characterization study that is being done by TRC.	
Objective: This study will look at healthcare mixed use private college hotels and food service segments: to investigate options for achieving ZNE in prototype buildings and their impact on GHG and demand and to identify a new loading order for efficiency renewables and load management by building type and location.	
Key Research Questions: 1. What are the options for achieving ZNE in prototype buildings and their impact on GHG and demand? 2. What contributes to a new loading order for efficiency renewables and load management by building type and location?	
Potential EM&V Methods: Site survey and Literature review.	

Table 20. Study description: EE Programs' Effectiveness in California Building Standards Code Compliance

Study Title: EE Programs' Effectiveness in California Building Standards Code Compliance	Budget: $150,000
Completion Date: Q2 2021	Study Manager: SoCalGas
Description: Energy and Green Building Standards codes (or CALGreen) are part of the California Building Standards code. We understand that code compliance is not guaranteed at 100%. Our programs are the helping hands to achieve code compliance and offer measures above code. We are seeking an opportunity to prove our program's effectiveness in bringing customers to comply with the code by participating in our programs.	
Objective: The study will look at how programs can complement the Energy code (Part 6) and Green Building Standards code (Part 11 or CALGreen) to achieve energy efficiency for Residential Commercial and Agriculture.	
Key Research Questions: 1. Do our programs help to make code compliance easier? 2. Do we need programs to make customers comply with the code? 3. How effective is the code compliance without our programs?	
Potential EM&V Methods: Customer survey and market research.	

Table 21. Study description: Commercial Whole Building Needs Assessment

Study Title: Commercial Whole Building Needs Assessment	Budget: $200,000
Completion Date: Q4 2020	Study Manager: SoCalGas
Description: Explore sub segments in Commercial Whole Building and bundled measures in retrofit and new construction: Healthcare Mixed Use MF Highrise Private Colleges/Universities Tech Creative Spaces and Industrial Facilities that act like a commercial entity.	
Objective: To look at leased buildings corporations and chain accounts to understand what factors influence our customers to participate in our program.	
Key Research Questions: 1. What is the market's reactor to technical assistance financial incentives and financing offered with our programs' measures? 2. What are segments' program potential participation outlook and needs assessment in each specific segment?	
Potential EM&V Methods: Customer survey and IOUs' data analysis.	

Table 22. Study description: Unitary HVAC Market Research

Study Title: Unitary HVAC Market Research	Budget: $30,000
Completion Date: Q1 2021	Study Manager: SCE
Description: Navigant is undertaking important and timely EUL research. SCE will supplement ongoing effort with an examination of Unitary EULs. Since cooling drives peak afternoon and evening demand providing market participants with EUL data has clear statewide and SCE benefits. Our experience is that manufacturer data is either insufficient or unavailable for this measure type. SCE anticipates a combination of secondary and primary research including a review of ex post reviews.	
Objective: Estimate reliable EUL values for program planning. These values are essential for estimating offer cost effectiveness.	
Key Research Questions: HVAC represents a key driver of both energy and demand resources in SCE's service territory. and estimates of EUL for all measures are important determinants of cost effectiveness for programs to address this key technology class.	
Potential EM&V Methods: Research Methods include surveys secondary research and project reviews/disposition reviews. The exact methods will be determined with input from the Commercial PCG.	

Table 23. Study description: RCx HOPPs utilizing NMEC

Study Title: RCx HOPPs utilizing NMEC	Budget: $75,000
Completion Date: Q4 2020	Study Manager: SDG&E
Description: SDGE's RCx Program is a Paid for Performance (P4P) using site-specific NMEC and is implemented by a 3P. This project verifies the implementation of NMEC prior to the payment. If there is funding available, SDG&E will pilot population NMEC for this program. Given the release of the draft NMEC rulebook, the study will utilize the final version and focus on one of SDG&E's RCx HOPPs that has NMEC related projects and validate the methodology and also document lessons learned/best practices.	
Objective: 1. Assist SDG&E in managing risk by providing early feedback on RCx-NMEC related projects. 2. Validate the rulebook's methodology including documenting lessons learned/best practices. 3. Document metering strategies to capture the best relevant data for the specific project.	
Key Research Questions: 1. Is the 3P implementer conducting each customer's NMEC analysis correctly? 2. What are the best methodologies for an RCx program? 3. What level of metering validation is needed to acquire accurate pre- and post-install data collection?	
Potential EM&V Methods: Apply the recently adopted NMEC rulebook	

Table 24. Study description: Evaluability and Process Evaluation of PG&E's Commercial Whole Building and Public Sector NMEC Program

Study Title: Evaluability and Process Evaluation of PG&E's Commercial Whole Building and Public Sector NMEC Program	Budget: $120,000
Completion Date: Q3 2022	Study Manager: PG&E
Description: This is an evaluability study and process evaluation of PG&E's first program to claim savings using the site-based Normalized Meter-Based Energy Consumption (NMEC) methodology. Its focus is to position the program for evaluation success by examining the program's processes and documentation specifically those related to: tracking reporting and use of performance metrics for program planning; M&V plan reviews; attribution; development of identification of non-routine events and accounting for them in savings models; installation verification; measure-level savings estimates of EUL and functional testing processes for savings "tune-ups". Funds permitting this research will include "Early M&V" to inform a savings claim for this program.	
Objective: There are three objectives of this research: evaluability process evaluation and Early M&V. The first objective is to identify possible changes to implementation to improve evaluation success. The second is to document program processes and identify improvements to follow best practices). The final objective is to assess performance of the totality of site-level projects to inform the savings claim to be made to the CPUC that will withstand the scrutiny of a third-party impact evaluation.	
Key Research Questions: Is PG&E following best practices in its administration and implementation of its Commercial Whole Building and Public Sector NMEC program? How can PG&E's improve its administrative and operational practices with respect to site-level NMEC in program processes and documentation specifically: documenting customer contacts (e.g. attribution and influence and non-routine events) and accounting for them in savings calculations; verifying the installation of measures and documenting "black-out" period(s) that define "pre" and "post" for savings calculations; processes for making measure-level savings estimates of EUL and development of functional testing for savings "tune-ups"? What changes should be made to improve premise screening and vendor qualification processes and procedures? Is PG&E following best practices in calculating performance payments? Are performance payments equitable to implementers PG&E and ratepayers? What other changes would improve the program?	
Potential EM&V Methods: Reviews of: policy/procedure manuals; program- and project-level documentation with a focus on attribution measures customer contacts and non-routine events. Interviews with customers implementers PG&E staff and others outside of territory	

Table 25. Study description: ZNE Non-Energy Benefits

Study Title: ZNE Non-Energy Benefits	Budget: $150,000
Completion Date: Q4 2021	Study Manager: SoCalGas
Description: This is phase II of the ZNE Commercial Market Characterization study that is being done by TRC to elaborate on the recommendations of the study. It is the same as the ESAP study in which non-energy benefits are analyzed but in these segments: mixed use healthcare private colleges and offices.	
Objective: To emphasize non-energy benefits and high ROI to potential program participants. It is not an intent to use the value of the non-energy benefits for cost-effectiveness evaluation. The value of the non-energy benefits is what we can offer to our customers as part of the incentives.	
Key Research Questions: 1. What are the potential non-energy benefits in the ZNE commercial market? 2. How realistic are market actor perceptions such as improved occupant health/indoor air quality improved marketability and improved thermal comfort? 3. Do non-energy benefits contribute to program participation in ZNE and decarb mixed fuel projects? 4. Are there barriers in program participation such insufficient budget inexperienced design team lack of team coordination in the ZNE commercial market characterization which prove that non-energy benefits can be helpful?	
Potential EM&V Methods: Literature review and customer survey.	

Table 26. Study description: Commercial Energy Efficiency Programs Ex Ante vs. Ex Post Gap Analysis

Study Title: Commercial Energy Efficiency Programs Ex Ante vs. Ex Post Gap Analysis	Budget: $110,000
Completion Date: Q4 2020	Study Manager: PG&E
Description: Study goal is to analyze ex ante vs. ex post savings gaps with the end goal of decreasing the gaps. Past evaluations have shown that gaps can be due to a combination of factors almost all of which the program can influence. Deliverable will be a report with analysis and specific recommendations to reduce ex ante vs. ex post gaps.	
Objective: Analysis and specific recommendations to reduce ex ante vs. ex post gaps.	
Key Research Questions: To the extent they can be determined from available recent impact evaluations: 1) What are the major ex ante vs. ex post savings gaps by sub-program/measure? 2) To what extent do the gaps appear to be systemic vs. random? 3) What program steps can be taken to reduce the gaps? 4) What evaluation steps can be taken to reduce gaps if appropriate?	
Potential EM&V Methods: Will likely include literature review and analysis of existing recent impact evaluations.	

4.4 Ex Ante Coordination

Ex ante processes for the commercial sector (including DEER updates, Uncertain Measures List updates and workpaper review) incorporate data and results from the latest EM&V studies. This section highlights the ex-ante values that are relevant to this sector.

4.4.1 Summary of DEER Updates

Commercial sector DEER updates for 2018 include:[8]

- Revised to standard practice for lighting measures to reflect more efficient baselines
- Consideration of updated definition of peak demand

Commercial sector DEER updates for 2019 include:[9]

- A limited number of NTG values are updated base on recent EM&V findings.
- The commercial refrigerant charge measures are updated based on recent EM&V study results.
- LED lighting is established as the standard practice baseline for normal replacement, new construction and replace-on-burnout measures.
- Net-to-Gross
- The
- EUL/RUL
- The below-code NTG adjustment factor for accelerated replacement (AR) applications has been suspended, effective 2019-01-01 and lasting indefinitely
- Net-to-Gross methodology has been updated to include treatment of measure utilizing existing conditions baselines rather than code/standard practice baseline in the case of accelerated replacement (AR) measure application type or a normalized metered energy consumption (NMEC) savings estimation approach
- The available measure application types, delivery types, and measure impact types were updated to reflect E 4818. The final lists and associated acronyms for the revised codes are shown in Resolution E-4952, Section 5.6
- EUL/RUL policy for add-on equipment and Behavioral, Operational and Retrocommissioning (BRO) measures. EUL update for screw-in LED A-lamps.

DEER updates for 2020 and 2021 are more comprehensive. Please refer to "Appendix D. CPUC ED Resolution E-4952 Approving DEER Updates for 2019 and 2020 Including DEER2020 and Revised DEER2019 Update Statement" for CPUC ED Resolution E-4952 approving DEER updates for 2019 and 2020.[10]

Commercial sector DEER updates for 2020 include:[11]

- Peak demand savings and lighting HVAC interactive effects have been updated for all previous DEER measures with no expiration date, or with an expiration date after December 31, 2019.
- New methods and tools for chiller measures to allow calculation of values for deemed measures and custom programs.
- A new commercial building prototype has been added to DEER that includes extended hours of operation of high load activity areas, for use in chiller measures for custom programs.

[8] Source: http://www.deeresources.com/index.php/deer-versions/deer2018
[9] Source: http://www.deeresources.com/index.php/deer-versions/deer2018
[10] CPUC ED, 2019. Energy Division Resolution E-4952. Approval of the Database for Energy-Efficient Resources updates for 2020 and revised version 2019 in Compliance with D.15-10-028, D.16-08-019, and Resolution E-4818. October 11, 2018.
[11] Source: http://www.deeresources.com/index.php/deer-versions/deer2020

- The commercial building prototypes were updated to align with the DEER2016 commercial lighting hours-of-use update.
- The numerous building vintage classifications used in previous DEER versions have been consolidated into "Old", "Median", "Recent", and "New" classifications.
- A correction has been made to the occupant density and corresponding outdoor air ventilation rates for the commercial DEER building prototypes.
- Several minor commercial HVAC updates in the 2019 Title-24 have been incorporated.
- Non-residential upstream packaged HVAC and maintenance measures NTG values are update based on recent evaluation results.
- The results of recent CPUC sponsored laboratory testing show that LED A-lamps are unlikely to obtain their rated life or even the Commission staff approved value of 20,000 hours. Based on the testing results the LED screw-in A-Lamp EUL is reduced from 20,000 hours to 10,000 hours effective 1 January 2019.
- Subsequent to E-4952 the linear lamp and fixture measures were revamped significantly through non-DEER workpapers. There is no plan to migrate linear measures back into DEER.
- All workpapers will be statewide for 2020 and beyond.
- Consolidate savings by climate zone to eliminate PA-specific records.
- Removed DEER 2020 measures which had been previously expired but never removed.

Commercial sector DEER updates for 2021 include:[12]

- Further review and assessment of lighting measures.

4.4.2 Summary of Uncertain Measure Updates

The tables below identify commercial measures and parameters on the 2018 and 2019 Uncertain Measures lists (

[12]Source: http://deeresources.com/index.php/deer-versions

Table 27 and Table 28, respectively). Note that while the 2018 list identifies not only the uncertain measure group but also the specific energy resource or resources (i.e., electric or gas) and parameters, the 2019 and 2020 lists identify the measure group only. This is consistent with the information provided in the uncertain measure lists for each year.

Table 27. 2018 Uncertain Measures - Commercial Sector

Market Sectors	Measure Group	Energy Resource	Parameter(s) of Interest
Com	HVAC Chiller Water Cooled	Electric	Installation Rate, Gross Realization Rate, Net-to-Gross Ratio
Com	HVAC Maintenance	Electric	Gross Realization Rate, Net-to-Gross Ratio
Com	HVAC Pump VFD	Electric	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Res	HVAC RCA	Electric	Gross Realization Rate, Net-to-Gross Ratio
Ag, Com, Ind	HVAC Rooftop or Split System	Electric, Gas	Gross Realization Rate, Net-to-Gross Ratio, Unit Energy Savings
Com	HVAC VRF/Mini Split	Electric	Net-to-Gross Ratio, Gross Realization Rate
Com, Res	Lighting Indoor LED Fixture	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Res	Lighting Indoor LED High Bay Fixture	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Res	Lighting Indoor LED Lamp	Electric, Gas	Gross Realization Rate, Net-to-Gross Ratio
Com, Res	Lighting Indoor LED Reflector Lamp	Electric, Gas	Gross Realization Rate, Net-to-Gross Ratio
Ag, Com, Ind, Res	Lighting Outdoor LED Fixture	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Ind	Pool Pump	Gas	Gross Realization Rate, Net-to-Gross Ratio
Com	Refrigeration Case LED Lighting	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Res	Water Heating Boiler	Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Res	Water Heating Tankless Water Heater	Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life

Source: 2018 ESPI Uncertain Measures List Memo. https://pda.energydataweb.com/#!/documents/1947/view

Table 28. 2019 Uncertain Measures - Commercial Sector

Market Sectors	Measure Group
Ag, Com, Ind	Lighting Indoor LED High Bay Fixture
Ag, Com, Ind	Lighting Indoor LED High Bay Fixture
Ag, Com, Ind, Res	Lighting Outdoor LED Fixture
Com	HVAC Controls PTAC
Com	Process Ozone Laundry
Com	Refrigeration Case LED Lighting
Com	Refrigeration Case LED Lighting
Com, Res	HVAC Maintenance
Com, Res	HVAC RCA
Com, Res	Lighting Indoor LED Fixture
Com, Res	Lighting Indoor LED Fixture
Com, Res	Lighting Indoor LED Lamp
Com, Res	Lighting Indoor LED Lamp
Com, Res	Lighting Indoor LED Reflector Lamp
Com, Res	Water Heating Tankless Water Heater

Source: Final 2019 Uncertain Measure List Memo, https://pda.energydataweb.com/#!/documents/2100/view

Table 29. 2020 Uncertain Measures - Commercial Sector

Market Sectors	Measure Group
Res, Com	HVAC Coil Cleaning
Com, Ind	Pipe Insulation Hot Water Application

Source: 2020 Uncertain Measures List Memo, https://pda.energydataweb.com/#!/documents/2305/view

4.4.3 Program Administrators' Workpaper Submissions

Planned workpapers, and updates to existing workpapers for the upcoming portfolio cycle are submitted to Commission staff and reviewed and logged. These workpapers often use DEER data and/or methodology to add technologies that are not in DEER to the energy efficiency portfolio. Table 30 and Table 31 summarize the quantity of 2018 and 2019 commercial workpaper submissions, respectively, by end-use category and IOU. Appendix C provides the workpaper locations where more information and the papers themselves can be found.

Table 30. 2018 Commercial Sector Workpaper Summary by End-Use Category and IOU

End-Use Category	IOU				
	PG&E	SCE	SCG	SDG&E	Statewide
Any	1	1			
Appliance or Plug Load	1	1			
Commercial Refrigeration	2	3		1	
Food Service	2	5	1	3	
HVAC	3	4		3	1
Lighting	10	8		5	4
Recreation		1			
Service and Domestic Hot Water	2		5	2	

Source: CPUC Workpaper and Disposition Archive, *http://www.deeresources.net/workpapers*

Table 31. 2019 Commercial Sector Workpaper Submissions by End-Use Category and IOU

End-Use Category	IOU				
	PG&E	SCE	SCG	SDG&E	Statewide
Appliance or Plug Load		1	2		
Commercial Refrigeration	9	7			
Compressed Air		1			
Food Service	1	2	2		
HVAC	10	8	1	2	1
Irrigation	1				
Lighting	8	12		3	1
Other					
Pool and Spa Equipment	1	1	1		
Process Heat			1		
Service				1	
Service and Domestic Hot Water	1		10	1	

Source: CPUC Workpaper and Disposition Archive, http://www.deeresources.net/workpapers

5 Public Sector

5.1 Public Sector Portfolio of Programs

The public portfolio of programs includes the following:

- Calculated Incentives
- Deemed Incentives
- Direct Install

Please note that some of these programs may be discontinued in the future. For questions, contact CPUC ED and PA staff. Please refer to the CEDARS website for details regarding program budgets and anticipated energy savings and demand reductions for each PA.[13] The CPUC has not yet contracted with EM&V consultants for this sector's 2017 – 2019 EM&V studies. The 2019 EM&V Plan will provide descriptions for these studies once those contacts are in place.

5.2 2018 and 2019 EM&V Studies

Table 32 summarizes the 2018 and 2019 public sector EM&V studies including details regarding budgets and timing. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 32. 2018 and 2019 Public Sector EM&V Studies

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Pub-534	Assessment of Community Choice Aggregators CCAs)	CPUC ED	Other	$150,000	Q4 2021
2018-Pub-533	Assessment of CCAs	CPUC ED	Other	$137,500	Q4 2020
2019-Pub-538	Assessment of Local Government Partnerships and RENS	CPUC ED	Other	$362,500	Q4 2020
2018-Pub-537	Assessment of Local Government Partnerships and RENS	CPUC ED	Other	$350,000	Q4 2019
2018-Pub-510	Model Assessment and Process Evaluation of Southern California Edison's Energy Leader Partnership Model	SCE	Impact Evaluation	$225,000	N/A
2019-Pub-503	Statewide Public Sector Market Study	PG&E	Market Study	$300,000	Q4 2020
2019-Pub-523	Statewide Study to Quantify Co-benefits and Local Economic Benefits of LGPs in HTR and DAC	PG&E	Market Study	$100,000	Q3 2020

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

[13] CEDARS website: https://cedars.sound-data.com/

5.3 Planned 2020 EM&V Studies

Currently, there are no public sector EM&V studies planned using 2020 budget.

6 Industrial

6.1 Industrial Portfolio of Programs

The industrial portfolio of programs includes the following:

- Calculated Incentives
- Continuous Energy Improvement
- Deemed Incentives
- Direct Install
- Energy Advisor

Please note that some of these programs may be discontinued in the future. For questions, contact CPUC ED and PA staff. Please refer to the CEDARS website for details regarding program budgets and anticipated energy savings and demand reductions for each PA.[14]

6.2 2019 EM&V Studies

Table 32 summarizes the 2019 industrial sector EM&V studies including details regarding budgets and timing. These studies include impact evaluations of the 2019 programs as well as market studies active during 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 33. 2019 Industrial EM&V Summary

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Ind-583	2018 Industrial Strategic Energy Management (SEM) Evaluation	CPUC ED	Impact Evaluation	$ 1,357,000	Q2 2021
2019-Ind-514	Statewide Industrial Large Customer Wants and Needs	SCE	Market Study	$ 200,000	N/A

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

6.3 Planned 2020 EM&V Studies

Table 34 summarizes industrial sector EM&V studies planned for 2020 and subsequent years.

[14] CEDARS website: https://cedars.sound-data.com/

Table 34. Planned 2020 Industrial Sector EM&V Studies- PA managed study only

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2020-Ind-578	Evaluability Process Evaluation of PG&E's Strategic Energy Management Program	PG&E	Process Evaluation	$ 110,000	Q2 2022
2020-Ind-558	Industrial Electrification Potential Study	SCE	Market Study	$ 150,000	Q3 2021
2020-Ind-556	Compressed Air Market Study	SCE	Market Study	$ 50,000	Q1 2021

Source: Program Administrators, CPUC ED, and their consultants via https://psr.energydataweb.com/

The tables below provide further detail regarding the study in Table 34 above.

Table 35. Study description: Evaluability and Process Evaluation of PG&E's Strategic Energy Management Program

Study Title: Evaluability and Process Evaluation of PG&E's Strategic Energy Management Program	Budget: $110,000
Completion Date: Q2 2022	Study Manager: PG&E
Description: Strategic Energy Management (SEM) is not a new program design but it is new to California and the state has unique rules governing SEM implementation. This project is a process evaluation. The focus is on reviewing program processes and documentation program metrics staffing roles and responsibilities and the interactions between the customers the implementers the program administrator the regulator and its consultants. The key deliverable will be a report that assesses how PG&E's implementation of SEM compares to best practices and will provide recommendations to help PG&E improve its program administration to maximize operational efficiencies streamline knowledge transfer and ensure favorable evaluation outcomes.	
Objective: The objective of this project is a process evaluation: to assess the extent to which PG&E's program and evaluation teams their consultants and implementers are following best practices in the execution of the Strategic Energy Management (SEM) program. SEM is a new and critical program for PG&E's industrial customers and therefore PG&E must ensure that it follows industry best practices in program administration and implementation.	
Key Research Questions: 1. Is PG&E following best practices in its administration and implementation of its Strategic Energy Management (SEM) program? 2. What recommendations would improve its administrative and operational practices with respect to program processes and documentation specifically: developing collecting and acting on program metrics; in contracting in documenting program activities including customer recruitment on-site meetings and other activities; documenting non-routine events and accounting for them in savings calculations and accounting installation of measures? 3. What changes could be made to improve implementer performance? Is PG&E following best practices in providing and transferring AMI data in data cleaning in dealing with regulators and in calculating performance payments? 4. Are these equitable to implementers PG&E and its ratepayers? 5. How does PG&E's administration compare to best-of-breed SEM programs? 6. What other changes would improve the SEM program?	
Potential EM&V Methods: Reviews of policy/procedure manuals and other documentation. Reviews of program performance metrics and their development tracking and their use in program management. Interviews with customers implementers staff regulators and SEM experts.	

Table 36. Study description: Industrial Electrification Potential Study

Study Title: Industrial Electrification Potential Study	Budget: $150,000
Completion Date: Q3 2021	Study Manager: SCE
Description: Recent research for example McKenzie and Company's "Decarbonization of the Industrial Sector: The Next Frontier" (2018) notes that "Almost 45 % of industry's CO2 emissions result from the manufacturing of cement (3 Gton CO2) steel (2.9 Gton CO2) ammonia (0.5 Gton CO2) and ethylene (0.2 Gton CO2). Despite these facts there are few PA programs that address this opportunity. Using existing research as well as SCE's recent Commercial Electrification research this project will assess electrification potential in the industrial sector via the methods outlined above.	
Objective: To identify the potential for energy demand and GHG savings in the industrial sector and understand market barriers that must be overcome to reach this potential.	
Key Research Questions: 1. What is the market potential for industrial facility electrification? 2. What are the potential barriers and opportunities? 3. What program strategies make sense to reach this potential? Other questions will be derived as the scope is finalized by the PCG.	
Potential EM&V Methods: We anticipate secondary and primary research including surveys.	

Table 37. Study description: Compressed Air Market Study

Study Title: Compressed Air Market Study	Budget: $50,000
Completion Date: Q1 2021	Study Manager: SCE
Description: Compressed air systems represent a major energy end use in the commercial and industrial sectors of the United States and Canada consuming 91.56 TWh of electricity in the United States annually and representing 16.5 % of motor-driven systems energy use in US manufacturing facilities. At the same time the savings potential in compressed air systems is significant. According to a 2010 United Nations Industrial Development Organization (UNIDO) report Motor Systems Efficiency Supply Curves over	
Objective: To describe the compressed air market in order to achieve energy savings in this crucial energy using category.	
Key Research Questions: Southern California Edison continues to have large industrial customers with significant compressed air loads. This study has three main objectives: 1) Determine if there are their continuing savings potential in the Compressed Air area for California PAs? 2) If so and since these savings have not been captured by programs to date what are the barriers to achieving reductions in wasted energy? 3) What customer types are more likely to respond to PA compressed air programs?	
Potential EM&V Methods: We anticipated primary and secondary research including surveys literature reviews and the review of past compressed air projects and dispositions.	

6.4 Ex Ante Coordination

Ex ante processes for the industrial sector (including Uncertain Measures List updates and workpaper review) incorporate data and results from the latest EM&V studies. This section highlights the ex ante values that are relevant to this sector.

6.4.1 Summary of Uncertain Measure Updates

Table 38 and Table 39 below identify industrial measures and parameters on the 2018 and 2019 Uncertain Measures lists. Note that while the 2018 list identifies not only the uncertain measure group but also the specific energy resource or resources (i.e., electric or gas) and parameters, the 2019 and 2020 lists identify the measure group only. This is consistent with the information provided in the uncertain measure lists for each year.

Table 38. 2018 Uncertain Measures - Industrial Sector

Market Sectors	Measure Group	Energy Resource	Parameter(s) of Interest
Ag, Com, Ind	HVAC Rooftop or Split System	Electric, Gas	Gross Realization Rate, Net-to-Gross Ratio, Unit Energy Savings
Ag, Com, Ind, Res	Lighting Outdoor LED Fixture	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Com, Ind	Pool Pump	Gas	Gross Realization Rate, Net-to-Gross Ratio

Source: 2018 Energy Savings Performance Incentive (ESPI) Uncertain Measures List Memo. https://pda.energydataweb.com/#!/documents/1947/view

Table 39. 2019 Uncertain Measures – Industrial Sector

Market Sectors	Measure Group
Ag, Com, Ind	Lighting Indoor LED High Bay Fixture
Ag, Com, Ind, Res	Lighting Outdoor LED Fixture

Source: Final 2019 Uncertain Measure List Memo, https://pda.energydataweb.com/#!/documents/2100/view

Table 40. 2020 Uncertain Measures - Industrial Sector

Market Sectors	Measure Group
Com, Ind	Pipe Insulation Hot Application

Source: 2020 Uncertain Measures List Memo, https://pda.energydataweb.com/#!/documents/2305/view

6.4.2 Program Administrators' Workpaper Submissions

Planned workpapers, and updates to existing workpapers for the upcoming portfolio cycle are submitted to Commission staff and reviewed and logged. These workpapers often use DEER data and/or methodology to add technologies that are not in DEER to the energy efficiency portfolio. Table 41 and Table 42 summarize the 2018 and 2019 industrial workpaper submissions, respectively, by end-use category and IOU. Appendix C provides the workpaper locations where more information and the papers themselves can be found.

Table 41. 2018 Industrial Sector Workpaper Summary by End-Use Category and IOU

End-Use Category	IOU			
	PG&E	SCE	SCG	SDG&E
Any	1	1		
HVAC	1			
Lighting	1	1		1
Service and Domestic Hot Water	1		1	

Source: CPUC Workpaper and Disposition Archive, http://www.deeresources.net/workpapers

Table 42. 2019 Industrial Sector Workpaper Summary by End-Use Category and IOU

End-Use Category	IOU			
	PG&E	SCE	SCG	SDG&E
Commercial Refrigeration	1			
Compressed Air		1		
HVAC	1	5		
Irrigation	1			
Lighting	1	1		1
Service and Domestic Hot Water	1		2	

Source: CPUC Workpaper and Disposition Archive, http://www.deeresources.net/workpapers

7 Agriculture

7.1 Agriculture Portfolio of Programs

The agriculture portfolio of programs includes the following:

- Calculated Incentives
- Continuous Energy Improvement
- Deemed Incentives
- Energy Advisor

Please note that some of these programs may be discontinued in the future. For questions, contact CPUC ED and PA staff. Please refer to the CEDARS website for details regarding program budgets and anticipated energy savings and demand reductions for each PA.[15]

7.2 2019 EM&V Studies

Table 43 summarizes the 2019 agriculture sector EM&V studies including details regarding budgets and timing. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view. Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 43. 2019 Agricultural EM&V Summary

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Ag-515	Statewide Horticulture Indoor Agriculture Market Study	SCE	Market Study	$150,000	N/A

Source: Program Administrators, CPUC ED, and their consultants via https://psr.energydataweb.com/

7.3 Planned 2020 EM&V Studies

Currently, there are no agriculture sector EM&V studies planned using 2020 budget.

7.4 Ex Ante Coordination

Ex ante processes for the agricultural sector (including Uncertain Measures List updates and workpaper review) incorporate data and results from the latest EM&V studies. This section highlights the ex ante values that are relevant to this sector.

7.4.1 Summary of Uncertain Measure Updates

The tables below identify agricultural measures and parameters on the 2018 and 2019 Uncertain Measures lists (Table 44 and Table 45, respectively). Note that while the 2018 list identifies not only the uncertain measure group but also the specific energy resource or resources (i.e., electric or gas) and parameters, the 2019 list identifies the measure group only. This is consistent with the information provided in the uncertain measure lists for each year. There are no Agricultural measures include in the 2020 Uncertain Measure list memo located here: https://pda.energydataweb.com/#!/documents/2305/view.

[15] CEDARS website: https://cedars.sound-data.com/

Table 44. 2018 Uncertain Measures – Agriculture Sector

Market Sectors	Measure Group	Energy Resource	Parameter(s) of Interest
Ag	Agricultural Irrigation	Electric	Gross Realization Rate, Net-to-Gross Ratio
Ag, Com, Ind	HVAC Rooftop or Split System	Electric, Gas	Gross Realization Rate, Net-to-Gross Ratio, Unit Energy Savings
Ag, Com, Ind, Res	Lighting Outdoor LED Fixture	Electric, Gas	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life
Ag	Process Pumping VFD*	Electric	Installation Rate, Unit Energy Savings, Net-to-Gross Ratio, Expected Useful Life

Source: 2018 Energy Savings Performance Incentive (ESPI) Uncertain Measures List Memo. https://pda.energydataweb.com/#!/documents/1947/view

Table 45. 2019 Uncertain Measures – Agriculture Sector

Market Sectors	Measure Group
Ag	Agricultural Irrigation
Ag	Process Pumping VFD
Ag, Com, Ind	Lighting Indoor LED High Bay Fixture
Ag, Com, Ind, Res	Lighting Outdoor LED Fixture

Source: Final 2019 Uncertain Measure List Memo, https://pda.energydataweb.com/#!/documents/2100/view

7.4.2 Program Administrators' Workpaper Submissions

Planned workpapers, and updates to existing workpapers for the upcoming portfolio cycle are submitted to Commission staff and reviewed and logged. These workpapers often use DEER data and/or methodology to add technologies that are not in DEER to the energy efficiency portfolio. Table 46 and Table 47 summarize the quantity of 2018 and 2019 agriculture workpaper submissions, respectively, by end-use category and IOU. Appendix C provides the workpaper locations where more information and the papers themselves can be found.

Table 46. 2018 Agriculture Sector Workpaper Summary by End-Use Category and IOU

End Use Category	Count			
	PG&E	SCE	SDG&E	Statewide
Any	1	1		
Not listed	2			

Table 47. 2019 Agriculture Sector Workpaper Summary by End-Use Category and IOU

End-Use Category	Count			
	PG&E	SCE	SDG&E	Statewide
Any	1	1		
Not listed	2			

Source: CPUC Workpaper and Disposition Archive, *http://www.deeresources.net/workpapers*

8 Cross-Cutting

8.1 Cross-cutting Portfolio of Programs

The cross-cutting portfolio of programs includes the following:

- ARRA-Originated Financing
- Codes and Standards
- CRM
- Integrated Demand-Side Management
- Lighting Innovation
- Lighting Market Transformation
- ME&O
- New Financing Offerings
- On-bill Financing
- Primary Lighting
- Technology Assessments
- Technology Development Support
- Technology Introduction Support
- Third-Party Financing
- Career Connections
- Career & Workforce Readiness
- Integrated Energy Education & Training
- Residential NMEC

Please note that some of these programs may be discontinued in the future. For questions, contact CPUC ED and PA staff. Please refer to the CEDARS website for details regarding program budgets and anticipated energy savings and demand reductions for each PA.[16]

8.2 Marketing, Education & Outreach

The marketing, education and outreach studies in Table 48 were active during 2018 and/or 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view. Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

[16] CEDARS website: https://cedars.sound-data.com/

Table 48. 2018 and 2019 Cross Cutting- Marketing, Education & Outreach EM&V Studies

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Cross-543	ME&O Program Transition from IOUs to Third Parties and CCAs - 2019	CPUC ED	Other	$ 250,000	Q4 2021
2018-Cross-543	ME&O Program Transition from IOUs to Third Parties and CCAs - 2018	CPUC ED	Other	$ 250,000	Q4 2021
2019-Cross-542	Marketing Education and Outreach Consensus Project - 2019	CPUC ED	Other	$ 375,000	Q4 2019
2018-Cross-542	Marketing Education and Outreach Consensus Project - 2018	CPUC ED	Other	$ 375,000	Q4 2019
2019-Cross-541	Cross-Cutting Marketing Effectiveness Study - 2019	CPUC ED	Process Evaluation	$ 1,900,000	Q4 2019
2018-Cross-541	Cross-Cutting Marketing Effectiveness Study - 2018	CPUC ED	Process Evaluation	$ 1,900,000	Q4 2019

Source: Program Administrators, CPUC ED, and their consultants via https://psr.energydataweb.com/

Currently, there are no EM&V studies planned using 2020 budget that focus on Marketing, Education and Outreach.

8.3 Emerging Technologies

Table 49 summarizes the 2019 emerging technologies EM&V studies including details regarding budgets and timing. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 49. 2019 Emerging Technologies EM&V Studies

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2018-Cross-540	Emerging Technology Handoff Study	CPUC ED	Other	$150,000	Q1 2020
2018-Cross-539	Emerging Technology to Portfolio Evaluation Study	CPUC ED	Other	$270,000	Q2 2020

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

Currently, there are no EM&V studies planned using 2020 budget that focus on Emerging Technologies.

8.4 Codes & Standards

The codes and standards studies in

Table 50 were active during 2018 and/or 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 50. 2018 and 2019 Cross Cutting-Codes & Standards EM&V Studies

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2018-Cross-531	Codes and Standards Harmonization Study	CPUC ED	Other	$125,000	Q4 2019
2018-Cross-530	Codes and Standards Cost Effectiveness	CPUC ED	Other	$125,000	Q1 2021
2019-Cross-516	Statewide Revisit Attribution Methodology for Codes & Standards	SCE	Process Evaluation	$199,000	N/A

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

Table 51 below summarizes the codes and standards study planned for 2020.

Table 51. Planned 2020 Cross-Cutting- Codes & Standards EM&V Studies- PA managed studies only

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2020-Cross-575	Comprehensive Logic Models for the Codes Standards and Crosscutting Programs	PG&E	Process Evaluation	$115,000	Q4 2020

Source: Program Administrators, CPUC ED, and their consultants via https://psr.energydataweb.com/

The table below provides further detail regarding the Codes & Standards study planned for 2020.

Table 52. Study description: Comprehensive Logic Models for the Codes Standards and Crosscutting Programs

Study Title: Comprehensive Logic Models for the Codes Standards and Crosscutting Programs	Budget: $115,000
Completion Date: Q4 2020	Study Manager: PG&E
Description: The goal of this research is to develop updated logic models for the SW C&S program and all sub-programs and crosscutting programs such as future new construction programs designed to support codes and standards advocacy and compliance improvement taking into consideration detailed program manager input. The final LMs will need to be at a level of detail that shows explicit linkages between other EE portfolio programs and C&S and incentive program data collection requirements required to support market effects attribution estimation for each measure graduated to a building code or appliance standard.	
Objective: The primary objective is to support future evaluation to estimation of market effects attribution for each measure graduated to a building code or appliance standard.	
Key Research Questions: The development of logic models always should include several questions: 1) What are the program activities? 2) What are barriers to adoption? 3) What are anticipated outputs of program activities? 4) What are anticipated outcomes to result from program activities and outputs? 5) What are the time scales for the above: short med long terms?	
Potential EM&V Methods: Will likely include interviews with multiple program managers in an iterative process to update and review logic models.	

8.5 Workforce, Education, and Training (WE&T)

Table 53 summarize the Workforce, Education, and Training EM&V studies conducted in 2018 and 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 53. 2019 WE&T EM&V Summary

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Cross-544	WE&T and Installation Improvement Evaluation Study - 2019	CPUC ED	Impact Evaluation	$ 470,000	Q4 2021
2018-Cross-544	WE&T and Installation Improvement Evaluation Study - 2018	CPUC ED	Impact Evaluation	$ 470,000	Q4 2021
2019-Cross-548	Knowledge Skills and Abilities Market Studies - 2019	CPUC ED	Other	$ 275,000	Q1 2020
2019-Cross-545	Partnerships with Training Institutions Impact Evaluation - 2019	CPUC ED	Other	$ 455,000	Q3 2021
2018-Cross-548	Knowledge Skills and Abilities Market Studies - 2018	CPUC ED	Other	$ 275,000	Q1 2020
2018-Cross-545	Partnerships with Training Institutions Impact Evaluation - 2018	CPUC ED	Other	$ 455,000	Q3 2021
2019-Cross-547	Career and Workforce Readiness Process Evaluation - 2019	CPUC ED	Process Evaluation	$ 120,000	Q4 2021
2019-Cross-546	WE&T Career Connections Process Evaluation - 2019	CPUC ED	Process Evaluation	$ 120,000	Q4 2021
2018-Cross-547	Career and Workforce Readiness Process Evaluation - 2018	CPUC ED	Process Evaluation	$ 120,000	Q4 2021
2018-Cross-546	WE&T Career Connections Process Evaluation - 2018	CPUC ED	Process Evaluation	$ 120,000	Q4 2021

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

Currently, there are no EM&V studies planned using 2020 budget that focus on Workforce, Education, and Training.

8.6 Finance

Table 54 summarizes the Finance EM&V studies conducted in 2018 and 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 54. 2018 and 2019 Cross Cutting- Finance EM&V Studies

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2018-Cross-527	SW On Bill Financing Impact Evaluation 2018	CPUC ED	Impact Evaluation	$ 400,000	Q4 2020
2018-Cross-526	REEL Pilot Financing Impact Evaluation	CPUC ED	Impact Evaluation	$ 400,000	Q4 2019
2019-Cross-527	SW On Bill Financing Impact Evaluation 2019	CPUC ED	Impact Evaluation	$ 400,000	Q4 2020
2019-Cross-528	SW Small Business & Multifamily Pilot Process Evaluation	CPUC ED	Process Evaluation	$ 400,000	Q4 2021
2019-Cross-505	PG&E On-Bill Financing Alternative Pathway Early M&V	PG&E	Process Evaluation	$ 88,892	Q1 2020

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

The Statewide On-Bill Financing Impact Evaluation will initiate as early as Q1 of 2020.

8.7 Integrated Demand Side Management (IDSM)

Table 55 summarizes the studies conducted in 2019 that focused on Integrated Demand Side Management (IDSM). More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 55. 2019 IDSM EM&V Studies Summary

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Cross-521	Statewide Effectiveness of IDSM ME&O Efforts Study	SDG&E	Process Evaluation	$100,000	Combined
2019-Cross-522	Statewide Interactive Effects of IDSM Projects Study	SDG&E	Process Evaluation	$105,000	Initiation

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

Table 56 summarizes the IDSM studies proposed for 2020.

Table 56. Proposed 2020 Cross-Cutting- IDSM EM&V Studies- PA managed studies only

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2020-Cross-570	IDSM & EE+DR Cost Effective Methodology	SDG&E or CPUC	Other	$150,000	Q4 2020
2020-Cross-568	IDSM & EE+DR Load Impact Methodology	SDG&E or CPUC	Other	$150,000	Q4 2020

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

The tables below provide further detail regarding each of the studies in Table 56 above.

Table 57. Study description: IDSM & EE+DR Cost Effective Methodology

Study Title: IDSM & EE+DR Cost Effective Methodology	Budget: $150,000
Completion Date: Q4 2020	Study Manager: SDG&E or CPUC
Description: Develop an EE+DR Cost Effectiveness (CE) methodology to appropriately value the EE+DR initiatives. For the EE offering the goal for program offerings aims to be cost effective but when its low and is required for DR how do we incorporate both to help each approach. For example, smart communicating thermostats. This study will investigate a new CE methodology when we combine EE+DR. This will help the 3rd Party implementers better develop their programs. This study will also help inform the CPUC and their consultants revolving the next P&G study to be released in 2021. Could also be considered for the Energy Division to take over given the commonality for P&G.	
Objective: 1. Reevaluate and update the 2010-2012 Integrated Demand-Side Management (IDSM) Cost-Effectiveness Framework White Paper by Â Black & Veatch to specifically apply to EE+DR programs. 2. Conduct review of available sources of information on residential and commercial sectors. 3. Identify tools that would need to be revised to deploy the new method. 4. Identify the steps to conduct an EE+DR cost effective methodology.	
Key Research Questions: 1. What research is available both in- and out-of-state that showcase common benefits to allow EE+DR? 2. What are the costs that need to be revised in order to achieve EE+DR Cost Effective improvements? 3. What are the current policy or tool barriers that impact this newly developed methodology? 4. What are the loading order of sub cost effective methodologies since we are laying EE+DR onto each other?	
Potential EM&V Methods: Build on the 2010-2012 IDSM study develop modification to the current TRC/PAC tests.	

Table 58. Study description: IDSM & EE+DR Load Impact Methodology

Study Title: IDSM & EE+DR Load Impact Methodology	Budget: $150,000
Completion Date: Q4 2020	Study Manager: SDG&E or CPUC
Description: Develop an EE+DR Cost Effectiveness (CE) methodology to appropriately value the EE+DR initiatives. For the EE offering the goal for program offerings aims to be cost effective but when its low and is required for DR how do we incorporate both to help each approach. A measure that comes to mine is the smart communicating thermostats. This study will investigate a new CE methodology when we combine EE+DR. This will help the 3rd Party implementers better develop their programs. Subsequently the result of this study can inform future P&G study work to incorporate EE+DR market potential. To the extend we have additional funds we could incorporate a load impact methodology for Virtual Power Plant (VPP).	
Objective: 1. Conduct review of available sources of information on residential and commercial sectors. 2. Determine the barriers to launch the newly developed methodology 3. Determine any existing measures and programs that are suitable to launch the methodology. 4. Provide representative model specification and data requirements. 5. Develop methodologies to evaluate the EE+DR general requirements as described in D.18-05-041 page 36	
Key Research Questions: 1. What load research is available both in- and out-of-state that shows meaningful results?2. What are the barriers to develop an EE+DR methodology?3. Which existing measures and programs are good candidates to consolidate and deploy the newly developed methodology?	
Potential EM&V Methods: Literature Survey actual development of methodology	

8.8 Zero Net Energy (ZNE) and Decarbonization

Table 59 summarizes the ZNE and Decarbonization EM&V studies that were conducted in 2018 and 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 59. 2019 ZNE and Decarbonization EM&V Summary

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2018-Cross-551	ZNE Retrofit Timelines and Costs - 2018	CPUC ED	Other	$ 335,000	Q4 2021
2018-Cross-550	IOU and CCA Cross-Cutting Program Evaluation and Program Facilitation - 2018	CPUC ED	Other	$ 1,100,000	Q4 2021
2018-Cross-549	ZNE Community Case Study - 2018	CPUC ED	Other	$ 485,000	Q4 2021
2019-Cross-551	ZNE Retrofit Timelines and Costs - 2019	CPUC ED	Other	$ 335,000	Q4 2021
2019-Cross-550	IOU and CCA Cross-Cutting Program Evaluation and Program Facilitation - 2019	CPUC ED	Other	$ 1,100,000	Q4 2021
2019-Cross-549	ZNE Community Case Study - 2019	CPUC ED	Other	$ 485,000	Q4 2021

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

Table 60 summarizes the ZNE and Decarbonization EM&V studies planned for 2020.

Table 60. Proposed 2020 Cross-Cutting- ZNE and Decarbonization EM&V Studies- PA managed studies only

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2020-Cross-569	Feasibility Study for the Electrification of Hot Water and Space Conditioning Systems in Residential and Small Commercial	PG&E	Market Study	$300,000	Q4 2020
2020-Cross-571	Costs and Processes of Secondary Service Upgrades in Electrification Retrofits	PG&E	Market Study	$100,000	Q4 2020

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

Table 61. Study description: Feasibility Study for the Electrification of Hot Water and Space Conditioning Systems in Residential and Small Commercial

Study Title: Feasibility Study for the Electrification of Hot Water and Space Conditioning Systems in Residential and Small Commercial	Budget: $300,000
Completion Date: Q4 2020	Study Manager: PG&E
Description: The CA legislature has established ambitious climate and energy policies which provide a foundation for building electrification and the use of clean energy technologies. The retrofit of existing gas-fueled hot water and space conditioning systems with efficient electrical alternatives can provide significant carbon emission reductions and may have additional benefits such as load shifting energy storage capabilities. This study will explore cost-effective solutions to electrify domestic hot water and space conditioning systems for single family low and high-rise multifamily and small commercial buildings in CA.	
Objective: This study aims to understand the feasibility of electrifying existing gas-powered hot water and space conditioning systems in residential and small commercial buildings by evaluating available technologies and characterizing the installed base of gas systems within the IOU service territories.	
Key Research Questions: 1. What viable technologies exist to electrify existing gas-powered hot water and space conditioning systems in single family multifamily and small commercial buildings? 2. What is the expected technical potential for replacement of gas space conditioning and water heating systems with electrical alternatives? 3. What physical and operational constraints exist that could prevent successful retrofit of gas systems with electric alternatives? This may include: a. Existing electrical capacity b. Electrical distribution c. Physical space including extra storage to facilitate load shifting d. Maintenance and other operational needs e. Occupant comfort and ease-of-use 4. What is the cost differential between replacement electrical systems and high efficiency gas systems? 5. What are the potential energy GHG and cost savings impacts from switching these systems from gas to electric?	
Potential EM&V Methods: TBD	

Table 62. Study description: Costs and Processes of Secondary Service Upgrades in Electrification Retrofits

Study Title: Costs and Processes of Secondary Service Upgrades in Electrification Retrofits	Budget: $100,000
Completion Date: Q4 2020	Study Manager: PG&E
Description: Decarbonizing building energy end uses will be essential to achieve State GHG reduction targets. While new construction can be designed with this in mind cost effectively retrofitting existing systems continues to see challenges. Separate from the equipment costs there is a lack of knowledge of the cost of and process for secondary service upgrades. While upgrading wiring or replacing a panel in a unit is relatively easy increasing capacity or a service drop to a site is much more challenging due to high costs and long lead times with the utilities. Furthermore, climate change is increasingly requiring adding air conditioning in areas where it would not have previously been necessary further increasing the electrical load.	
Objective: This study aims to understand the costs and processes associated with second service installations required in electrification/decarbonization retrofits.	
Key Research Questions: 1. What are the current retrofit processes in place to complete electrification retrofits that require secondary service upgrades? a. What happens on both sides of the meter? b. What is the implementation timeline? c. How can these processes be standardized and streamlined? 2. What are the costs associated with these upgrades? Secondary service upgrade costs can stem from electrical capacity issues and decommissioning existing gas infrastructure and can be split into three main categories: a. Building-level Electrical Upgrades i. Paid by customer ii. Varies widely by building age location incumbent system(s) b. Infrastructure- electrical distribution i. Paid by electric ratepayers. Costs likely not incurred from any one project but a collection of projects or programs; impact may be small to individual ratepayers. c. Infrastructure- existing natural gas infrastructure i. Paid by customer & gas ratepayers ii. Customers may pay a fee to disconnect natural gas service; rate impacts to remaining utility customer pool 3. What data sources are available? 4. Who should incur the costs of these upgrades?	
Potential EM&V Methods: TBD	

8.9 Industrial Agricultural and Large Commercial (IALC)

Table 63 summarizes the IALC EM&V study that was conducted in 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 63. 2019 IALC EM&V Summary

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2019-Cross-582	2018-19 Custom Industrial Agricultural and Commercial (CIAC) Impact Evaluation	CPUC ED	Impact Evaluation	$ 5,045,000	Q2 2021

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

Table 64 summarizes the IALC EM&V study planned for 2020.

Table 64. Proposed 2020 Cross-Cutting- IALC EM&V Studies- PA managed studies only

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2020-Cross-577	Barriers to Efficiency Program Participation for Industrial Agriculture and Large Commercial Customers	PG&E	Process Evaluation	$ 95,000	Q4 2020

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

The table below provides further detail regarding the study in Table 64 above.

Table 65. Study description: Barriers to Efficiency Program Participation for Industrial Agriculture and Large Commercial Customers

Study Title: Barriers to Efficiency Program Participation for Industrial Agriculture and Large Commercial Customers	Budget: $95,000
Completion Date: Q4 2020	Study Manager: PG&E
Description: Participation of IALC customers in custom EE projects is declining and the reasons behind this trend are poorly understood. Given that these projects can have significant savings associated with them it is important to understand what factors may prevent an IALC customer from participating in EE programs.	
Objective: To understand barriers to participation in custom EE projects for IALC customers and to determine specific recommendations to increase program uptake.	
Key Research Questions: 1. What challenges do current program participants face? 2. Which IALC customers are not participating in custom EE programs? 3. Are there IALC customers that have participated in the past but have forgone participation for subsequent projects? 4. What factors are preventing customers from participating? This may include: a. Lack of awareness b. Process hurdles c. Misconceptions or poor perceptions around EE programs or specific IOUs d. Financial considerations e. Others to be discovered 5. What changes could be made to the programs in order to improve participation of IALC customers?	
Potential EM&V Methods: Could include customer interviews IOU account rep interviews and third-party implementer interviews.	

8.10 Other Cross-Cutting Studies

Table 66 summarizes the Other Cross-Cutting EM&V studies that were conducted in 2018 and 2019. More detailed information on these studies including study descriptions and objectives are available in the 2018 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan Version 8 available on the Public Document Area here: https://pda.energydataweb.com/#!/documents/2119/view.

Detailed information on past and current studies can also be found on the searchable Project Status Reporting site located here: https://psr.energydataweb.com/

Table 66. 2018 and 2019 Other Cross-Cutting EM&V Summary

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2018-Cross-497	Updating California's Typical Meteorological Year Weather Files	PG&E	Other	$ 70,000	Q3 2019
2019-Cross-478	Statewide Energy Efficiency Program Composition Review	PG&E	Process Evaluation	$ 169,570	Q2 2019

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

Table 67 summarizes the Other Cross-Cutting EM&V study planned for 2020.

Table 67. Proposed 2020 Cross-Cutting- Other EM&V Studies- PA managed studies only

Study ID	Study Title	Study Manager	Study Type	Budget	Completion Date
2020-Cross-574	Calmac and CALEE2018 Maintenance	PG&E	Other	$ 85,000	Q4 2021

Source: Program Administrators, CPUC ED and their consultants via https://psr.energydataweb.com/

The table below provides further detail regarding the study in

Table 67 above.

Table 68. Study description: Calmac and CALEE2018 Maintenance

Study Title: Calmac and CALEE2018 Maintenance	Budget: $85,000
Completion Date: Q4 2021	Study Manager: PG&E
Description: This project is to provide for the ongoing maintenance and upgrading of the CALMAC website. CALMAC houses more than 900 research reports dating from 1990 in its searchable database. CALMAC also houses the CALEE2018 weather data. In addition to ongoing hosting and maintenance of CALMAC site this contract provides for ongoing development of weather data including deployment of an application programming interface (API) for more streamlined retrieval of weather data for NMEC-based and other analyses.	
Objective: Maintain CALMAC website update CALEE2018 weather files and refresh TMY weather files on a monthly basis. To address the limitation that the selection of TMY files doesn't account for time dependence in climate data and to test the implicit assumption that climate conditions are steady-state this project will apply linear and other regressions to forecast weather for the next 5 to 10 years to see how they differ so that we can determine which set provides the best estimates of future weather.	
Key Research Questions: How will an application programming interface (API) streamline the retrieval of weather files for savings estimation of programs and projects analyzed using the normalized meter-based energy consumption (NMEC) platform? How will actual and linearly-forecasted future weather compare?	
Potential EM&V Methods: Due to the stochastic variations in the weather "typical meteorological year" weather files are built with sophisticated methods and include dry-bulb and dew point temperature humidity solar radiation wind speed and direction.	

Appendix A. 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 B. Impact Evaluation Standard Reporting Guidelines

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[17] and lifecycle savings as well as average portfolio Effective Useful Life (EUL)$_2$[18]. 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.

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.*

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

[17] 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

[18] $_2$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.

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 savings[3][19] should be included in Appendix A within a Measure Group[4][20]. 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 reported[5][21] 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.

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

[19] Evaluated savings have been updated by impact parameter measurements and/or NTG adjustments.

[20] 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).

[21] 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.

- 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 Ex-Ante Gross*	B Ex-Post Gross*	C = B/A GRR*	D % Ex Ante Gross Passed Through	E Eval GRR‡	F 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 Ex-Ante Net*	H Ex-Post Net*	I = H/G NRR*	J = G/A Ex-Ante NTG	K = H/B Ex-Post NTG	L % Ex Ante NTG Passed Through	M Eval Ex-Ante NTG‡	N Eval Ex-Post NTG‡	O 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. Workpaper Details

All workpapers through 2019 can be found on the CPUC Workpaper and Disposition Archive here: http://www.deeresources.net/workpapers

This archive provides the links to download each workpaper.

The planned 2020 workpapers will be added to the CPUC Workpaper and Disposition Archive throughout 2020. All in-progress workpapers, which includes workpapers that have been submitted but not disposed at the time of the publish date of the report, and also workpapers in development with a workpaper plan are available here: http://www.deeresources.com/index.php/non-deer-workpapers

This site is updated monthly.

Appendix D. CPUC ED Resolution E-4952 Approving DEER Updates for 2019 and 2020 Including DEER2020 and Revised DEER2019 Update Statement

The full draft resolution is publicly available here:
https://docs.wixstatic.com/ugd/849f65_30eb43c43f3644da8aa3b18e81fc6fc7.pdf

Appendix E. EM&V Studies Table

A table containing all the EM&V studies can be found in the attached Excel document titled, "**Appendix E - All Studies_2018_2020**".

Appendix F. Public Comments

A table containing all public comments can be found in the attached Excel document titled, "**Appendix F – Public Comments_2018_2020** ".