Opinion Dynamics

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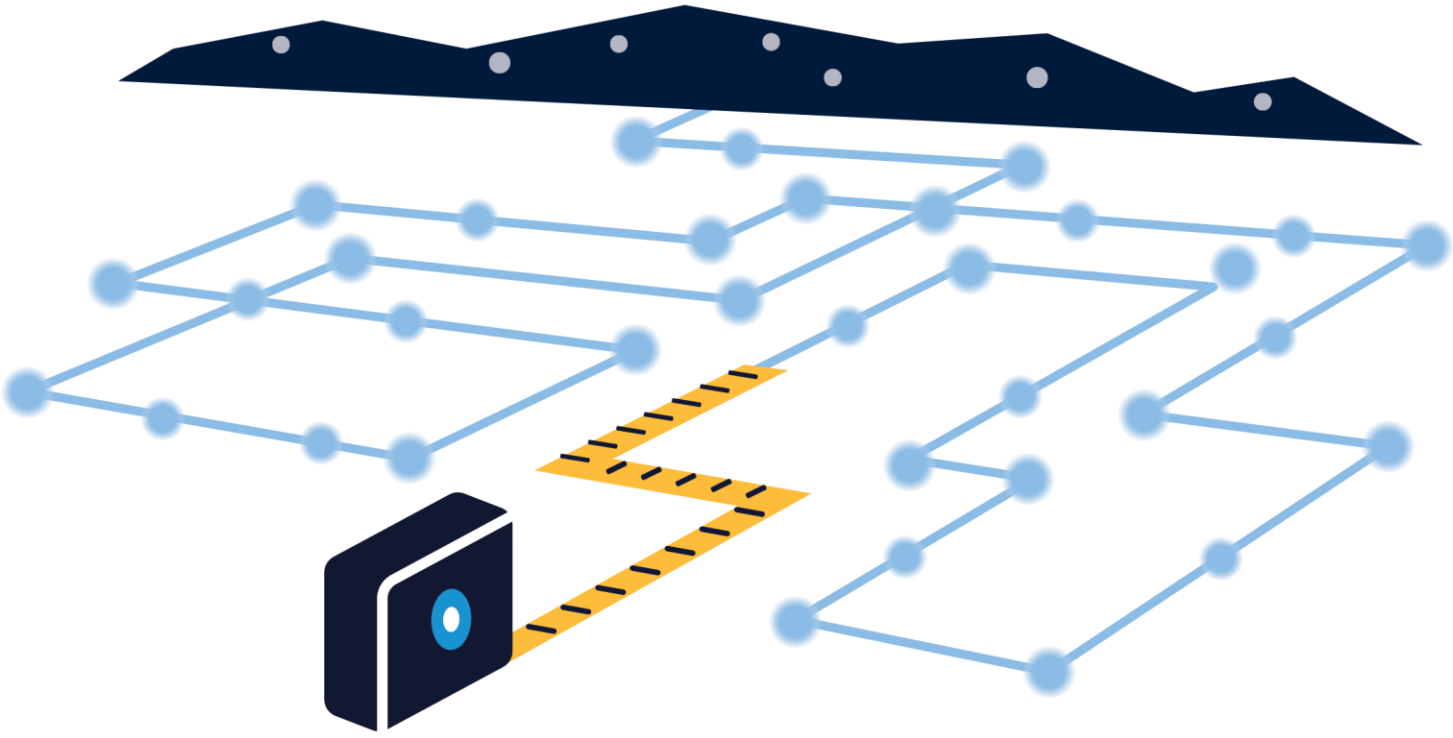
Emerging Technologies Program Technology to Portfolio Evaluation

Prepared for the California Public Utilities Commission by Opinion Dynamics



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Legal Notice

Abstract

This research examines the effects of the Emerging Technologies Program (ETP) from 2009–2017. Each of the four California Investor-Owned Utilities (IOUs) administers an ETP, with the overall goal of serving as a pipeline to deliver emerging technologies (ETs) to ratepayer-funded energy efficiency (EE) programs. ETP helps to meet the state's energy reduction needs by identifying and vetting technologies that deliver reliable energy savings. In the 2009–2017 timeframe, ETP studied numerous technologies, or novel applications of technologies, resulting in some being recommended for consideration in the California EE Portfolio (hereafter referred as Portfolio) and some being ruled out.

This study met the following objectives set forth by the California Public Utility Commission (CPUC):
(1) Evaluated the market uptake (defined as the number of measures incentivized) and achieved savings of all technologies and approaches that moved from ETP into the Portfolio or directly into codes or standards (C&S) from 2009 to 2017, (2) Estimated Portfolio evaluated lifetime savings resulting from these measures, (3) Developed recommendations for Portfolio database specification changes or other pertinent tracking mechanisms that may improve and streamline quantifying ETP-associated savings in the future, and (4) Developed preliminary baselines for the recently-adopted ETP metrics codified in the IOU business plans.

The study revealed that ETP-associated measure codes generated nearly one million matches to the Portfolio, representing over 7 billion evaluated net lifetime kWh, nearly 1 million kW, and 54 million evaluated net lifetime therms. In the 2009–2017 timeframe this equated to, on average, 8% of Portfolio kWh savings, 17% of kW savings (2016–2017 only), and 2% of positive therms savings (excludes interactive effects). The majority of these savings were in the non-residential sector, and indoor lighting measures were the most prevalent technologies and/or applications. Though the non-residential sector dominated savings, a considerable portion of ETP-associated savings was derived from residential projects as well (35%–48% across kWh, kW, and therms).

The study also uncovered a myriad of data tracking inconsistencies and challenges that prevent ETP-associated measures to be reliably measured or tracked in a streamlined or automated fashion. This report details findings and makes recommendations for how data tracking can be improved.

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Table of Abbreviations

ABAL	Annual Budget Advice Letters
C&S	Codes and Standards
CA	California
CalTF	California Technical Forum
CCA	Community Choice Aggregators
CEDARS	California Energy Data and Reporting System
CPUC	California Public Utilities Commission
DEER	Database for Energy Efficiency Resources
EE	Energy Efficiency
EPA	Environmental Protection Agency
ET	Emerging Technologies
ETCC	Emerging Technologies Coordinating Council
ETP	Emerging Technologies Program
GHG	Greenhouse Gas
IOU	Investor-Owned Utility
LED	Light-emitting diode
PG&E	Pacific Gas and Electric Company
REN	Regional Energy Network
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
SoCalGas/SCG	Southern California Gas Company
PA	Program Administrator

1. Executive Summary

1.1 Introduction

This research examines the effects of the Emerging Technologies Program (ETP) from 2009–2017. Each of the four California (CA) Investor-Owned Utilities (IOUs) administers an ETP, with the overall goal of serving as a pipeline to deliver emerging technologies (ETs) to ratepayer-funded energy efficiency (EE) programs. ETP helps to meet the state's energy reduction needs by conducting an array of projects to identify and vet technologies that deliver reliable energy savings. In the 2009–2017 timeframe, ETP conducted a range of projects studying numerous technologies, or novel applications of technologies, resulting in some being recommended for consideration in the CA EE Portfolio (hereafter referred to as the Portfolio) and some being ruled out.

Typically, the effects of ETP are not quantified in terms of kWh, kW, and therm savings because this program does not offer rebates or account for energy savings. This is because as a non-resource acquisition program, its objective is to fill the pipeline of high-efficiency technologies (referred to as measures) offered to customers through other utility incentive programs. A central element of the IOU portfolio is incentive programs that offer rebates and incentives to customers that adopt these measures.[1] However, there is great value in understanding the energy savings associated with technologies adopted from this long-standing program. To this end, we:

- Evaluated the market uptake of high-efficiency technologies (defined as the number of measures incentivized) and achieved savings of all technologies and approaches that moved from ETP into the Portfolio or directly into Codes and Standards (C&S) from 2009 to 2017;
- Estimated Portfolio evaluated lifetime savings resulting from measures;[2]
- Developed recommendations for Portfolio database specification changes or other pertinent data tracking mechanisms that may improve and streamline quantifying ETP-associated savings in the future; and
- Developed preliminary baselines[3] for recently adopted ETP savings metrics (ETP-1 through ETP-5) codified in the IOU business plans[4].

1.2 Research Approach

The analysis required a multi-faceted approach to gathering data due to the inconsistencies regarding data quality and completeness in historical ETP and Portfolio databases. The analysis primarily utilized two sources of data: (1) the ETP databases from each IOU, and (2) the Portfolio database (Figure 1).[5] In addition to the primary source files, we also cross-referenced Annual Budget Advice Letter (ABAL) files, the IOU measure

[1] "Measures" are technologies selected for inclusion into the IOU incentive portfolio.
[2] Evaluated lifetime savings refers to savings influenced by the program that have been verified and adjusted through evaluation, measurement, and verification studies.
[3] Notably, these baselines and related metrics may currently be better suited to program tracking as opposed to the establishment of targets. However, the possibility of establishing program targets should be revisited by PAs, third-party implementers, and the CPUC in the future once baselining practices are firmly established and baselines understood in context.
[4] Southern California Edison Company's (U 338-E) Energy Efficiency Business Plan Metrics, SCE, Rosemead, CA, 2018.
[5] Although we refer to the Portfolio database as a single entity, this database consists of five independent databases that represent groups of years according to program cycles. These databases are listed separately in Figure 1 but are referred to collectively as the Portfolio database throughout this report. This database is also known as CPUC Claims data, CPUC program tracking data, or claims data available on California Energy Data and Reporting System or CEDARS.

catalogues,[6] over 25 workpapers, and several Emerging Technology Coordinating Council (ETCC) reports to gather sufficient information to track ETP-associated technologies in their journey from ETP to the Portfolio.

Given the complexity of the analysis, we present only the core steps of the analytical approach here, which were as follows:

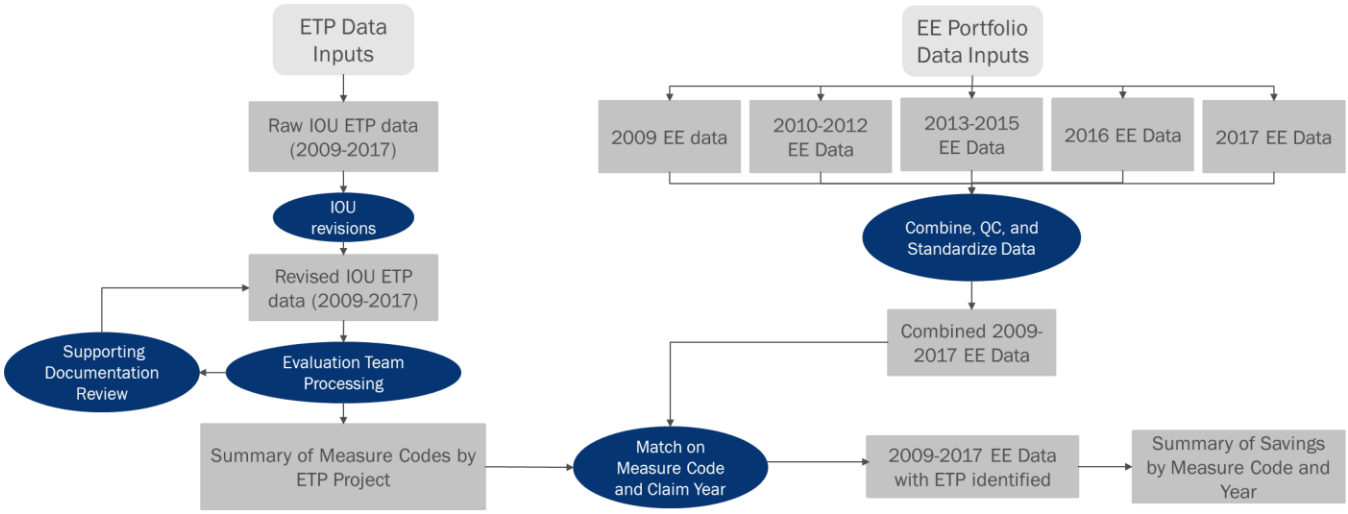
1. Determine the outcome of each ETP project in the 2009–2017 timeframe, including determining which ETP-associated technologies were recommended for adoption to the Portfolio;

2. For technologies that were recommended for adoption to the Portfolio, determine the unique identifier (i.e., measure code) for that technology; and

3. Match the unique measure code to the evaluated lifecycle kWh, kW, and therms savings from the Portfolio database for that ETP-associated technology.

Figure 1 provides an overview of the analysis workflow, including data inputs and outputs (gray boxes), and computational steps (blue ovals).

Figure 1. Emerging Technologies Program Savings Tracking Data Sources Workflow

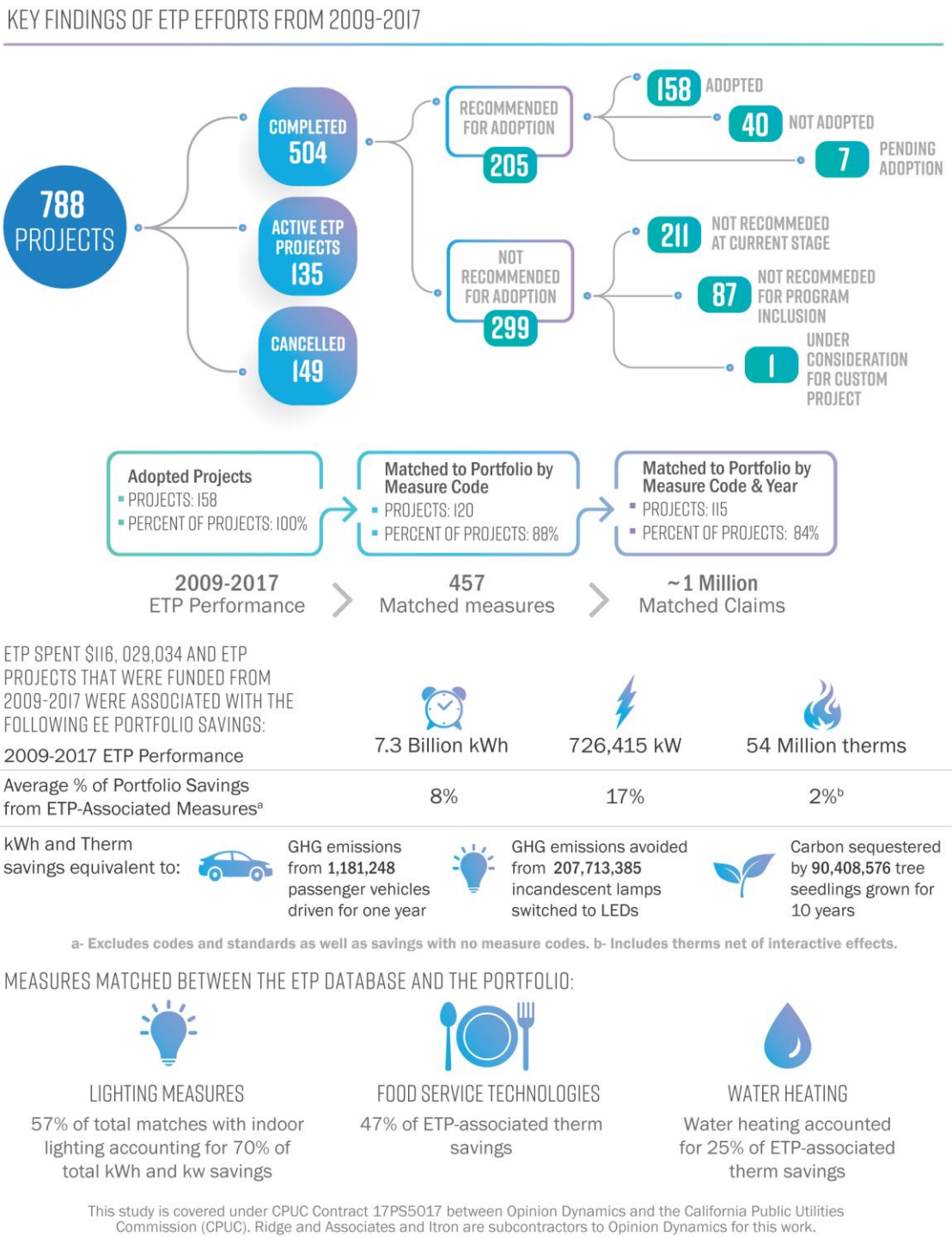


[6] The IOU measure catalogues (referred to as Master Measure Database by SCE and Workpaper Database by PG&E) list energy saving technologies offered by each IOU (i.e., PG&E, SCE, SCG, and SDG&E) to their customers between 2008–2020. While there are variations between each measure catalogue, each one includes information regarding the program year each measure was offered to customers via EE programs, measure names and descriptions, measure categories or end uses, and unique identifiers that enabled the evaluation team to track each measure supported by ETP. Measures listed in the catalogues include measures with and without energy savings claims.

1.3 Summary of Findings and Recommendations from 2009-2017

Based on the analyses conducted in this study, we present a summary of key findings in Figure 2.

Figure 2. Key Findings of ETP Efforts from 2009–2017



Note: Greenhouse Gas (GHG) equivalencies were calculated using the Environmental Protection Agency's (EPA) GHG Equivalencies Calculator at https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

To further illuminate the historical effects of ETP, we provide detailed insights and recommendations based on the findings of this study:

- **Key Finding #1: ETP has been successful in driving technology adoption into the portfolio.** Twenty percent of the projects ETP pursued from 2009 to 2017 resulted in measures being adopted to the Portfolio. Though this figure may appear low, we highlight that the purpose of ETP is not only to provide a pipeline of promising technologies but also to scrutinize and eliminate unsuitable technologies. In the timeframe of this study, 720 measure codes assessed in 205 ETP projects were recommended for adoption to the portfolio to support potential measure development. Of the 205 projects recommended for adoption to the portfolio, 158 (80%) were adopted as one or more measures in the portfolio (Section 3.1).
- **Key Finding #2: ETP-associated measures are associated with significant savings in the portfolio,** representing over 7 billion evaluated lifecycle kWh, nearly 1 million evaluated lifecycle kW, and 54 million evaluated lifecycle positive[7] therms. In the 2009-2017 timeframe this equated to, on average, 8% of Portfolio kWh savings, 17% of kW savings (2016–2017 only), and 2% of positive therms savings.[8] The majority of these savings were in the non-residential sector, and indoor lighting measures were the most prevalent technologies and/or applications. Though the non-residential sector dominated savings, a considerable portion of ETP-associated savings was derived from residential projects (35%–48% across kWh, kW, and therms).
- **Key Finding #3: ETP has been successful at supporting measure development for portfolio inclusion.** This study provided findings to support the Business Plan metrics, which indicated that ETP has impacted the Portfolio over the last decade. We developed baselines using all available historical data, which indicated that ETP-associated measures were associated with 51 measures (or 4% of new Portfolio measures) on average annually from 2009 to 2017 (Section 3.3).
  - *Recommendation: Results from this study should be used as to inform baselines for further metrics tracking.* However, given the transition of ETP to third-party implementation, future technology targets, and other factors, ongoing review of metrics will be required to ensure they are appropriate for the program as it evolves. Ongoing tracking of these metrics against this baseline will provide ETP PAs and implementers insight into the effectiveness of technology adoption to the portfolio as the program is deployed over time.
- **Key Finding #4: It is critical that ETP track its contributions to the portfolio.** The current data tracking and communication protocols for ETP-associated technologies do not allow for accurate and timely quantification of ETP contributions to the Portfolio, nor do they provide an adequate foundation for creating a streamlined, repeatable approach that the California Public Utilities Commission (CPUC) and IOUs can implement to readily track progress against metrics in the future. In particular, this analysis relied heavily on the ability to use measure codes to cross-reference the ETP and Portfolio databases, but ETP does not consistently record the eventual measure code that a technology is assigned once leaving the ETP program (Sections 2.2.3 and 4.1.1). We acknowledge that the measure-tracking processes may inherently differ as we transition to third-party implementers. This changing landscape, in addition to the challenges identified above, should be considered when developing third-party tracking processes. With that in mind, we offer the following recommendations:
  - *Recommendation: Track linkages between ETP and EE programs.* The IOUs, program implementers, CPUC, California Technical Forum or CalTF, and other stakeholders should coordinate to put in place protocols to make ETP-associated measure reporting a standard

[7] We present therms savings without interactive effects. Therms impacts inclusive of interactive effects are presented in Appendix B.
[8] Codes & Standards claims are excluded from the Portfolio when calculating percentages, which we describe in more detail in the methodology (Section 2.2). When C&S is included in the denominator of the percentage, ETP represents 5% of kWh, 8% of kW, and 1% of therms impacts over the timeframe of the study.

practice. Given the movement to a third-party program design, we suggest convening a stakeholder workshop to identify the advantages of different models, including feedback from the stakeholders listed above. As an outcome from the stakeholder workshop, we recommend that the stakeholder workshop group produce recommendations for methods for tracking projects transferring from ETP to the portfolio, including interim stages such as workpaper development and CalTF documentation, for each entity involved in the process. We acknowledge that the measure development process can continue long after an ETP project is recommended for adoption, which makes it challenging to track down the outcome of the process, but by having third-party implementers establish communication and reporting protocols, we are confident that ETP can increase the number of measure codes it records for its projects (Section 4.1.2).

  - *Recommendation: Track the outcome of each ETP project in the ETP database.* The ETP third-party administrator should collect the outcomes of each ETP project: (1) whether it was recommended for adoption; (2) whether a workpaper was developed, and if so, what the workpaper ID is; (3) the eventual measure codes associated with the technology; and (4) savings associated with those measure codes.

- **Finding #5: Portfolio data inconsistencies make comparisons over time difficult.** This historical analysis aimed to understand how effective ETP has been over the last decade, which ideally would allow for examining trends in ETP-associated measure performance over time (e.g., understanding how well measures persist). When examining trends in claims and savings over time, we found that ETP's proportion of the Portfolio database highlights data inconsistencies due to lack of standardized tracking systems or possibly trends seen in the portfolio at large, which makes it difficult to isolate ETP-associated savings of the program over time. For example, it is not possible to assert that an increase in ETP-associated measure savings relative to the Portfolio year over year is due to the demand for ETP-associated measures, because it could also be due to a decrease in overall Portfolio savings, as demonstrated in Section 3.3. Trends in overall Portfolio savings could be attributed to a range of causes, including how and when claims were entered into the Portfolio database (i.e., if they are not entered in the year in which the project took place), variability in the accuracy of record keeping and measure code assignments over the years, the market influence on the Portfolio, and effects of our analysis (Section 3.3). Section 2.2.3 details the limitations to this study.

  - *Recommendation: To mitigate data tracking issues enumerated under Finding 4, and support historical tracking, ETP-associated savings should be evaluated on an annual basis going forward.* With consistent tracking in each year, as well as the establishment of data tracking protocols, many of the data challenges faced in this study would be alleviated or eliminated. This analysis used historical data across multiple tracking systems to determine historical trends. If a similar analysis is conducted regularly, supported by ongoing tracking, it will increase the ability of evaluators and program implementers to isolate first-year measures in the Portfolio and examine the performance of ETP-associated measures against non-ETP associated measures of the same vintage, which are subject to the same market conditions.

It is evident that the technologies and applications that ETP has studied over the years have laid the groundwork for future energy savings in the Portfolio. As ETP evolves in the coming years, the findings from this retrospective study may serve as a guidepost for developing future metrics and contextualizing future savings potential.

2. Study Overview

This study examines the historical effects and accomplishments of the ETP from 2009–2017. Each of the four CA IOUs administers an ETP, with the overall goal of serving as a pipeline to deliver ETs to ratepayer-funded EE programs. ETP helps to meet the state's energy reduction needs by identifying and vetting EE measures that deliver reliable energy savings.[9] ETP is a non-resource acquisition program,[10] and therefore, the energy impacts of the program are not typically quantified. Rather, the value and accomplishments of the program are assessed in non-energy terms, and the program helps to support both legislative and regulatory needs, as well as program administrator (PA) and customer needs.[11] However, there is great value in understanding the associated energy impacts and efficacy of this long-standing program. This report presents findings from a close examination of the technologies ETP has recommended for adoption to the CA Public Utility Commission (CPUC) EE Portfolio (hereafter referred to as the Portfolio).[12]

2.1 Evaluation Objectives

The objective of this study is to assess the historical impact of ETP on the Portfolio's energy savings and establish a framework for tracking ETP-associated measures moving forward. To achieve this objective, we:

- Evaluated the market uptake (defined as the number of measures incentivized) and achieved savings of all technologies and approaches that moved from ETP into the Portfolio or directly into C&S from 2009 to 2017;
- Estimated Portfolio evaluated net lifetime savings resulting from these measures; and
- Developed recommendations for Portfolio database specification changes or other pertinent tracking mechanisms that may improve and streamline quantifying ETP-associated savings in the future.

In addition to the study objectives listed above, this research developed preliminary baselines for the recently-adopted ETP metrics codified in the IOU business plans for metrics ETP-T1, ETP-T2 as well as ETP-4 and ETP-5 (Table 1). Although this evaluation assessed ETP-T3 and ETP-T4, we did not identify any direct linkages between ETP to Codes & Standards. Additional linkages of ETP-associated measures that supported eventual code will be explored in subsequent studies.

Going forward, the IOUs will measure their progress against these metrics, and the CPUC and its evaluators were charged with helping the IOUs establish baselines against which to measure their progress. This study attempts to offer both quantitative findings that can inform metric baselines and suggestions for successful metric tracking in the future, as the ability to track the market uptake of ETP-associated measures and quantify EE savings is a requisite step in assessing ETP metrics. Notably, the establishment of targets for each metric should be revisited by the PAs, third-party implementers, and the CPUC once baselining practices are firmly established.

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[9] Barsley, G., Mack, J., Rodriguez, K., Thomas, M., Wallenrod, M., Weber, T., & Wood, K. (2017). Southern California Edison Company's Energy Efficiency Rolling Portfolio Business Plan for 2018-2025 (p. 311).

[10] Non-resource acquisition programs are EE programs or activities that aim to fill the pipeline of high-efficiency technologies (referred to as measures) offered to customers through other utility incentive programs. A central element of the IOU portfolio is incentive programs that offer rebates and incentives to customers that adopt these high-efficiency technologies "measures".

[11] PAs operate the EE programs ordered by the CPUC. PAs include the Investor-Owned Utilities (IOUs), Regional Energy Networks (RENs), and community choice aggregators (CCA). Source: Summit Blue Consulting, LLC, ADM Associates, Inc., California Technology International, Inc., E Source, Energy Market Innovations, & Opinion Dynamics Corporation. (2010). *Final Report: Evaluation of the California Statewide Emerging Technologies Program* (p. 205).

[12] The California Energy Efficiency Portfolio is comprised of a range of EE programs that help California reduce electricity and natural gas consumption, and consequently, greenhouse gas emissions. Source**:** Ibid.

Table 1. ETP Metrics (ETP-T1 through ETP-T5)

Metric Name	Metric Description	Unit of Measurement
ETP-T1	Prior year: % of new measures added to the portfolio that were previously ETP technologies	%
ETP-T2	Prior Year: # of new measures added to the portfolio that were previously ETP technologies	#
ETP-T3	Prior year: % of new codes or standards that were previously ETP technologies	%
ETP-T4	Prior Year: # of new C&S that were previously ETP technologies	#
ETP-T5a	Energy savings of measures currently in the portfolio that were supported by ETP, added since 2009. Ex ante with gross and net for all measures, with ex post where available	Lifecycle Net kWh
ETP-T5b	Demand savings of measures currently in the portfolio that were supported by ETP, added since 2009. Ex ante with gross and net for all measures, with ex post where available	Lifecycle Net kW[a]
ETP-T5c	Therms savings of measures currently in the portfolio that were supported by ETP, added since 2009. Ex ante with gross and net for all measures, with ex post where available	Lifecycle Net Therms

[a] Though technically kW impacts are only first-year, here we report Lifecycle kW impacts to stay consistent with the units reported in the Energy Efficiency Business Plan Metrics and the Portfolio.

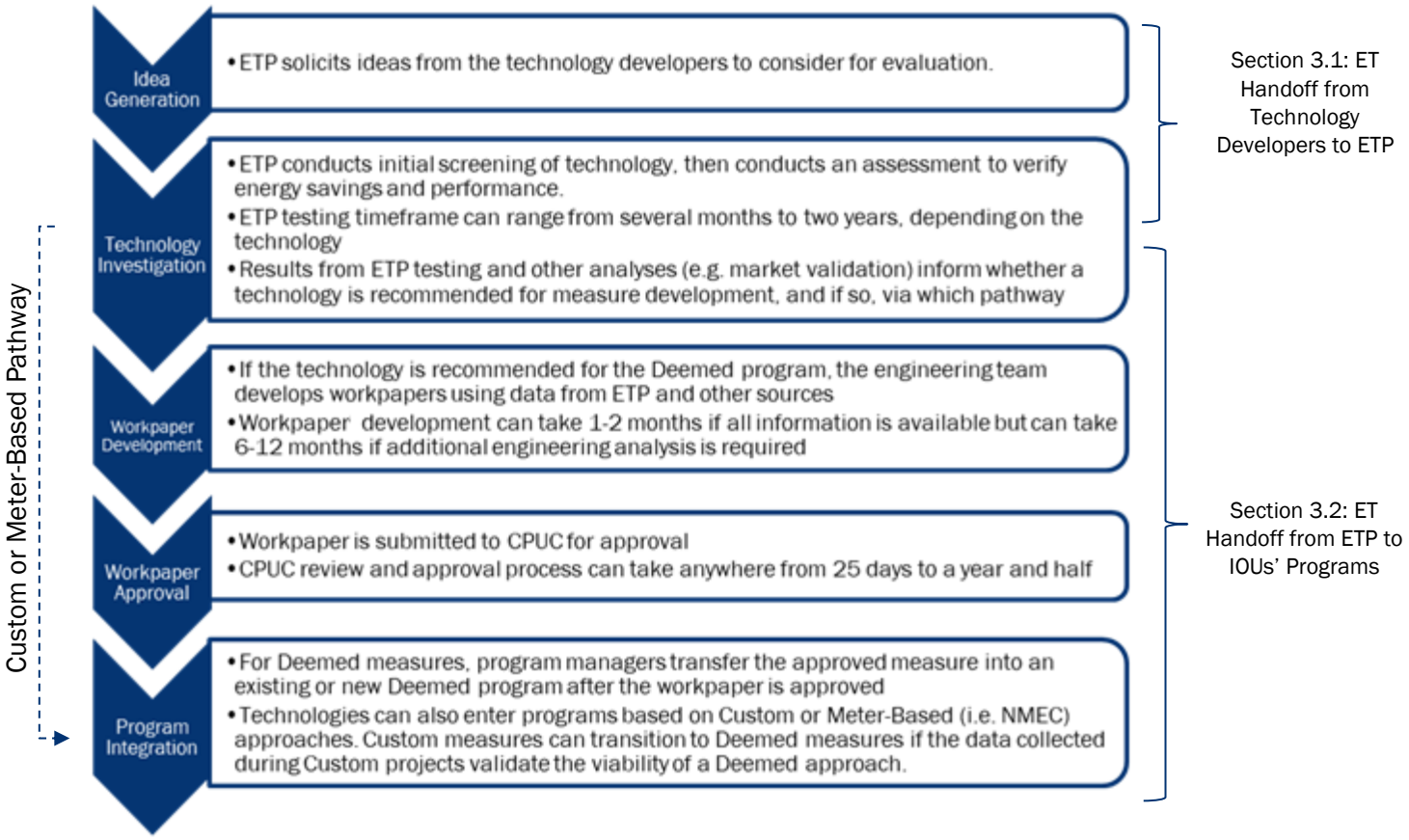
Source: Valdberg, A., & Cole, J. L. (2018). *Southern California Edison Company's (U 338-E) Energy Efficiency Business Plan Metrics* (p. 146).

2.2 Evaluation Methodology

ETP is one of many contributors introducing new technologies to the Portfolio. To appropriately contextualize ETP's role, it is necessary to examine the Portfolio measure development process and how ETP fits into that process. In ETP's case, measure development is the process by which a technology's energy savings and costs, inform and support the development of workpapers,[13] and ultimately EE measures that are offered through PA incentive programs.[14,15] Figure 3 provides an overview of the IOU measure development process in CA, and Appendix A describes each IOU's decision-making process prior to including measures in an EE program. In order to track the journey and eventual savings of each ETP-associated technology from 2009–2017, we reviewed data representing the key stages in the measure development process below, including the ETP database (Technology Investigation Stage), custom data inputs resulting from data requests to the IOUs (Workpaper Development & Approval), and California Energy Data and Reporting System (CEDARS) and ABAL records (Program Integration).

[13] Workpapers are technical documents submitted for approval to the CPUC that determine the cost effectiveness and market suitability of a given technology in preparation for measure deployment.
[14] Opinion Dynamics Corporation, Energy and Resource Solutions (2015) *PY2013–2014 Emerging Technologies Program Targeted Effectiveness Study Report.*
[15] Evergreen Economics, & Willems, P. (2015). *Final Report: Study of the California Utility Internal Measure Development Process* (p. 122).

Figure 3. Summary of the CA IOU Technology Intake and Measure Development Process



Source: Opinion Dynamics & Guidehouse. (2020). *Emerging Technologies Program Handoff Process Evaluation* (p. 5).

The following sections provide a high-level description of the methods employed to complete this analysis, followed by the detailed analytical steps and limitations of the study.

2.2.1 Historical Analysis Overview

This section provides an overview of the approach used to track ETP-associated savings for technologies recommended for adoption into the statewide Portfolio. The analysis primarily utilized two sources of data: (1) the ETP databases from each IOU, and (2) the Portfolio database (Figure 4).[16] However, the analysis required a multi-faceted approach to data gathering due to a wide range of data quality and completeness issues present in the ETP database and the Portfolio database. In addition, variations in measure code[17] development processes across PAs and the fact that this evaluation analyzes data dating back to 2009, when data tracking was not as comprehensive, presented unique challenges in tracking ETP-associated technologies' journeys into the Portfolio.

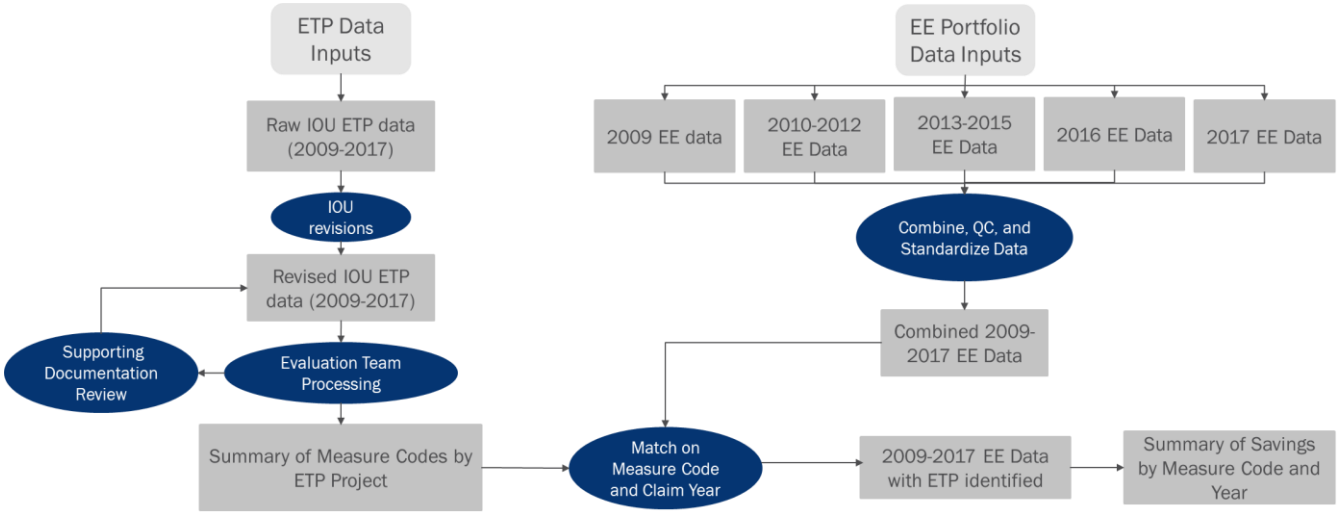
[16] Note that, although we refer to the Portfolio database as a single entity, this database consists of five independent databases that represent groups of years according to program cycles. These databases are listed separately in Figure 4 but are referred to collectively as the Portfolio database throughout this report. This database is also known as CPUC Claims data, CPUC program tracking data, or claims data available on CEDARS.

[17] A measure code is an alphanumeric identifier of a specific energy efficient technology or approach in the Portfolio.

In addition to the primary source files listed above, we also cross-referenced ABAL files, the IOU measure catalogues,[18] over 25 workpapers, and several Emerging Technology Coordinating Council (ETCC) reports,[19] and we submitted four data requests to the IOUs for additional or clarifying information. In total, this effort required consolidating nine data sources or versions of each data source and consultation of nearly 30 supplemental documents to arrive at complete input data files.

We performed quality checks and took steps to clean and compile data sources from each of the data types (i.e., data sources from each IOU and for each year of the analysis), and then cross-referenced the ETP database with the Portfolio. Figure 4 provides an overview of the analysis workflow; the subsequent sections provide further detail for each step of the analysis.

Figure 4. Emerging Technologies Program Savings Tracking Data Sources Workflow



2.2.2 Detailed Analytical Steps

To complete this analysis, we conducted five core analytical steps as described below. Throughout this process, we gathered information to support recommendations for future tracking, which we present in Section 4.2 of the report.

Step 1: Identify ETP Projects Recommended for Adoption and Adopted to the Portfolio

Within the ETP database, each ETP project includes a field to indicate whether it has been "adopted,"[20] which means that ETP staff have formally recommended at least one of the ETP technologies in the project for adoption and that the technology(s) have gone through the required processes (detailed in Appendix A) to be included in the Portfolio.[21] For adopted projects, an ETP project may have one or more technologies, and thus

[18] The IOU measure catalogues (referred to as Master Measure Database by SCE and Workpaper Database by PG&E) list energy saving technologies offered by each IOU (i.e., PG&E, SCE, SCG, and SDG&E) to their customers between 2008–2020. While there are variations between each measure catalogue, each one includes information regarding the program year each measure was offered to customers via EE programs, measure names and descriptions, measure categories or end uses, and unique identifiers that enabled the evaluation team to track each measure supported by ETP. Measures listed in the catalogues include measures with and without energy savings claims.

[19] Emerging Technology reports are published on the ETCC website: https://www.etcc-ca.com/

[20] ETP projects refer to ETP-supported studies of numerous technologies, or novel applications of technologies, resulting in some being recommended for consideration in the CA EE Portfolio and some being ruled out.

[21] One ETP project can study multiple technologies, and one technology may be included in multiple ETP projects.

eventual measure codes or workpaper IDs associated with it.[22] Each IOU has its own measure development process, which results in unique ETP database and Portfolio measure codes using different combinations of alphanumeric values. The evaluation team identified, and then verified with each IOU, the total number of adopted ETP projects between 2009–2017, and requested Portfolio measure codes or workpaper IDs for each project.

Step 2: Establish Measure Code(s) Associated with Each ETP Project

In some cases, the measure codes or workpaper IDs stemming from an ETP project are listed in the ETP database, and in other cases, there is no information listed even though the database indicates the project was adopted. We submitted four data requests and conducted several meetings with the CPUC and IOUs to clarify data and gather additional information to identify a measure code or workpaper ID for each adopted project. We then manually reviewed and updated the ETP database with additional information regarding each ETP project as it was received.

For 71 ETP projects, the IOUs could only provide workpaper IDs associated with the ETP project, not measure codes. Workpapers often provide research findings for many similar technologies, so some workpapers can have tens or hundreds of measure codes associated with them. Therefore, when only a workpaper ID was listed for an ETP project, we examined that workpaper to determine which measure codes in the workpaper were likely associated with the ETP project, if any. Before conducting the workpaper review, we tried to match the workpaper to the Portfolio. In cases where a workpaper ID listed in the ETP database did not have any claims in the Portfolio,[23] we did not conduct further research on those workpaper IDs. In total, we researched 34 workpapers representing 51 ETP projects.

Step 3: Clean and Aggregate Portfolio Measure and Savings Data

The scope of this study focused on EE program years 2009 through 2017.[24] In each EE program year, the PAs submit program savings claims to the CPUC. This data is reviewed and updated for errors by CPUC consultants to ensure data quality. For each year included in this study, we used the evaluator reviewed data, though the sources of the data vary over the history of the Portfolio. For example, 2016–2017 data was available on the CEDARS,[25] whereas older data was sourced from the Efficiency Savings and Performance Incentive (ESPI) mechanism. In each case, we pulled all variables relevant to this study, including PA reported savings claims (also referred to as ex ante savings) and evaluated gross and net savings (also referred to as ex post savings) and numerous descriptive fields such as project sector, PA, year of savings claim, measure code number, and workpaper ID. Because the final platform on which evaluated data was hosted varied over the past decade, we then cleaned, standardized, and compiled the program years. Through this effort, we developed a database of Portfolio PA reported and evaluated savings claims from 2009 through 2017, which we used to identify ETP-associated measure codes. Notably, demand data prior to 2016 is not consistently available on any platform, so this study only includes kW results from 2016 and 2017.

Upon consultation with the CPUC, we removed C&S claims from the matching analysis after determining that ETP projects have not resulted in any discernable C&S claims (please see Section 3.4 for results). This choice focuses findings and baseline metrics on the portion of the Portfolio that ETP has historically affected to appropriately scale ETP's contribution. In other words, all percent calculations remove C&S claims.

[22] A workpaper ID is an alphanumeric identifier of a workpaper, which is a broader categorization than a measure code. One workpaper may have many measure codes associated with it.
[23] A claim, or savings claim, is the record of an EE technology or process being installed or implemented through a Portfolio program. Claims are documented in the Portfolio database.
[24] We began with 2009 because ETP had no formal ETP tracking database prior to this time.
[25] The California Energy Data and Reporting System or CEDARS is accessible via: https://cedars.sound-data.com

Step 4: Cross-Reference Adopted ETP-Associated Projects to the Portfolio

The measure code, claim year, and additional ETP project descriptions were used to match ETP projects to associated measures in the Portfolio. Ideally, attempts to match measure codes to the Portfolio would result in reliable one-to-one matches. However, in practice, we completed an iterative process in which the pool of matches was refined based on a series of matching criteria described below.

Excluding Ineligible Projects from Portfolio

Since measure codes and claim years are key to identifying ETP-associated claims, we excluded Portfolio claims that did not have any unique identifier (i.e., measure code, measure ID, or workpaper ID) from analyses that compare ETP-associated claims to Portfolio claims as claims missing measure codes could not be matched with ETP-associated measures. In addition, as mentioned above C&S claims are also excluded. Evaluated net savings excluded from the analyses are presented in Appendix C.

Matching Criteria for Measures

To match ETP projects to associated measures in the Portfolio, we utilized the following data variables: measure codes, ETP project completion date, and Portfolio claim year. We established different levels of matching with a match on measure code alone as the least stringent (Level 1) and a match on measure code and project completion date as more stringent (Level 2). We used the matching levels as follows:

1. **Matching Level 1 (Measure Code Only)**: The first level for matching ETP projects to Portfolio projects was based on measure code, which exists in both the ETP database and the Portfolio database and provides a reliable way to identify a specific technology. If measure codes matched between the two databases, we considered the ETP project as having achieved a Level 1 Match. Notably, we gathered additional data from the IOUs through supplemental data requests to ensure we achieved the highest match rate possible between the ETP data and the Portfolio data. After several iterations with the IOUs, we were able to match 88% of adopted ETP projects (n=137) to the Portfolio via measure codes.

   We also utilized workpaper IDs listed in the ETP database as an intermediary analytical step when measure codes were not available for an ETP project. First, we searched the Portfolio database for the workpaper IDs provided in the ETP database. If the workpaper ID had positive matches in the portfolio, we flagged it for further research. In total, there were 71 ETP projects [26] for which only a workpaper ID was provided.[27] Of the 51 workpapers representing the 71 ETP projects, 17 did not have an associated claim in the portfolio and were excluded from further consideration. For the remaining 34 workpapers, the team located the workpaper in the Database of Energy Efficiency Resources (DEER) and studied it to discern which measure codes it covered and to what extent they were related to the technology covered in the ETP project in question. We also consulted each IOU's measure catalogue and ETCC reports if we could not find the actual workpaper that the ETP database referenced,[28] or if additional information on the technology was needed. This process relied heavily on the project description given in the ETP database to confirm a connection between the studied technology and the eventual measure code. In total, we discovered 217 measure codes that matched the ETP database description of the ETP project. Six workpapers were excluded from the analysis due to the inability to confirm a connection to the ETP project under which it was listed. However, only one of the 71 ETP projects was excluded

[26] Some ETP projects share workpaper IDs.
[27] Workpaper ID alone is not necessarily a reliable identifier of a single technology, because workpapers can include tens or sometimes hundreds of measure codes. Therefore, matching on workpaper ID alone has the potential to overestimate savings associated with a single ETP technology. Measure codes, conversely, typically represent one specific technology and therefore provide a more granular way to identify technologies and cross-reference projects between databases.
[28] There may be instances where a workpaper ID is replaced with another workpaper ID. In such instances, we may not be able to find the workpaper.

from the analysis via this methodology, since many ETP projects list multiple workpapers and had a positive match through at least one of them. We discuss the limitations of this analytical approach in the study limitations section (Section 2.2.3). For the remainder of this paper, we refer to measure codes sourced from the ETP database and measure codes identified through the workpaper review collectively as measure codes.

2. **Matching Level 2 (Measure Code and Project Completion Date):** The second level for matching used the measure code in addition to temporal information. We leveraged the ETP project completion date (based on the "Progress Point: Report/deliverable complete" field in the ETP database [29]) and the claim year (based on the "ClaimYearQuarter" field in the Portfolio) to ensure that the timing of the match aligned with when the ETP project was completed. A level two match was achieved when the claim year corresponding with each matching measure code is at least one year after the ETP project completion date. This lag is necessary because once an ETP-associated measure is adopted to an EE program, it takes time for the measure to achieve savings claims, depending on market uptake. This criterion was important to operationalize because the study team found some ETP measure codes with matching claims *before* the ETP project took place. In those instances, one can deduce that ETP was not associated with savings from that measure code before the ETP project started. By including this criterion, we eliminated some, but not all, spurious matches. We discuss the limitations of this analytical approach in the study limitations section (Section 2.2.3).

Step 5: Analyze Data

After matching the ETP database to the Portfolio database, we analyzed the resulting matches, in addition to analyzing data from the Portfolio at large.

Calculate ETP Metrics

In addition to characterizing and measuring the adoption of ETP-associated technologies to the Portfolio, we calculated the historical averages for the ETP metrics (see Table 1) specified in SCE's (U 338-E) Energy Efficiency Business Plan Metrics.[30] We were directed to provide baselines for the metrics based on historical data,[31] against which the IOUs may track their effectiveness in the future. We understand that ETP will be undergoing changes as it moves into third-party implementation meaning that the measures available, program administration approach, and resulting measure adoption will likely change; but the metrics based on historical results reflect the best information available to date to inform baseline development. As new data become available, the metrics and their respective baselines should be updated.

The metrics baselines provided in this report are based on Matching Level 2 and reflect results from all historical data.

Due to data tracking limitations, we were unable to develop some of the baselines for some of the study years:

- **Demand (kW) Reported and Evaluated Net Savings prior to 2016:** We did not determine demand (kW) savings prior to 2016 because kW savings associated with EE projects were not reported in the Portfolio until 2016.
- **Evaluated Savings for 2009:** Ex post energy (kWh), demand (kW), and gas (therm) savings were not reported in 2009 in the Portfolio.

[29] In cases where there was no ETP project completion date provided in the ETP database, the team used the project initiation date (i.e., "Progress Point: Project Funded/Initiated" field in the ETP database).
[30] Valdberg, A., & Cole, J. L. (2018). *Southern California Edison Company's (U 338-E) Energy Efficiency Business Plan Metrics* (p. 146).
[31] A baseline is the first assessed value of a metric.

Analyze Data by Cohort

To capture the share of ETP-associated measures relative to all measures submitted to the portfolio in the same year, we analyzed the data by "cohort" (i.e., all measures that share the same first year in the Portfolio), in addition to analyzing it by claim year. This approach allows for the examination of how ETP-associated measures perform relative to other new measures, as opposed to how they perform against well-established measures. It also can provide insights into how ETP measure prevalence changes over the years relative to other measures of the same vintage. Appendix B presents these findings.

2.2.3 Study Limitations

A significant limitation of the analytical process of this study is uncertainty in the validity of matches, due to a lack of consistent record keeping with respect to measure codes across the Portfolio. This was primarily due to either insufficient data coverage or quality at the Portfolio level, Portfolio and ETP-database-entry errors, or the fact that only workpaper IDs were provided for some ETP projects, limiting the ability to effectively match ETP projects with associated Portfolio measures. While the eventual outcome of the iterative matching process was an estimation of ETP-associated savings, these results inherently include considerable uncertainty from various sources, as follows:

- **Incomplete and poor-quality data.** This study drew on nearly 50 data and information sources due to the fact that no single database provided complete information. Several of the data quality and availability issues have been ameliorated on the Portfolio side with the development of CEDARS since 2016 and will not affect analyses for 2016 and beyond. However, this analysis was impacted by a lack of demand impact data prior to 2016, inconsistent or missing measure codes in both the Portfolio and ETP databases, and the inability to identify first-year measures in the portfolio. Additionally, we excluded Portfolio claims that did not have any unique identifier (i.e., measure code or workpaper ID) from analyses that compared ETP-associated claims to Portfolio claims as measure codes are required to identify ETP-associated claims and Portfolio claims. Without these measure codes, claims could not be included in matching ETP-associated measures to Portfolio measures and we removed them from the analysis. These exclusions—in terms of records and kWh, kW, and therms—are presented in Appendix C.
- **Potential overestimation of ETP metrics due to lack of measure code tracking.** Seventy-one ETP projects listed only workpaper IDs, rather than measure codes. As such, the study risked either potentially underestimating ETP-associated savings if workpaper IDs were omitted from the analysis, or overestimating savings if the workpapers or their associated measure codes were included. As discussed above, we used all available sources to find measure codes listed within workpapers and then confirm their connection with ETP projects, but the ability to draw that connection relied heavily on the brief (1–2 sentence) description of the ETP project provided in the database. Table 2 summarizes the percent of matched ETP claims and savings derived from measure codes that we identified and connected to ETP via our workpaper review. The table illustrates that a considerable portion of the matched ETP claims and savings in each claim year—up to 98% in 2010—were derived from measure codes that we identified through the workpaper review process. While we are confident in the relationship between ETP and the measure codes we identified through the workpaper review, there still exists some potential for error, as we cannot definitively say that ETP projects were associated with every measure code based on existing documentation. We provide a list of workpaper IDs, ETP projects they are associated with, and measure codes that we uncovered in Appendix D. The results from this study should be viewed in light of this information.

Table 2. Percent of ETP to Portfolio Matches Based on Workpaper Review

Claim Year	Percent of Matched Claims Derived from Evaluation Team's Workpaper Review	Percent of Matched Ex Post Net kWh[a] Derived from Evaluation Team's Workpaper Review
2010	98%	93%
2011	74%	64%
2012	25%	17%
2013	10%	11%
2014	31%	19%
2015	34%	23%
2016	26%	30%
2017	30%	14%
Average	**41%**	**34%**

[a] Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

- **Re-use of measure codes.** In addition to the potential overestimation due to the use of workpaper IDs, there is also a possibility that not all matching measure codes were ETP supported due to the re-use of existing measure codes to track similar measures. Technologies may be assigned an existing measure code even though they are new technologies in the Portfolio. In some cases, we found that ETP adopted a new technology into the Portfolio, but it was given a measure code that was in existence before the ETP project occurred. This makes it challenging to discern which technologies and EE claims associated with those technologies actually had ties to ETP, and which stemmed from further back in the Portfolio's history. Initial review of Portfolio data revealed that twelve ETP-associated measure codes already existed *prior* to the completion of ETP projects with matching measure codes. To address this issue, we utilized the Matching Level 1 and Matching Level 2 approach described above, which ensures that matches meet both measure code and temporal conditions.
- **Relabeling of measure codes.** In some instances, we found that measure codes only exist in the Portfolio database for one year, though the technology that they represent persists in the Portfolio with a new measure code. This poses a challenge for matching to measure codes provided in the ETP database, because there is no record of changes in Portfolio measure codes over the years. Given the great volume of measure codes and claims in the Portfolio, and each utility's unique measure development process, it was beyond the scope of this study to discern which of these measure codes could have been associated with ETP technologies over the course of the last decade. It is also difficult to ascertain the scale of the uncertainty associated with re-using and relabeling measure codes.
- **Many-to-many relationship between ETP Projects and Measure Codes.** Upon review of the ETP database, we found that there are ETP projects initiated in different years that share measure codes with other ETP projects. While we were able to match ETP measure codes to measure claims in the Portfolio, this many-to-many relationship between measure codes and ETP projects limited our ability to accurately trace a measure code back to *one* ETP project in cases where a measure code is associated with multiple ETP projects. While this is not a potential source of overestimation, it prevents us from assessing the impacts of specific ETP projects.

- **Measurement of first-year savings.** Although Appendix B presents a cohort analysis to better characterize ETP-associated savings in the first year that the technology was claimed, we acknowledge limitations to this approach. First, due to the re-use and relabeling of measure codes, it is impossible to assign technologies to a certain cohort without error. Some technologies may have been in existence in the Portfolio for years but were just assigned a new measure code, making them appear as a "first-year" measure. Other technologies may be assigned an existing measure code even though they were new technologies and thus were not flagged for first-year savings even though they should have been.

  Additionally, when examining trends in claims and savings over time, whether by cohort or by claim year, it is critical to keep in mind that ETP's proportion of the Portfolio database is highly sensitive to the underlying fluctuations in claims and savings in the portfolio at large. Underlying fluctuations in historical Portfolio savings could be due to several reasons, including how and when claims are entered into the portfolio in a given program cycle (for example, we see clustering of savings in some years and less savings in others), variability in the accuracy of record keeping and measure code assignments over the years, the limitations associated with accurately assigning both ETP-associated and Portfolio measures to cohorts, and importantly, external market conditions.

- **Exclusion of ETP-associated activities prior to 2009**. Given data limitations prior to 2009, this study reviews claimed savings and measures as of 2009 and excludes prior years of ETP deployment. As a result, ETP-associated savings prior to 2009 are likely included in our denominator (e.g., the Portfolio savings) for this analysis. Measures existing in the Portfolio as of 2009 could have been derived from ETP-associated activities. In 2010, an evaluation study assessed ETP contributions to the Portfolio from 2006-2008, which include a host of measures prevalent in the Portfolio for many years, such as CFLs, LED exterior lights, etc.[32]

[32] CPUC, Final Report: Evaluation of the California Statewide Emerging Technologies Program. Summit Blue Consulting, 2010. http://www.calmac.org/publications/Final_Comprehensive_ETP_Final_Report_02-04-10_R7_3.pdf

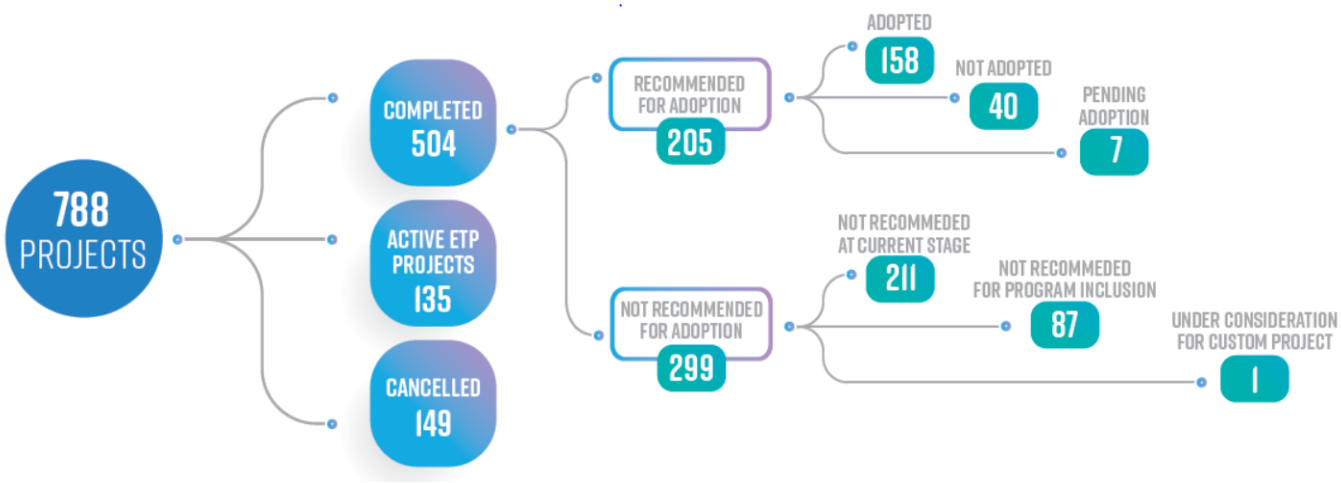
3. Study Findings

In this section, we present the status of all 2009–2017 ETP projects. We then provide detailed information on matches of ETP projects to the Portfolio in terms of project counts and energy and demand savings to provide the market uptake and achieved savings of all technologies and approaches that moved from ETP into the Portfolio.[33] Lastly, we address the ETP program metrics codified in the EE Business Plans.[34]

3.1 ETP Projects Eligible for Adoption in Portfolio

We reviewed databases from the four IOUs to identify the total number of ETP projects that were conducted between 2009–2017. Overall, 788 projects were initiated from 2009 to 2017 (Figure 5). Of these, 504 (or 64%) were complete at the time of this analysis. The remaining projects were classified as active (135, or 17%) or cancelled (149, or 19%). Of the completed projects, less than half (205, or 41%) were recommended for adoption. Of those recommended projects, 158 (80%) were adopted.[35] These adopted projects comprise the population of projects that we sought to match to Portfolio claims.

Figure 5. ETP Project Adoption Status from 2009 to 2017



Overall, 20% of the 788 projects ETP pursued from 2009–2017 resulted in measures being adopted to the Portfolio. While this figure may appear low, we highlight that the purpose of ETP is not only to provide a pipeline of promising technologies but also to scrutinize and eliminate unsuitable technologies. Further, while ETP staff play a major role in identifying and screening new ETs, several other IOU groups are involved in the measure development process at various stages, as outlined in Figure 3 (see Section 2.2). The eventual adoption of an ETP-associated measure is therefore the culmination of a rigorous process subject to expertise from ETP staff, engineering staff, the CPUC, incentive program managers, C&S managers, and measure development

[33] Notably, the Portfolio excludes C&S claims (see Section 2.2).
[34] Valdberg, A., & Cole, J. L. (2018). *Southern California Edison Company's (U 338-E) Energy Efficiency Business Plan Metrics* (p. 146).
[35] Technology adoption refers to a technology being approved for inclusion in the Portfolio via the completion of a workpaper or custom measure documentation. For more information on the measure development process see: Summit Blue Consulting, LLC, ADM Associates, Inc., California Technology International, Inc., E Source, Energy Market Innovations, & Opinion Dynamics Corporation. (2010). *Final Report: Evaluation of the California Statewide Emerging Technologies Program* (p. 205).

management. For more information on this process please see the Emerging Technologies Program Handoff Process Evaluation.[36]

Table 3 summarizes the status of the 788 ETP projects, by IOU. Consistent with the size of each program, Pacific Gas and Electric Company (PG&E) and Southern California Edison (SCE) accounted for 66% of projects. Importantly, only two projects in the ETP database indicated that they would be adopted directly to C&S, and those projects were still pending adoption at the time of the analysis.

Table 3. ETP Project Adoption from 2009-2017 by IOU

Project Status	PGE	SCE	SCG[a]	SDG&E[b]	Total	Percent of Total Projects
Total Completed Projects	**157**	**196**	**67**	**84**	**504**	**64%**
Completed, Recommended for Adoption	**63**	**79**	**28**	**35**	**205**	**26%**
Total Adopted	52	56	24	33	158	20%
Adopted	*51*	*55*	*19*	*33*	*151*	19%
Adopted but Measure Codes Unknown	*1*	*1*	*5*	*0*	*7*	1%
Not Adopted	12	20	6	2	40	5%
Pending/On hold	0	4	1	0	5	1%
Pending Adoption to Codes & Standards	0	0	2	0	2	0.3%
Completed, Not recommended for Adoption	**94**	**117**	**39**	**49**	**299**	**38%**
Complete, not recommended for adoption at this stage	45	93	24	49	211	27%
Under consideration for Custom Project	0	1	0	0	1	0.1%
Project Completed - Not intended for Program Inclusion	49	23	15	0	87	11%
Active ETP Projects	**14**	**61**	**43**	**17**	**135**	**17%**
Cancelled	**37**	**56**	**38**	**18**	**149**	**19%**
Total Projects	**208**	**313**	**148**	**119**	**788**	

[a] Southern California Gas Company
[b] San Diego Gas & Electric (SDG&E)

3.2 ETP Projects Represented in the Portfolio

This analysis focused on the 158 ETP projects that were adopted into the Portfolio. Of the 158 adopted projects, seven were excluded from the analysis because they were missing the measure codes or workpaper IDs that would have allowed us to track their associated savings in the Portfolio. We also excluded 14 additional projects as 13 workpapers did not result in any matching claims, while one workpaper could not reliably be linked back to ETP based on workpaper review. Of the 137 remaining projects, 120 (88%) had at least one matching savings claim in the Portfolio, based on measure code (Matching Level 1) and 115 or 84% had at least one matching claim based on measure code and year (Matching Level 2, Figure 6). In summary, we were unable to match some projects due to lack of claims, claims occurring outside of the analysis time frame, or measure codes that were not claimed to date. This match rate is the highest evaluators have achieved to date and includes both deemed and custom measures.[37] Future research can provide greater

[36] Opinion Dynamics & Guidehouse. (2020). *Emerging Technologies Program Handoff Process Evaluation.*
[37] For example, the 2013–2014 evaluation of ETP matched 55% of the provided ETP measure codes to the Portfolio. Opinion Dynamics Corporation, Energy and Resource Solutions (2015) *PY2013–2014 Emerging Technologies Program Targeted Effectiveness Study Report.*

insights into the percentage of measures supported by ETP projects that are promoted in EE programs but unclaimed.

Figure 6. Summary of Matches by Criteria (n=158)

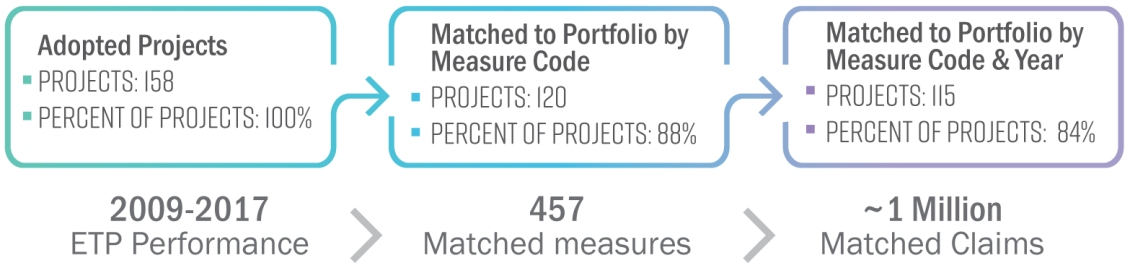


Table 4 summarizes the number of measure codes matched for the 158 ETP projects. We used two levels of matching, described in Section 2.2.2. Table 4 presents the dispositions of the ETP-associated measure codes. The table demonstrates that imposing Matching Level 2 only disqualified 13 measure codes from the analysis.[38] The remainder of the results section only presents findings from Matching Level 2.

Table 4. Summary of Measure Code Dispositions by Matching Level (n=748)

Disposition	Matching Level 1		Matching Level 2	
	Number of Matches	Percent	Number of Matches	Percent
Valid Measure Code[a]	**733**	**98%**	**720**	**96%**
Valid Match with Claims	470	63%	457	61%
Valid Match with No Claims	236	32%	236	32%
Valid but Claim Outside Date Range	24	3%	24	3%
Inexact[b] Match with Matching Claims	3	0.4%	3	0.4%
Invalid Measure Code / Workpaper ID[c]	**15**	**2%**	**15**	**2%**
Only Matched on Matching Level 1[d]			**13**	**2%**
Total	**748**	**100%**	**748**	**100%**

[a] Valid measures are unique measure identifiers that either matched between the ETP database and the Portfolio or ones that IOUs confirmed to be valid either through responses to data requests or through search within each IOU's measure catalogue.
[b] Inexact matches were matches where formatting may have been different between the ETP database and the Portfolio (e.g., due to spaces or dashes), but the match was reviewed and assumed to be valid.
[c] Invalid measure codes or workpaper IDs are unique measure identifiers provided by IOUs, which IOUs noted as being placeholders rather than actual measure codes or workpaper IDs. Per IOU instruction, these invalid measure codes and/or workpaper IDs may be excluded from the analysis.
[d] Measure codes that only matched on Matching Level 1 are measure codes that matched between the ETP database and the Portfolio but did not satisfy the year criterion for Matching Level 2, which stipulates that a measure can start achieving savings claims no sooner than one year after its corresponding ETP project has been completed.

[38] Note that, although Matching Level 2 only disqualified 13 measures, it did also render some claims ineligible for the Matching Level 2 results if the claim occurred before the ETP project with which it was associated was completed (i.e., measure codes with some eligible claims and some ineligible claims were kept in the Matching Level 2 findings). This phenomenon is likely due to measure code recycling.

3.3 ETP to Portfolio Match Characteristics and Savings

This section presents findings from the 457 ETP-associated measure codes that we matched to the Portfolio based on Matching Level 2.

We found inconsistent data coverage across electric and gas savings as well as demand impacts in the Portfolio databases. For energy savings, electric and gas savings claims were available consistently from 2009 across the Portfolio. However, for electric demand impacts, demand impact data was not available Portfolio-wide prior to 2016. Notably, we did not find any ETP-associated therms matches between the ETP database and the Portfolio in 2010–2012, despite the Portfolio reporting therms savings at the time. This suggests that ETP-associated measures only claimed therms savings in the Portfolio after 2013. Notably, ETP did not generate C&S claims throughout this period (discussed further in Section 3.4). Table 5 provides a summary of ETP-associated measures, claims, and savings by claim year in the Portfolio. Matched measures, claims, and kWh savings consistently increase year over year.

Table 5. Summary of ETP-Associated Measures, Claims, and Ex Post Savings

Claim Year	Number of Measures	Number of Claims	Ex Post Lifecycle Net kWh	Ex Post Lifecycle Net kW[b]	Ex Post Lifecycle Net Therms[d]
2009[a]					
2010	5	180	15,753,231	N.A.	0
2011	11	1,099	52,897,843	N.A.	0
2012	53	11,224	182,347,412	N.A.	0
2013	95	25,721	371,510,835	N.A.	8,209,749
2014	184	127,003	923,441,704	N.A.	10,984,648
2015	244	239,815	1,796,551,357	N.A.	16,816,785
2016	304	209,167	1,614,900,797	375,644	8,531,642
2017	330	322,224	2,368,434,104	350,772	9,885,344
Total	**457[c]**	**936,433**	**7,325,837,282**	**726,415**	**54,428,169**

[a] 2009 was not eligible for matching under Matching Level 2, as the earliest ETP projects in this study were completed in 2009 and subsequently became eligible for matching in 2010.
[b] Demand impact data is not available prior to 2016 at the Portfolio level.
[c] Measure code total represents the cumulative unique matched measure codes and is not additive over claim years.
[d] Negative values were removed from therms savings data to omit interactive effects. Appendix B provides detailed findings including interactive effects.
Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Table 6 presents the measures, claims, and total savings by the IOU who completed the associated ETP project.[39] PG&E and SCE represent the majority of ETP matches to the Portfolio, which is commensurate with the relative sizes of their programs. Other IOU claims per measure ranged from 464 to approximately 3,000 on average. In total, ETP spent $116,029,034 and ETP-associated projects resulted in 7,325,837,282 kWh, 726,415 kW, and 54,428,169 therm savings from 2009–2017.Note that given limitations with the demand data, ex post lifecycle net kW reflects 2016–2017 values only.

[39] This table reflects the provenance of the IOU ETP measures claimed in the Portfolio, however, the associated claims could have been submitted by any PA.

Table 6. Total ETP-Associated Measures, Claims, and Ex Post Savings by IOU ETP Program

	Number of Measure Codes 2009–2017		Number of Claims 2009–2017		Ex Post Lifecycle Net kWh		2016–2017 Ex Post Lifecycle Net kW		Ex Post Lifecycle Net Therm[a]	
IOU	#	%	#	%	#	%	#	%	#	%
PG&E	193	42%	581,770	62%	4,111,399,254	56%	486,619	67%	39,378,268	72%
SCE	187	41%	269,659	29%	2,573,927,552	35%	154,060	21%	122,336	0.2%
SCG	14	3%	55,798	6%	15,966,634	0%	188	0%	14,766,330	27%
SDG&E	63	14%	29,206	3%	624,543,843	9%	85,548	12%	161,234	0.3%
Total	**457**	**100%**	**936,433**	**100%**	**7,325,837,282**	**100%**	**726,415**	**100%**	**54,428,169**	**100%**

[a] Negative values were removed from therms savings data to omit interactive effects. Appendix B provides detailed findings including interactive effects.
Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

ETP to Portfolio Matches and Savings by Sector

Examining the number of ETP-associated measures by sector shows that most of the measures associated with ETP have been in the non-residential sector (Table 7), which aligns with record-keeping in the ETP database. Note that due to tracking inconsistencies in the Portfolio, sector cannot be analyzed on a more granular level than residential versus non-residential (e.g., by commercial, industrial, or agriculture).

Table 7. Number of Unique ETP-Associated Measure Codes by Sector and Claim Year[a]

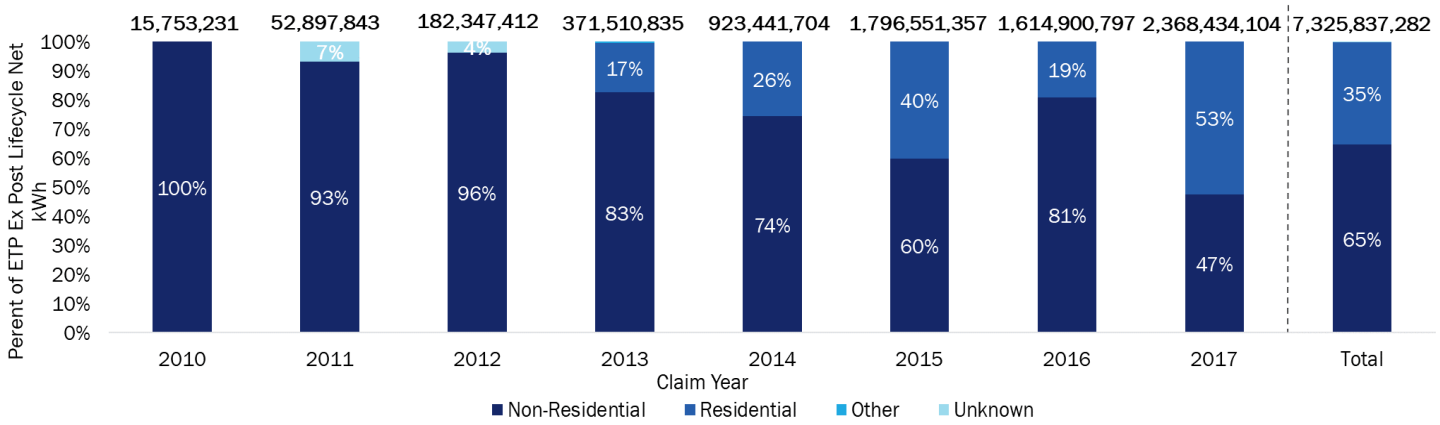
Sector	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Non-Residential		5	13	50	80	158	204	253	230	343
Residential		0	0	7	33	69	98	84	153	208
Other		0	0	0	2	1	0	0	0	3
Unknown		0	1	1	0	0	0	0	0	1
Total by Claim Year		**5**	**14**	**58**	**115**	**228**	**302**	**337**	**383**	**555[b]**

[a] Measure code total represents the cumulative unique matched measure codes and is not additive over claim years.
[b] Measure codes by sector do not equal total number of measure codes associated with ETP (n=457) because some measure codes are both residential and non-residential.

Consistent with the measure distribution by sector, ETP-associated savings were also driven by non-residential projects, representing 65% of total kWh savings from 2009–2017 (Figure 7), 58% of total kW savings over 2016–2017 (Figure 8), and 52% of therms (Figure 9).

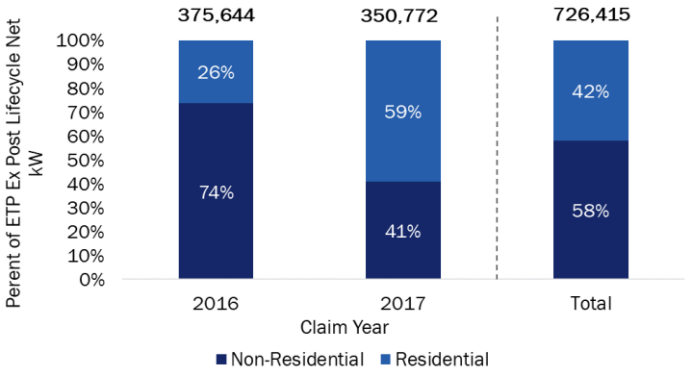
Figure 7 through Figure 9 show the percent of ETP-associated claims and savings by claim year. It is important to note that these data reflect not only what measures were claimed in the Portfolio but how well these claims were tracked.

Figure 7. Percent of ETP-Associated Ex Post Lifecycle Net kWh by Sector and Claim Year



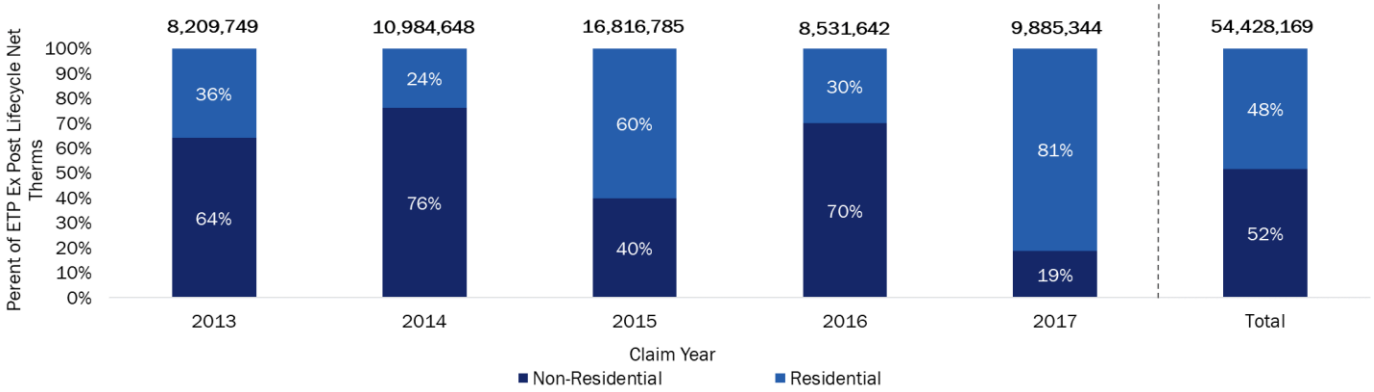
Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Figure 8. Percent of ETP-Associated Ex Post Lifecycle Net kW by Sector and Claim Year



Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Figure 9. Percent of ETP-Associated Ex Post Lifecycle Net Therms by Sector and Claim Year [a]

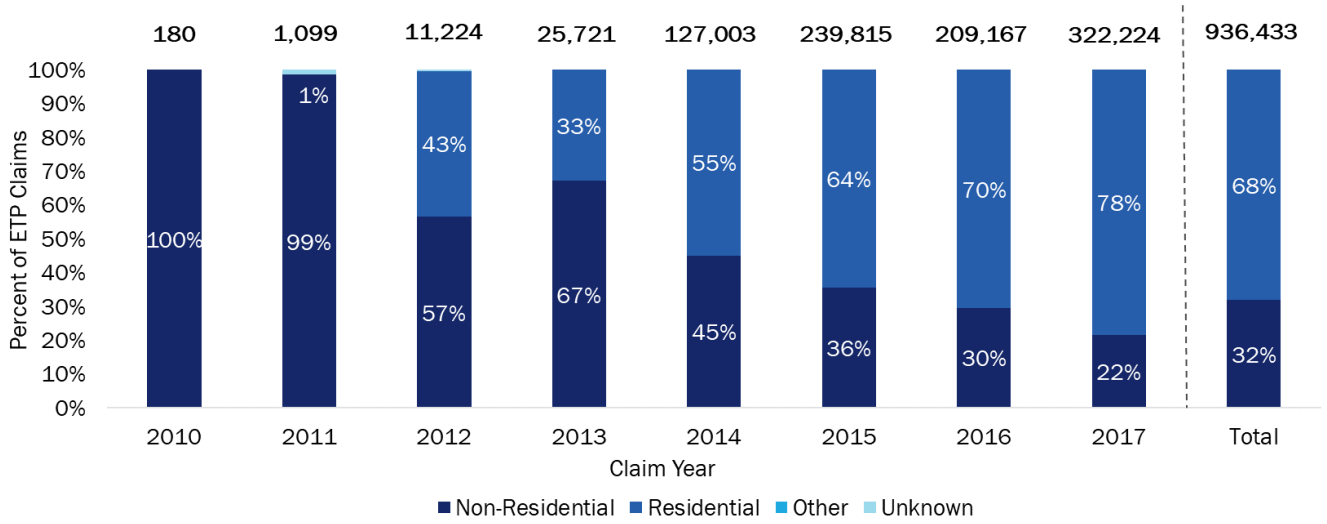


[a] Only positive savings included in calculation of therm savings. Appendix B provides detailed findings including interactive effects.
Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Residential projects did make increasingly notable contributions to the number of claims (Figure 10), along with kWh (Figure 7) and therms savings (Figure 9) as time went on. In fact, residential projects accounted for a greater proportion of claims consistently from 2014–2017 and represented the majority (68%) of claims overall.[40] This trend was due to residential lighting projects, which drove a high number of claims, but a lower amount of overall savings compared to non-residential projects. We discuss savings by technology in more detail throughout the remainder of this section. We do note that variations in the accuracy of record keeping over the years could drive some of these trends.

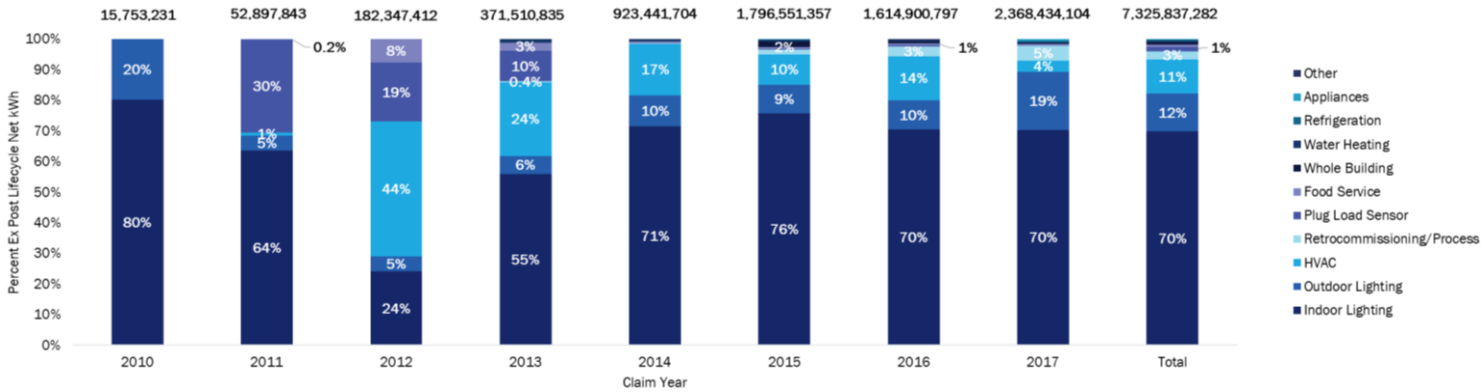
[40] Note that unlike other program years, the 2016 ESPI savings were based on proxy multipliers because there was no impact evaluation, and therefore no "evaluated" 2016 savings. However, the claimed savings for 2016 are technically ex post savings, but not evaluated like other years.

Figure 10. Percent of ETP-Associated Claims by Sector and Year



To further characterize ETP-associated measures present in the Portfolio, we grouped savings based on equipment groups.[41] Overall, lighting measures (including indoor and outdoor) dominated the measure matches between the ETP database and the Portfolio, with 57% of matched measures. This finding is also consistent with the project descriptions provided in the ETP database. Indoor lighting accounted steadily accounted for roughly 70% of kWh (Figure 11) and kW savings (Figure 12). Outdoor lighting was the second highest energy saver in terms of kWh and kW, meaning that lighting in general comprised the vast majority of ETP-associated savings over the years of this study. Given that lighting has played such an important role in the ETP program and Portfolio savings at large, we expect to see a significant shift in the focus of ETP as lighting incentives are phased out of the Portfolio.

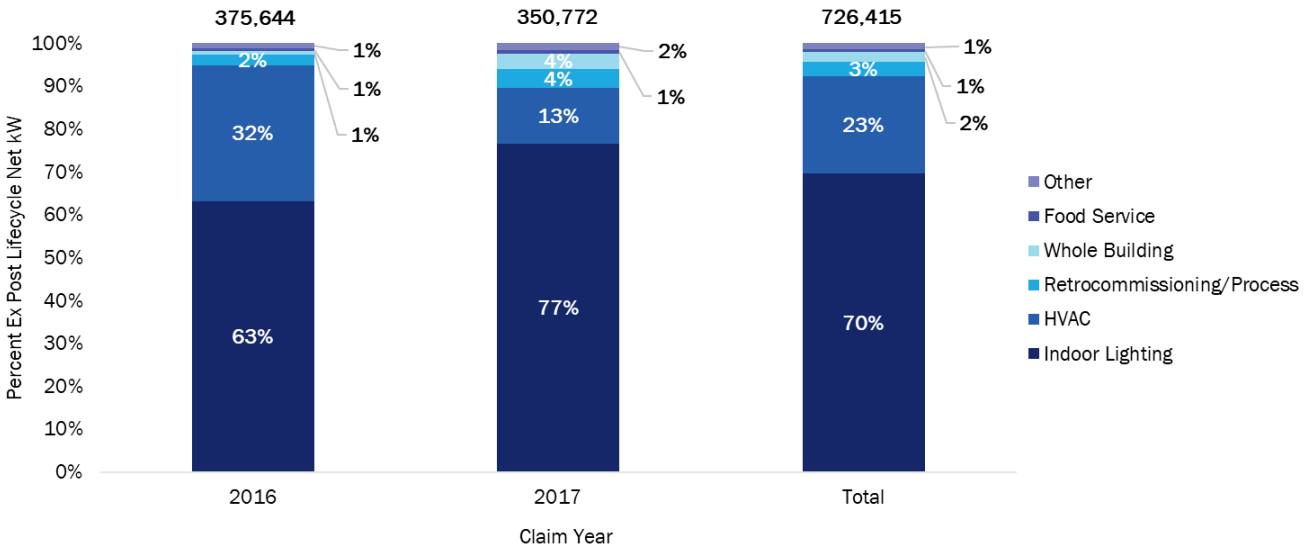
Figure 11. Percent of ETP-Associated Ex Post Lifecycle kWh Savings by Technology



Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

[41] To assign claims and associated savings to equipment groups, we cleaned and standardized the "Measure Group" variable in the Portfolio. Measure group includes the following categories: Indoor Lighting, Appliances, HVAC, Irrigation, Refrigeration, Building Envelope, Other, Lighting Other, C&S Title 20, C&S Title 24, Retrocommissioning/Process, Office Equipment, EMS, Water Heating, C&S Appliance, Outdoor Lighting, Plug Load Sensor, Pool Pump, Steam Trap, Unknown, Whole Building, and Food Service.

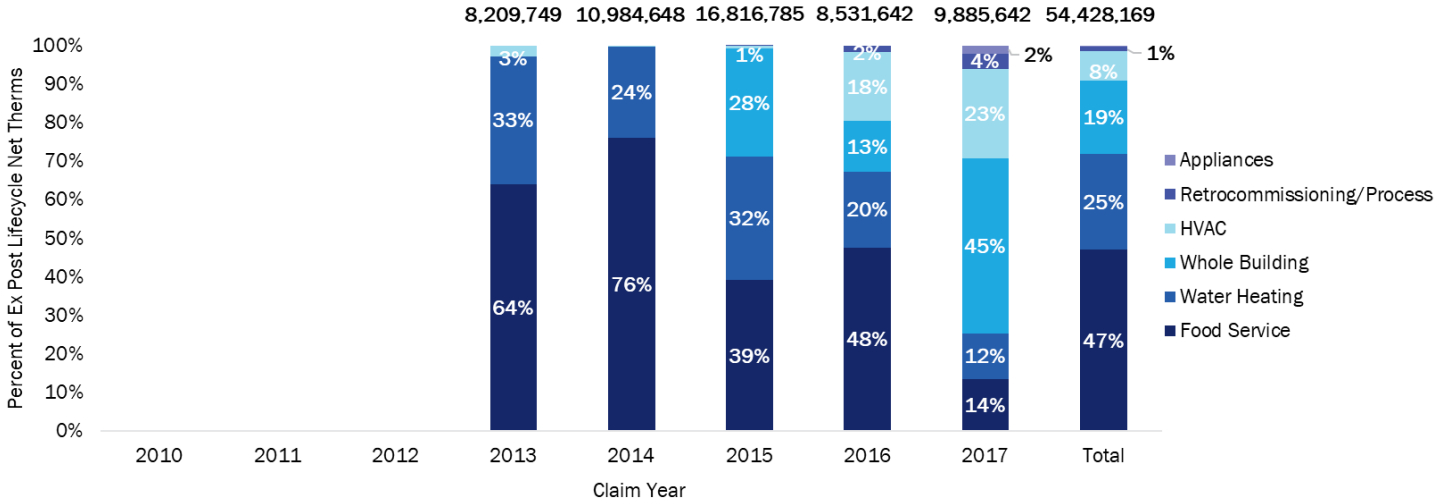
Figure 12. Percent of ETP-Associated Ex Post Lifecycle kW Savings by Technology



Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Food service technologies comprised between 14% and 65% of ETP-associated therms savings, while water heating also accounted for a significant portion of ETP-associated therms savings (Figure 13). In 2017, whole building upgrades, or energy management systems, accounted for 45% of therms savings, which could signify a shift in the types of technologies ETP is studying. Analysis of years after 2017 could confirm whether this was a unique occurrence or a more permanent shift. Notably, ETP associated measures were not associated with a number of technology groups present in the Portfolio, such as building envelope upgrades, steam traps, and pool pumps, to name a few.

Figure 13. Percent of ETP-Associated Ex Post Lifecycle Therm Savings by Technology [a]



[a] Negative values were removed from therm savings data to omit interactive effects. Appendix B provides detailed findings including interactive effects.
Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

3.4 EE Business Plan Metrics

Through this study, we developed preliminary baselines for the five ETP savings metrics, against which the ETP program can be evaluated in future years. These analytical outputs provide insights to inform baselines and approaches to estimate ETP program effectiveness. To develop baselines, we considered the average output of ETP over the 2009–2017 timeframe. This approach leverages all available data on the historical performance of the program.

We fully expect that the suggested baselines from this analysis will adjust over time as ETP is deployed as a third-party program. Further, a retrospective study such as this must take into account that the types of technologies have evolved considerably since 2009, and the nature of the technologies that ETP will study will continue to evolve going forward. Given upcoming program changes and the variations in funding, targeted technology type, and other factors, ongoing review of the baselines will be required to ensure they are appropriate to future program types. Table 8 provides an overview of the Business Plan Metrics and a summary of results, which we recommend using as baselines moving forward.

Table 8. Emerging Technologies Program Metrics and Findings[42]

Metric Name	Metric Description	Unit of Measurement	2009-2017 Average Result / Recommended Baseline
ETP-T1	Prior year: % of new measures added to the portfolio that were previously ETP technologies	%	4%
ETP-T2	Prior Year: # of new measures added to the portfolio that were previously ETP technologies	#	51
ETP-T3	Prior year: % of new codes or standards that were previously ETP technologies	%	0
ETP-T4	Prior Year: # of new C&S that were previously ETP technologies[a]	#	0
ETP-T5a	Energy savings of measures currently in the portfolio that were supported by ETP, added since 2009. Ex ante with gross and net for all measures, with ex post where available	Lifecycle Ex Post Net kWh	915,729,660
ETP-T5b	Demand savings of measures currently in the portfolio that were supported by ETP, added since 2009. Ex ante with gross and net for all measures, with ex post where available	Lifecycle Ex Post Net kW[b]	363,208
ETP-T5c	Energy savings of measures currently in the portfolio that were supported by ETP, added since 2009. Ex ante with gross and net for all measures, with ex post where available	Lifecycle Net Therms[c]	10,885,634

[a] Notably, one ETP-associated measure resulted in five matching claims under C&S. However, the claims did not satisfy the second matching criteria as the claims were for years prior to when the associated ETP project was completed and recommended for adoption.

[42] Valdberg, A., & Cole, J. L. (2018). *Southern California Edison Company's (U 338-E) Energy Efficiency Business Plan Metrics* (p. 146).

[b] Though technically kW impacts are only first-year, here we report Lifecycle kW impacts to stay consistent with the units reported in the Energy Efficiency Business Plan Metrics and the Portfolio; kW impacts represent 2016 and 2017 average only, as those are the only years with available data.
[c] Negative values were removed from therms savings data to omit interactive effects. (Note: Excludes C&S claims.)

Table 9 shows the number and percent of new measures added to the portfolio that were previously ETP technologies, by year. Notably, the denominator excludes C&S claims to provide an equivalent comparison. The average over the timeframe of this study was 51 measures per year, or 4% of new Portfolio measures, with higher numbers of ETP-associated measures entering the Portfolio in more recent years. Given that this number reflects an average of activities, we understand that the results in a given year may fluctuate for many reasons – including transitioning to a third-party program, changes in program funding, changes in Portfolio strategy. Given this, we recommend prioritizing ETP-T2 over ETP-T1 as a baseline through the first year of the third-party program transition. The rationale for prioritizing number of measures (e.g., 51 measures) over percent of measures in Portfolio (e.g., 4%) is the uncertainty associated with changes to the overarching Portfolio. In addition, while we recommend using 51 measures as the baseline, given the historical and future uncertainty of measures adopted into the Portfolio, we consider an acceptable range of measures to be 13 to 89 (or one standard deviation from the average). We anticipate that the CPUC and stakeholders will revisit this baseline as the program design and implementation of this program evolve.

Table 9. Number and Percent of New ETP Measures Added to the Portfolio

Claim Year	Total number of new measures added to the Portfolio[a]	Number of new measures added to the portfolio that were previously ETP technologies (ETP-T2)	Percent of new measures added to the portfolio that were previously ETP technologies (ETP-T1)
2009	3,430	0	-
2010	2,162	5	0%
2011	860	7	1%
2012	665	41	6%
2013	767	51	7%
2014	761	110	14%
2015	1,020	79	8%
2016	1,635	73	4%
2017	967	91	9%
Total	12,267	457	NA
Average 2009-2017	1,363	51	4%

[a] Excludes C & S claims

Exclusion of Codes and Standards Claims when Comparing ETP to the Portfolio

The study found that zero ETP projects resulted in technologies being adopted into C&S, despite the hypothesis that the program supports C&S claims and there being a metric to measure the number of ETP projects claimed in C&S. As previously noted, two projects were pending adoption to C&S at the time of this analysis, but older projects did not indicate a direct relationship to C&S. Our measure code matching analysis confirmed this trend, as the ETP-associated measures that we tracked in the Portfolio returned matches solely from incentive programs. We note the possibility that an ETP-associated measure may become part of C&S after it is sunset from incentive programs (i.e., if market transformation is achieved). The available data did not allow for exploring this possibility as part of this study.

As a result of this finding, we removed C&S claims from the Portfolio claims that we incorporated in the matching analysis. This results in reporting ETP-associated measures effects on the portfolio as a percent of deemed and custom projects from 2009-2017, exclusive of Codes and Standards claims. This was a strategic choice that allows the study to focus on where ETP has historically affected the Portfolio and appropriately scales its contribution.

This outcome is consistent with the recent findings from the ETP Handoff Process Evaluation,[43] which found that there is currently no process to transition measures or data that originated in ETP to C&S advocacy work. While it is theoretically possible for ETP evaluations to feed directly into C&S, this handoff is rare for a number of reasons, including the fact that C&S managers typically seek data and information outside of the scope of what ETP produces, and the individual technologies and/or applications that ETP focuses on are on a different scale than what interests the C&S team. The ETP Handoff Process Evaluation provides additional insights into the gap between ETP and C&S and makes recommendations on how these two programs may coordinate better in the future.

Table 10 summarizes the evaluated net savings of ETP-associated measures overall and as a percent of the Portfolio. Over the timeframe of this evaluation, we estimate that ETP-associated measures saved over 7 billion net ex post lifecycle kWh, 726,415 net ex post lifecycle kW, and 54 million net ex post lifecycle therms (not accounting for interactive effects[44]). Generally, the absolute amount and percent of kWh savings increased year over year. From 2009–2017, ETP-associated measures comprised, on average, 8% of Portfolio kWh savings, and 2% of positive ex post net therms savings. For kW, data is available for 2016–2017 only, during which ETP-associated measures comprised 17% of kW savings.[45] We recommend that the IOUs consider these percentages in developing the metrics baselines.

[43] Opinion Dynamics & Guidehouse. (2020). *Emerging Technologies Program Handoff Process Evaluation.*

[44] Please see Appendix B to see therms savings interactive effects included.

[45] It is important to note the exclusions made from the Portfolio (i.e., the denominator) in the percentage calculations, which we describe in more detail in the methodology (Section 2.2). When C&S is included in the denominator of the percentage, ETP represents 5% of kWh, 8% of kW, and 1% of therms impacts over the timeframe of the study.

Table 10. Ex Post Net Savings and Percent Savings of ETP Measures Added to the Portfolio (ETP-T5a – ETP-T5c)

Claim Year	Total Portfolio Savings from 2009–2017[b]			Savings of ETP-Associated Measures from 2009–2017			Percent of ETP kWh Savings Relative to Total EE Portfolio Savings from 2009–2017		
	Lifecycle Ex Post Net kWh	Lifecycle Ex Post Net kW	Lifecycle Ex Post Net Therms[a]	Lifecycle Ex Post Net kWh	Lifecycle Ex Post Net kW	Lifecycle Ex Post Net Therms[a]	% Lifecycle Ex Post Net kWh	% Lifecycle Ex Post Net kW	% Lifecycle Ex Post Net Therms
2009									
2010	14,898,713,818	N.A.	476,108,364	15,753,231	N.A.	0	0.1%	N.A.	0%
2011	13,818,658,780	N.A.	613,978,902	52,897,843	N.A.	0	0.4%	N.A.	0%
2012	13,577,502,421	N.A.	538,942,863	182,347,412	N.A.	0	1%	N.A.	0%
2013	9,341,212,202	N.A.	314,435,869	371,510,835	N.A.	8,209,749	4%	N.A.	3%
2014	10,723,729,814	N.A.	314,737,602	923,441,704	N.A.	10,984,648	9%	N.A.	3%
2015	9,354,006,851	N.A.	202,867,438	1,796,551,357	N.A.	16,816,785	19%	N.A.	8%
2016	7,910,339,437	1,687,671	188,271,723	1,614,900,797	375,644	8,531,642	20%	22%	5%
2017	9,043,587,748	2,570,157	209,145,402	2,368,434,104	350,772	9,885,344	26%	14%	5%
Total	88,667,751,071	4,257,827	2,858,488,163	7,325,837,282	726,415	54,428,169	N.A.	N.A.	N.A.
Average 2009–2017	**11,083,468,884**	**2,128,914**	**357,311,020**	**915,729,660**	**363,208**	**10,885,634**	**8%**	**17%**	**2%**

[a] Negative values were removed from therms savings data to omit interactive effects.

[b] Excludes C&S claims.

Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

4. Framework for Tracking ETP-Associated Measures

An objective of this research was to establish a framework by which current and future ETP-associated measures can be tracked and quantified in the Portfolio. To meet this objective, we tabulated the tracking challenges encountered in this study and developed actionable solutions that allow for streamlining future estimation of ETP's association with the portfolio. The present study required an arduous process that cannot feasibly be repeated with regularity. Given that data tracking mechanisms are evolving and improving, however, it is possible that the steps outlined in our methodology section could be automated and repeated if key aspects of data tracking are improved. As noted below, we recommend convening a stakeholder workshop with key entities to facilitate improvements to tracking ETP-associated measures. We recommend that the convened group of stakeholders use the following framework of data tracking challenges, organizational challenges, and proposed framework to serve as a guide for this workshop. As such, this section details data tracking improvements that will make a framework possible and suggestions for framework design.

4.1 ETP to Portfolio Matching Challenges and Considerations

The extent to which we can confidently match ETP-associated measures to the Portfolio directly affects our ability to create a framework, as the ideal framework would include streamlined processes for measuring ETP-associated savings, quantifying and establishing baselines for ETP metrics, and tracking these metrics over time.

Below we document challenges we encountered as we addressed the objectives of the study. Notably, we incorporate previous evaluation findings and recommendations, as there have been attempts as recently as 2015 to quantify the historical savings of ETP. Many of the challenges that existed in prior evaluations persist today.[46]

We find that the inability to track ETP-associated savings largely falls into two categories: (1) data tracking challenges, and (2) organizational challenges. We detail these challenges and potential considerations below.

4.1.1 Data Tracking Challenges

The key challenges and considerations for the improvement of data tracking are as follows:

- **Challenge 1:** Once an ETP project is recommended for adoption, the ETP database does not consistently include the relevant Portfolio measure code. It is critical for ETP managers to obtain measure codes when an ETP project is adopted in the Portfolio. The ability to track eventual savings of ETP technologies rests on having the eventual measure code of that technology.
  - *Consideration 1:* Develop a process for relevant parties associated with the ETP project to obtain information during the measure development process to ensure measure codes are tracked in the ETP database. Adoption of Consideration 1 should facilitate Consideration 2a and b below.
    - *Responsible Parties*: ETP, IOU Measure Development, CalTF, and EE Reporting teams.
- **Challenge 2**: The ETP database includes internally conflicting information with respect to project adoption. For example, an ETP project may be described as "canceled" but the same project is described as "recommended" in the recommendation field. These discrepancies make it difficult to

[46] Appendix D presents a summary of selected recommendations made in past studies specific to ETP and the measure adoption process.

accurately ensure that all relevant ETP projects are included within the analysis. For example, future potential analyses will be limited to projects with a status in the ETP database as recommended for adoption and a valid measure code.

- *Consideration 2a:* Create and populate one streamlined field in the ETP database that tracks whether an ETP project was adopted into the Portfolio.
- *Consideration 2b:* Ensure proper quality control checks within the ETP database to ensure consistency between fields (e.g., to ensure that a project listed as adopted does not have conflicting information from other field sources).
  - *Responsible Party:* ETP managers and staff.

- **Challenge 3:** Once an ETP project is adopted in the Portfolio, we found that in some instances, the measure code alone was not enough to determine if a measure's savings could be traced back to ETP. This issue arises when: (1) a measure code applies to a broad group of technologies (e.g., LEDs), but ETP may have only been involved with one discrete application of that umbrella measure code; (2) the measure code provided was in existence before the ETP project took place; or (3) the measure code provided was only claimed in the portfolio for one year before being renamed. These circumstances introduce error into the analysis, as they inhibit tracking the trajectory of a technology in the Portfolio over time. Notably, the practice of re-using and retiring/replacing measure codes not only affects the ability to understand the performance of ETP-associated measures over time but limits the ability to examine the trajectory of any technology once it enters the Portfolio.
  - *Consideration 3a:* In cases where ETP was only associated with one aspect of a measure (for example, one use case of a measure that can be used much more broadly), develop a field in the ETP database that qualifies or describes how the measure code should be linked to the Portfolio. Alternatively, a new measure code could be generated for the specific use case of a technology, allowing for direct tracking of the associated savings.
  - *Consideration 3b:* Discontinue the practices of re-using (giving a new technology an old measure code) and renaming (giving the same technology or slightly improved technology a new measure code) measure codes. We do not recommend conducting a retrospective study to understand how measure codes have been re-used or renamed in the past, as this is likely infeasible given the scale of the Portfolio and lack of historical documentation. Going forward, however, we suggest that the practices of re-using or renaming be examined and discontinued.
    - *Responsible Party:* IOU Measure Development teams and CalTF

4.1.2 Organizational Challenges

As previously noted, many of the data tracking issues identified in our 2019 evaluation have persisted for over a decade. This suggests that the challenges ETP staff face with tracking its technologies may stem from both data tracking as well as organizational barriers. The UIMD and ETP Handoff Process Evaluation,[47] as well as our team's prior evaluation research, serve as a useful guide to enumerating potential organizational barriers. Drawing on this research, we outline the following key challenges and considerations for overcoming organizational barriers:

[47] Evergreen Economics & Willems, P. (2015). *Study of the California Utility Internal Measure Development Process: Final Report* (p. 122).

- **Challenge 1**: According to the UIMD and ETP Handoff Process Study, each IOU encounters barriers specific to their structure, programs, and information-sharing protocols and processes.
- **Challenge 2**: Within each IOU there is uncertainty about the process and its communication protocol. This confusion and complexity are in themselves barriers to effectively tracking ETP measures throughout their journey from the ETP program to the Portfolio.
- **Challenge 3**: When an IOU encounters a barrier to implementing needed changes, there is no incentive to overcome that barrier.
  - *Overarching Consideration:* We acknowledge that this study did not seek to understand barriers and incentives to tracking ETP measures. As such, we do not presume to understand the intricate workings of each IOU and thus cannot make seamless, one-size-fits-all recommendations. While the Portfolio database is managed by the CPUC, each utility may have unique needs in meeting requests for changes in data tracking and recording. As such, a more effective approach might be to ask the IOUs to design and adopt a system of tracking ETP-associated measures that works within their unique systems and is tied to the program metrics enumerated in Table 1. As programs transition to third parties, this reporting and coordination could be required.
    - *Sub-Consideration:* An IOU-designed approach could include developing communication feedback loops or teams to ensure appropriate communication flows, that correspond with specific data requirements associated with ETP metrics. In particular, the IOUs may want to work with the various stakeholders to understand the specific barriers faced (both from a database and organizational perspective) and to solicit feedback on relevant and actionable approaches to ensure appropriate program metrics tracking. As an outcome from the stakeholder workshop, we recommend that the stakeholder workshop group produce recommendations for methods for tracking projects transferring from ETP to the portfolio, including interim stages such as workpaper development and CalTF documentation, for each entity involved in the process.
      - *Responsible Parties:* ETP, Ex Ante Workpaper, CalTF and EE Reporting teams.

Notably, while we identify challenges with organizational change through the UIMD and our preliminary research,[48] we acknowledge that the measure-tracking processes may inherently be different as we transition to third-party implementers. This changing landscape, in addition to the challenges identified above, should be considered when designing new tracking processes.

4.2 Framework for Tracking Measures

More broadly, based on this analysis, we recommend using Matching Level 2 (measure code and ETP project completion date compared with savings claim date) to verify ETP-associated claims in the Portfolio. If data tracking challenges are addressed and provide the necessary foundation for a repeatable analysis, we recommend standardizing the key analytical steps tested through this study to track ETP savings going forward. This approach would be streamlined as follows:

1. Identify ETP Projects Recommended for Adoption and Adopted into the Portfolio
   a. Create an ETP flag in the Portfolio to clearly signify an ETP-associated measure. We note that as a result of this evaluation, the Energy Division has developed an ETP flag in the portfolio, which will serve

[48] Ibid.

as a critical tool in developing a broader ETP-associated measure tracking methodology. Details of this tracking methodology should be fleshed out in the stakeholder tracking workshop recommended by this study.

b. Streamline this flagging process across IOU ETPs.

2. Establish Measure Code(s) Associated with Each ETP Project

   a. Create clear communication channels to learn the eventual measure code assignment of the ETP-associated technology after it leaves ETP and completes the measure development process.

   b. Record eventual measure codes in the ETP database using a consistent approach across IOU ETPs.

3. Clean Annual Portfolio Measure and Savings Data

   a. Leverage CEDARS cost-effectiveness (evaluated) tables to obtain streamlined and accurate Portfolio claims data.

   b. CPUC, ETP administrators, and new third party implementers work together to arrive at a set of data cleaning steps and decisions that all parties agree to be accurate and beneficial, which can be repeated year over year.

4. Cross-Reference ETP-Associated Measures to Portfolio via Matching Level 2

   a. Measure development teams from each IOU support ETP third parties by sharing information about how measure codes were developed in that year (i.e., did measure code re-use or renaming take place? Is a new class of technology unrelated to ETP becoming available in the Portfolio in this year, and can that help contextualize the relative impact of ETP?).

5. Calculate ETP Metrics

   a. Use results from the matching analysis to calculate the results of the metrics.

5. Key Findings and Recommendations

Based on the analyses conducted in this study, we present the following key findings and recommendations to illuminate the historical effects of ETP:

- **Key Finding #1: ETP has been successful in driving technology adoption into the portfolio.** Twenty percent of the projects ETP pursued from 2009 to 2017 resulted in measures being adopted to the Portfolio. Though this figure may appear low, we highlight that the purpose of ETP is not only to provide a pipeline of promising technologies but also to scrutinize and eliminate unsuitable technologies. In the timeframe of this study, 720 measure codes assessed in 205 ETP projects were recommended for adoption to the portfolio to support potential measure development. Of the 205 projects recommended for adoption to the portfolio, 158 (80%) were adopted as one or more measures in the portfolio (Section 3.1).
- **Key Finding #2: ETP-associated measures are associated with significant savings in the portfolio,** representing over 7 billion evaluated lifecycle kWh, nearly 1 million evaluated lifecycle kW, and 54 million evaluated lifecycle positive[49] therms. In the 2009-2017 timeframe this equated to, on average, 8% of Portfolio kWh savings, 17% of kW savings (2016–2017 only), and 2% of positive therms savings.[50] The majority of these savings were in the non-residential sector, and indoor lighting measures were the most prevalent technologies and/or applications. Though the non-residential sector dominated savings, a considerable portion of ETP-associated savings was derived from residential projects (35%–48% across kWh, kW, and therms).
- **Key Finding #3: ETP has been successful at supporting measure development for portfolio inclusion.** This study provided findings to support the Business Plan metrics, which indicated that ETP has impacted the Portfolio over the last decade. We developed baselines using all available historical data, which indicated that ETP-associated measures were associated with 51 measures (or 4% of new Portfolio measures) on average annually from 2009 to 2017 (Section 3.3).
  - *Recommendation: Results from this study should be used as to inform baselines for further metrics tracking.* However, given the transition of ETP to third-party implementation, future technology targets, and other factors, ongoing review of metrics will be required to ensure they are appropriate for the program as it evolves. Ongoing tracking of these metrics against this baseline will provide ETP PAs and implementers insight into the effectiveness of technology adoption to the portfolio as the program is deployed over time.
- **Key Finding #4: It is critical that ETP track its contributions to the portfolio.** The current data tracking and communication protocols for ETP-associated technologies do not allow for accurate and timely quantification of ETP contributions to the Portfolio, nor do they provide an adequate foundation for creating a streamlined, repeatable approach that the CPUC and IOUs can implement to readily track progress against metrics in the future. In particular, this analysis relied heavily on the ability to use measure codes to cross-reference the ETP and Portfolio databases, but ETP does not consistently record the eventual measure code that a technology is assigned once leaving the ETP program (Sections 2.2.3 and 4.1.1). We acknowledge that the measure-tracking processes may inherently differ as we transition to third-party implementers. This changing landscape, in addition to the

[49] We present therms savings without interactive effects. Therms impacts inclusive of interactive effects are presented in Appendix B.
[50] Codes & Standards claims are excluded from the Portfolio when calculating percentages, which we describe in more detail in the methodology (Section 2.2). When C&S is included in the denominator of the percentage, ETP represents 5% of kWh, 8% of kW, and 1% of therms impacts over the timeframe of the study.

challenges identified above, should be considered when developing third-party tracking processes. With that in mind, we offer the following recommendations:

- *Recommendation: Track linkages between ETP and EE programs.* The IOUs, program implementers, CPUC, CalTF, and other stakeholders should coordinate to put in place protocols to make ETP-associated measure reporting a standard practice. Given the movement to a third-party program design, we suggest convening a stakeholder workshop to identify the advantages of different models, including feedback from the stakeholders listed above. As an outcome from the stakeholder workshop, we recommend that the stakeholder workshop group produce recommendations for methods for tracking projects transferring from ETP to the portfolio, including interim stages such as workpaper development and CalTF documentation, for each entity involved in the process. For example, we acknowledge that ETP staff do not create tags on measure identifiers to track their relationship to ETP projects nor are responsible for ensuring measure codes are not re-used. Subsequent to the publishing of this report, the Energy Division incorporated a tag in the CEDARS database to track ETP-projects moving forward. We acknowledge that the measure development process can continue long after an ETP project is recommended for adoption, which makes it challenging to track down the outcome of the process, but by having third-party implementers establish communication and reporting protocols, we are confident that ETP can increase the number of measure codes it records for its projects (Section 4.1.2).
- *Recommendation: Track the outcome of each ETP project in the ETP database.* The ETP third-party administrator should collect the outcomes of each ETP project: (1) whether it was recommended for adoption; (2) whether a workpaper was developed, and if so, what the workpaper ID is; (3) the eventual measure codes associated with the technology; and (4) savings associated with those measure codes.

- **Finding #5: Portfolio data inconsistencies make comparisons over time difficult.** This historical analysis aimed to understand how effective ETP has been over the last decade, which ideally would allow for examining trends in ETP-associated measure performance over time (e.g., understanding how well measures persist). When examining trends in claims and savings over time, we found that ETP's proportion of the Portfolio database highlights data inconsistencies due to lack of standardized tracking systems or possibly trends seen in the portfolio at large, which makes it difficult to isolate ETP-associated savings of the program over time. For example, it is not possible to assert that an increase in ETP-associated measure savings relative to the Portfolio year over year is due to the demand for ETP-associated measures, because it could also be due to a decrease in overall Portfolio savings, as demonstrated in Section 3.3. Trends in overall Portfolio savings could be attributed to a range of causes, including how and when claims were entered into the Portfolio database (i.e., if they are not entered in the year in which the project took place), variability in the accuracy of record keeping and measure code assignments over the years, the market influence on the Portfolio, and effects of our analysis (Section 3.3). Section 2.2.3 details the limitations to this study.
  - *Recommendation: To mitigate data tracking issues enumerated under Finding 4, and support historical tracking, ETP-associated savings should be evaluated on an annual basis going forward.* With consistent tracking in each year, as well as the establishment of data tracking protocols, many of the data challenges faced in this study would be alleviated or eliminated. This analysis used historical data across multiple tracking systems to determine historical trends. If a similar analysis is conducted regularly, supported by ongoing tracking, it will increase the ability of evaluators and program implementers to isolate first-year measures in the Portfolio and examine the performance of ETP-associated measures against non-ETP associated measures of the same vintage, which are subject to the same market conditions.

It is evident that the technologies and applications that ETP has studied over the years have laid the groundwork for future energy savings in the Portfolio. As ETP evolves in the coming years, the findings from this retrospective study may serve as a guidepost for developing future metrics and contextualizing future savings potential.

Appendix A. CA IOU Measure Development Process

Figure 14. IOU Measure Development Process Decision Points

Table 24: Process Decision Points and Gates

Utility	Notes
PG&E	PG&E's process has up to three gates, but initial screening is done before a measure reaches Gate 1, during an internal RFP process that quantitatively scores measures on energy savings, market potential and cost-effectiveness and selects the most promising for ET funding. After the ETP assessment, a measure goes through Gate 1 review and, if successful, work paper development is initiated unless additional research is required, in which case a Gate 2 review is triggered. The final checkpoint, Gate 3, is qualitative and is more of a checklist to assure that all preconditions for measure launch have been met. Because of the preliminary screening through preparation for the RFP process, few measures fail the Gate 1 and subsequent reviews.
SCE	The SCE process has five gates. In Gate 0, the initial feasibility screening stage, approval is based on qualitative assessments of how the measure aligns with corporate, regulatory and customer strategy. Gate 1, project initiation approval, is based on scores developed on the Idea Scorecard that considers quantitative factors such as energy savings potential, market size and cost effectiveness, as well as qualitative factors including organizational capacity and business priority. Gate 2, approval to build project, is based on the results of limited lab and field-testing, customer blue-printing and identification of marketing channels among other activities. If approved, the product passes on to the product development phase during which a work-paper is developed. The Gate 3 decision point is based on approval of the work paper and the success of the product demonstration and is a qualitative assessment. If approved, the product passes into the launch stage. Gate 4, post-stabilization hand-off, is passed through if a qualitative assessment of the success of the product launch is passed. At this point, the measure is fully transferred from the measure development process to DSM Operations.
SoCalGas	SoCalGas has six stages. The first four are developmental and require scores in six categories: portfolio strategy, market attractiveness, opportunity magnitude, operations, financial and regulatory. The weight of each category varies across the first four stages. A different score is required at various stages in order to assure that resources are only dedicated to the most promising measures. A minimum score must be met at each stage to move on to the following stage. At Stage 1, the minimum score is 2.0 and at Stage 2 it is 2.5; the next two stages are 2.75.
SDG&E	SDG&E does not have a scoring process, but Project Teams do evaluate measures before ETP does Technical Assessments via project evaluation forms. It looks for measures to pass a Total Resource Cost (TRC) test score of 1.25.
LADWP	LADWP does not have a formal stage gate process.
SMUD	SMUD's process consists of five steps, one of which is a 4-stage gating process. The entire process has as many as six primary decision points, depending on the type and level of maturity of the measure. While a mixture of qualitative and quantitative information informs each decision point, only Stage 1 of the stage gate process, the technological assessment, has a specific scoring system in place. At this stage, a weighted score is developed based on technical savings potential, market potential, market readiness and the strength of the manufacturer.

Source: Evergreen Economics and Willems, Phil. *Study of the California Utility Internal Measure Development Process.* Evergreen Economics: Portland, 2015.

Appendix B. Supplemental Detailed Findings

Below we provide a series of tables that support the EE Business Plan Metric and cohort analyses presented in this report.

Detailed Metrics Analysis Tables

Table 11 provides each year's lifecycle kWh savings for the Portfolio as well as ETP-Associated measures added to the Portfolio for each year of the study.

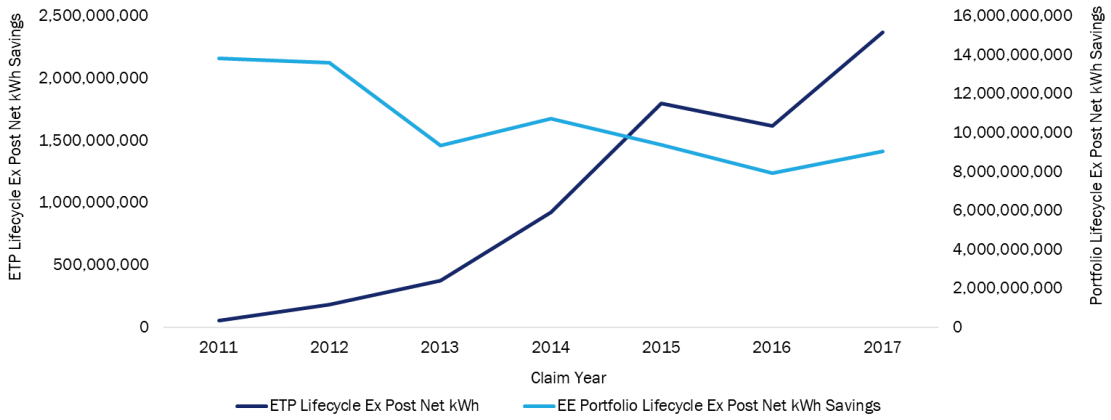
Table 11. Ex Ante and Ex Post kWh Savings and Percent of New ETP Measures Added to the Portfolio (ETP-T5a)

Claim Year	Portfolio kWh Savings from 2009–2017				kWh Savings of ETP-Associated Measures from 2009–2017				Percent of ETP kWh Savings Relative to Portfolio Savings from 2009–2017			
	Lifecycle Ex Ante Gross kWh	Lifecycle Ex Ante Net kWh	Lifecycle Ex Post Gross kWh	Lifecycle Ex Post Net kWh	Lifecycle Ex Ante Gross kWh	Lifecycle Ex Ante Net kWh	Lifecycle Ex Post Gross kWh	Lifecycle Ex Post Net kWh	% Lifecycle Ex Ante Gross kWh	% Lifecycle Ex Ante Net kWh	% Lifecycle Ex Post Gross kWh	% Lifecycle Ex Post Net kWh
2009	26,690,636,465	18,491,902,211	Data Unavailable	Data Unavailable								
2010	29,816,619,019	20,608,150,146	24,124,624,146	14,898,713,818	19,422,674	15,881,883	19,221,655	15,753,231	0.1%	0.1%	0.1%	0.1%
2011	27,625,629,289	19,333,315,594	22,208,964,703	13,818,658,780	68,117,346	53,204,785	67,637,750	52,897,843	0.2%	0.3%	0.3%	0.4%
2012	27,131,780,636	19,163,563,806	21,742,434,250	13,577,502,421	395,537,389	267,777,304	296,077,953	182,347,412	1%	1%	1%	1%
2013	17,692,756,250	12,376,463,522	15,198,663,384	9,341,212,202	724,921,311	518,436,156	566,637,310	371,510,835	4%	4%	4%	4%
2014	19,719,540,968	13,926,418,908	17,965,064,097	10,723,729,814	1,535,700,032	1,112,093,167	1,648,132,366	923,441,704	8%	8%	9%	9%
2015	16,549,577,752	11,566,298,414	15,201,800,040	9,354,006,851	2,474,809,947	1,740,040,547	3,313,209,407	1,796,551,357	15%	15%	22%	19%
2016	14,261,172,149	9,541,010,254	12,665,174,958	7,910,339,437	2,874,665,825	1,870,713,606	2,646,177,228	1,614,900,797	20%	20%	21%	20%
2017	15,858,144,258	12,095,834,914	12,604,306,675	9,043,587,748	3,769,418,976	2,720,958,805	3,505,708,901	2,368,434,104	24%	22%	28%	26%
Total	**195,345,856,785**	**137,102,957,769**	**141,711,032,253**	**88,667,751,071**	**11,862,593,501**	**8,299,106,252**	**12,062,802,572**	**7,325,837,282**	**6%**	**6%**	**9%**	**8%**

Notes: Excludes Codes & Standards claims.
Ex ante savings refer to EE program savings claims reported by PAs, while ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Figure 15 plots claims overtime, sourced from the table above. Here, we can see that ETP's savings have increased over time, likely owing to the cumulative effect of having added ETP measures to the Portfolio over the past decade and these measures persisting over time. Other findings in this report also support the conclusion that ETP-associated measures generally persist over the years. Please note the difference in scales between the Portfolio and ETP axes.

Figure 15. Portfolio and ETP-Associated Ex Post kWh Savings Comparison by Claim Year



Notes: Excludes Codes & Standards claims.
Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Table 12 provides each year's lifecycle kW savings for the Portfolio as well as ETP-Associated measures added to the Portfolio for each year of the study. Notably, demand data are available for 2016–2017 only.

Table 12. Ex Ante and Ex Post kW Savings and Percent of New ETP Measures Added to the Portfolio (ETP-T5b)

Claim Year[a]	Portfolio kW Savings from 2009–2017				kW Savings of ETP-Associated Measures from 2009–2017				Percent of ETP kWh Savings Relative to Portfolio Savings from 2009–2017			
	Lifecycle Ex Ante Gross kW	Lifecycle Ex Ante Net kW	Lifecycle Ex Post Gross kW	Lifecycle Ex Post Net kW	Lifecycle Ex Ante Gross kW	Lifecycle Ex Ante Net kW	Lifecycle Ex Post Gross kW	Lifecycle Ex Post Net kW	% Lifecycle Ex Ante Gross kW	% Lifecycle Ex Ante Net kW	% Lifecycle Ex Post Gross kW	% Lifecycle Ex Post Net kW
2009												
2010												
2011												
2012												
2013												
2014												
2015												
2016	2,857,099	1,935,624	2,593,400	1,687,671	616,630	410,801	588,552	375,644	22%	21%	23%	22%
2017	3,646,578	3,090,341	3,175,262	2,570,157	822,181	642,916	528,358	350,772	23%	21%	17%	14%
Total	**6,503,676**	**5,025,965**	**5,768,661**	**4,257,827**	**1,438,811**	**1,053,717**	**1,116,910**	**726,415**	**22%**	**21%**	**19%**	**17%**

[a] Demand (kW) savings data unavailable for years prior to 2016.
Note: Excludes Codes & Standards claims. Ex ante savings refer to EE program savings claims reported by PAs, while ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

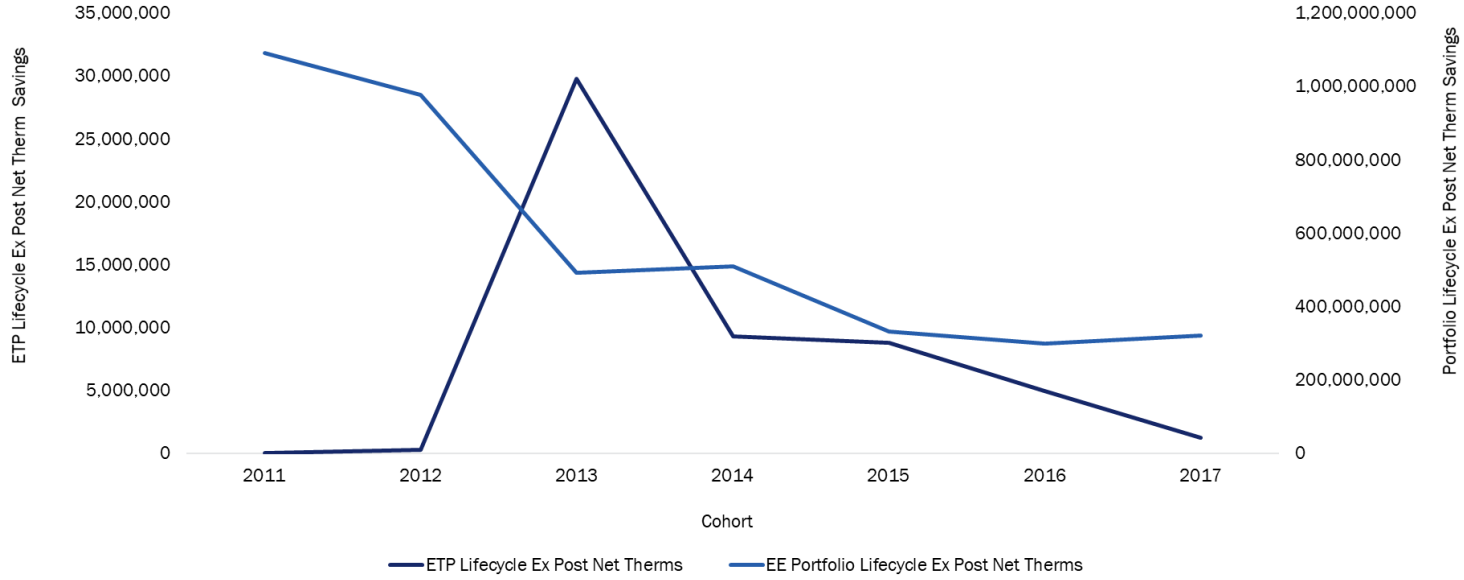
Table 13 and Table 14 provide each year's lifecycle therm savings for the Portfolio as well as ETP-Associated measures added to the Portfolio for each year of the study. The first table excludes negative therms, and the second includes them. Figure 16 plots claims overtime, sourced from the table below. Notably, there were no ETP-associated measure claims from 2010–2012. Please note the difference in scales between the Portfolio and ETP axes.

Table 13. Ex Ante and Ex Post Therm Savings and Percent of New ETP Measures Added to the Portfolio (ETP-T5c) – Excluding Negative Therms

Claim Year	Portfolio Therm Savings from 2009–2017				Therm Savings of ETP-Associated Measures from 2009–2017				Percent of ETP Therm Savings Relative to Portfolio Savings from 2009–2017			
	Lifecycle Ex Ante Gross Therms	Lifecycle Ex Ante Net Therms	Lifecycle Ex Post Gross Therms	Lifecycle Ex Post Net Therms	Lifecycle Ex Ante Gross Therms	Lifecycle Ex Ante Net Therms	Lifecycle Ex Post Gross Therms	Lifecycle Ex Post Net Therms	% Lifecycle Ex Ante Gross Therms	% Lifecycle Ex Ante Net Therms	% Lifecycle Ex Post Gross Therms	% Lifecycle Ex Post Net Therms
2009	0	0	0	0								
2010	829,970,716	556,193,779	827,912,527	827,912,527	0	0	0	0	0%	0%	0%	0%
2011	1,083,882,467	721,348,842	1,091,347,226	1,091,347,226	0	0	0	0	0%	0%	0%	0%
2012	932,392,555	617,472,780	977,646,315	977,646,315	0	0	0	0	0%	0%	0%	0%
2013	640,220,209	408,374,823	493,076,823	493,076,823	14,675,150	9,286,359	14,675,150	8,209,749	2%	2%	3%	2%
2014	696,194,794	451,960,268	511,065,961	511,065,961	17,724,202	11,282,699	17,724,202	10,984,648	3%	2%	3%	2%
2015	452,742,858	297,008,237	331,336,450	331,336,450	26,452,688	16,860,882	26,414,392	16,816,785	6%	6%	8%	5%
2016	356,131,406	228,568,137	298,416,162	298,416,162	15,108,159	9,320,344	14,503,247	8,531,642	4%	4%	5%	3%
2017	389,096,844	259,249,967	321,105,582	321,105,582	22,071,998	13,154,456	18,213,235	9,885,344	6%	5%	6%	3%
Total	**5,380,631,848**	**3,540,176,833**	**4,851,907,046**	**4,851,907,046**	**96,032,197**	**59,904,739**	**91,530,227**	**54,428,169**	**2%**	**2%**	**2%**	**1%**

Notes: Savings excludes negative therms.
Excludes Codes & Standards claims.
Ex ante savings refer to EE program savings claims reported by PAs, while ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Figure 16. Portfolio and ETP-Associated Ex Post Therm Savings Comparison by Claim Year



Note: Savings excludes negative therms.
Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Table 14. Ex Ante and Ex Post Therm Savings and Percent of New ETP Measures Added to the Portfolio (ETP-T5c) – Including Negative Therms

Claim Year	Portfolio Therm Savings from 2009–2017				Therm Savings of ETP-Associated Measures from 2009–2017				Percent of ETP Therm Savings Relative to Portfolio Savings from 2009–2017			
	Lifecycle Ex Ante Gross Therms	Lifecycle Ex Ante Net Therms	Lifecycle Ex Post Gross Therms	Lifecycle Ex Post Net Therms	Lifecycle Ex Ante Gross Therms	Lifecycle Ex Ante Net Therms	Lifecycle Ex Post Gross Therms	Lifecycle Ex Post Net Therms	% Lifecycle Ex Ante Gross Therms	% Lifecycle Ex Ante Net Therms	% Lifecycle Ex Post Gross Therms	% Lifecycle Ex Post Net Therms
2009	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable	Data Unavailable
2010	587,531,196	395,245,839	720,006,189	406,425,906	0	0	0	0	0%	0%	0%	0%
2011	874,705,013	580,723,240	997,819,309	554,017,469	0	0	0	0	0%	0%	0%	0%
2012	732,767,778	480,231,790	875,985,203	473,387,912	-42,186	-35,155	-1,374	-886	-0.01%	-0.01%	0.00%	0.00%
2013	558,673,025	357,181,953	403,060,513	268,864,188	13,834,552	8,616,925	13,829,074	7,701,651	2%	2%	3%	3%
2014	605,355,168	391,610,824	400,146,115	252,251,018	10,024,053	5,275,726	6,381,660	6,052,936	2%	1%	2%	2%
2015	351,490,089	231,305,110	216,059,002	135,212,937	11,849,800	6,602,803	-2,436,570	3,565,159	3%	3%	-1%	3%
2016	277,589,254	179,448,710	222,156,218	140,593,243	-3,050,441	-1,598,787	-3,519,731	-2,296,268	-1%	-1%	-2%	-2%
2017	278,595,056	171,005,075	236,068,576	142,686,040	-10,093,392	-11,559,454	-15,910,075	-17,624,956	-4%	-7%	-7%	-12%
Total	**4,266,706,579**	**2,786,752,541**	**4,071,301,125**	**2,373,438,714**	**22,522,386**	**7,302,058**	**-1,657,016**	**-2,602,365**	**1%**	**0.26%**	**-0.04%**	**-0.11%**

Note: Actual therm savings totals, including negative therms. Excludes Codes & Standards claims
Ex ante savings refer to EE program savings claims reported by PAs, while ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

ETP-Associated Savings Cohort Comparison

To capture the influence of ETP-associated measures relative to all measures submitted to the portfolio in the same year, we analyzed the metrics by "cohort." Throughout the following results tables, "Cohort" represents the first year that a measure and its savings entered the Portfolio. This approach allows for the examination of how ETP-associated measures perform in their first year relative to other new measures and their subsequent growth (as opposed to looking at them relative to the entire Portfolio). In addition, a cohort-based analysis can provide unique insights into both ETP measure persistence and how ETP measure prevalence (expressed as a percentage of all new Portfolio measures of the same vintage) changes over time.

We do note that these findings should be treated with caution, however, since any trends in the percent of ETP-associated measures and savings over time are sensitive to the fluctuations in the Portfolio as well as data tracking limitations (see Section 2.2.3).[51] For example, this historical analysis aimed to understand how effective ETP has been over the last decade, which ideally would allow for examining trends in ETP-associated measure performance over time (e.g., understanding how well measures persist). When examining trends in claims and savings over time, however, we found that ETP's proportion of the Portfolio database reflect data inconsistencies or trends seen in the portfolio at large, which makes it difficult to isolate the effect of the program over time. For example, it is not possible to assert that an increase in ETP-associated measure savings relative to the Portfolio year over year is due to the demand for ETP-associated measures, because it could also be due to a decrease in overall Portfolio savings, as demonstrated in Section 3. Trends in overall Portfolio savings could be attributed to a range of causes, including how and when claims were entered into the Portfolio database (i.e., if they are not entered in the year in which the project took place), variability in the accuracy of record keeping and measure code assignments over the years, the market influence on the Portfolio, and effects of our analysis data cleaning and cohort assignments.

It is not possible, therefore, to assert that ETP-associated measures performed better than non-ETP measures, as their prevalence is influenced by a range of factors, including variations in the accuracy of Portfolio record keeping over time and our ability to correctly assign "new" technologies to cohorts. The following figures compare ETP-associated evaluated net savings with portfolio savings.

Table 15 presents the number of ETP-associated measures added to the portfolio by cohort (cells shaded in light gray). The largest cohort of ETP-associated measures was in 2014, with 110 measures entering the portfolio. Measure counts in subsequent claim years provide an indication of the persistence of new ETP measures over time. Not surprisingly, the absolute number of measures from each cohort decreases over time as some of the measures drop out of the Portfolio. When looking at the share of ETP-associated measures and kWh relative to Portfolio measures of the same cohort, however, ETP-associated measures and savings tend to hold constant, or even increase, over the years.

[51] Due to the re-use and relabeling of measure codes, it is impossible to assign technologies to a certain cohort without error. Some technologies may have been in existence in the Portfolio for years but were just assigned a new measure code, making them appear as a "first-year" measure. Other technologies may be assigned an existing measure code even though they were new technologies and thus were not flagged for first-year savings even though they should have been. ETP's proportion of the Portfolio database is highly sensitive to the underlying fluctuations in claims and savings in the portfolio at large. Underlying fluctuations in historical Portfolio savings could be due to several reasons, including how and when claims are entered to the portfolio in a given program cycle (for example, we see clustering of savings in some years and less savings in others), variability in the accuracy of record keeping and measure code assignments over the years, the limitations associated with accurately assigning both ETP-associated and Portfolio measures to cohorts, and importantly, external market conditions.

Table 15. Number of Unique ETP-Associated Measures by First-Year Cohort and Claim Year

Cohort	Claim Year									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	% of ETP - Associated Measures over Portfolio Measures
2009										
2010		5	4	5	4	4	5	5	3	1%
2011			7	7	7	7	6	4	3	3%
2012				41	33	29	26	25	12	15%
2013					51	34	32	29	22	12%
2014						110	96	95	92	35%
2015							79	73	51	19%
2016								73	56	13%
2017									91	9%
Total by Claim Year		**5**	**11**	**53**	**95**	**184**	**244**	**304**	**330**	**12%**

Note: Excludes Codes & Standards claims.

Note that, the 101% in 2017 is partially an artifact of the cohort analysis methodology and assignment of savings to certain years, which makes ETP and Portfolio savings misaligned in some cases. The claim-year based analysis is not subject to this challenge. Moreover, removing C&S from the denominator of the percentage can inflate the contribution of ETP.

Table 16 and Table 17 present the percent and absolute amount of ETP-associated evaluated net first year kWh savings by cohort and claim year. Overall, percentages steadily increase over time, with some substantial variation. As part of this analysis, we reviewed the type of ETP-associated measures claimed in each year and found that there was a larger contribution of measures from ETP to the portfolio in 2014 based on the ETP database and claims matches but were generally consistent with other years largely reflecting indoor and outdoor lighting. The variation may also be due to the fluctuations in the Portfolio as well as data tracking limitations. Note that, the 101% in 2017 is partially an artifact of the cohort analysis methodology and assignment of savings to certain years, which makes ETP and Portfolio savings misaligned in some cases. The claim-year based analysis is not subject to this challenge. Moreover, removing C&S from the denominator of the percentage can inflate the contribution of ETP.

Table 16. Percent of ETP-Associated Ex Post Net kWh Savings by Cohort and Claim Year

Cohort	Claim Year								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
2009									
2010		0.1%	0.3%	0.2%	0.2%	0.3%	0.2%	1.3%	0.6%
2011			2%	4%	11%	2%	1%	4%	2%
2012				17%	18%	27%	42%	18%	79%
2013					13%	20%	24%	12%	15%
2014						39%	47%	44%	101%
2015							37%	49%	50%
2016								18%	19%
2017									10%

Cohort	Claim Year								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Average 2009–2017									8%

Note: Excludes Codes & Standards claims.
Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Table 17. Ex Post Net kWh Savings of ETP-Associated Measures by First-Year Cohort and Claim Year

Cohort	Claim Year								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
2009									
2010		15,753,231	34,552,437	22,562,375	10,739,938	20,044,816	8,330,148	23,371,293	9,237,229
2011			18,345,406	50,790,781	52,301,927	14,075,286	5,878,779	11,887,827	2,005,624
2012				108,994,256	135,360,542	262,508,967	521,475,570	51,987,648	326,089,315
2013					173,108,428	296,785,844	394,360,303	128,420,940	135,380,138
2014						330,026,790	600,210,219	766,774,976	1,026,700,273
2015							266,296,338	298,397,076	366,071,508
2016								334,061,036	179,459,798
2017									323,490,220
Total by Claim Year		**15,753,231**	**52,897,843**	**182,347,412**	**371,510,835**	**923,441,704**	**1,796,551,357**	**1,614,900,797**	**2,368,434,104**

Note: Excludes Codes & Standards claims.
Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Table 18 and Table 19 present the absolute and percent of ETP-associated ex post net first year kW savings by cohort and claim year. Overall, percentages steadily increase over time, with some variation. As noted above, we reviewed the type of ETP-associated measures claimed in each year and found that there was a larger contribution of measures from ETP to the portfolio in 2014 based on the ETP database and claims matches but were generally consistent with other years largely reflecting indoor and outdoor lighting. Note that, although we do not have kW impact data previous to 2016, the measures contributing to 2016–2017 impacts could be from previous years' cohorts if the measures were introduced previous to 2016.

Table 18. Percent of ETP-Associated Ex Post Net kW Savings by Cohort and Claim Year

Cohort	Claim Year	
	2016	2017
2009		
2010	0.7%	0.3%
2011	0.5%	0.0%
2012	14%	71%
2013	16%	22%
2014	51%	83%
2015	35%	24%
2016	19%	21%
2017		2%
Average 2009–2017		17%

Note: Excludes Codes & Standards claims.
Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Table 19. Ex Post Net kW Savings of ETP-Associated Measures by First-Year Cohort and Claim Year

Cohort	Claim Year	
	2016	2017
2009		
2010	2,460	766
2011	472	20
2012	9,561	50,130
2013	37,791	33,069
2014	189,685	146,538
2015	62,959	52,082
2016	72,715	32,301
2017		35,865
Total by Claim Year	375,644	350,772

Note: Excludes Codes & Standards claims.
Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Table 20 and Table 21 present the absolute and percent of ETP-associated ex post net first year therm savings by cohort and claim year. This analysis excludes negative therm savings. Overall, percentages steadily increase over time, with some variation.

Table 20. Percent of ETP-Associated Ex Post Net Therm Savings by Cohort and Claim Year

Cohort	Claim Year								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
2009									
2010		0%	0%	0%	0%	0%	0%	0%	0%
2011			0%	0%	0%	0%	0%	0%	0%
2012				0%	2%	0%	1%	0%	0%
2013					11%	14%	21%	25%	7%
2014						5%	10%	4%	3%
2015							18%	10%	13%
2016								3%	10%
2017									5%
Total 2009–2017									**2%**

Notes: Therm savings totals exclude negative therms; therms savings inclusive of interactive effects are presented Table 14.
Excludes Codes & Standards claims.
Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Table 21. Ex Post Net Therm Savings of ETP-Associated Measures by First-Year Cohort and Claim Year

Cohort	Claim Year								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
2009									
2010		-	-	-	-	-	-	-	-
2011			-	-	-	-	-	-	-
2012				-	230,981	243,885	309,069	309,069	309,069
2013					7,978,768	17,074,746	24,070,899	28,387,679	29,778,018
2014						1,875,767	6,868,760	8,261,483	9,330,744
2015							4,762,455	6,289,225	8,803,627
2016								1,295,369	4,938,757
2017									1,267,954
Total by Claim Year		**-**	**-**	**-**	**8,209,749**	**19,194,397**	**36,011,183**	**44,542,825**	**54,428,169**

Notes: Therm savings totals exclude negative therms; therms savings inclusive of interactive effects are presented in Table 14.
Excludes Codes & Standards claims. Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.
ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Appendix C. Portfolio Exclusions

We made two exclusions to the overall Portfolio data: (1) C&S claims and (2) measures with no identifiers.

Upon consultation with the CPUC, we removed C&S claims from the matching analysis after determining that ETP projects have not resulted in any discernable C&S claims (please see Section 3.4 for results). This choice focuses findings and baseline metrics on the portion of the Portfolio that ETP has historically affected to appropriately scales ETP's contribution. The rationale for this exclusion is that no ETP-associated measures were adopted into C&S throughout the 2009–2017 period of study; and given that C&S claims represent a major portion of Portfolio savings, limited the team's ability to identify trends or impacts from ETP. We detail the ex post net savings claims associated with the excluded C&S claims below, including the percent of the total portfolio that they represented.

Table 22. Codes & Standards Ex Post Net Savings by Claim Year

Claim Year	Ex Post Lifecycle		
	Net kWh Savings	Net kW Savings[a]	Net Therm Savings[b]
2010	939,329,449	N.A.	11,185,343
2011	1,185,641,668	N.A.	18,327,226
2012	1,346,666,394	N.A.	17,025,623
2013	4,669,434,863	N.A.	23,804,460
2014	5,776,635,779	N.A.	19,414,733
2015	12,146,775,732	N.A.	109,634,888
2016	9,107,518,780	1,964,525	293,398,109
2017	12,479,560,045	2,509,644	398,042,815
Total	47,651,562,710	4,474,169	890,833,195
Percent of Portfolio	27%	36%	21%

[a] Demand impact data is not available prior to 2016.
[b] Negative values were removed from therms savings data to omit interactive effects.
Note: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

We also excluded portfolio claims that did not have unique identifiers, such as measure codes, from the analyses. We removed these records from the analysis because we could neither confirm nor refute that these records had connection to ETP. We detail the evaluated net savings claims associated with the excluded claims below, including the percent of the total portfolio that they represented.

Table 23. Unidentifiable Ex Post Net Savings by Claim Year

Claim Year	Ex Post Lifecycle		
	Net kWh Savings	Net kW Savings[a]	Net Therm Savings[b]
2010	1,682,482,808	N.A.	9,772,293
2011	2,492,748,467	N.A.	32,255,864
2012	2,368,404,191	N.A.	33,367,402
2013	3,742,686,718	N.A.	15,116,943
2014	4,705,907,531	N.A.	16,382,071
2015	9,676,178,864	N.A.	55,786,528
2016	7,395,760,149	1,601,830	152,278,305
2017	10,252,669,705	2,107,890	225,101,195
Total	**42,316,838,434**	**3,709,720**	**540,060,603**
Percent of Portfolio	**24%**	**30%**	**13%**

[a] Demand impact data is not available prior to 2016.
[b] Negative values were removed from therms savings data to omit interactive effects.
Notes: Ex post savings are EE Program savings that have been verified and adjusted through evaluation, measurement, and verification studies.

Appendix D. Workpaper Review Results

For ETP projects that only provided a resulting workpaper ID, Table 24 lists the workpapers provided in the ETP database, the ETP projects the workpaper was associated with, and the measure code that the evaluation found through their workpaper and supporting literature review. Please note that one workpaper ID could be associated with many ETP projects.

Table 24. Workpaper IDs, ETP Projects, and Measure Codes Identified by Evaluation Team

Workpaper ID from ETP Database	ETP Project 1	ETP Project 2	ETP Project 3	ETP Project 4	ETP Project 5	Measure Code
WPSDGENRLG0081	ET09SDGE0006	ET09SDGE0015	ET11SDGE0003	ET11SDGE0011	ET09SDGE0002	L-011
WPSDGENRLG0081	ET09SDGE0006	ET09SDGE0015	ET11SDGE0003	ET11SDGE0011	ET09SDGE0002	L-021
WPSDGENRLG0081	ET09SDGE0006	ET09SDGE0015	ET11SDGE0003	ET11SDGE0011	ET09SDGE0002	L-031
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	402266
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463073
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463074
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463075
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463076
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463077
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463078
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463080
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463081
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463082
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463083
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463084
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463085
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463086
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463087
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463088
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463089
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463090
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463091
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463092
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463093
WPSDGENRLG0196	ET09SDGE0016	ET13SDG7011	ET11SDGE0003	ET11SDGE0004	ET09SDGE0005	463094
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	464046
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	464047
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	401195
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	401196
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	401197
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	401198

Workpaper ID from ETP Database	ETP Project 1	ETP Project 2	ETP Project 3	ETP Project 4	ETP Project 5	Measure Code
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	402258
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	402259
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	402260
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	402261
WPSDGENRLG0181	ET09SDGE0009	ET09SDGE0010	ET09SDGE0012	ET11SDGE0006	ET12SDGE0001	403192
SCE13PR006	ET11SCE1040	ET12SCE1040	ET10SCE1160			PR-78447
SCE13HC013	ET10SCE1110	ET11SCE1130	ET11SCE1190			AC-17382
SCE13HC013	ET10SCE1110	ET11SCE1130	ET11SCE1190			AC-19317
SCE13HC013	ET10SCE1110	ET11SCE1130	ET11SCE1190			AC-78424
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			402262
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			402263
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			428087
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			429087
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462698
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462699
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462702
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462703
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462704
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462707
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462708
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462709
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			463834
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462700
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462705
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			462706
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			401199
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			401200
WPSDGENRLG0080	ET09SDGE0004	ET10SDGE0002	ET12SDGE0002			403198
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT007
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT008
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT009
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT010
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT011
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT012
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT013
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT014
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT015
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT016

Workpaper ID from ETP Database	ETP Project 1	ETP Project 2	ETP Project 3	ETP Project 4	ETP Project 5	Measure Code
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT017
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT018
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT019
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT020
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT021
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT022
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT023
PGECOLTG151	ET09PGE7914	ET09PGE1906				LT024
WPSDGENRHC1050	ET09SDGE0003	ET09SDGE0011				416359
WPSDGENRHC1050	ET09SDGE0003	ET09SDGE0011				416360
WPSDGENRHC1050	ET09SDGE0003	ET09SDGE0011				416363
WPSDGENRHC1050	ET09SDGE0003	ET09SDGE0011				416364
SCE13HC036	ET11SCE1030	ET10SCE1110				AC-18793
SCE13HC036	ET11SCE1030	ET10SCE1110				AC-20693
SCE13HC036	ET11SCE1030	ET10SCE1110				AC-39286
SCE13HC036	ET11SCE1030	ET10SCE1110				AC-49676
SCE13HC036	ET11SCE1030	ET10SCE1110				AC-57395
SCE13HC036	ET11SCE1030	ET10SCE1110				AC-69593
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-72014
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-97565
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-63277
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-14815
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-30287
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-67253
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-18726
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-36894
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-32399
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-42889
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-88048
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-52735
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-32686
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-70123
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-62985
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-71385
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-28655
SCE13HC045	ET13SCE1050	ET13SCE1070				AC-12899
SCE17CC014	ET10SCE1450	ET13SCE1190				FS-77556
PGECOFST102	ET12PGE8201	ET13SCG0002				F205

Workpaper ID from ETP Database	ETP Project 1	ETP Project 2	ETP Project 3	ETP Project 4	ETP Project 5	Measure Code
PGECOFST102	ET12PGE8201	ET13SCG0002				F206
SCE17LG117	ET14SCE1040	ET15SCE8040				LT-10001
SCE17LG117	ET14SCE1040	ET15SCE8040				LT-10002
SCE17LG117	ET14SCE1040	ET15SCE8040				LT-10003
SCE17LG117	ET14SCE1040	ET15SCE8040				LT-11950
SCE17LG117	ET14SCE1040	ET15SCE8040				LT-11966
SCE17LG117	ET14SCE1040	ET15SCE8040				LT-19146
SCE13HC012	ET10SCE1110					AC-50375
SCE13HC012	ET10SCE1110					AC-81566
SCE13HC012	ET10SCE1110					AC-37735
SCE13HC012	ET10SCE1110					AC-31588
SCE13HC012	ET10SCE1110					AC-87532
SCE13HC012	ET10SCE1110					AC-77878
SCE13HC012	ET10SCE1110					AC-22408
SCE13HC012	ET10SCE1110					AC-75087
SCE13HC012	ET10SCE1110					AC-46105
SCE13HC012	ET10SCE1110					AC-83486
SCE13HC012	ET10SCE1110					AC-26490
SCE13HC012	ET10SCE1110					AC-50319
SCE13HC012	ET10SCE1110					AC-70613
SCE13HC012	ET10SCE1110					AC-97648
SCE13HC012	ET10SCE1110					AC-66543
SCE13HC012	ET10SCE1110					AC-96580
SCE13HC012	ET10SCE1110					AC-69747
SCE13HC012	ET10SCE1110					AC-86967
SCE13HC012	ET10SCE1110					AC-61866
SCE13HC012	ET10SCE1110					AC-87169
SCE13HC012	ET10SCE1110					AC-97980
SCE13HC012	ET10SCE1110					AC-92105
SCE13HC012	ET10SCE1110					AC-59729
SCE13HC012	ET10SCE1110					AC-65475
SCE13HC012	ET10SCE1110					AC-99784
SCE13HC012	ET10SCE1110					AC-60134
SCE13HC012	ET10SCE1110					AC-65806
SCE13HC012	ET10SCE1110					AC-62068
SCE13HC012	ET10SCE1110					AC-73283
SCE13HC012	ET10SCE1110					AC-89637
SCE13HC012	ET10SCE1110					AC-53855

Workpaper ID from ETP Database	ETP Project 1	ETP Project 2	ETP Project 3	ETP Project 4	ETP Project 5	Measure Code
SCE13HC012	ET10SCE1110					AC-61202
SCE13HC012	ET10SCE1110					AC-62602
SCE13HC012	ET10SCE1110					AC-71681
SCE13HC012	ET10SCE1110					AC-94444
SCE13HC012	ET10SCE1110					AC-89435
SCE13HC012	ET10SCE1110					AC-67740
SCE13HC012	ET10SCE1110					AC-69545
SCE13HC012	ET10SCE1110					AC-50853
SCE13HC012	ET10SCE1110					AC-56930
SCE13HC012	ET10SCE1110					AC-75420
SCE13HC012	ET10SCE1110					AC-83228
SCE13HC012	ET10SCE1110					AC-73081
SCE13HC012	ET10SCE1110					AC-53523
SCE13HC012	ET10SCE1110					AC-98919
SCE13HC026	ET10SCE1110					AC-29859
SCE13LG103	ET11SCE3020					LT-61219
SCE13LG103	ET11SCE3020					LT-68701
SCE13LG103	ET11SCE3020					LT-16307
SCE13LG103	ET11SCE3020					LT-89884
SCE13RN025	ET10SCE1050					RF-37766
SCE13RN025	ET10SCE1050					RF-90868
SCGWP100303B	ET12SCG0020					504008
SCGWP100303B	ET12SCG0020					506046
SCGWP100303B	ET12SCG0020					525005
SCGWP100303B	ET12SCG0020					530389
SCGWP100303B	ET12SCG0020					530390
SCGWP100303B	ET12SCG0020					540160
SCGWP100303B	ET12SCG0020					540362
SCGWP100303B	ET12SCG0020					540363
SCGWP100315A	ET12SCG0004					505020
SCGWP100315A	ET12SCG0004					505021
WPSCGNRWH121113A	ET12SCG0019					530637
WPSCGNRWH121113A	ET12SCG0019					530638
WPSCGNRWH121113A	ET12SCG0019					530689
WPSCGNRWH121113A	ET12SCG0019					540385
WPSCGNRWH121113A	ET12SCG0019					540418
WPSCGNRWH121113A	ET12SCG0019					540779
WPSCGREHC110603A	ET12SCG0018					530068

Workpaper ID from ETP Database	ETP Project 1	ETP Project 2	ETP Project 3	ETP Project 4	ETP Project 5	Measure Code
WPSCGREHC110603A	ET12SCG0018					530069
WPSCGREHC110603A	ET12SCG0018					530285
WPSCGREHC110603A	ET12SCG0018					530351
WPSCGREHC110603A	ET12SCG0018					540917
WPSCGREHC160624A	ET13SCG0017					540401
WPSCGREHC160624A	ET13SCG0017					540402
WPSCGREWH161128A	ET12SCG0003					540014
WPSCGREWH161128A	ET12SCG0003					540015
WPSCGREWH161128A	ET12SCG0003					540372
WPSCGREWH161128A	ET12SCG0003					540373
WPSCGREWH161128A	ET12SCG0003					540441
WPSCGREWH161128A	ET12SCG0003					540442
WPSDGENRCC0019	ET11SDGE0016					FS-17337
WPSDGENRLG0082	ET09SDGE0007					402270
WPSDGENRLG0082	ET09SDGE0007					402273
WPSDGENRLG0082	ET09SDGE0007					402271
WPSDGENRLG0082	ET09SDGE0007					402274
WPSDGENRLG0106	ET11SDGE0004					463911
WPSDGENRLG0106	ET11SDGE0004					463855
WPSDGENRLG0106	ET11SDGE0004					463913
WPSDGENRLG0106	ET11SDGE0004					463858
WPSDGENRLG0106	ET11SDGE0004					463919
WPSDGENRLG0106	ET11SDGE0004					463867
WPSDGENRLG0106	ET11SDGE0004					463921
WPSDGENRLG0106	ET11SDGE0004					463870
WPSDGENRLG0106	ET11SDGE0004					463927
WPSDGENRLG0106	ET11SDGE0004					463879
WPSDGENRLG0106	ET11SDGE0004					463929
WPSDGENRLG0106	ET11SDGE0004					463882
WPSDGENRLG0198	ET15SDG8021					463341
WPSDGENRRN0016	ET15SDG1092					464028
WPSDGENRRN0016	ET15SDG1092					464029
WPSDGENRRN0016	ET15SDG1092					464030
WPSDGENRRN0016	ET15SDG1092					464031

Appendix E. Selection of Tracking Issues and Recommendations from Prior ETP Evaluations

This appendix presents a summary of issues and recommendations given in prior CPUC-funded studies, which we selected based on relevance to the current evaluation and program metrics. This appendix is not intended to comment on the extent to which recommendations have or have not been adopted but to provide a summary of historical issues and potential solutions. Please note that the issues and recommendations may be paraphrased or presented as direct quotes from their source reports.

Issue	Resulting Recommendation	Source Study
Inconsistent ETP database project status to indicate whether or not a project and (its associated measures) has been adopted	CPUC and IOU staff agree on an update to the status variables in the ETP database to help relieve this issue. We described such a change in the ETP Targeted Effectiveness Evaluation Report.	1
Missing ETP project measure ID for adopted projects	ETP program staff ensure that all adopted projects have associated measure ID in ETP database.	1
Lack of corresponding ETP Measure ID in Portfolio	The CPUC and IOUs should consider the best approach to flag ETP measures in the EE database to review and summarize savings. These approaches have varying burden to existing systems and stakeholders: ▪ Develop IDs that are one-to-one matches across ETP measure IDs and EE database IDs. This approach should ensure that future evaluation teams could trace any measure to its associated ETP project, but may be more burdensome to institute across the various stakeholders involved, or ▪ Develop a flag to capture measure origin to track ETP relationship to on each measure. Despite being less burdensome to institute, this approach has drawbacks because it does not link to the specific ETP project or IOU associated with the project but does indicate whether ETP was associated with the measure. Additionally, this approach eliminates the ability to perform quality assurance on IOU reported influence.	1
Inability to match custom measures to Portfolio	Discuss benefits and costs to enhancing custom measure tracking with stakeholders to enable comprehensively capturing benefits from measures associated with ETP projects. The inability to identify ETP measures in custom projects likely reflects an incomplete assessment of ETP contributions to the Portfolio, and as such, key stakeholders should consider enhancing how custom projects are defined within the tracking data.	1
Internal communication issues throughout the PG&E measure development process	We recommend that PG&E Product Management consistently and formally share ETP results with the engineering team and others to ensure that all	2

Issue	Resulting Recommendation	Source Study
	available data are used in workpaper development. We recommend that there be a formal procedure to ensure this interaction.	
Internal communication issues throughout the SCE measure development process	SCE Engineering and ETP staff should work with the CPUC and other IOUs to see if there are ways to enhance or develop new guidance for workpaper development, which could help reduce uncertainty about required study sites and data collection.	2
Internal communication issues around tracking procedures at SDG&E. While one staff member reported tracking ETP information sources on a quarterly basis for the CPUC, at least two other measure development staff members were not aware of this tracking process.	SDG&E should share tracking processes internally and could consider merging information sources inside of ETP with those outside of ETP if they see this as valuable.	2
Internal communication issues throughout the SDG&E measure development process	Consider publishing a quarterly status report, which can allow ETP to communicate its role in measure development to stakeholders who may be unfamiliar with it. This report can also be used to educate new program staff about ETP's capabilities, as well as provide documentation of the path ETs take through the utilities measure development process.	2
	SCE Engineering and ETP staff should work with the CPUC and other IOUs to see if there are ways to enhance or develop new guidance for work paper development, which could help reduce uncertainty about required study sites and data collection.	
	SDG&E measure development stakeholders should formally disseminate customer utilization data with ETP and Engineering staff and solicit their feedback to document customer barriers.	
Internal ETP data tracking issues	Going forward, basic data tracking activities should be implemented to facilitate informative review of and provide insights into ETP. Such activities would include the following: ▪ Assigning unchanging master ID numbers to ETP projects, ▪ Archiving data in a standard format as it is collected, and ▪ Refining implementation processes to facilitate tracking of technologies adopted from ETP to EE programs. ETP staff should collaborate with EE program staff to create consistent project naming and numbering conventions, decision documentation, and feedback loops between ETP and the EE programs to which technologies were recommended for adoption. Doing so will increase project stakeholder involvement in the post-assessment process, thereby helping to drive the incorporation of ETP technologies into EE	3

Issue	Resulting Recommendation	Source Study
	programs. It will also facilitate improved tracking of adoptions of ETP technologies in EE programs to support program management and subsequent program evaluations.	
Lack of quality and consistency of documentation procedures for program- and project-level budget expenditures and program elements	▪ ETP should strive to create consistent project naming and numbering conventions, decision documentation, and feedback loops between ETP and the EE programs to which technologies were recommended for adoption. ▪ The utilities should continue efforts to refine program implementation processes to develop more formal and better documented procedures, especially for the adoption phase. A major focus should be placed on improving the quality and consistency of documentation regarding program decision-making (e.g., rationale for recommending a technology for adoption) and data tracking processes (e.g., assigning unchanging master ID numbers to all ETP projects).	3
Need for improved documentation of program processes and procedures and associated decision making.	The 2010–2012 ETP PIPs reflect continued progress made by ETP managers and staff to address recommendations generated during program evaluation efforts; however, attention is still needed on the following priority areas: ▪ Generating feedback loops between ETP and EE programs to assess the success of adopted technologies, and identify and mitigate barriers to anticipated levels of market adoption; ▪ Improving program data tracking systems and operations including consistent updates of the ETCC database; and ▪ Collaborating with the utilities' respective regulatory affairs staffs to streamline internal review processes for final technology assessment reports.	3
The current data-tracking and communication protocols for ETP-associated technologies do not allow for accurate and timely quantification of ETP contributions to the Portfolio. Particularly, the resulting measure codes from ETP-associated technologies are often not recorded in the ETP database.	▪ As ETP transitions to third-party management, requisite data tracking should include the outcomes of each ETP project: (1) whether it was recommended for adoption; (2) whether a workpaper was developed, and if so, what the workpaper ID is; and, (3) what the eventual measure codes associated with the technology are. ▪ Protocols should be put in place to make ETP-associated measure reporting a standard practice. We acknowledge that the measure development process can continue long after an ETP project is recommended for adoption, which makes it challenging to track down the outcome of the process, but by establishing communication and	Present Study

Issue	Resulting Recommendation	Source Study
	reporting protocols, we are confident that ETP can increase the number of measure codes it records for its projects. ▪ While we identify potential change management challenges, we acknowledge that the measure-tracking processes may inherently differ as we transition to third-party implementers. This changing landscape, in addition to the challenges identified above, should be considered when designing new tracking processes.	
When examining trends in claims and savings over time, we found that ETP's proportion of the Portfolio database reflect data inconsistencies or trends seen in the portfolio at large, which makes it difficult to isolate the effect of the program over time.	▪ ETP-associated savings should be evaluated on an annual basis going forward to eliminate the error introduced when reaching back several years to calculate savings. If the analysis is conducted regularly, it will be possible to confidently isolate all first-year measures in the Portfolio and examine the performance of ETP-associated measures against measures of the same vintage, which are subject to the same market conditions.	Present Study

Cited Studies:

1. Opinion Dynamics, & Guidehouse. (2020). Emerging Technologies Program Handoff Process Evaluation (p. 69).

2. Evergreen Economics, & Willems, P. (2015). *Study of the California Utility Internal Measure Development Process: Final Report* (p. 122).

3. Summit Blue Consulting, ADM Associates, Inc., California Technology International, Inc., E Source, Energy Market Innovations, & Opinion Dynamics Corporation. (2010). Final Report: Evaluation of the California Statewide Emerging Technologies Program (p. 205).

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