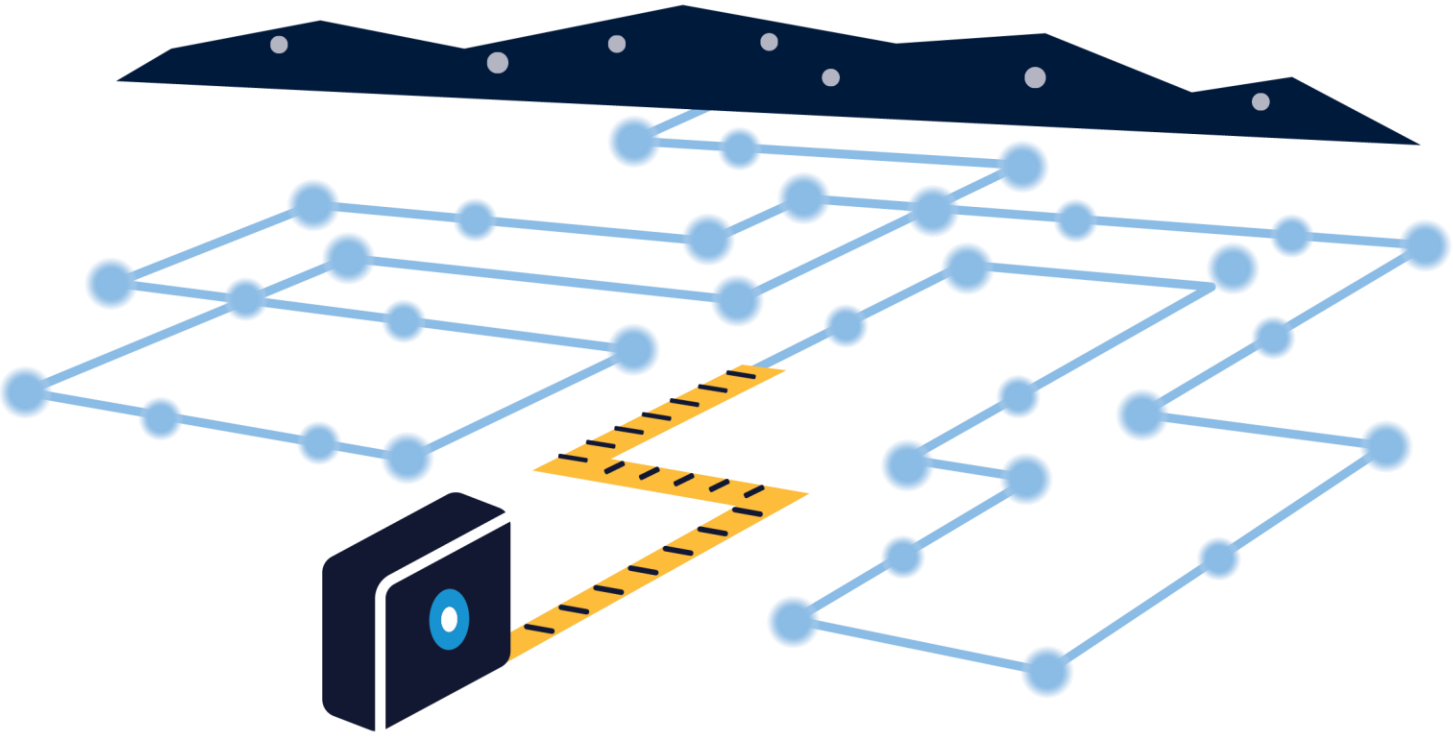
Opinion Dynamics

Guidehouse

Emerging Technologies Program Handoff Process Evaluation

Prepared for California Public Utilities Commission
By Guidehouse



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Abstract

This research study evaluates the handoff process of emerging technologies across California's greater emerging technology (ET) market, the Emerging Technologies Program (ETP), and the investor-owned utility (IOU) programs. In this study, the "handoff process" includes 1) the recruitment of market-ready ETs for study within ETP, 2) research on and vetting of the ETs through ETP, and 3) passing of the ETs to incentive and/or Codes and Standards (C&S) programs once they are vetted. This study assesses the effectiveness of ET handoff in California's ET ecosystem and provides recommendations intended to streamline the existing processes and collaboration among involved stakeholders to effectively move emerging technologies at an increased rate into the market. The study also discusses issues beyond ETP (e.g. documentation of technologies required by the California Public Utilities Commission,) to identify process streamlining opportunities.

To meet the objectives of this evaluation, the evaluation team conducted a series of primary and secondary data collection activities by reviewing process documents, interviewing ETP staff, incentive program staff, C&S staff, technology developers (TDs), and technology development actors (TDAs), and conducting a review of similar emerging technology programs in other regions. The study documents findings from the interviews and provides recommendations to improve the process of handing off emerging technologies along its lifecycle. Recommendations can be used for future program administrators and implementers to improve handoff effectiveness.

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Table of Abbreviations

4S	Screening, Scoring, and Selection System
BPA	Bonneville Power Administration
C&S	Codes and Standards
CA	California
CalPlug	California Plug Load Research Center
CalSEED	California Sustainable Energy Entrepreneur Development
Caltech	California Institute of Technology
Cal TF	California Technical Forum
CASE	Codes and Standards Enhancement
CEC	California Energy Commission
CEE	Consortium for Energy Efficiency
CPUC	California Public Utilities Commission
DEER	Database for Energy Efficiency Resources
DG	Distributed Generation
DOE	Department of Energy
DR	Demand Response
E3T	Energy Efficiency Emerging Technology
ED	Energy Division
EE	Energy Efficiency
EM&V	Evaluation, Measurement & Verification
EPIC	Electric Program Investment Charge
EPRI	Electric Power Research Institute
ESR	Energy Savings Reliability
ETCC	Emerging Technologies Coordinating Council
ETP	Emerging Technologies Program
GTI	Gas Technology Institute
HVAC	Heating, Ventilation and Air Conditioning
IDSM	Integrated Demand-Side Management

IOU	Investor-Owned Utility
IPMVP	International Performance Measurement and Verification Protocol
LBNL	Lawrence Berkeley National Laboratory
MEEA	Midwest Energy Efficiency Alliance
MT	Market Transformation
NEB	Non-energy benefits
NEEA	Northwest Energy Efficiency Alliance
NPD&L	New Product Development and Launch
NW	Northwest
NYSERDA	New York State Energy Research and Development Authority
OEM	Original Equipment Manufacturers
PA	Program Administrator
PG&E	Pacific Gas and Electric Company
PIP	Program Implementation Plan
PON	Program Opportunity Notices
QA/QC	Quality Assurance/ Quality Control
R&D	Research & Development
RFP	Request for Proposal
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
SME	Subject Matter Expert
SoCalGas	Southern California Gas Company
TA	Technology Assessment
TD	Technology Developer
TDA	Technology Development Actor
TFP	Technology Focused Pilot
TPMs	Technology Priority Maps
TRC	Total Resource Cost
TRL	Technology Readiness Level
UIMD	Utility Internal Measure Development

Executive Summary

Introduction

The California Public Utilities Commission (CPUC) authorizes the investor-owned utilities (IOUs) to fund a portfolio of customer programs that encourage the adoption of energy-efficient technologies. A central element of the IOU portfolio is incentive programs that offer rebates and incentives to customers that adopt high-efficiency technologies (referred to as measures). However, technologies that were considered high efficiency a decade ago are increasingly becoming the new normal in today's market; these technologies no longer need incentives, and thus, some are "retired" from incentive programs because they have become the new minimum code or standard. To continue to support California's aggressive energy and demand savings targets, incentive programs are continually seeking new, emerging technologies (ETs) that can provide new energy savings.

Background

To identify new technologies, each IOU administers an Emerging Technologies Program (ETP) to serve as a pipeline to deliver ETs to energy efficiency incentive programs. A key function of ETP is to conduct the research required to have high confidence in a technology and then to pass vetted technologies to incentive or Codes and Standards (C&S) programs. This process—referred to in its entirety as the ETP "handoff process"— includes 1) the recruitment of market-ready ETs for study within ETP, 2) research on and vetting of the ETs through ETP, and 3) passing of the ETs to incentive and/or C&S programs once they are vetted. As such, the handoff process consists of both the "technology intake" and "measure development" subprocesses. Technology intake is the process by which IOU staff obtain ETs from technology developers[1] (TDs) for participation in ETP. Measure development is the process by which a technology's energy savings and costs, as determined by ETP research, inform and support the development of workpapers[2] and ultimately energy efficiency measures that are offered through IOU incentive programs. The measure development process is largely an internal process within the IOUs. In some rare instances, ETP has transitioned technologies directly to C&S, entirely skipping the broad market deployment that is achieved through incentive programs. To date, ETP has been administered and implemented by IOU staff. However, going forward, ETP will become a statewide program designed and implemented by a third-party on behalf of the IOUs.

Research Approach

The CPUC funded this study to evaluate the process by which ETs are "handed off" across California's ET market, ETP, and the IOU programs. While IOUs have established measure development processes, which have been occurring for years, there are opportunities to further streamline and enhance the effectiveness of technology handoff. This study assesses the effectiveness of handoff activities and identifies

[1] Technology Developers (TDs) include manufacturers of the ETs.

[2] 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.

opportunities for improvement. Success factors and process improvement recommendations from this study can help inform future third-party program implementers, as they will undertake a greater share of program design and implementation activities that have historically been performed by IOUs.

This study includes the following research objectives:

- Evaluate the effectiveness of the existing processes for passing technologies between technology developers and technology development actors (TDAs),[3] ETP, the incentive programs, and C&S.
- Conduct a review of similar ETPs in other states and regions to document best practices, success factors and strategies for effective handoff and intake.
- Make recommendations primarily for ETP, but also discusses issues relating to other groups (e.g., CPUC-required documentation of technologies such as workpapers) to allow process improvements in the broader California technology development pipeline.

The key findings and recommendations are drawn from the data collected through the following research activities, as approved and budgeted for in the study's workplan:

- In-depth interviews with 15 IOU staff, including ETP managers, incentive program managers, and C&S managers. This represents a census of the ETP and C&S program managers. It also includes the incentive program manager at each IOU that interacts most with ETP. [See Appendix A for interview guide]
- In-depth interviews with 11 technology development actors and one technology developer.[4] [See Appendix B for interview guide]
- In-depth interviews with three ETP managers from external ET programs. [See Appendix C for interview guide and Appendix D for external ET program profiles]

Research Findings

The handoff process is a collaborative effort involving several internal IOU staff and occasionally external parties. Some of the key findings from this study are:

- The existing processes and requirements for incentive programs hinder IOUs' flexibility in deploying innovative technologies with higher risk profiles. Namely, the risk of affecting portfolio cost-effectiveness limits the number of new technologies that IOUs are willing to consider for program inclusion. [See Recommendations 1 & 2]
- IOU staff, including ETP staff, incentive program staff, and C&S staff, were generally satisfied with their internal handoff processes, but they also recognized potential areas for improvement. [See Recommendation 2]

[3] Technology Development Actors (TDA) include organizations such as consulting firms, universities and research centers, who are involved in the research and development of ETs.

[4] One TD was available to participate in the study. TDAs, who work closely with TDs, were able to share perspectives and concerns of TDs, which are included in the study findings.

- Long timelines pose a challenge to bringing technologies into energy efficiency incentive programs, especially given how quickly the market landscape can evolve for ETs. Factors that have led to longer-than-anticipated timelines to bring a technology from ETP to an incentive program include lengthy ETP assessment timelines, rigorous data requirements from both ETP and incentive programs, and internal resource constraints. Moreover, IOU staff have shared that the CPUC's criteria[5] for approving workpapers is unclear and inconsistent. This has led to multiple rounds of draft workpaper submissions and additional data collection during the CPUC workpaper approval process. [See Recommendation 2]
- The level of understanding of CPUC workpaper requirements varies by IOU team. IOU product development and/or engineering staff who are responsible for workpaper development generally have a sound understanding of requirements. However, ETP and incentive program staff have limited understanding. [See Recommendation 2]
- While ETP and incentive program managers work together during technology intake, there are opportunities to align data collection expectations and priorities between ETP and incentive programs, align timelines and data collection expectations between ETP and C&S, and align data rigor expectations and improve coordination between IOUs and the CPUC, especially as many of these roles are transitioned to third parties. [See Recommendation 2]
- TD and TDAs identified that a lack of transparency in the ETP intake process (particularly with regard to how ETP conducts initial screening and what evaluation criteria ETP uses) and in the internal IOU measure development process (particularly with regard to informing these external parties of project status and timelines) has led to difficulties and frustration in engaging with IOUs. [See Recommendation 3]

Recommendations

Based on the evaluation activities conducted in this study, the evaluation team makes the following recommendations to enhance the effectiveness of the ETP handoff process.

- **Recommendation 1: Leverage technology-focused pilots (TFPs)[6] and market transformation (MT) to enable more flexibility in program deployment to promote innovative ETs.** The existing processes and requirements for incentive programs hinder IOUs' flexibility in deploying innovative technologies with higher risk profiles. CPUC staff indicated that TFPs and the new MT framework are intended to address this challenge. ETP and MT administrators should ensure that TFPs and MT initiatives, both of which will be developed by third-party implementers, are designed to support more flexible and innovative program deployment strategies, for example, by being tailored to specific technologies' strengths and weaknesses and reflecting market conditions. The outcomes of these activities should provide clear market strategies for ETs that will be deployed in incentive programs or market

[5] CPUC workpaper requirements are provided in multiple CPUC decisions, resolutions, rulings, and policies. The IOUs have consolidated their interpretation of these in the Statewide Deemed Workpaper Rulebook, which can be accessed at https://static1.squarespace.com/static/53c96e16e4b003bdba4f4fee/t/5c955be0971a1829778b2d51/1553292260908/SW+Deemed+Workpaper+Rulebook_Version+1.0.pdf

[6] TFPs are meant to identify and address market barriers for high-impact technologies and approaches through collaboration with relevant programs

transformation framework initiatives and enable program adjustments in response to market feedback and customer needs, which will support programs in managing the risks associated with uncertainty when deploying new technologies. [Section 3.2.1]

- **Recommendation 2: Ensure close coordination internally and with the CPUC.** IOU staff, particularly ETP administrators, must ensure close coordination between ETP implementers, engineering staff, C&S, incentive program implementers, and the CPUC ex ante team, especially during and after the transition to third-party implementation. IOUs should share lessons learned and historical challenges with third-party implementers.
    - As observed by those working in external ET programs, the handoff between ETP and incentive programs works best when it functions more like a gradual transition. Internal coordination across various actors in the measure development process seems to be most effective when there is a designated group overseeing the entire process and identifying opportunities for improvement, as well as when ETP, C&S, and program staff are on the same team. ETP administrators should ensure that incentive program implementers and ETP implementers coordinate on data needs before conducting ETP evaluations. For example, this can be achieved by peer-reviewing Measurement & Verification (M&V) plans before field tests to ensure that the data collected during the test is valuable to stakeholders downstream in the measure development process. [Section 3.2.1]
    - ETP administrators and CPUC ex ante staff should coordinate closely to clarify and align documentation requirements and expectations on the level of data rigor, especially given that ETP projects produce site-specific data. This discussion should also clarify the role of ETP in informing workpaper development, particularly since there are data rigor requirements during workpaper development stages that ETP is not currently well-suited to meet. This coordination will improve alignment between data development capabilities and CPUC's measure approval criteria, which will reduce the number of iterations during the approval process and mitigate delays in this stage. [Section 3.2.1]
    - ETP administrators should ensure that all key actors involved in the handoff process, such as such as ETP implementers, incentive program implementers, engineering staff, and C&S staff, have a clear understanding of the metrics being tracked, for example, by involving these actors in discussions regarding metrics reporting and clearly communicating the list of tracked metrics to these actors. [Section 3.4]
    - ETP and C&S implementers and administrators (SCG and SCE for ETP; PG&E for C&S)should identify potential synergies in priorities, data requirements, and timelines between C&S and ETP by mapping expected future C&S code changes with the technologies being considered by ETP. This will enable C&S to leverage results from ETP studies, as well as provide an avenue for C&S to recommend technologies that are not yet code-ready for ETP consideration [Section 3.2.2]
- **Recommendation 3: Provide additional transparency to technology developers and technology development actors.** External actors seek additional transparency regarding ETP priorities, the technology intake process, and the measure development process. ETP administrators might consider several activities to address this gap:

- To support intake, ETP administrators should provide clear technology eligibility requirements and timeline expectations during the pre-screening process. [Section 3.1.2 and Section 3.3.2]
- As technologies move through the process, ETP administrators should provide updates to technology developers, so they are not "left in the dark." [Section 3.3.2]
- ETP administrators should provide stakeholders with greater visibility into the needs and priorities regarding new technologies, technologies that ETP is currently considering, and technologies ETP is actively assessing. For example, ETP administrators should consider making Technology Priority Maps (TPMs) publicly available to communicate their technology priorities. This would improve the relevancy of ET applications to ETP and minimize duplicative efforts externally. [Section 3.1.1 and Section 3.3.2]
- To increase the quality of future applications, ETP administrators and implementers should provide feedback to applicants either through automated feedback during the pre-screening process or via debrief meetings. [Section 3.1.2 and Section 3.3.2]
- IOUs and CPUC staff, especially those involved in ETCC, should identify potential synergies in data requirements between external research activities (e.g., the Electric Program Investment Charge program) and data needs within the IOUs' measure development process to minimize duplicative research by ETP, optimize the use of resources, and accelerate the handoff timeline. [Section 3.3.2]

- **Recommendation 4: Ensure that metrics track the effectiveness of the handoff process.** ETP administrators should ensure that the new ETP metrics[7] are formally tracked once the ED finalizes the calculation methodology, as well as consider additional metrics specific to the handoff process to include as goal or tracking metrics. A list of metrics that can be used as a starting point for this development can be found in Section 3.4. The Emerging Technology to Portfolio Evaluation Study (ETP-2) will identify possible gaps in ETP tracking and additional metrics that could inform future related efforts. Adopting handoff-specific metrics will support PAs in tracking improvements in the recommended areas and identify issues early on. [Section 3.4]

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[7] The metrics outlined in Attachment A of D.18-05-041 can be accessed at http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M215/K706/215706139.PDF

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1. Study Overview

1.1 Evaluation Objectives

The California Public Utilities Commission (CPUC) funded this study to evaluate the process by which emerging technologies (ETs) are "handed off" across California's ET market, emerging technology program (ETP), and the investor-owned utility (IOU) programs. This study assesses the effectiveness of the handoff of ETs in California's ETP ecosystem. It provides recommendations to streamline the existing processes and collaboration among involved stakeholders to move ETs both effectively and at an increased rate into the market. In this study, the term "handoff" is defined as transitioning "market-ready" ETs into incentive programs and/or into the Codes and Standards (C&S) Program.

The study has the following research objectives including:

- Evaluate the effectiveness of the existing processes for passing technologies between technology development actors (TDAs)[8] and technology developers (TDs), ETP, the incentive programs, and C&S
- Conduct a review of similar ETPs in other regions and states to document best practices, success factors, and strategies for effective handoff and intake.
- Make recommendations primarily for the ETP, but also for other groups, to allow process improvements in the broader California technology-development ecosystem

The study also discusses issues beyond ETP (e.g., CPUC-required documentation of technologies) to identify process streamlining opportunities.

1.2 Evaluation Methodology

To meet the objectives of this evaluation, the evaluation team conducted a series of primary and secondary data collection activities. The team reviewed Program Implementation Plan (PIP) documents, other documents such as California Utility Internal Measure Development (UIMD) Report,[9] ETP Targeted Effectiveness Study,[10] and information provided by ETP staff in response to the evaluation team's data request. As approved and budgeted for in the study's workplan, qualitative and quantitative data were collected through in-depth interviews with 15 IOU staff (including ETP managers, incentive program managers, and C&S managers), in-depth interviews with 11 TDAs (including consulting firms, research centers, and other ETP partners) and one technology developer, and in-depth interviews with ETP managers from three external ETPs for the best practices review. Table 1 provides a summary of the data collection activities conducted to support the process evaluation.

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[8] Technology Development Actors (TDA) include universities, research centers, consulting firms and other organizations such as EPIC, CalSEED, CalPlug and technology clusters.

[9] Study of the California Utility Internal Measure Development Process can be accessed at http://www.calmac.org/publications/SCE_Final_UIMD_Report.pdf

[10] PY2013–2014 California Statewide ETP Targeted Effectiveness Research Study can be accessed here http://www.calmac.org/publications/PY2013-2014_ETP_Targeted_Effectiveness_Evaluation_Volume_I_FINAL.pdf

Table 1. Data Collection Activities

Data Collection Type	Targeted Population	Sample Source	Sample Size	Timing
In-Depth Telephone Interviews	ETP and program staff of SCE, PG&E, SDG&E, and SoCalGas. IOU staff included ETP managers, incentive program managers, product development staff, and C&S managers	Contacts from the IOUs ETP Program Staff	15 [a]	Jun-Jul 2019
	TDs and TDAs (e.g., consulting firms, universities and research centers)[b]	Contacts from the IOUs ETP Program Staff	12 [c]	Jul-Aug 2019
	Program staff of Bonneville Power Administration (BPA), Nicor Gas, and New York State Energy Research and Development Authority (NYSERDA)	Contacts from the evaluation staff	4	Oct-Nov 2019

[a] For a breakout of the number of interviews by role and utility, please see Table 22 in Appendix G.

[b] TDs have submitted ET ideas to ETP, and TDAs have worked with IOUs through various stages of technology handoff. During the interviews, TDs and TDAs shared their feedback regarding their engagement with IOUs on emerging technologies.

[c] Includes 11 TDAs and 1 TD. One TD was available to participate in the study. TDAs, who work closely with TDs, were able to share perspectives and concerns of TDs, which are included in the study findings.

Source: Guidehouse analysis.

- Staff of SCE, PG&E, SDG&E, and SoCalGas were interviewed by telephone during June-July 2019. IOU staff included ETP managers, incentive program managers, product development staff, and C&S managers. Each interview lasted roughly an hour and covered an overview of ETP handoff process, CPUC documentation (i.e., workpaper[11]) development process, the role of IOUs, communication, and coordination among IOU staff and with external stakeholders, metrics used for tracking ET handoff process and feedback loop, and IOUs' engagement with technology development actors. The interview guide can be found in Appendix A.
- TDs (i.e., manufacturers) and TDAs (e.g., consulting firms, universities, and research centers)) were interviewed by telephone during July-August 2019. Each interview lasted roughly an hour and covered an overview of the ETP program, the role of TDs and TDAs, the perceived role of IOUs, the current process of the TDs and TDAs engagement with IOUs on ETs, TDs' and TDAs' current involvement and interest in the workpaper development process, communication and coordination with IOU staff on ETs, as well as perceived drivers, and challenges. The interview guide can be found in Appendix B. Note that even though one TD was available to participate in the study, TDAs who work closely with TDs, were able to share perspectives and concerns of TDs.
- Program staff of Bonneville Power Administration (BPA), Nicor Gas, and New York State Energy Research and Development Authority (NYSERDA) were interviewed by telephone during October-

[11] Workpapers are prepared by the program administrators or program implementers to document the data, methodologies, and rationale used to develop ex-ante saving estimates. IOUs submit workpapers to the CPUC for review in order to get a measure approved. As CA IOUs transition to a third-party implementation framework, there is an increased focus on the rules and requirements regarding workpapers developed by third parties.

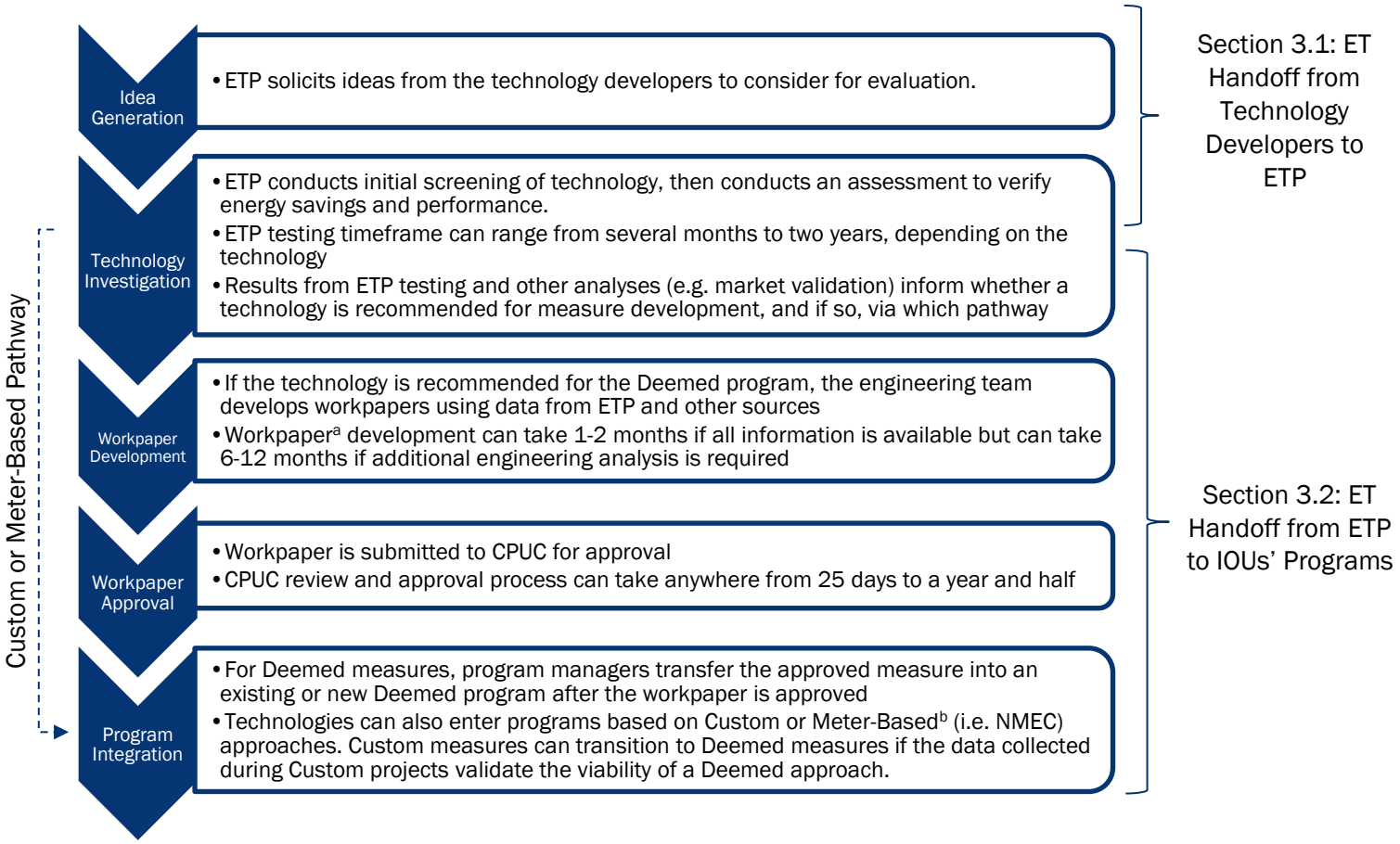
November 2019. Initially, the evaluation team conducted high-level research of existing ET programs across a wide range of utilities/organizations. These three external ETPs were then selected for in-depth research to represent a mix of geographic areas, organizational types, fuel types, populations served, and budgets, as detailed in Appendix D. Program staff were asked questions regarding their roles, organizational structure, ET intake processes, ET handoff processes, experience with third-party implementation and metrics to track program effectiveness, engagement with external stakeholders, challenges, success factors and lessons learned. The interview guide is in Appendix C and profiles of these external ET programs are in Appendix D.

2. Overview of the Emerging Technologies Handoff Process

2.1 Overview of Technology Intake and Measure Development Processes

This chapter provides a high-level overview of the processes that take in new ideas (hereafter referred to as "technology intake") and integrate them into programs (hereafter referred to as the "measure development process"), and it also outlines the key actors involved in this process. Figure 1 summarizes these processes based on interviewee responses and a review of the California Utility Internal Measure Development (UIMD) Report.[12] ETs can enter into Deemed, Custom, or Meter-Based (e.g. NMEC) programs, however, most of the discussion with interviewees centered around the Deemed approach. Interviewed IOU staff noted that, at a high level, the measure development process currently in practice is as outlined in the UIMD report, which also contains additional details.

Figure 1. Summary of the CA IOU Technology Intake and Measure Development Process



[12] Report can be accessed at http://www.calmac.org/publications/SCE_Final_UIMD_Report.pdf

[a] Workpapers are prepared by the program administrators or program implementers to document the data, methodologies, and rationale used to develop ex-ante saving estimates. IOUs submit workpapers to the CPUC for review to get a measure approved. Note that workpapers can be developed for technologies that entered the measure development process outside of ETP

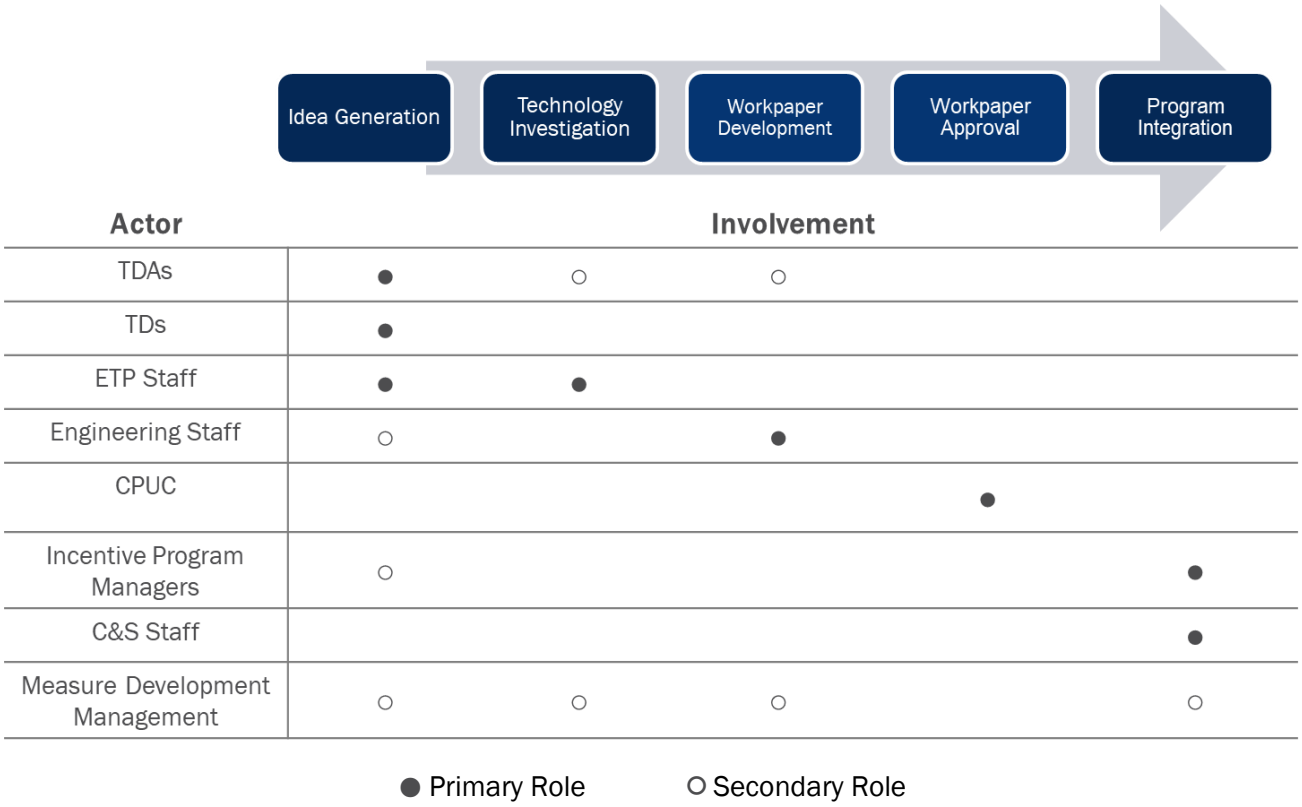
[b] Technologies do not need to be pre-approved for Meter-Based approaches as savings are calculated solely based on energy consumption data, thus ETs do not need to go through the ETP process to be included in Meter-Based projects.

Source: Interviews with IOU staff, UIMD Report

2.2 Key Actors

While IOU's ETP staff plays a major role in identifying and screening new ETs, several other IOU's staff are involved in the measure development process at various stages, as outlined in Figure 1 above. Error! Reference source not found. illustrates the involvement of the key actors in each step of the technology intake and measure development processes. Filled bubbles indicate that the actor leads activities in that step, and open bubbles indicate that the actor plays a secondary role by providing support or input at that step. The various staff involved in the process and their roles are described below the figure.

Figure 2. Involvement of Key Actors



Source: Interviews with IOU staff, UIMD Report

- **Technology Developers (TDs):** TDs are product manufacturers and vendors who promote new products and submit their technologies for ETP testing.

- **Technology Development Actors (TDAs):** TDAs are the actors who do not develop technologies, but rather provide support to IOUs during the measure development process (e.g., research institutions, consulting firms, universities, accelerators, utility partner organizations). TDAs recommend new technologies to ETP, assist with ET testing and evaluation, measurement, and verification (EM&V), support workpaper development, and facilitate collaboration between IOUs and external organizations.
- **ETP Staff:** ETP staff participate in the Idea Generation stage by identifying new ETs for research and program integration. They conduct initial assessments of technology performance, energy/demand savings, and cost, which are summarized in project reports, which are posted to the Emerging Technology Coordinating Council (ETCC).[13] ETP staff often work in conjunction with external organizations (e.g., technical consulting firms, universities, and research centers) to conduct testing and evaluation for some projects. ETP staff present results of ET studies to decision-makers along the process. During the workpaper development process, ETP staff provide ad-hoc support to the engineering team as questions or additional data needs arise.
- **Engineering Staff**: Engineering staff are primarily responsible for developing workpapers, performing quality assurance (QA) and quality control (QC) of custom measures and updating the measure tracking database in the Workpaper Development stage. Engineering staff may coordinate with ETP during ET project design to align their data needs with testing procedures, and they are usually involved in deciding if a measure moves forward in the measure development process.
- **CPUC**: CPUC's Energy Division (ED) conducts numerous activities related to regulating and overseeing the IOUs in California. Activities specific to the ET handoff process primarily occur at the Workpaper Approval stage. They include the following: reviewing custom measures and projects, reviewing fully developed workpapers, and providing dispositions or approvals on reviewed workpapers.
- **Incentive Program Managers:** Program staff are responsible for managing program delivery to IOU customers and integrating new technologies into the portfolio, primarily at the Program-Integration stage. Occasionally, program staff identify potential new measures for ETP to evaluate. They are involved in the decision making if a measure moves forward in the measure development process and in the determination of the next steps if the measure is approved for the incentive programs.
- **Codes & Standards (C&S) Staff** C&S staff conducts advocacy activities to improve building and appliance efficiency regulations to advise the periodic rulemakings conducted by the California Energy Commission (CEC). C&S staff develop and submit Codes and Standards Enhancement (CASE) studies to standards- and code-setting bodies. The C&S team also provides expert testimony at public workshops and hearings, participates in stakeholder meetings, communicates with industry, and conducts a variety of other support activities.
- **Measure Development Management**: Prior evaluations have indicated that it can be useful to have a "champion" who moves the process forward because they desire a measure to be included in the portfolio. IOU staff noted that there is currently no such individual who follows a single technology throughout the measure development process. Instead, all the utilities have a designated group, consisting of representatives from various departments, that manages the measure development process. Its roles include overseeing the measure development process, identifying improvements to

[13] Reports can be accessed at https://www.etcc-ca.com/reports

the process, ensuring key stakeholders are present, and managing project teams working on individual measures. Table 2 presents the team(s) responsible for measure development management at each IOU.

Table 2. Measure Development Management Across IOUs

IOU	Measure Development Management
SCE	New Product Development and Launch (NPD&L)
PG&E	Historically, Product Management initiated a Core Team, which oversaw a new technology through the measure development process. This team will be transitioned to third parties moving forward
SDG&E	Measure Coordination Team
SoCalGas	Project Managers execute the Innovation Now! process

Source: Interviews with IOU staff, UIMD Report

3. Key Findings

This chapter documents the key findings based on the information gained from in-depth interviews and secondary research. Findings from this study can help inform third party implementers as they undertake a greater share of program design and implementation activities historically performed by IOUs. For each of the sections listed below, we presented findings from IOU interviews first, followed by findings from TDA interviews (if applicable), then followed by findings from interviews and secondary research on ETPs in other states.[14] Each section will provide a brief overview of the topic, characterize ETP's role concerning other actors, evaluate the effectiveness of the existing processes by identifying challenges and success factors, and document best practices and/or recommendations provided by interviewees.

- ET Handoff from Technology Developers to ETP
- ET Handoff from ETP to IOUs' Programs
- Interaction with External Stakeholders
- Metrics and Tracking
- Additional Considerations

3.1 ET Handoff from Technology Developers to ETP

This section focuses on the technology handoff between the Idea Generation and Technology Investigation stages outlined in Figure 1. The discussion includes how ETP communicates its technology priorities to the market (e.g., idea generation), the ET intake process (e.g., technology investigation), and associated challenges, recommendations, and best practices from the perspective of interviewed IOUs, TDAs, TD, and external ET entities.

3.1.1 Communicating Technology Priorities to Technology Developers

CA IOUs

CA IOUs primarily rely on informal communication with TDAs and TDs in conferences, workshops, and ad-hoc meetings to communicate their priorities to technology developers. This used to include targeted solicitations, but the related "TRIP" subprogram was discontinued. The CA IOUs are increasingly focused on developing technology priority maps (TPMs) to guide their technology priorities. TPMs are intended to identify high priority areas and minimize duplication of research across IOU program administrators, and, as stated in the business plans of the IOUs responsible for ETP statewide (SW) administration,[15] TPMs developed will identify technologies most suitable for market transformation and determine high-risk technologies. In developing profiles for over 200 technologies to inform TPMs, the IOUs have drawn upon their existing

[14] External entities interviewed include Bonneville Power Administration (BPA), Nicor Gas, and New York State Energy Research and Development Authority (NYSERDA).

[15] SoCalGas business plan can be accessed at https://www.socalgas.com/regulatory/documents/a-17-01-016/SoCalGas_Business_Plan-1.17.17-FINAL.PDF; SCE's 2018-2025 business plan

technology roadmaps that were developed several years ago, sought input from the ETCC Advisory Council, and investigated the following parameters for each technology category in TPMs.[16] Note that not all of these fields are subject to ETP investigation, however initial estimates for some of these fields are considered during ETP project scoping. Technology parameters included in TPMs include:

- Technology category and subcategories
- Current state of the technology
- Marketplace characterization[17]
- Desired end state and timeline to achieve the end state
- Technology milestones and specific ETP interventions to achieve those milestones
- Alignment with statewide goals
- Technical potential
- Collaboration strategy[18]

TPMs will be critical in guiding statewide ET planning efforts and third-party implementation in the upcoming years. TPMs developed by CA IOUs are currently being updated. These roadmaps could be potentially useful tools to communicate ETP priorities to the market, and while they are not currently available to the public, IOUs plan to undergo a public vetting process and potentially share TPMs with third-party implementation bidders in the future. During the interviews, one IOU staff explained that TPMs are meant to guide the internal selection of technologies submitted without excluding technologies that are not covered, and sharing TPMs publicly could bias the technologies that are submitted to ETP. This respondent would like to see what the market naturally offers without potential bias from TPMs, emphasizing that the IOUs are interested in exploring technologies not called out in the TPMs. However, there will need to be a way to ensure that these natural market winners (i.e. technologies submitted to IOUs without the influence of TPMs) provide the level of savings ETP is seeking. In addition, it is unclear how TPMs align with the criteria used for evaluating submitted technologies, if at all. Additional clarity on this item would be provided in third-party solicitations. There is an opportunity for TPMs, if they are made public, to communicate IOU priorities to early-stage R&D efforts such that the technologies being commercialized are better aligned with ETP needs.

TDAs and TDs

Interviewed TDAs and TD noted that they are, for the most part, unaware of the types of technologies IOUs are seeking. TDAs and TD would like to use TPMs to identify products that IOUs need that are not commercially available in the market, as well as to understand the challenges that drive utility technology

[16] Utility Incentives and Natural Refrigerants presentation can be accessed at http://www.atmo.org/presentations/files/5b20df73720ab1528881011LzxcX.pdf

[17] This may include market potential, key actors, and key barriers.

[18] This includes the role that ETP will play in advancing this technology (e.g. leader or collaborator) and high level ETP plans on interacting with stakeholders to move ideas forward

needs and priorities. Interviewed TDAs and TD noted that the usefulness of TPMs depends on their level of detail. They identified the following types of information that would be most useful to include:

- IOU strategic priorities*
- Performance and cost targets*[19]
- Products that IOUs are seeking that do not currently exist in the market*
- Market information*[20] (e.g., market size)
- Best-in-class technologies to improve upon
- Research goal
- Desired applications
- Required features[21]
- Timeline[22]
- IOU's rationale for interest in a certain technology or functionality

*Indicates that this item was mentioned by multiple interviewees

Most of the information that TDAs are seeking were included in the 2017 IOU TPM, with the notable exception of desired applications and market information. Technical potential can be a rough proxy for market size, but its usefulness is limited as it does not consider market barriers.

One TDA strongly recommended making TPMs publicly accessible. If TPMs were publicly available, 6 of the 12 interviewed TDAs stated that they would use TPMs to recommend technologies that better align with utility needs and priorities, minimize duplicative efforts, and inform their research and development work. The TPMs could serve as ETP needs assessments that TDAs could respond to. One TDA believed that TPMs would influence original equipment manufacturers' (OEMs') strategic direction and help them understand how to modify technologies to provide more value to IOUs. This TDA helped connect an OEM with IOUs to align their technology with IOUs' expectations for connectivity and controllability. More of this type of alignment between market actors and IOUs would be expected to occur if TPMs were made publicly available. While most of the TDAs have at least a high-level awareness of TPMS, there was little to no indication from the interviews that IOUs are actively coordinating with TDAs to enhance their understanding of TPM content. One TDA emphasized that TPMs should not only be publicly accessible but also be developed publicly and involve independent advisors (e.g., universities, national labs) since the expectation is that these documents influence how ratepayer funding will be spent on new technologies.

[19] One TDA suggested looking at DOE Funding Opportunity Announcements (FOA) for example performance and cost targets. See Table 3 in the linked document for sample FOAs https://eere-exchange.energy.gov/FileContent.aspx?FileID=39dac4e2-5f53-47ed-9b5a-6fffc2606173

[20] Similar information is captured in other documents, for example the Potential and Goals Study and IOU business plan.

[21] According to IOU business plans, these are potentially included in TPMs.

[22] Examples may include technological readiness level, expected market adoption timing, and expected code adoption timing.

As noted above, half of the interviewed TDAs said TPMs would be useful. However, one TD and two TDAs indicated that they would not significantly alter their technology development priorities or strategic focus based on IOUs' TPMs because they are focused on meeting market and customer needs instead of IOU program-specific needs. In addition, most TDs do not design products specifically for IOU programs.

Three TDAs noted that it can be difficult to find information on ongoing and completed ETP projects. Even though the ETCC website[23] hosts final reports and descriptions for current projects, ETP reports are not always posted immediately after the completion of a project, and it is unclear whether all the ongoing projects have been posted, especially since some utilities have very few or no projects labeled "Active." Five of 12 interviewed TDAs and TD noted that the IOUs should also consider sharing information on customer needs and obtaining customer feedback on ETs (perhaps collected through surveys). This underscores the importance of being able to track technologies that have been deployed to EE programs and adopted by customers in order to understand how these ETs met their expectations. Additional discussion on metrics tracking can be found in Section 3.4.

External Emerging Technology Programs

NYSERDA conducts targeted solicitations to communicate their priorities and obtain proposal ideas, while BPA and Nicor Gas rely on informal communication with vendors and manufacturers they encounter at trade shows, conferences, and other industry events. NYSERDA solicits stakeholder input to develop high-level roadmaps that recommend near-term policy and regulatory and programmatic actions to support the development of an identified energy category (e.g., energy storage, offshore wind). The NYSERDA interviewee notes that these roadmaps are useful for communicating the short- and long-term innovation needs to the technology development ecosystem and informing decision-makers and investors about future technology trajectories. Nicor Gas staff notes that they do not develop technology roadmaps because they do not have enough certainty of specifying exactly which technologies they need. The Nicor Gas website provides access to the reports of technologies that they have tested.

BPA historically developed comprehensive technology roadmaps[24] that not only guided their Office of Technology in developing annual solicitations for EE R&D projects but also guided research occurring in external organizations. BPA jointly managed the roadmap development process with the Northeast Energy Efficiency Alliance, Portland State University Engineering and Technology Management Department, and Electric Power Research Institute (EPRI), and the stakeholder outreach process involving over 100 organizations. These included research organizations, national labs, consulting firms, equipment manufacturers, and vendors. BPA's technology roadmaps spanned several volumes, and while there was useful content, BPA found that it was cumbersome to develop and leverage such lengthy documents.

BPA no longer relies on these roadmaps as heavily and is instead driven by forecasted obligations. BPA forecasts power obligations and existing resources to determine system needs and then optimizes on cost to determine the amount of EE from each end-use needed to fulfill system needs cost-effectively. Using this

[23] ETCC website can be accessed at https://www.etcc-ca.com/reports/search

[24] Technology Innovation Document Archive can be accessed at https://www.bpa.gov/Doing%20Business/TechnologyInnovation/Pages/Technology-Innovation-Document-Archive.aspx?RootFolder=%2FDoing%20Business%2FTechnologyInnovation%2FDocuments%2F2015&FolderCTID=0x012000730DFB666418A74E882572CECFD27E47&View=%7b6F1E6857-8E98-4C4D-BD9B-BF814AEAC5C2%7d

information, BPA's ET team seeks out technologies that best contribute to the savings requirements for each end-use. The interviewee from BPA noted that this transition from roadmaps did not negatively affect operations and effectiveness of program activities. BPA shared a few best practices and lessons gleaned from their experience with road-mapping. They emphasized that technology roadmaps need to be nimble, regularly updated, and streamlined, containing only the information which is essential to support decision-making. The interviewee recommended that IOUs identify technology priorities in-house and outsource ET research, for example, by collaborating with external research entities.

BPA manages a regularly updated database[25] that serves a similar purpose as the ETCC website, providing information about electricity-saving technologies that are commercially available, but not yet in use widely in the Pacific Northwest. For each technology, they provide energy savings estimates, Energy Savings Reliability (ESR),[26] TAG rating,[27] and in-depth assessment results. This makes it significantly easier to scan technologies based on their savings potential and value to the portfolio without having to delve into every report.

3.1.2 Technology Intake Processes

CA IOUs

The ETCC Idea Proposal Form[28] and the SCE Idea Submission Form[29] are official avenues through which the public can submit ideas for consideration by ETP, but the vast majority of TDAs provide their ideas through direct communication with IOU staff. TDAs and TDs without strong personal connections with IOU staff may face challenges in communicating their ideas to IOU staff. Universities, research institutions, and consulting firms, who have existing working relationships with IOUs, generally approach ETP staff with new promising technologies. A few universities help TDs connect with IOU staff and submit their technology to ETP for testing and potential inclusion into incentive programs. Occasionally, IOUs approach universities and research institutions and share their interest in a specific technology. In certain cases, ETP and incentive program staff inform TDAs and TDs of desired use cases and program integration requirements, but this is usually done on an informal basis. Based on responses from ETP interviewees and supplemental information from the UIMD report[9], IOUs evaluate new ideas on the following criteria to determine if an ETP assessment is warranted:

- Energy Savings Potential
- Technical Readiness and Risk
- Value to Customer

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[25] Bonneville Power Administration's (BPA) Energy Efficiency Emerging Technology (E3T) Program database can be accessed at http://e3tnw.org/Home.aspx

[26] ESR rating indicates the status of the technology, ranging from untested to approved measure.

[27] TAG rating is a single, rough rating (from 1 to 5) of a technology by Technology Advisory Group (TAG) members and is used to estimate the overall value of a technology

[28] ETCC Idea Proposal Form can be accessed at https://www.etcc-ca.com/idea-proposal-form

[29] SCE idea form can be accessed at https://sceideas.com/

- Customer Fit
- Program Alignment
- Organizational Capacity (Sufficient internal bandwidth and expertise)
- Costs and Benefits to Utility

ETP interviewees primarily focused on criteria based on the first four bullets. While the last two bullets were mentioned in the UIMD report, interviewees did not call those out specifically.

TDAs and TDs

Several TDAs and TD noted that external actors are not always aware of the ETP project selection criteria. One TDA shared that there have been instances where TDs did not have sufficient technology and commercial maturity required for the ETP program,[30] which led to the termination of studies because products did not work effectively in the field. It needs to be clear to vendors that ET projects are for market-ready technologies and not products that are still in development. Inconsistencies across how IOUs assessed applications were also noted as a challenge. One TDA mentioned that some TDs have received different feedback from different IOUs after submitting their ideas through ETCC, suggesting a need for additional coordination across the IOUs. The TDAs and TD interviewed suggested that IOUs provide as much clarity on the screening and evaluation considerations as possible, for example, by publishing projects that are submitted, projects that are being considered, and data requirements and evaluation criteria up front. Currently, since evaluation criteria are not posted on the ETCC website or IOU websites, applicants are only able to see the requirements and criteria as they complete the application.

In addition to improving visibility into application criteria, one TDA suggested that the IOUs can better align the requirements of the ET intake form with the data needs for program integration. It is important to note that there is a tradeoff between comprehensive application requirements and the usability of the application as a screening tool.

TDAs and TD have expressed concerns about neither having visibility into which step of the intake process a measure is currently in nor a clear timeline on next steps. One TDA shared that there does not seem to be adequate adherence to a formal timeline, noting that some TDs did not receive timely responses to their proposals. ETP's screening process should be timely and transparent not only to the TD but also to the market so that implementers can start considering how the measure may fit into IOU programs. There have been instances where the CEC recommended promising technologies to IOUs that were rejected due to Total Resource Cost Test (TRC) requirements. Still, the evaluation criteria that were used were not shared with the CEC. IOUs may consider providing feedback after reviewing initial applications as NYSERDA found that doing so improves the quality of future applications and provides transparency into the process. There is an opportunity for the IOUs to centralize their online applications, clearly outline the process and expected timeline to applicants, provide timely feedback to applicants, and use a more automated screening process. Moving forward, third-party implementers will need to coordinate closely with IOUs and ETCC to improve the transparency and consistency of the technology intake process.

[30] ETP supports commercially-available technologies that are new-to-market or under-utilized.

External Emerging Technology Programs

The technology intake procedures for the external ET programs interviewed were more formalized than that of the CA IOUs. They tended to have a centralized online application where the criteria for evaluation is specified. Nicor Gas provides a summary of the application process and timeline on their application portal,[31] and they also allow the applicant to review the application questions before beginning the process. NYSERDA's model is unique in that the Innovation Challenges are focused on a very specific technology need, but, like Nicor Gas, they fully disclose their evaluation criteria in the solicitations, and their process to screen applications is very structured, if not more so, than the other interviewed entities. As CA IOUs identify priority areas through TPMs, they can consider adopting an approach similar to NYSERDA's for targeted solicitations. The technology intake processes of each of the external ET program interviewed are described in detail in the following sections.

Table 3 summarizes the technology intake criteria considered by the ETP from each entity interviewed. Note that criteria for the CA IOU column were sourced only from interviews, whereas criteria from the external entities were sourced from both interviews and literature review activities. There are criteria considered by external ETP programs that were not brought up by IOU interviewees (e.g., non-energy benefits), and it could be worthwhile for IOUs to confirm that the criteria currently included providing the best indicators of portfolio success for an ET.

Table 3. Summary of Technology Intake Criteria

Criteria	BPA	Nicor Gas	NYSERDA	CA IOUs
Energy Savings	✓	✓	✓	✓
Non-Energy Benefits	✓	✓	✓	
Market Viability		✓	✓	✓ [a]
Market Barriers			✓	
Technology Readiness and Risk	✓		✓	✓
Portfolio Alignment		✓		✓
Value to Customer	✓			✓
Cost-Effectiveness		✓	✓	
Team Strength			✓	

[a] The only criteria mentioned relating to this was "customer fit."

Source: Interviews, literature review on external entities

BPA

[31] Nicor Gas' application portal can be accessed at http://gasapps.gastechnology.org/webroot/app/etpsurvey/home.aspx

BPA collaborates with regional and national entities and consults a diverse panel of subject matter experts to identify promising new technologies.[32] Ideas can also be offered informally, for example via conversations with technology development actors, or through the Energy Efficiency Emerging Technology (E3T) website.[33] BPA learned from prior experience that extensive initial application requirements made it very time-consuming to sort through all the ideas to find key data points, and they found in-person interaction with technology development actors more effective for obtaining critical information about new technology. This is not to say that formal applications are not valuable; they can be a useful method of collecting idea submissions if designed to obtain the appropriate level of detail from applicants. Of the ideas submitted, BPA prioritizes internal and regional stakeholder requests, followed by those from other organizations and experts.

The technologies will initially be screened by E3T Technical Advisory Groups (TAG) based on the following criteria[34] (in no particular order):

- Energy Savings (per unit)
- Non-Energy Benefits
- Technical Readiness
- Ease of Adoption
- Value to Customer

Nicor *Gas*

The Nicor Gas ETP uses a screening, scoring, and selection system (4S) or as they call it "Ready, Set, Go". Nicor ETP staff found it difficult to publicize their online application portal,[35] but when they meet technology developers at conferences or workshops with technologies Nicor is interested in, they will direct them to complete an application online. This portal serves as a database for submitted ideas and ensures that all necessary information is collected so that all ideas can be fairly evaluated. At the *Ready* stage, the applicant completes a short, 5-minute questionnaire[36] and will either be moved forward into the *Set* stage or receive automatic feedback if their submission does not meet the basic criteria. At the *Set* stage, the applicant completes a more comprehensive application[37] that will be reviewed by Nicor ETP staff using the criteria

[32] BPA Emerging Overview video can be accessed at https://www.youtube.com/watch?v=Pt29gIMtTSo

[33] E3T ET submission form can be accessed at http://e3tnw.org/SubmitNewET.aspx

[34] Additional details on the criteria can be accessed at the TAG meeting slides here http://e3tnw.org/Documents/MF%20TAG%20July%2028%20FINAL%20presentation%20for%20PDF.pdf

[35] Nicor Gas' application portal can be accessed at http://gasapps.gastechnology.org/webroot/app/etpsurvey/home.aspx

[36] Nicor Gas' questionnaire can be accessed at http://gasapps.gastechnology.org/webroot/app/etpsurvey/files/etpreadyv4.pdf

[37] Nicor Gas' data request form can be accessed at http://gasapps.gastechnology.org/webroot/app/etpsurvey/files/etpsetv5.pdf

listed below[38] (in no particular order). Market viability is a critical component of ETP screening, as demonstrated by the fact that three out of the seven screening criteria are in that category:

- Cost-Effectiveness
- Energy Savings Potential
- Value to Portfolio
- Non-Energy Benefits
- Support and distribution within service territory (Market viability)
- Technological maturity (Market viability)
- Ease of implementation (Market viability)

The timeline for follow-up at the *Set* stage is 2-4 weeks after submittal. At the *Go* stage, Nicor ETP staff conducts a more thorough review using additional data sources before recommending a project for Nicor ETP pilot assessment and developing proposed Action Plans. If a project is recommended, the applicant will be notified within 4-8 weeks of submittal, and the Technical Review Committee will make the final endorsement of which applications are selected as pilot assessment projects.

NYSERDA

NYSERDA has two main approaches for soliciting new technologies for short-term product development and demonstration funding, outlined below. The percentage of project costs covered by funding will depend on the commercialization stage (Feasibility, Development, or Demonstration).

- Innovation Challenges: These seek to identify innovative solutions in a specific technology area that deliver energy and GHG savings over those from current commercial offerings found in the US market. These challenges identify opportunities for technology innovation in the area of focus and challenge innovators to develop solutions in those opportunities. Each challenge provides information on the market opportunity, performance requirements, target price point, and expected commercialization timeframe.
- Advanced Clean Energy Exploratory Research Program (ACE Program)[39]**:** This is a funding mechanism for high-impact applied research projects that are not covered under existing Innovation Challenges.

Both the Innovation Challenges and the ACE Program have a two-step application process. Applicants first submit a 4-page Concept Paper to be reviewed by a Scoring Committee. After this first stage, NYSERDA provides feedback and recommendations for future proposals to all applicants, regardless of if they were invited to submit a Full Proposal. NYSERDA invites applicants that submitted Concept Papers that scored above a certain threshold[40] on the evaluation criteria to submit a Full Proposal. After the Full Proposals are

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[38] Nicor Gas Emerging Technology Program Webinar can be accessed at https://www.gti.energy/wp-content/uploads/2018/11/ETP-Intro-Webinar-Illinois-03-14-2013-FINAL.pdf

[39] A sample Advanced Clean Energy (ACE) Program Opportunity Notice (PON) can be accessed at https://portal.nyserda.ny.gov/servlet/servlet.FileDownload?file=00Pt000000ASeCBEA1

[40] The threshold for Innovation Challenges is 65 points, and the threshold for the ACE Program is 85 points.

reviewed, NYSERDA notifies each proposer of their proposal evaluation results, and proposers receiving favorable evaluations may be invited to enter into contract negotiations with NYSERDA to receive funding.

Concept Papers are scored on the following evaluation criteria (in order of importance):

- New York State Impact: Feasible, innovative, and superior to alternatives, and will make significant progress toward solving the identified problem. Consistent with NYSERDA goals and mission.
- Innovation: Proposal is unique, technically sound, and outlines a market-based approach to technology development.
- Competitive Landscape and Market Barriers: Proposal demonstrates an understanding of market landscape and barriers, as well as efforts to engage the market.
- Risks and Challenges: Proposal identifies and prioritizes key technical and commercial challenges.
- Team: Project team has relevant expertise and resources.
- Project Plan: Project plan is feasible, addresses key risks, and outlines a clear path to market.

Full Proposals are scored on the following evaluation criteria (in order of importance):

- Proposed Solution/Scope: Feasible, innovative, and superior to alternatives, and will make significant progress toward solving the identified problem, consistent, consistent with NYSERDA goals and mission.
- Project Benefits: Ability to significantly reduce GHG emissions or energy use, provide economic benefits, and provide non-energy benefits.
- Market Potential: Scalable, well-conceived go-to-market strategy, market demand is demonstrated.
- Project Value: Cost is justified regarding value delivered and proposal outlines plan to pursue additional funding and development support.
- Project Team and Support: The Project team has relevant expertise and has successfully commercialized products or services.

Additional details on each of these criteria can be found in Innovation Challenge Program Opportunity Notices (PON).[41]

3.2 ET Handoff from ETP to IOUs' Programs

This section focuses on the second research objective of investigating the handoff of ETs from ETP to incentive program and to C&S program, including identifying challenges, recommendations, and best practices from the perspective of interviewed IOUs, TDAs, TD, and external ET entities.

3.2.1 ETP Handoff to Incentive Programs

CA IOUs

[41] NextGEN HVAC PON can be accessed at https://portal.nyserda.ny.gov/servlet/servlet.FileDownload?file=00Pt000000I2HX1EAN

Based on interviews with the four IOUs, after the selection of technology through the ET screening process, ETP develops an initial project scoping plan with input from program staff, engineering teams, and other stakeholders. ETP then evaluates the technical performance of the ET and identifies any potential implementation issues. Positive technology evaluations result support the business case for inclusion into the EE incentive portfolio. As part of the Technology Investigation stage, results from technology evaluations are integrated with additional market research to estimate technical measure data (e.g., savings, effective useful life, etc.), measure costs, market acceptance, and the TRC and then presented to a group of stakeholders and/or managers who determine if the technology should move forward in the stage-gated measure development process. If so, it will be developed into a measure for subsequent inclusion into Custom[42], Deemed, or Meter-based programs. Note that only mass-market technologies that have robust data from multiple vendors and whose savings are not highly site-specific will be recommended for a Deemed measure development approach. IOU Engineering group manages workpaper development for measures recommended for the Deemed approach, and ETP provides support as needed during workpaper development.

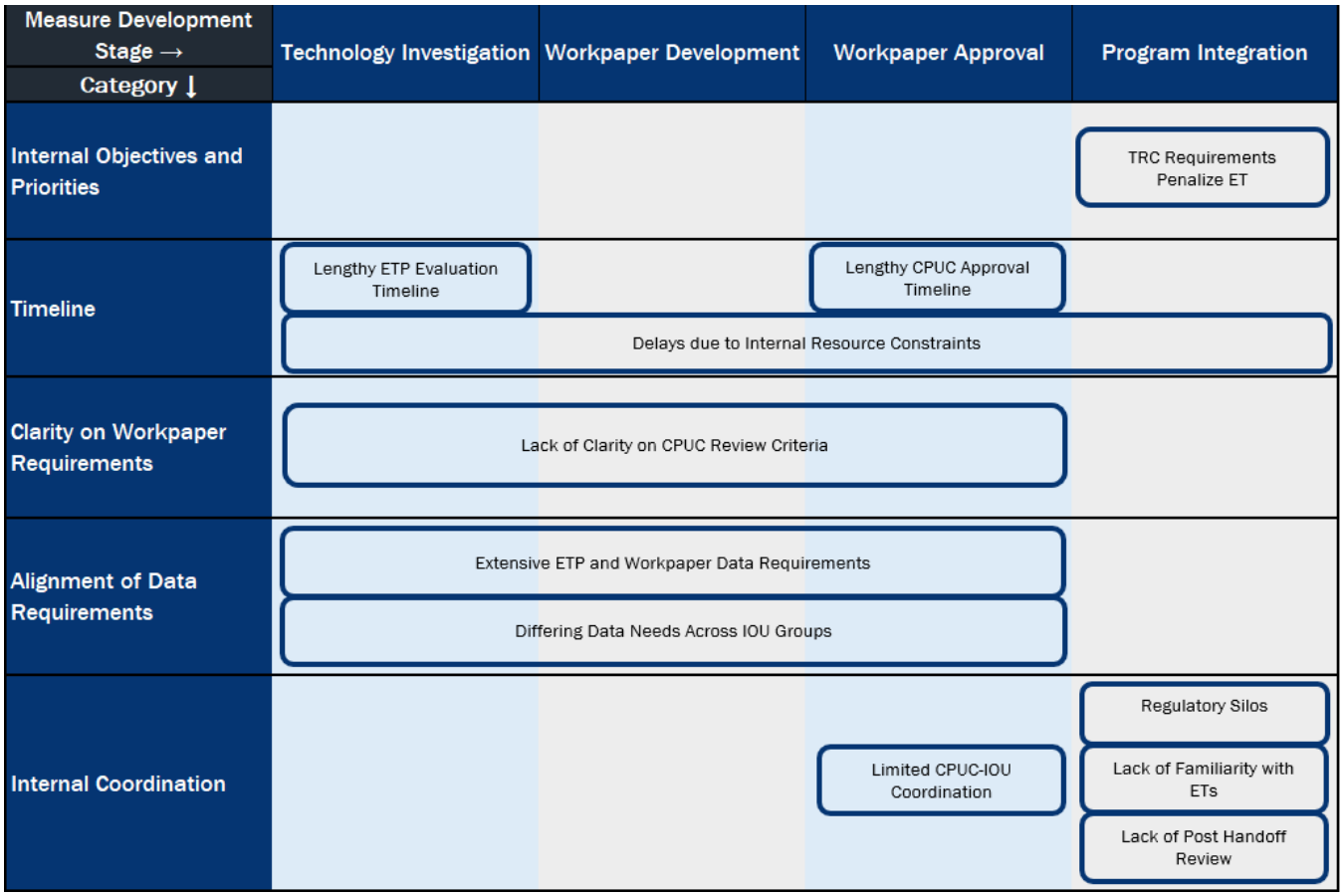
When asked to give an overall score to the ET handoff process, an average score of seven out of ten was given by eight out of the 15 interviewees,[43] indicating that IOU staff were generally satisfied with the process, but they also recognized the potential for improvement. Seven out of the 15 interviewees declined to provide a rating. The following sections discuss various factors that impact the effectiveness and timeliness of handing measures off from ETP into utility programs through the measure development process, and ultimately into the broader market.

Table 4 maps the various stages of the measure development process (presented in Figure 1) to specific challenges identified by interviewees. The table excludes the “Idea Generation” stage since it has been discussed in Section 3.1; this section focuses on handoff activities from ETP to other teams within the utilities.

[42] Custom measures can transition to Deemed measures if the data collected during Custom projects validate the viability of a Deemed approach. This occurs when key data parameters can be obtained, medium to high measure volume is demonstrated, and average savings across all installs is a good approximation for actual site-level savings.

[43] IOU interviewees included ETP staff, Incentive Program staff, C&S staff, and Engineering staff

Table 4. Summary of Challenges Identified by IOUs that Impact the Handoff



Source: Guidehouse analysis

Internal Objectives and Priorities

The IOU and ETP program staff have similar objectives to identify and implement new measures that can provide cost-effective energy savings at scale. Interviewed IOU staff noted that technologies recommended by ETP are generally well aligned with the program objectives. Table 5 outlines the criteria that each IOU team prioritizes. ETP managers tend to focus more on technical performance, while incentive program managers focus more on market conditions and value delivered to the customer.

Table 5. Technology Priorities Across IOU Teams

Technology Priorities	ETP	Incentive Programs	C&S
Provides energy savings	✓	✓	✓
Fits with existing programs	✓	✓	
Applicable to CA market	✓	✓	✓
Cost-effective	✓[a]	✓	✓

Technology Priorities	ETP	Incentive Programs	C&S
Applicable to a broad customer base	✓	✓	✓
Promotes integrated demand-side management (IDSM)		✓	
Smooth installation		✓	
Facilitates EM&V		✓	
Facilitates customer engagement		✓	
Provides recurring savings opportunities		✓	
Demonstrated track record for savings			✓

[a] For ETs, there is no specific cost-effectiveness cut-off.

Source: Interviews with IOU staff

While all IOU teams consider the cost-effectiveness of a technology, interviewees noted that program staff tend to focus more on short-term cost-effectiveness and can be reluctant to offer ETs when their impact on overall portfolio cost-effectiveness is uncertain or negative in the short-term. This puts ET measures at a disadvantage because of higher initial cost and greater perceived performance uncertainty. ETP is forward-looking and identifies technologies that promise long-term savings, but these technologies are not necessarily immediately cost-effective. There is an opportunity to better align short-term cost-effectiveness requirements with long-term savings opportunities. Three interviewees would like to see a framework to introduce ETs to the market and enable IOUs to test and iterate on new offerings without risk of affecting portfolio TRC. Technology Focused Pilots (TFPs), which will identify and address market barriers for high-impact technologies and approaches through collaboration with relevant programs[44], and the Market Transformation (MT) framework are currently under development to address some of these concerns. There is an opportunity for TFPs and MT initiatives to support more flexible and innovative incentive program deployment strategies. The outcomes of these activities should provide clear market strategies for ETs that will be deployed in incentive programs and enable program adjustments in response to market feedback and customer needs, which will support programs in managing the risks associated with uncertainty when deploying new technologies. Additional investigation in the future will be required to understand the effectiveness of TFPs in supporting ET integration into the portfolio, the MT framework, and the market at large.

Timeline

Both IOU and TDA respondents expressed that the timeline for passing measures through to programs tends to be lengthy, which leads to IOU customer frustration and hinders the ability of technology developers to

[44] Description of TFPs sourced from Advice Letter 4011-G/5375-E, which can be accessed at https://www.pge.com/pge_global/common/pdfs/for-our-business-partners/energy-efficiency-solicitations/PGE_Annual_Advice_Letter.pdf

keep up with the rapidly changing market. Delays can occur anywhere in the process, and the following section discusses major factors that affect the timeline in each step.

One factor that impacts the ET technology handoff is the ETP technology investigation timeline, which can often last anywhere from several months to two years. The testing timeline depends on specific technology characteristics and data availability. For example, a weather-sensitive measure (e.g., HVAC) may need to be tested in certain seasons or across multiple seasons, and this leads to a longer project timeline. Data accuracy issues or additional data requests could also increase the timelines for data collection. One IOU respondent commented that there had been a few instances where limited data availability, particularly regarding market outlook and costs, has caused some technologies to be placed on hold in the initial stages of the measure development process. There are also cases where ETP will not recommend technologies with only one vendor, and having to wait for additional vendors to mitigate the supply chain risk of potential insolvency will significantly increase the time it takes for an ET to be recommended for program inclusion.

Internal resource constraints can also delay the process downstream of ETP (i.e., after the technology investigation stage). One program manager noted that external resources could be leveraged to speed up the process (e.g., by assisting with workpaper development) for technologies that have a higher strategic priority, but for other technologies, internal constraints often lead to longer timelines. One interviewee shared that "having a good project manager and getting the right people in the room from the beginning speeds up the process." The "right people" usually include, but are not limited to, the actors outlined in section 2.2.

The handoff timeline also depends on the complexity of the technology and completeness of data provided to the receiving party. Minor updates to existing measures in the Database for Energy Efficient Resources (DEER) can be completed in 2-8 weeks due to the low complexity and limited additional data needs. The workpaper development process can take up to 1-2 months if sufficient data is available. While ETP results are not the only source of data for workpapers, if significant additional data collection and engineering analyses beyond ETP results are required to estimate energy savings, the process can take 3-12 months. After the workpaper is completed, the Engineering team submits it to the CPUC for approval. Many respondents noted that the CPUC review and approval process could be lengthy and take anywhere from 25 days to a year and a half, depending on the level of review, additional data requests, and whether a resubmission is required. For workpapers chosen for review, there is a 15-day preliminary review and a 25-day detailed review timeline, and if the resubmission is required, there will be a 25-day timeline for subsequent review and disposition. Workpapers not selected for review will receive "interim" approval but remain subject to prospective review.[45] The legislation SB 1131 and subsequent Public Utility Code 381.2[46] has recently applied an accelerated timeline for custom measure review, requiring the CPUC to complete project reviews within 30 business days of receiving complete documentation. Workpaper and custom project approvals can occur promptly if only one round of review is required. However, multiple resubmissions can lead to significantly longer timelines. One respondent noted that while CPUC generally manages the workload effectively, past the Ex Ante level, approval/rejection process can be delayed due to

[45] Statewide Deemed Workpaper Rulebook can be accessed at https://static1.squarespace.com/static/53c96e16e4b003bdba4f4fee/t/5c955be0971a1829778b2d51/1553292260908/SW+Deemed+Workpaper+Rulebook_Version+1.0.pdf

[46] SB 1131 and PUC 381.2 amendment can be accessed at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1131

the multiple levels of review required. In addition, program managers cannot start the process of adding a measure into the portfolio until they receive CPUC approval. The inability to conduct their work in parallel with the CPUC further lengthens the timeline.

Another issue that was brought up by an interviewee is that the portfolio-cycle timeline is very tight. Specifically, the Annual Budget Advice Letter (ABAL) deadline is the same day as the DEER resolution, which impacts what measure data can be used in the following year to claim program savings. CPUC staff is aware of this issue and is working to allow IOUs to use preliminary measure data before it gets formally approved.

Clarity on Workpaper Requirements

The level of understanding of workpaper requirements varies by IOU teams. IOU product development and/or engineering staff who are responsible for workpaper development generally have a good understanding of workpaper requirements. However, most of the interviewed ETP and incentive program staff tend to have only a high-level understanding of the requirements. One IOU interviewee noted that regulatory requirements for workpaper development are stringent, and ETP staff might not be aware of all the requirements. While memos and past workpaper dispositions are available for review, the dispositions have not always been consistent, so it is difficult to anticipate the final decision on a workpaper or a Custom measure. Sometimes, CPUC requests additional data during the workpaper review process, so having clearer criteria and data needs for savings and costs upfront would reduce the back-and-forth that occurs during CPUC review. Some ETs are placed in Custom programs to obtain additional data before transitioning to a Deemed measure. However, one IOU respondent from the engineering team mentioned that the requirements for a measure to move from Custom to Deemed are not clear (e.g., What is the length of time that a measure needs to stay in Custom before transitioning to Deemed? How many projects are needed?). They shared that additional guidance resources for Custom processes, especially about industry-standard practices and free ridership, would be useful.

Alignment of Data Requirements

Interviewees also discussed the alignment of the data collected by ETP and the data required for workpaper development. While ETP plays a supporting role during the workpaper development, there are limitations to what kind of data ETP can reasonably collect. ETP projects tend to have small sample sizes and produce results specific to the test site. While ETP results are usually a good starting point, Engineering staff and C&S staff often need to collect additional data when developing workpapers or Codes and Standards Enhancement (CASE) studies. One interviewee commented that ETP has a well-defined list of data requirements and protocols, but it is not clear how these feed into workpaper development. For example, costs collected during ET studies may be too site-specific or outdated by the time they reach Engineering and Program staff. One incentive program manager expressed that CPUC data requirements for calculating energy impacts and incremental costs are more stringent than what is available at the ET investigation stage and that there is an opportunity to better align regulatory expectations with the type of data available from ETP, whose primary priority is to prove technology performance and energy savings. One incentive program manager noted that stringent regulatory requirements for workpaper and “pursuit of perfection on the front-end” hinders the ability of IOUs to offer ETs to their customers more quickly. To address part of this challenge, another interviewee suggested developing additional guiding resources to inform how ET data can best contribute to workpaper development.

Several IOU interviewees noted that ETP could not be expected to collect all the information required by the engineering or program teams. In addition, getting good data or estimates for market conditions and adoption rates for new technology is challenging because ETP might not specialize in that type of research, and program staff might not have enough resources to undertake that research. Without information on market outlook and costs, it is difficult for the incentive program manager to determine a technology's impact on the portfolio cost-effectiveness and include it into programs.

One ETP manager shared that there is a fundamental tradeoff between the comprehensiveness of technology assessments and the number of assessments ETP can conduct in a year. While the ETP operates carefully and often only does one study or project on a new technology, one ETP manager noted that CPUC would like ET assessments to be more comprehensive and involve more sites. The manager shared that conducting an extensive pilot for every technology recommended to the workpaper team would greatly limit the number of technologies ETP is able assess. Furthermore, more extensive studies could extend testing timelines, possibly by years.

Internal Coordination

When asked about rating the level of coordination and communication between incentive program managers and ETP, nine respondents, including a mix of ETP, Incentive, and Engineering staff, gave an average score of 8.1 out of 10, indicating general satisfaction. Generally, program staff are involved in the measure screening process. Still, the level of involvement differs across IOUs, as does the regularity of communication across ETP and programs, as summarized in Table 6.

Table 6. Coordination Strategies between ETP and Incentive Program across IOUs

Utility	Coordination Strategies (ETP and Incentive Programs)
SoCalGas	▪ ETP holds monthly meetings that primarily function as an ET staff meeting where the team discusses promising ETs, associated issues, next steps, and deadlines. Staff from engineering services, incentive program, marketing, and the process team are invited to attend ▪ Program managers are involved in deciding whether new technologies move forward through the various measure development stages
PG&E	▪ ETP and program managers do not have regular meetings, but meet on an ad-hoc basis when needed ▪ ETP worked closely with Product Managers, who historically managed the measure development process. This role has been transitioned to the workpaper team. ▪ Program managers are involved in deciding whether new technologies warrant ETP investigation
SCE	▪ Program managers at SCE communicate with ETP staff informally on a weekly or ad-hoc basis, and they coordinate with ETP during kickoff meetings, midstream check-in meetings, and at the end of an ETP project to discuss results and data needs for programs ▪ Program managers are not as involved during ETP technology selection, however, "Fit with existing programs"[a] is a decision-making criterion
SDG&E	▪ ETP team meets regularly with incentive program managers and C&S teams since they all sit in the same group

Utility	Coordination Strategies (ETP and Incentive Programs)
	▪ The measure development team ("Project Team") consists of staff from incentive programs, engineering, EM&V, and policy, and they coordinate to assign tasks and vet technologies identified by ETP

[a] As outlined in the UIMD Report which can be accessed at http://www.calmac.org/publications/SCE_Final_UIMD_Report.pdf

Source: Interviews with IOU staff, UIMD Report

While IOU staff are generally relatively satisfied with ETP-incentive program coordination, some program managers have mentioned that coordination can be improved by having regularly scheduled meetings with ETP, which would help mitigate issues that arise when certain teams withdraw from communications when they get busy with other work. Another interviewee recommended developing a live dashboard that tracks the status of all ET projects, which would increase transparency into ETP work, streamline project update meetings, and facilitate coordination between ETP and other IOU teams.

Internal coordination across various actors in the measure development process seems to be most effective when there is a designated group overseeing the entire process and identifying opportunities for improvement, as well as when ETP, C&S, and program staff are on the same team. For example, after the formation of the Measure Coordination Team at SDG&E, the IOU has been able to minimize data discrepancies that could impact savings claims, streamline claims reporting, and regularly identify improvements needed to enhance the measure coordination process. One ETP manager emphasized the importance of obtaining input from program teams at the beginning of the process, which would enable efficient use of time and resources in researching technologies that programs would be most interested in. ETP staff noted that check-ins with program staff occur prior to and throughout ET evaluations, however, the incentive program staff interviewed tended to be more involved at the end of ET evaluations during knowledge transfer. The evaluation team recommends ETP SW administrators to ensure that coordination throughout the entire ET evaluation occurs consistently and continues to do so under a third-party implementation framework.

One IOU staff pointed out that there are opportunities to improve the coordination of EE and Demand Response (DR) ET programs, especially for measures with joint EE-DR benefits. While there have been discussions with the CPUC, different regulatory proceedings for EE, DR, and distributed generation (DG) programs have created funding silos that hinder coordination of IDSM projects and customer incentives.

Several respondents have identified coordination between IOUs and CPUC as a current challenge. A few IOUs recognized recent improvements in CPUC-IOU coordination mainly due to new consultants to the CPUC who have been more responsive in sharing information about the issues and timelines related to workpaper decisions. One IOU Engineering team tries to involve the CPUC early in the measure development process to better align data collection with CPUC needs but noted that there is a still need for closer coordination with the CPUC.

Other Concerns Related to Internal Coordination

Respondents noted that after an ET has transitioned to an incentive program or C&S program, staff do not hold debriefing meetings to review how well the handoff process occurred. The IOUs might consider conducting post-handoff reviews of successful as well as rejected ET projects to learn from challenges, draw lessons on best practices, and apply them to future projects.

IOU ETP respondents shared that measures previously rejected by ETP can be revisited, but that is done so rarely and that there is no official process. They noted that internal resource constraints have limited their ability to revisit rejected technologies. Measures can be revisited when evaluation criteria change, costs decline, manufacturers present ETP with a similar technology, or when program advisors request ETP to do so. Measures that were rejected due to significant market adoption barriers (e.g., inadequate distribution, high incremental costs) are usually not revisited.

TDAs and TDs

While TDs primarily interact with ETP via the technology intake process discussed in section 3.1.1, TDAs work with various internal IOU groups throughout the measure development process, and they have an external perspective on the efficacy of the handoff.

The interviewed TD also recognized the long timelines as a challenge to effective measure handoff, noting that the measure development timeline is often too slow in a market where products and customer needs change rapidly. One TDA shared that the long measure development timeline is a major barrier to working with IOUs. Another TDA noted that "customers who are excited about a certain technology have to wait years before a program is in place." While installations for ET field projects may only take a few days, completing paperwork and coordinating across vendors, site management, subcontractors, and other parties, demonstration agreement, and site selection can take 2-3 months. An interviewee noted that because field testing is time-consuming and resource-intensive, it might not be appropriate for all technologies being evaluated.

TDAs provided various suggestions to accelerate the timeline. One is to limit the field demonstration agreements to one page to minimize delays preceding installation and commissioning. Two respondents suggested collecting less data (e.g. using the 80/20 rule) and relaxing rigid data requirements (e.g. accepting wider error bounds around estimated savings) to minimize delays caused by pursuing small marginal gains in accuracy. Another respondent noted that ETP primarily focuses on field tests and that there are opportunities to leverage modeling, lab tests, previous ET studies, and local market research more heavily as part of the upfront measure screening before conducting lengthy and resource-intensive field tests. IOUs can also consider “fast-tracking” measures with built-in measurement and verification (M&V). A few interviewees suggested IOUs mesh workpaper development more tightly with ETP projects. For example, if an ETP project looks promising, then workpaper and program development could start while the ET project is still ongoing. One TDA pointed out that the opportunity costs of delaying program rollout may be higher than costs incurred to start workpaper and program development during the ET process.

Despite their limited visibility into the IOU measure development process, several TDAs felt that the process was too complex and not coordinated well internally. The interviewees identified opportunities to improve communication between ETP, incentive programs, contractors around analysis methodology, criteria, and evaluation processes. One TDA noted that peer-reviewing M&V plans could improve internal IOU coordination before field tests, which would ensure that the data collected during the test is valuable to stakeholders downstream in the measure development process. Another TDA also noted each “handoff” from one team to another led to a loss in information and recommended reducing the number of handoffs as much as possible. One technology developer mentioned that program staff are sometimes uncertain about how to claim savings and how the new technology fits into existing programs. This suggests there are opportunities for incentive programs to obtain complete information from ETP to enable smooth integration of ETs into

new or existing programs, as well as to proactively collaborate with CPUC and stakeholders to develop savings methodologies for innovative technologies that have no precedent.

External Emerging Technology Programs

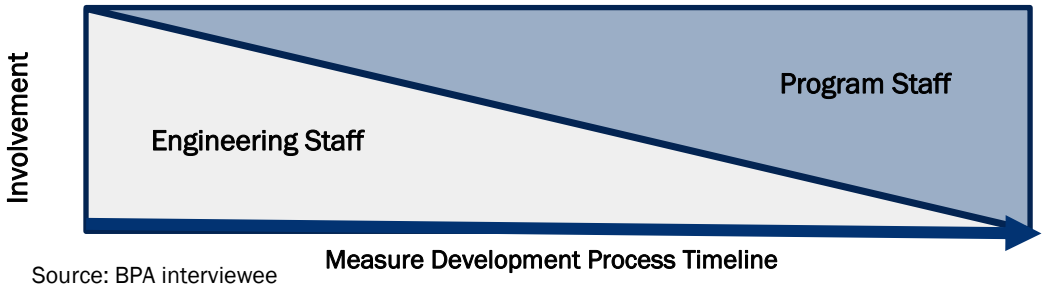
ETP managers from the external entities interviewed noted that each stage of testing, measure development, and regulatory approval can take up to a year and that the process is very nonlinear. The interviewed external entities noted that the entire timeline from ET testing to program inclusion could take 1.5-3 years. Nicor Gas interviewees also noted that for new technologies, developing training programs for contractors and having to iterate on the product until it is market-ready will cause delays to the timeline. BPA commented that the regulatory approval process could be time-consuming and cause delays in measure handoff.

However, there are also opportunities to speed up the measure development timeline. Nicor Gas noted that the testing timeline is very technology-dependent and can range from a few months to several years. Technologies that need to be tested in a specific season or require iterative engineering improvements will take longer to move through the handoff process. One strategy used by Nicor Gas to quickly identify whether a technology is worth pursuing is first to do a back-of-the-envelope market viability calculation using the number of applicable customers to estimate the number of potential adopters for the product's target segment. This exercise ensures ratepayer funds are not used to conduct lengthy and expensive field tests on technologies targeted at a very small segment of the population. If a technology is too large or expensive to test in-house, Nicor Gas contacts, other utilities to obtain data. Additional strategies to reduce the measure development timeline include using approved measures from other states to develop workpapers, developing business plans collaboratively, and collaborating with other utilities to support manufacturers seeking to bring a given technology to scale. Nicor Gas emphasized that it is important to have a good understanding of the market and leverage points that it is well-positioned to influence.

The representatives from these external entities also shared factors that compromise the efficiency of handoff. Issues arise when there is a lack of a clear understanding of priorities across the teams, when engineering does not closely coordinate with programs, and when there is a lack of effective collaboration platforms and tools. In the Northwest, engineers and planners noted that the fact that "they have to do ET on top of their day job" makes it difficult to prioritize ET. Another challenge is that program staff are too occupied with managing existing programs to be able to conduct forward-looking program strategy work, so it is important to have dedicated staff taking on that responsibility.

The primary success factors that contribute to effective technology handoff was regular collaboration and communication. Two of the interviewees explained that their process relies less upon passing data or measures across teams and more on a slow transition involving continuous collaboration via cross-functional groups, as illustrated in Figure 3. Initially, the engineering team conducts most of the screening and testing activities. As the measure moves through the pipeline, program teams gradually assume more of the responsibility of moving it through the measure development process and integrating it into a program.

Figure 3. Measure Transition Process



Source: BPA interviewee

The team on the front-end of the handoff process needs to be accountable to the team on the receiving end, and the receiving team needs to have resources to implement the measure. The priorities of all the teams involved need to be clear and aligned, and this alignment can be supported by regular meetings or via collaboratively developed priority roadmaps.

At BPA and NYSERDA, the program team is involved in the screening and scoring process, and they confirm that the technology being evaluated aligns with the program need. As part of the handoff process, the engineering staff at BPA and Nicor Gas make recommendations to program staff regarding what kind of program design and deployment strategy will work best for the technology. Nicor Gas noted that their ET team educates and updates the Operations team, implementation contractors, and marketing team, and, if budget permits, a program transition plan is developed collaboratively. Depending on budget availability, they also develop a transition plan into programs. One interviewee commented that NYSERDA's culture fosters collaboration at all levels, from the executive team to department heads to project managers, and this supports the timeliness and effectiveness of the technology handoff processes.

Not only is internal coordination important, but coordination with external actors is also critical to avoid duplication of work and non-optimal usage of resources. To ensure that their resources are spent most appropriately, NYSERDA evaluates whether other organizations are already driving innovation on an ET and if their contribution will have a meaningful incremental impact in that area. For example, they do not focus on HVAC refrigerants because a lot of work is already occurring at a national level, nor do they focus on LED lighting because the market has already been transformed over the past several years.

Market Transformation

Of the external entities interviewed, BPA and Nicor Gas engage in MT activities. BPA achieves market transformation by providing funding to the Northwest Energy Efficiency Alliance (NEEA), which develops and delivers programs that capture savings associated with market transformation in the regions served by its funding utility members. NEEA also predicts market transformation savings to inform BPA's savings forecasts.[47] Because MT initiatives are not internal, BPA does not have a formalized handoff process from ETP to MT. Instead, incentive program staff hold strategy discussions with NEEA.

Historically at Nicor Gas, few technologies were passed from ETP into Deemed programs, especially if the incremental costs were very high. The market transformation initiative, defined by the Illinois Technical Resource Manual (TRM) as "the strategic process of intervening in a market to create lasting change that

[47] BPA EE Action Plan and savings forecasts can be accessed at https://www.bpa.gov/EE/Policy/EEPlan/Documents/2016-2021_BPA_EE_Action_Plan.pdf

results in the accelerated adoption of energy-efficient products, services, and practices," helps new technologies bridge the gap between ET and Operations by focusing on industry training, moving programs upstream, and identifying building codes opportunities.[48] Examples of questions considered by Nicor Gas' MT are listed below:[49]

- What are the barriers that prevent market adoption?
  - Do contractors know this product?
  - How is it different from the current product(s) in the market?
  - Are there additional educational needs?
- What activities/interventions will catalyze market change?
- What are the measurable market outcomes for these activities?
- What should the final state of the market look like?

Resource Innovations supports Nicor Gas' MT initiatives, and directors from Nicor Gas' ETP and energy efficiency program are also involved. MT initiatives "overlay" an MT lens onto existing or new programs by analyzing the current adoption characteristics, identifying market barriers and target markets, and tracking market progress. A protocol has recently been established in the Illinois TRM v8.0[50] to claim savings from MT. Nicor Gas also cofounded the Midwest Market Transformation Collaborative (MW MTC), is a forum that facilitates knowledge-sharing across utilities and MT experts (e.g., Resource Innovations, GTI, Midwest Energy Efficiency Alliance (MEEA), NEEA), facilitates resource pooling, and supports the development of MT initiatives and best practices. In 2019, the MW MTC hosted multiple meetings and continued to deliver legacy programs.[51]

Nicor Gas noted that products with non-energy benefits (NEB), in addition to energy savings, are most successful in MT programs. They also noted that if regulators and evaluators started to value NEB benefits, adoption of these new technologies could be accelerated, and their TRCs increased.

3.2.2 ETP Handoff to Codes and Standards

CA IOUs

[48] Stakeholder Advisory Group (SAG) 3/11/2019 MT Savings Working Group meeting notes can be accessed at https://s3.amazonaws.com/ilsag/SAG_MT_Savings_Working_Group_3-11-19_Meeting_Attendees_and_Notes_Final.pdf. Additional resources by this working group is available at https://www.ilsag.info/mt_savings_working_group/

[49] The list of questions considered by MT is sourced from interviews with Nicor Gas representatives and the Update on Nicor Gas MT Activities, which can be accessed at https://s3.amazonaws.com/ilsag/SAG_Meeting_Nicor_Gas_MT_PPT_Panel-Overlay_Workshop_Slides_11-7-2018.pdf

[50] Attachment C to IL-TRM Version 8.0: Framework for Counting Market Transformation Savings in Illinois can be accessed at https://s3.amazonaws.com/ilsag/MT_Savings_Paper_Final_08-23-2019.pdf

[51] Midwest Market Transformation Collaborative (MW MTC): Update presentation can be accessed at https://s3.amazonaws.com/ilsag/Midwest_MT_Collaborative_SAG_MT_Working_Group_Update_11-20-19_Final.pdf

C&S staff at the IOUs have been responsible for conducting advocacy activities to improve building and appliance efficiency regulations and advise the periodic rulemakings conducted by CEC, and moving forward, this role will be taken on by third-party implementers. The C&S team also provides expert testimony at public workshops and hearings, participates in stakeholder meetings, communicates with industry, and conducts a variety of other support activities. C&S staff develop and submit Codes and Standards Enhancement (CASE) studies to standards- and code-setting bodies. As shown in Table 5, C&S is more focused on factors that indicate the technology is ready to become the "new normal," i.e., standard practice.

Currently, there is no official 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, the current framework does not lend itself to linear handoff. C&S teams tend to work more closely with incentive program staff, and this coordination was rated an average of 7.25 out of 10[52] by three respondents. Interactions between ETP and C&S tend to be informal, where, instead of interacting through a linear handoff process, the teams at some IOUs collaborate during the development of ETP reports and CASE studies. One ETP manager noted that it does not make sense to conduct ET studies on technologies expected to be integrated into code in the near future because of the long timelines (one year for study, one year for measure development). The C&S team at one utility noted that obtaining data from ETP is a very "ad-hoc process" and that they generally "do not find a lot of useful data from ETP reports." One reason is because C&S seeks data that is beyond the scope of ETP projects, such as the level of market acceptance, costs of statewide implementation, costs relative to existing technologies, and feasibility for code integration. Another discrepancy is that ETP projects tend to focus on individual widgets, but the C&S team is more interested in the entire package of technologies that work together. Furthermore, C&S proposals require greater sample sizes, greater levels of statistical significance, or different methodologies than what is provided in ETP projects. If data is inadequate, the C&S team will develop additional data using CEC methodologies.

Not only are there fundamental differences in data requirements for ETP and C&S, the timelines are also not well-coordinated; there have been instances where ETP reports were not released in time to be used in C&S rulemaking. One interviewee pointed out that there are similarities between workpapers and C&S proposals and that there are opportunities for additional alignment, and they recommended mapping C&S measures with the technologies being considered by ETP to identify potential synergies in data requirements and timelines.

Several respondents have observed a lack of coordination between the ETP and C&S teams within utilities, though the level of coordination varies across utilities. Only four respondents felt comfortable providing a rating, which averaged to a seven out of ten and is the lowest score across all coordination categories.[53] ETP staff at SCE and SDG&E are fairly satisfied with the level of ETP-C&S coordination, but PG&E staff have been less satisfied. At PG&E, the C&S team first identifies the Department of Energy (DOE) and CEC rulemaking direction, then reaches out to ETP or checks the ETCC website to obtain data on relevant measures. At SCE, one interviewee explained that the Engineering Services team houses both C&S and ETP, which facilitates collaboration between the two groups. Generally, the C&S team at SCE considers retired EE measures for C&S advocacy, but it also collaborates with ETP on projects (e.g., ZNE) and test methods, reviews ET

[52] Two individuals provided high ratings, while one individual provided a significantly lower rating.

[53] Interviewees were asked to provide a rating on the coordination level between ETP—Incentive Programs, Incentive Programs—C&S, and ETP—C&S.

roadmaps, and participates in the technology intake process by providing their perspectives on technologies relevant to C&S. At SCE, the same subject matter expert that is working on the ETP project often supports a CASE study in similar areas. At both SCE and SoCalGas, C&S and ET have historically jointly funded projects and field tests, some of which were then developed into workpapers, but this framework is expected to change under the new statewide administration structure discussed in more detail in section 3.5.1. Ensuring that existing collaboration activities continue, promoting additional coordination, and aligning coordination efforts across IOUs would enable the C&S team to send promising ideas they receive from technology developers that are not yet code-ready to ETP for additional testing and data collection. In addition, since technologies that are not cost-effective in an incentive program could be cost-effective in code, improving coordination between ETP and C&S teams could provide an avenue for technologies that fall into this category.

External Emerging Technology Programs

None of the interviewed external ETPs have formalized processes to bring ETs to C&S. BPA does not do so because codes occur at the state legislature level. Nicor Gas noted that the ET program indirectly accelerates the adoption of efficient technologies into code.

3.3 Interaction with External Stakeholders

This section summarizes the interactions of CA IOUs with TDAs and TDs, presents challenges and recommendations noted by TDAs, and outlines how other entities interact with external stakeholders. Note that findings related to the handoff between TDs and ETP (i.e. intake processes and interactions) are discussed in section 3.1.

3.3.1 Summary of Interactions with TDAs and TDs

CA IOUs, TDAs and TDs

TDAs and TDs have different motives for engaging with IOUs. TDs engage because they benefit from the support that IOUs provide to address technical and market challenges for their technologies. TDAs, such as universities, consulting firms, and research entities, support IOU research and evaluation efforts because ETP's mission aligns with the type of work they focus on.

TDAs and TDs currently engage with IOUs through multiple channels. Generally, TDAs and TDs connect with IOU staff at conferences and energy summits, as well as through joint project work. Research institutions and consulting firms recommend promising technologies to ETP,[54] assist with ET testing and EM&V, support workpaper development, and interface with technology vendors. These organizations may be involved in all or some activities in an ET project, which include scope development, vendor coordination, product installation, technology evaluation, data gathering, report writing, and results presentation. For example, ETP occasionally outsources research projects to university engineering departments to address specific research questions and inform manufacturers. In other instances, ETP conducts technology testing at university facilities. Some TDAs work directly with TDs to guide them through the ETP process and provide

[54] Additional discussion on this step is presented in section 3.1.

them constructive feedback based on ETP evaluation results, which can then lead to a revaluation by IOUs. Occasionally, TDs help with installation and customer recruitment, but additional involvement by these organizations in ET studies is not recommended because it could lead to biased results. When asked about opportunities for additional involvement from TDAs, IOUs did not mention specific aspects that they needed additional resources for, however, they noted that existing external collaborations have been beneficial and that they are open to additional collaboration from TDAs.

In addition to collaborating on ETP projects, TDAs and IOUs interact to share knowledge. The CEC meets with utilities approximately once every three months at ETCC meetings, where both CEC and IOUs share information on projects. IOUs obtain technology and market data from lab tests, field tests, and literature reviews conducted by manufacturers and research organizations. IOUs have noted that while they occasionally engage with EPRI, CEC, research universities, and Lawrence Berkeley National Laboratory (LBNL), these groups tend to work with products that are too early stage to be useful to ETP. Research institutions and independent utility partner organizations (e.g., ETCC, California Technical Forum (CalTF), California Plug Load Research Center (CalPlug), Consortium for Energy Efficiency (CEE)) facilitate collaboration and knowledge-sharing between IOUs and external organizations by providing platforms and resources, hosting conferences, and organizing regular meetings.

External Emerging Technology Programs

All three external ETPs collaborate with other organizations for technology testing and data sharing. Nicor Gas shares ET ideas and results with the Midwest Market Transformation Collaborative and Midwest Energy Efficiency Alliance (MEEA), and they collaborate with other utilities like ComEd and SoCalGas on technology pilots.

Nicor Gas draws on NEEA expertise as they consider undertaking a market transformation program for Condensing Rooftop Units (CRTUs). Interviewees noted that coordinating market transformation programs between the Midwest and Northwest is expected to lead to greater leverage with manufacturers and portfolio building owners and more opportunities for cost-sharing.[55]

BPA partners with regional and national stakeholders (e.g., other utilities, research organizations, and consulting firms) to advance technologies through the following activities:[56]

- ET Field Tests
- Baseline Research
- Technology Innovation Research and Development Solicitation

BPA's Energy Efficiency Emerging Technology (E3T) team and NEEA are leading the Pacific Northwest's efforts to coordinate regional ET research, clarify common needs and facilitate cost sharing. The organizations involved in this regional collaboration include the ETCC, EPRI, NEEA, and Consortium for

[55] Natural Gas Advisory Committee Meeting Packet can be accessed at https://neea.org/img/documents/Q2-May-2019-NGAC-Meeting-Packet.pdf

[56] Additional information on collaboration opportunities can be accessed at https://www.bpa.gov/EE/Technology/EE-emerging-technologies/Pages/Collaboration%20Opportunities.aspx

Energy Efficiency (CEE).[57] BPA also advises and prioritizes technology research with the US DOE, national labs, CEE, EPRI, and others to advance the Northwest's agenda for ET.[58]

NYSERDA collaborates with local New York State utilities, federal programs, and offices (e.g., Advanced Research Projects Agency-Energy, or ARPA-E, and U.S. DOE Building Technologies Office, or BTO), national labs, and NY universities. Local utilities may ask for more information on certain technologies, and NYSERDA can help with research and demonstrations.

3.3.2 Success Factors and Challenges

Table 7 summarizes factors that enable successful interaction between ETP teams and external collaborators, as well as challenges that can impact this interaction.

Table 7. Summary of Success Factors and Challenges Related to Engagement with External Stakeholders.

Entity	Success Factors	Challenges
TDAs	▪ Strong personal connections with IOU staff facilitate project engagement ▪ ETP provides resources otherwise unavailable to technology developers	▪ Lack of visibility into internal IOU processes, priorities, and activities ▪ High barrier to entry for organizations without personal connections with IOU staff ▪ Smaller technology developers struggle with an iterative, lengthy evaluation process ▪ Redundant testing activities across multiple jurisdictions ▪ Processes and requirements place small organizations with limited resources at a disadvantage
External ETPs	▪ Recognize and leverage the strengths of collaborators ▪ Consistent communication minimizes redundancies ▪ Have coordinating groups to facilitate interactions across multiple organizations	Interviewees did not share any challenges pertaining to interaction with external collaborators

TDAs and TDs

When asked about their experience communicating with IOUs, four TDAs shared that they had good personal connections with IOU staff and had minimal issues with communication. Those that had feedback shared

[57] BPA EE Action Plan can be accessed at https://www.bpa.gov/EE/Policy/EEPlan/Documents/2016-2021_BPA_EE_Action_Plan.pdf

[58] BPA EE Action Plan can be accessed at https://www.bpa.gov/EE/Policy/EEPlan/Documents/2016-2021_BPA_EE_Action_Plan.pdf

positive experiences, sharing that they were "impressed by the professionalism of the staff at IOUs and CPUC" and that they had great personal relationships. However, this dependency on personal connections is a risk for TDAs. One TDA who works closely with a few ETP staff shared a concern about IOUs staff turn-over because the success of their work is highly dependent on personal connections to specific individuals.

TDAs were also asked to comment on how effectively ETP helps to address the major challenges associated with bringing ETs to the market. Three TDA respondents mentioned that ETP effectively addresses technology assessment and some market acceptance challenges. The verification of energy efficiency performance of ETs is a time-consuming and resource-intensive process and is especially challenging for smaller technology developers. ETP addresses this challenge by providing support with independent testing and evaluation, market assessments, funding for research projects, and networking and potential partnership opportunities. Despite this support, smaller companies and startups find it challenging to undergo a lengthy, iterative technology testing process due to their internal resource and capital constraints. Another TDA noted that TDs often lack the resources to conduct market research and acquire customers, which is another barrier to market adoption. TDAs have noticed that IOU support helps to indirectly alleviate market barriers via programs, which increase market adoption, signal to manufacturers to develop more efficient products and provide credibility to vendors. In addition, some ET reports provide market assessments that may include savings potential, product landscape, or customer surveys. However, a fourth of the respondents noted that ETP does not support product or business development and marketing for early-stage ideas, and neither do they help manufacturers identify how to make a product more cost-effective. These activities are out of ETP's scope and may be supported in the future through MT efforts.

The most commonly cited challenges by TDAs and TD are related to a lack of transparency, which encompasses low visibility into the internal IOU processes, priorities, and timelines. IOU programs. The ETP project selection process and criteria can also be opaque to external actors, and this challenge was discussed more in-depth in section 3.1. Key themes raised by TDAs and TD relating to a lack of transparency are outlined below:

- Low awareness on the type of support IOUs are seeking: TDAs interested in providing support to IOUs struggle with understanding IOUs project needs and noted that IOUs often are not aware of which companies can assist with ETP project activities. Several TDAs have indicated a decline in project engagement with IOUs in the last few years, and a few have had to restructure their businesses to cope with the inconsistent project pipeline from ETP. One respondent recommended IOUs develop ways to better connect IOU needs with external expertise, for example, by hosting fairs or posting project assistance needs online, which will enable IOUs to collaborate with TDAs that have subject matter expertise that the IOUs may not have.
- Lack of clarity on ETP scope: The scope of technologies considered by ETP is unclear to some TDAs and TDs, potentially leading to overlapping work by entities that also fund technology research. TDAs that worked closely with ETP on technology investigations have a good understanding of scope, but organizations that fund technology research and are not as involved in ETP projects have less clarity.
- Lack of clarity on the measure development process: Not all TDs have a clear understanding of the measure development process after a technology goes through ETP. TDAs also noted that there is a lack of follow-up from IOUs after ideas are submitted, which makes it very discouraging for TDs to engage with IOUs and exacerbates the confusion about the measure development process. While IOUs noted that they regularly revisit the process to make improvements, TDs find the changes in the process confusing and not well-communicated. The organizations that do have a robust

understanding of the internal IOU process have typically been involved in IOU projects for a long period of time and have provided support at various steps of the measure development process. These organizations can guide TDs who may not be as intimately familiar with the process, but not all TDs have the benefit of working with these organizations.

- Lack of transparency in CPUC workpaper approval process and criteria: Even for TDAs with extensive experience working in the measure development process, there is little visibility into the CPUC workpaper approval process criteria. If the lack of transparency into IOU ETP project and workpaper approval criteria was resolved, CEC staff expressed a willingness to consider modifying Electric Program Investment Charge (EPIC) solicitation language and scope of work to provide data that better aligns with workpaper requirements when doing so would not add significant costs and when the technology readiness level is suitable. This would help ensure that research activities between CEC and IOUs are complementary and accelerate the handoff timeline. It would be worthwhile to investigate opportunities to align data collected from externally funded research activities with data requirements associated with measure development.
- Low transparency into ETP project activities: Various respondents noted that it could be difficult to find information on ongoing and completed ETP projects. Even though the ETCC website hosts final reports and descriptions for current projects, ETP reports are not always posted immediately after the completion of a project, and it is unclear whether all the ongoing projects have been posted, especially since some utilities have very few or no projects labeled "Active." CEC staff involved in ETCC commented that IOUs tend only to share completed projects, and CEC would like more transparency into ongoing projects funded by ETP and by IOU EPIC budgets in order to ensure that their research efforts are complementary.
- Low transparency into project outcomes and metrics: TDAs requested that IOUs provide more transparency on project outcomes and metrics used to evaluate ETP. Moving forward, annual reporting on business plan metrics will provide better transparency on ET activities. Further discussion of these metrics is in section 3.4. An open question remains as to whether these metrics will sufficiently enable TDs' and TDAs' understanding ETP outcomes to inform collaboration and research coordination efforts, or if an additional level of granularity will be required, for example, at the individual project level.

While most of the concerns brought up in TD and TDA interviews were about the low transparency into IOU processes and priorities, there are a few additional challenges brought up that are worth mentioning. Two TDAs remarked on the lack of timeliness in the contracting process, which can take up to 6-8 months, a timeframe that is very challenging for smaller technology developers. One TDA believes that the contracting delays may be a result of low staff engagement and recommended that the IOUs educate staff who support billing and contracting about the importance of their work in meeting state policy goals and promoting sustainability. One TDA shared that it can be frustrating for technology developers to have to repeat ET projects in different utility regions and/or states due to differing requirements. They suggested minimizing redundant testing activities by allowing OEMs to extrapolate results from one project in a certain territory to other ET projects. Another TDA expressed frustration with how the process inherently puts small organizations at a disadvantage: there is a high barrier to entry if an organization does not have personal relations with ETP staff, contracting requirements impose unreasonable standards on what kinds of

organizations can obtain a Master Services Agreement, and, while this has not been known to happen, the payment frequency, as one respondent put it, “can drive a small business into bankruptcy".[59]

IOUs have not sought feedback from TDAs that support ET projects and/or other aspects of the measure development process regarding their interactions with IOUs, but several TDAs interviewed remarked that they would be willing to share feedback if asked to. There is an opportunity to implement a system to obtain feedback from external actors and further improve the process.

External Emerging Technology Programs

To external entities, collaborations are critical to success in ETP efforts. BPA explained that extensive collaboration is a key success factor because it reduces duplication of efforts, enables cost-sharing, and frees up resources for other priorities. They shared that engaging in these collaborations has also accelerated the assessment and transfer of promising technologies to energy efficiency programs and/or to the broader market, as well as increased their confidence in the technology recommendations that they make to energy efficiency programs. To maximize the value of these collaborations, each organization should be aware of the resources available through their partners and leverage the strengths of other organizations. For example, BPA rarely engages in midstream interventions and relies on others to do so, but BPA has end-use customers and assists DOE and labs with customer acquisition. It is critical to consistently communicate about the ongoing work to minimize redundancies across organizations, and it is useful to have coordinating groups like the Regional Emerging Technology Advisory Committee (RETAC) and NEEA to facilitate these interactions. There is an opportunity for CA IOUs to adopt best practices identified by these entities to ensure that all external stakeholders have a good understanding of ETP priorities and activities, that similar research across the state, not just within ETP but also across various research entities, is not duplicated, and that cost-sharing is leveraged when possible.

3.4 Metrics and Tracking

This section summarizes how organizations measure and track the success of their ET efforts.

CA IOUs

When asked about how the effectiveness[60] of the technology handoff process is measured, IOU interviewees generally referred to CPUC metrics and the quarterly ETP database that tracks ET project status. When asked about how or if hand-off related metrics are tracked (e.g. the tracking metrics mentioned in Appendix K of SCE’s business plan[61]), IOU respondents shared that these are not consistently tracked and readily accessible. Due to the historical lack of tracked metrics evaluating handoff effectiveness, SoCalGas’s ETP group have been using the number of ETP technologies reviewed through the CPUC ex ante review process

[59] This comment applies to all IOUs, but the interviewee noted that this was especially a challenge with SCE because of the 90-day payment frequency.

[60] Effectiveness is defined as how well promising ETs are moved through the intake and measure development processes and how well unsuccessful ETs are screened out.

[61] Appendix K of SCE’s business plan lists tracking metrics and can be accessed at https://4930400d-24b5-474c-9a16-0109dd2d06d3.filesusr.com/ugd/0c9650_8bd1cb09da8d472cbe8be45675f36525.pdf

as a proxy metric. However, several new metrics are now required by the CPUC, and as such, ETP programs will begin to track them formally when ED evaluation contractors finalize the baseline, methodology, and targets. The new metrics required by the Commission are listed in Appendix E of this report and Appendix A of Decision 18-05-041.[62] The required metrics cover the following:

- TPMs*
- Project activities*
- Technology-focused pilots*
- ET conversion to measures**
- Savings from technologies originated from ETP**
- Project submissions**.

*ETP-M metrics

**ETP-T metrics

ETP-M (ETP-M1 through ETP-M7[62]) metrics measure activities that are directly under ETP's control and ETP-T metrics, referred to as "tracking metrics" (ETP-T1 through ETP-T8[62]), measure the prevalence of ETP-associated measures and savings in the portfolio, though it is important to note that after a technology leaves the ETP program, the performance of that technology is influenced by a myriad of outside factors and cannot be attributed directly to ETP.

Since several of these metrics are fairly new, not all interviewees outside of ETP are aware of the metrics that are or will be tracked by ETP. There is an opportunity to ensure that all key actors throughout the handoff process have a clear understanding of the metrics, for example by involving these actors in discussions regarding metrics reporting and clearly communicating the list of tracked metrics to these actors.

Tracking ETP performance is important, but IOU staff reported challenges with previous metrics as well as the new metrics shown in Appendix E. While the goal of ETP is to identify technologies that would contribute cost-effective, reliable savings to the EE portfolio, IOU respondents noted that it is "as important" for ETP to screen *out* technologies that would not deliver sufficient savings. However, there are currently no metrics that quantify ETP's ability to eliminate potentially unsuitable technologies. Another challenge with respect to metric development, according to IOU interviewees, is that metrics that are highly dependent on external factors are not representative of ETP effectiveness. For example, the number of technologies transferred into the IOU portfolio is not completely representative of handoff effectiveness because these metrics depend on the number of new products in the market that are ready for ETP assessment, a factor outside of ETP's control. Three IOU respondents indicated that there is a limited number of new technologies, especially in the gas sector, which limits the amount of ET projects that can be done in a year. Interviewees also noted that the lag time for savings and cost-effectiveness impacts of ETs to appear in the portfolio, which can sometimes be up to 5-10 years, as well as the inability to attribute impacts to ETP completely, further complicate the tracking of handoff effectiveness.

[62] D.18-05-041 and Attachment A can be accessed at http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M215/K706/215706139.PDF

Despite these challenges, there is still value in developing metrics for handoff-specific activities as doing so can provide transparency into each step of the process, identify issues early on, and track progress towards implementing improvements, such as the recommendations from this study. In addition, Decision 18-05-041 states that "PAs may, and should, design and track additional metrics" in their annual reports. When developing new tracking and goal metrics, PAs can reference the list below, which consists of metrics that are not officially tracked and were mentioned by interviewees or identified by the evaluation team.

- Percentage of recommended by ETP that are handed off to IOU programs. Several respondents estimated that approximately 50% recommended ETs are subsequently included in incentive or Codes & Standards programs,
- Percentage of ETs recommended for workpaper development. Two interviewees estimated that only 10-20% of ET projects are recommended for workpaper development. An interviewee shared that workpapers do not explicitly note if a technology came from ETP. However, they will reference an ETP report if one was used, so it is not necessarily straightforward to link workpapers to ETP projects.
- Number of technologies screened out by ETP. This metric captures ETP activity that did not result in a measure being created.
- Percentage of measures originating in ETP with savings claimed. This metric recognizes that ETP technologies that are successfully handed off into the portfolio (incentive programs or MT initiatives) may still face market barriers that prevent savings from materializing, and it is important to monitor the magnitude of this challenge. Ideally, with the implementation of MT efforts, this metric would increase as ETP-originated measures that would have struggled in the portfolio would be able to claim savings within the MT framework.
- Ratio of savings achieved by technologies that originated in ETP as a percentage of portfolio savings relative to ETP budget as a percentage of portfolio budget. One IOU respondent estimated the savings percentage at 4% and the ETP budget at 1-2% of the portfolio, and they used the ratio of these two values as a proxy for the cost-effectiveness of ETP.
- Metrics related to the handoff effectiveness and/or level of coordination between ETP and C&S

The ongoing Emerging Technology to Portfolio Evaluation Study (ETP-2), which is part of the Energy Efficiency Program Evaluation of the Group B Sectors effort,[63] is, in part, establishing processes to support the tracking of key performance metrics like the ones specified in IOU business plans and mentioned above. ETP-2 is evaluating current and potential tracking mechanisms, and its objective is to assess the historical and continual impact of ETP on the PA EE portfolio's energy savings. Specifically, the evaluation tracks the number and associated savings of measures that originated in ETP before moving into the incentive portfolio. To achieve this objective, the ETP-2 study established the following research activities:

- Evaluate the market uptake (defined as the number of measures rebated) and achieved savings of all technologies and approaches that have moved from ETP into the EE Portfolio or directly into C&S since 2010;

[63] Program Evaluation Research Workplan can be accessed at https://pda.energydataweb.com/#!/documents/2109/view

- Establish a framework for tracking the ETP-originated energy efficiency measures that enter the PAs' portfolios as they are implemented as deemed or custom energy efficiency measures on an ongoing basis; and
- Develop a final report that includes results from the historical evaluation and produces recommendations for portfolio database specification changes or other pertinent tracking mechanisms, where relevant.

Once the final ETP-2 report has been reviewed by the CPUC and other interested stakeholders and eventually approved by the CPUC, a more reliable framework of methods and data can be assessed through the appropriate Project Coordination Group (PCG) and eventually codified by the CPUC and used going forward in tracking these key ETP performance metrics.

External Emerging Technology Programs

Table 8 outlines the types of metrics tracked by each of the external ETPs. This table shows that there are metrics tracked by external ETP groups that CA IOUs can consider including, namely those related to ETP expenditures, customer satisfaction with ETs, and market adoption of ETs.

Table 8. Metrics Tracked by External ETPs and CA IOUs

Metric	Description	Nicor Gas[64]	BPA	NYSERDA	CA IOUs
Project Volume	Number of applications and/or technologies evaluated by ETP	✓	✓	✓	✓
Savings[65]	Program savings from technologies that originated in ETP	✓	✓	✓	✓[66]
Expenditures	ETP spending		✓	✓	✓
Technologies Transferred	Number and/or percentage of technologies in programs that originated in ETP	✓	✓	✓	✓[67]
PA Satisfaction	How satisfied incentive program staff are with new measures		✓		
Market Adoption	Level of market adoption for technology			✓	

[64] A comprehensive list of metrics can be found on table 3-1 in Nicor Gas Plan Year 2 Emerging Technology Evaluation Report, which can be accessed at https://energy.mo.gov/sites/energy/files/nicor-gas-gpy2-etp-emv-report-2013-10-22-final.pdf

[65] The feedback loop from savings and ETP performance was not discussed, however this would be a valuable future investigation effort.

[66] Historically estimated, will be measured moving forward.

[67] To be tracked moving forward.

Source: Interviews with external ETPs, NYSERDA T&MD Semi-annual Report. Report can be accessed at https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/NYSERDA/TMD-report-2017jun.pdf

Nicor Gas tracks various metrics, many of which are related to the number of technologies that pass through each stage of their measure development process, but they do not set an annual target. The rationale is that these metrics are highly dependent on a factor that is out of the utility's control, specifically the number of new products available in the market that are ready for ETP to assess. Nicor Gas keeps a list of screened-out technologies and the reason for rejection, and they consider screening out technologies to be an indicator of success. There may be an opportunity for CA to do the same. BPA tracks their metrics internally, and NYSERDA is required to report metrics on entities that receive funding. NYSERDA also tracks performance milestones relative to targets for every program year.

3.5 Additional Considerations

3.5.1 Third-Party Implementation

This section includes brief discussions around third-party implementation framework, including IOUs concerns/ recommendations regarding upcoming third-party implementation framework in CA, particularly in the context of ETs. It also includes Nicor Gas experience and recommendations related to their third-party implementation of ETP and MT program.

CA IOUs

Decision 16-08-019 required the IOUs to outsource at least 60% of their portfolios to third parties. The outsourcing of ETP design and implementation to a third-party implementation is expected to be completed by Q1 2021 In response, ETP will transition to a statewide program, with SCE as the electric statewide lead and SoCalGas as the gas statewide lead. For ETP, each IOU will contribute funding and communicate priorities to the lead IOU and their third-party implementer, who will then determine how to allocate the funds among research activities best. According to the CPUC, this structural change will not significantly alter the implementation of ETP in practice, as the IOUs have historically coordinated with each other very closely on ETP activities. However, instead of technology priority documents specific to an individual utility, statewide TPMs will be developed to guide the program. Several IOU respondents expressed uncertainty regarding the transition process and its impact on the handoff process. At the moment, it is not clear to IOUs how third-party ETP implementers will interface with existing internal ETP staff and what the roles of various actors will be.

Even though third parties will be implementing an increasingly large portion of the EE portfolio, the IOUs are still accountable for the performance of those programs to the CPUC, so IOUs must provide clear requirements on reporting, tracking, and data parameters to the third parties. While third-party programs will likely be structured differently from existing IOU programs, one interviewee noted that it would be essential for IOUs to share lessons learned (e.g., from process evaluations) with the third-party implementers to ensure a smooth transition and more effective implementation. Efforts will also be needed to ensure that the data produced by ETP implementers is aligned with the data needs of other IOU program implementers, emphasizing the importance of close coordination between the two groups in the initial technology evaluation stage.

One respondent expressed concern regarding the transition to a statewide framework, noting that such a transition can create additional challenges with collaboration between ETP and C&S. As mentioned in section 3.2.2, ETP and C&S at SCE have jointly funded ETP projects and this interviewee articulated that coordinating funding from PG&E, the C&S statewide lead, to the new ETP implementers to continue to fund projects jointly will be "a big challenge if not a barrier."

External Emerging Technology Programs

Nicor Gas is the only entity interviewed with a third-party implementer, and they noted that seamless customer engagement is a key success factor. Since the initiation of Nicor Gas' ETP in 2011, the Gas Technology Institute (GTI) has been its third-party implementer. GTI provides the technical and engineering expertise to screen technologies and manage pilots. The Nicor Gas ETP team works closely with GTI staff. GTI engages customers under the Nicor Gas brand (e.g. GTI carries Nicor Gas business cards and wear Nicor Gas uniforms when interacting with customers), which ensures a consistent vision and customer experience.

Nicor Gas uses several performance indicators to track the performance of third-party implementers:

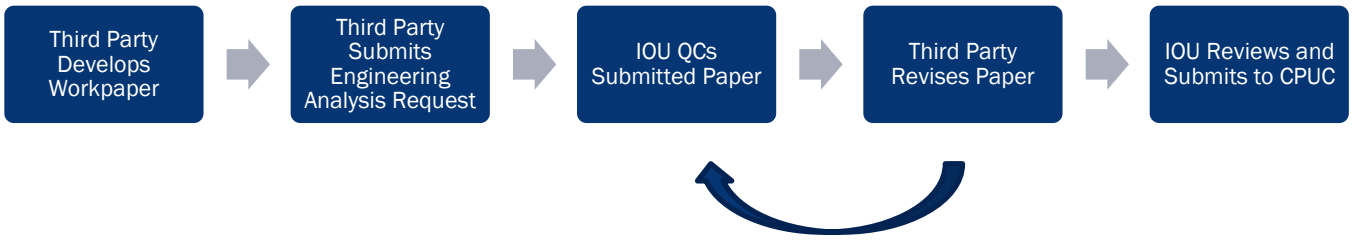
- Customer satisfaction: This is the most important metric and is assessed through customer satisfaction surveys
- Quality of work: Assess whether the third-party implementer is completing tasks according to the scope of work
- Quality of data: Assess whether any re-work needs to be done after the data is shared.
- Savings achieved
- Participation achieved
- Timeliness: Assesses whether the third-party implementer delivers their work on time.

Neither NYSERDA nor BPA's ETP groups work with third-party implementers. However, the market development team at NYSERDA contracts with third-party implementers to manage incentive paperwork and applications. They also work with contractors that manage marketing, outreach, and education for new technologies. As CA moves towards a third-party implementation framework, it will be critical to consider the best practices identified by these external entities.

3.5.2 Third-Party Workpapers

Workpaper Development is an important step in the measure development process for Deemed measures, and any changes to the framework will impact handoff effectiveness. Historically, workpapers were developed by IOU engineering teams, however, independent third parties are now allowed to develop workpapers and submit them via an IOU for CPUC review. As this is a relatively recent development, this portion of the evaluation assesses the perspectives of IOUs and TDAs on the process and the direction of this decision. Figure 4 illustrates the current process that independent third parties go through to submit a workpaper.

Figure 4. Current Process for Third-Party Workpapers



Source: Interviews with IOU staff

Interviewees were asked about whether third-party workpapers should continue to be allowed moving forward, and if so, what the optimal submission process would look like (i.e., how to provide quality control and if submissions directly to the CPUC should be allowed).

CA IOUs

The IOU staff interviewed were generally amenable to allowing third-party workpapers if the requirements are well-defined. The Statewide Deemed Workpaper Rulebook (2019),[68] developed jointly by the IOUs, is the main avenue by which these requirements are communicated. IOU Interviewees unanimously agreed that third parties should continue to submit workpapers to an IOU or a joint-IOU panel before submitting to CPUC because the process currently requires a significant amount of manual review and discussion. Submitting to IOUs first can minimize bias and allow for an extra quality control step. Several respondents noted that it might be challenging for the CPUC to take in workpapers from additional sources given their existing resource limitations. Still, in the future, there may be an opportunity to develop mechanisms to allow direct submissions of third-party workpapers to the CPUC.

As more third-party- driven workpapers are submitted, IOU staff shared that they will need additional clarity on the level of QC required from them, as well as who will be ultimately accountable for the accuracy of the workpaper (i.e. third parties or the host IOU). Third parties that submit workpapers are not required to bid on a program offering,[69] and one IOU respondent pointed out that there is limited value to workpapers that are developed and approved by the CPUC but are not implemented with a program, so there needs to be a method to prioritize workpapers for measures that are or will be offered in a program.

TDAs and TDs

Most TDAs and TDs interviewed felt that third-party workpapers should continue to be allowed because IOUs do not necessarily have sufficient resources and the in-house expertise on certain topics. Continuing to allow third-party workpapers would help ensure that ratepayer-beneficial technologies are not overlooked. TDAs also stated that in some cases, the third parties have much better data (often from field results) to refine measure parameters. One respondent who had a differing opinion believed that to ensure alignment

[68] Statewide Deemed Workpaper Rulebook can be accessed at https://static1.squarespace.com/static/53c96e16e4b003bdba4f4fee/t/5c955be0971a1829778b2d51/1553292260908/SW+Deemed+Workpaper+Rulebook_Version+1.0.pdf

[69] 2018 Third-Party Workpaper Development Process FAQ can be accessed at https://www.pepma-ca.com/Public/PublicEvents.aspx?f=t6S1qsQCXG%2f4vw4UiMqg2oPPp%2b8Oj0qUrdrNUBgkTyheT4NICwkoNHUHDYO5oiMI290%2f8RsgYWo%3d

between measure development and energy efficiency goals, workpaper development should be internal to the IOUs and not involve third parties. In addition, they noted that third-party submission to the CPUC might not necessarily speed up the workpaper development and approval process.

Four TDAs are already involved in or expressed interest in submitting workpapers and/or supporting IOU workpaper development. CEC staff are willing to consider submitting workpapers based on EPIC research projects, however their level of interest in doing so depends on the level of effort and type of information required. If they had more clarity into the resource intensity and data requirements for developing workpapers, CEC noted that it is possible to direct all EPIC projects to hire independent consultants to develop workpapers. One TDA who is not affiliated with a certain product stated that they would only be interested in submitting one if they will receive compensation and if doing so will reduce the time needed to integrate a measure into a program. Allowing TDAs to be compensated for submitting workpapers can be considered in the future. Some TDAs were not interested in developing workpapers due to concerns over the appearance of bias (i.e., endorsing certain products and not others) and taking on additional legal responsibility by doing so. However, there is interest from independent organizations (e.g., universities) in assisting the CPUC in evaluating workpaper submissions and verifying claimed savings and performance. Most respondents agreed that third parties should submit workpapers to an IOU instead of submitting to CPUC directly because IOUs can provide QA/QC and ameliorate CPUC staff constraints. Another respondent expressed that third parties should be allowed to submit directly to CPUC because there may be technologies that do not align with IOUs business model that would be excluded from the process. There have been several measures that third parties would like to update; however, utilities have not moved forward on these because they are prioritizing workpapers and workpaper enhancements for their internal product and program managers. This observation was touched upon by the IOUs and brought up the question of how IOUs and the CPUC should prioritize workpapers in a way that supports third-party workpapers.

When asked about the QA/QC process, some interviewees believed that IOUs should be responsible for quality control of the workpapers, while others recommended independent third-party verification, conducting testing only in certified labs, or leveraging the California Technical Forum (Cal TF) or CEC for QC support. One TDA emphasized that the QA/QC process should leverage the data dictionary and QA/QC guidelines developed by Cal TF, and they recommended that all workpaper developers undergo training on how to develop high-quality workpapers. They proposed a process whereby third parties would submit draft measures and workpaper ideas not to any individual IOU or to the CPUC directly, but rather to a central site, which would then be reviewed by a joint “Measure Review Committee” comprised of all staff from the IOUs, Cal TF, and other independent parties (e.g., labs, universities, CEC, etc.). These organizations have expressed an interest in providing third-party evaluation or verification of workpapers. If the measure passes the “Measure Review Committee” screening, it could then either be developed by the third party or sponsored and developed by an IOU. IOUs, according to this TDA, have indicated they may be willing to fund the development of a measure proposed by third parties.

4. Recommendations

Based on the evaluation activities conducted in this study, the evaluation team makes the following recommendations to enhance the effectiveness of the ET handoff process.

- **Recommendation 1: Leverage TFPs and MT to enable more flexibility in incentive program deployment to promote innovative ETs.** The existing processes and requirements for incentive programs hinder IOUs' flexibility in deploying innovative technologies with higher risk profiles. CPUC staff indicated that TFPs and the new MT framework are intended to address this challenge. ETP and MT administrators should ensure that TFPs and MT initiatives, both of which will be developed by third-party implementers, are designed to support more flexible and innovative incentive program deployment strategies, for example, by being tailored to specific technologies' strengths and weaknesses and reflecting market conditions. The outcomes of these activities should provide clear market strategies for ETs that will be deployed in incentive programs and enable program adjustments in response to market feedback and customer needs, which will support programs in managing the risks associated with uncertainty when deploying new technologies. [Section 3.2.1]
- **Recommendation 2: Ensure close coordination internally and with the CPUC.** IOU staff, particularly ETP administrators, must ensure close coordination between ETP implementers, engineering staff, C&S, incentive program implementers, and the CPUC ex ante team, especially during and after the transition to third-party implementation. IOUs should share lessons learned and historical challenges with third-party implementers.
  - As observed by those working in external ET programs, the handoff between ETP and incentive programs is most effective when it functions more like a gradual transition. Internal coordination across various actors in the measure development process seems to be most effective when there is a designated group overseeing the entire process and identifying opportunities for improvement, as well as when ETP, C&S, and program staff are on the same team. ETP administrators should ensure that incentive program implementers and ETP implementers coordinate on data needs prior to conducting ETP evaluations, for example by peer-reviewing M&V plans before field tests to ensure that the data collected during the test is valuable to stakeholders downstream in the measure development process. [Section 3.2.1]
  - ETP administrators and CPUC ex ante staff should coordinate closely to clarify and align documentation requirements and expectations on the level of data rigor, especially given that ETP projects produce site-specific data. This discussion should also clarify the role of ETP in informing workpaper development, particularly since there are data rigor requirements during workpaper development stages that ETP is not currently well-suited to meet. This coordination will improve alignment between data development capabilities and CPUC's measure approval criteria, which will reduce the number of iterations during the approval process and mitigate delays in this stage. [Section 3.2.1]
  - ETP administrators should ensure that all key actors involved in the handoff process, such as such as ETP implementers, incentive program implementers, engineering staff, and C&S staff, have a clear understanding of the metrics being tracked. For example, this could be achieved by involving these actors in discussions regarding metrics reporting and clearly communicating the list of tracked metrics to these actors. [Section 3.4]

- ETP and C&S implementers and administrators (SCG and SCE for ETP; PG&E for C&S) should identify potential synergies in priorities, data requirements, and timelines between C&S and ETP by mapping C&S measures with the technologies being considered by ETP. This will enable C&S to leverage results from ETP studies, as well as provide an avenue for C&S to recommend technologies that are not yet code-ready for ETP consideration. [Section 3.2.2]

- **Recommendation 3: Provide additional transparency to technology developers and technology development actors.** External actors seek additional transparency into the ETP priorities, the technology intake process, and the measure development process. ETP administrators might consider several activities to address this gap:
  - To support intake, ETP administrators should provide clear technology eligibility requirements (e.g., including the expected level of technological and commercial maturity) and an expected timeline for follow-up. Consider centralizing online applications used for intake and implementing an automated pre-screening process. [Section 3.1.2 and Section 3.3.2]
  - As technologies move through the process, ETP administrators should ensure that technology developers are aware of which step of the technology intake and measure development processes their technology is in. [Section 3.3.2]
  - ETP administrators should provide stakeholders with greater visibility into the needs and priorities regarding new technologies, technologies that ETP is currently considering, and technologies ETP is actively assessing. For example, ETP administrators should consider making TPMs publicly available to communicate their technology priorities. This would improve the relevancy of ET applications to ETP and minimize duplicative efforts externally. [Section 3.1.1 and Section 3.3.2]
  - To increase the quality of future applications, ETP administrators and implementers should provide feedback to applicants either through automated feedback during the pre-screening process or via debrief meetings. [Section 3.1.2 and Section 3.3.2]
  - IOUs and CPUC staff, especially those involved in ETCC, should identify potential synergies in data requirements between external research activities (e.g., the EPIC program) and data needs within the IOUs' measure development process to minimize duplicative research by ETP, optimize the use of resources and accelerate the handoff timeline. [Section 3.3.2]
- **Recommendation 4: Ensure that metrics track the effectiveness of the handoff process.** ETP administrators should ensure that the new ETP metrics are formally tracked once the ED finalizes the calculation methodology, as well as consider additional metrics specific to the handoff process to include as goal or tracking metrics. A list of metrics that can be used as a starting point for this development can be found in Section 3.4. The Emerging Technology to Portfolio Evaluation Study (ETP-2) will identify possible gaps in ETP tracking and additional metrics that could inform future related efforts. Adopting handoff-specific metrics will support PAs in tracking improvements in the recommended areas and identify issues early on. [Section 3.4]
- **Other considerations** (though not formal recommendations) as a result of our findings are listed below:
  - ETP administrators and implementers might consider conducting post-handoff reviews of successful as well as rejected ET projects to learn from challenges, draw lessons on best practices, and apply them to future projects. ETP administrators might also consider

implementing a system to obtain feedback from external actors and further improve the process based on this feedback loop. This has not been done in the past, but TDAs would be willing to share feedback if they had the opportunity to. [Section 3.3.2]

- CPUC staff involved in MT activities could consider coordinating MT initiatives regionally, valuing NEBs, and potentially including NEBs in workpaper cost-effectiveness calculations. These activities can improve the attractiveness of ETs to utilities and customers and accelerate adoption. [Section 3.2.1]
- To minimize delays in the measure development process, IOU staff involved in the measure development process could consider "fast-tracking" technologies with built-in measurement and verification and limiting the field demonstration agreements to one page. [Section 3.2.1]
- CPUC ex ante team could consider allowing workpapers to be based on projects or approved measures from other territories, as well as accepting wider error bounds around estimated savings to minimize delays caused by pursuing small marginal gains in accuracy. [Section 3.2.1]
- ETP administrators could consider implementing a live dashboard that tracks the status of all ET projects to increase transparency into ETP work, streamline project update meetings, and facilitate coordination between ETP and other IOU teams. [Section 3.2.1]
- IOUs should consider having third-party implementers engage with customers under the IOU brand, as this has been shown to facilitate a seamless customer experience in other territories. [Section 3.5.1]

Appendix A. Interview Guide for IOU Staff

Overview

This discussion guide will be used to interview IOU staff to understand their perspectives on the emerging technology (ET) handoff process, including successes and challenges. In this study, the term "handoff" is defined as transitioning the ETP technologies from "market-ready" into full-fledged programs and/or into relevant codes and standards processes. IOU staff who will be interviewed for this study include Emerging Technology Program (ETP) Program Managers (PMs), Incentive or Energy Efficiency Program PMs, Codes & Standards (C&S) PMs, and Subject Matter Experts (SMEs) including product development staff.

Key objectives of the interview include:

- Providing a better understanding of the existing processes for passing technologies, approaches, and projects between ETP, the IOU ET Incentive Portfolio, Codes and Standards, technology development actors (TDA) such as CEC, CalSEED, CalPlug, the four CA technology clusters, and external markets.
- Making recommendations primarily for the ETP, but also for other groups, to allow process improvements in the broader California technology development ecosystem.

The interview guide will also review emerging technology project opportunities beyond ETP (e.g., EPIC and third-party workpapers) to identify process streamlining opportunities.

Table 9 summarizes the proposed interview respondents, target number of interview completes and no. of interview questions by each respondent; Table 10 outlines the research objectives and associated questions. The interview will take about 45 mins to one hour to complete.

Table 9. IOU Interview Respondents

Qualified Respondent [a]	Target Number of Completes	Number of questions in the interview guide
IOU ETP PMs	4	30
IOU Incentive PMs	4-7	32
IOU Codes & Standards PMs	4-7	19
Relevant IOU SME and/or product development staff	4-7	28

[a] IOU ETP PMs provided the list of IOU staff who can speak to the process of developing and passing emerging technologies to IOUs incentive program and/or codes and standards program.

Table 10. Research Objectives and Questions

Topic Area	Research Objective	Questions
A: Introduction	Understand interviewee's role and activities in context of ETP program	1-2
B: Process Overview	Understand ET handoff process, drivers and barriers	3-12

Topic Area	Research Objective	Questions
C: Workpaper Development and Data	Understand workpaper development process, data requirements and resources	13-20
D: Review of recommended and rejected ETs	Understand review process of recommended as well as rejected ETs	21-24
E: Communication and Coordination	Understand communication and coordination among IOU staff and with external stakeholders	25
F: Metrics	Understand metrics used for tracking ET handoff process and feedback loop	26-27
G: TDA contacts	Understand engagement with TDs/TDs; obtain/ confirm TDAs contacts who have worked closely with IOUs on ETs	28-30
H: Closing	Wrap up the interview and give opportunity to interviewee to share any issues/concerns that were not discussed	31

Interview Guide

Table 11. IOU Interviewee Information

Information	
Name	
Title	
Contact Phone	
Contact Email	
Today's Date & Time	
Other Attendees, if any:	
Notes	

Interview introduction

Guidehouse has been engaged by CPUC to understand the existing process and identify streamlining opportunities for passing emerging technologies between ETP, incentive programs, codes and standards, technology development actors (such as EPIC, CalSEED, CalPlug, the four CA technology clusters) and external markets.

We are currently in the process of conducting interviews with IOU staff to collect feedback with the goal of identifying opportunities to improve the effectiveness of this handoff process. We are interested in asking you questions about your experience with the ET handoff process, so that we can better understand any successes and challenges and identify any opportunities to streamline existing processes and your working relationship with involved stakeholders to move emerging technologies both effectively and at an increased rate into the market. In this study, the term "handoff" is defined as transitioning "market-ready" emerging technologies (ET) into incentive programs and/or into relevant codes and standards program.

On behalf of CPUC, we thank you for agreeing to spend this time with us.

Section A: Introduction

[ASK ALL]

1. What is your position and role at [UTILITY] as it relates to the Emerging Technologies (ET) development or transition to IOU programs?

[ASK ALL]

2. Which other departments within [UTILITY] do you collaborate with for developing or passing new measures/ technologies to the portfolio or to the market?

Section B: Process Overview

[ASK ETP PM, INCENTIVE PM AND SME]

3. We understand that utilities have a formal process with well-defined stages/gates for measure screening and workpaper development. Could you please briefly describe the process or confirm if the process as laid out in the 2015 study of the California Utility Internal Measure Development (UIMD), is in practice?
    a. On a scale of 0 to 10, with 0 being 'not working at all' and 10 being 'working extremely well,' how well is the process working?
    b. What aspects are working well, and what can be improved?
    c. How do you document/track the progress and performance of individual ETs through each process gate, if at all? Is it shared with other stakeholders involved?

[ASK ALL]

4. What factors can accelerate or delay the handoff process. i.e., the process of passing ETs to your program?

[ASK ETP PM]

5. Do you involve Incentive PMs in the early stages of ET assessment/development prior to handoff? If so, how?

[ASK C&S PM]

6. What is the process for bringing ETs to Codes & Standards program?
    a. Who manages this process?

b. What are the typical sources of ETs that transition to Codes & Standards program? (probe for ETP, Incentive program, EPIC, any external sources?

c. On a scale of 0 to 10, with 0 being 'not working at all' and 10 being 'working extremely well,' how well is the process working?

d. What aspects are working well, and what can be improved?

[ASK ALL]

7. Is there a designated Project or Product Manager (PM) who follows a technology through the entire handoff process? Please share their name and contact information.

[ASK ETP PM, INCENTIVE PM AND C&S PM]

8. What are your objectives for including ET into your program [based on the interviewee include program name - ETP/ EE incentives/ C&S]?

   a. Are technologies recommendations for inclusion in your program well aligned with your objectives (e.g., long-term saving goals)?

   b. [ASK INCENTIVE PM AND C&S PM, IF NOT ALREADY COVERED] How do you communicate your needs to ETP?

   c. [ASK ETP PM] How do you know what type of technologies C&S team foresee to include in their program?

[ASK ETP PM AND INCENTIVE PM, SKIP THIS QUESTION IF DISCUSSED IN RESPONSE TO Q3]

9. What happens after ETP recommends an ET for adoption in the incentive program?

   a. Are you aware of any barriers that ETs typically face in the process of getting into the incentive program? If so, what are they?

[ASK INCENTIVE PM AND C&S PM, SKIP THIS QUESTION IF DISCUSSED IN RESPONSE TO IN Q4]

10. What happens after an ET is recommended for codes and standards program?

    a. Are you aware of any barriers that ETs typically face in the process of getting into the codes and standards program? If so, what are they?

[ASK ETP PM, INCENTIVE PM AND SME]

11. What is the average length of time between (i) when an ET is recommended for workpaper development and when the workpaper is completed and, (ii) when workpaper is developed, and ET is added to an EE incentive program?

    a. On a scale of 0 to 10, with 0 being 'extremely dissatisfied' and 10 being 'extremely satisfied,' how satisfied you are with this timeframe?

[ASK INCENTIVE PM, C&S PM AND SME]

12. What is the average length of time between when an ET is recommended for codes and standards and when ET is added to C&S program?

a. On a scale of 0 to 10, with 0 being 'extremely dissatisfied' and 10 being 'extremely satisfied,' how satisfied you are with this timeframe?

Section C: Workpaper Development and Data

We understand that if an ETP project is successful, one of the first steps to including it in the EE portfolio is to develop a workpaper. We understand that workpaper is required for deemed measures and not for the custom measures. We would like to ask you some questions about workpaper development process of deemed measures.

[ASK ETP PM, INCENTIVE PM AND SME]

13. Are you involved in the workpaper development for an ET? If so, what criteria are considered when deciding whether to move forward with workpaper development for an ET? (e.g., market potential, energy savings, etc.)

[ASK ETP PM, INCENTIVE PM AND SME]

14. Who generally develops the workpapers for emerging technologies?

    a. Do you coordinate with other IOUs if they are planning to incorporate the same measure/ technology in their portfolio? Does one IOU do the workpaper, or does each IOU develop their own utility-specific workpaper?

[ASK ETP PM, INCENTIVE PM AND SME]

15. Do you have clear information about CPUC workpaper requirements?

    a. On a scale of 0 to 10, with 0 being 'not at all clear' and 10 being 'extremely clear,' how clear are the CPUC workpaper requirements?

    b. How do you learn about these requirements? Who provides the data for the workpaper?

    c. Could you share a list of these workpaper data requirements?

[THANK YOU FOR THE INFORMATION. WE WILL SUBMIT A FORMAL REQUEST REQUESTING FOR A LIST OF DATA REQUIREMENTS FOR THE WORKPAPER DEVELOPMENT]

[ASK INCENTIVE PM AND SME]

16. How well does ETP inform workpaper development?

    a. Is the data provided by ETP generally sufficient for workpaper development? If not, what type of data is generally insufficient?

    b. Do you collect additional data from other sources? If so, which ones?

[ASK ETP PM, INCENTIVE PM AND SME]

17. Do you have any recommendations to streamline the IOU workpaper development process as it relates to getting ET into incentive programs?

[ASK ALL]

18. Workpapers go through a review process after they are developed. Are you familiar with this process? If so, please briefly describe it.
    a. Do you have any suggestions to make the workpaper review process more effective?

[ASK INCENTIVE PM AND SME]

19. Do you use EPIC demonstration project information to source emerging technologies? Why or why not?
    a. [ASK IF NOT DISCUSSED ALREADY] What are the barriers to using EPIC to source ETs and workpapers, if any?
    b. Describe the cases where ETs bypass ETP and where it makes more sense for them to go through ETP?

[ASK ETP PM, INCENTIVE PM AND SME]

20. Do you believe 3rd party workpapers should be allowed in CA? Why or why not?
    a. What advantages are there of allowing 3rd party workpapers or possible current missed opportunities by not allowing them?
    b. What should be minimum requirements or stipulations surrounding these workpapers?
    c. What might a QA/QC process look like for these?
    d. Who should a third party submit workpapers to (IOUs, or CPUC)?

Section D: Review of recommended and rejected ETs

[ASK ETP PM, INCENTIVE PM AND SME]

21. In your opinion, what percentage of recommended ETs make it into the EE incentive or Codes & Standards program?

[ASK ETP PM, INCENTIVE PM AND SME]

22. Is there a certain stage in the process with a disproportionate ET fallout/rejection rate?
    a. What are the reasons for rejection and the lessons that can be learned?
    b. In your opinion, is there an opportunity to reduce the number of projects that don't pass a stage-gate by either looking deeper into the project itself, filtering projects better at a pre-ETP evaluation stage, or changing the sources where projects are drawn from?

[ASK ETP PM, INCENTIVE PM AND SME - – NOT A PRIORITY]

23. If an ET was recommended for inclusion in an incentive program but did not make it through for any reason (e.g., TRC requirements, limited market size, etc.), is there a process to revisit and review the technology in the future once limiting factors are addressed?

[ASK ETP PM]

24. Is there a list of ETs rejected within ETP that may have future potential, which should be revisited in certain amount of time?

a. Do you have a process in place to revisit the technologies that were rejected within ETP but were promising, and could be recommended for EE programs in the future?

Section E: Communication and Coordination

[ASK ALL]

25. How do you communicate and coordinate with other teams (ETP/Incentive program/ C&S)? (e.g., monthly meetings, status update emails, SharePoint sites)
    a. [ASK ALL] On a scale of 0 to 10, with 0 being 'extremely dissatisfied' and 10 being 'extremely satisfied,' how satisfied you are with overall communication and coordination regarding passing of ETs among
        i. ETP – incentive program
        ii. ETP – C&S
        iii. Incentive program – C&S
        iv. Overall?
    b. [ASK ALL] Do you have any recommendations to improve coordination/ communication among teams (to eliminate challenges and streamline the process of passing technology)?

Section F: Metrics

[ASK ALL]

26. What metrics are used to measure the effectiveness of passing ETs to incentive program/ codes and standards program[if respondent is ETP PM, mention incentive program; if respondent is incentive PM, mention both incentive and C&S program; if respondent is C&S PM, mention C&S program], if any (probe if needed: number of reports, number of transferred technologies, etc.)?
    a. How are these metrics tracked and reported, if at all?
        i. In your opinion, what would be an optimal approach for tracking metrics?

[ASK ALL IF TIME PERMITS]

27. After an ET has transitioned to incentive program or codes & standards program, do you conduct a look-back meeting to review how the handoff process went? If so, whose input is solicited, and how is the feedback integrated into the process?

Section G: Engagement with TDs/TDAs

[ASK ALL]

28. How often do you engage with external stakeholders, e.g., Technology Developers, Technology Development Actors such as CalPlug?
    a. How do you benefit from these external engagements?
    b. Are there any aspects that can be improved?

[ASK ETP PM, INCENTIVE PM AND SME]

29. Are there opportunities for technology developers and TDAs to provide additional support, particularly with research tasks, data collection, and any other tasks supporting workpaper development?

[ASK ALL]

30. Have you received any feedback on the overall process from companies that have handed off their ET to the utility? If yes, what was the feedback?

[ASK ALL]

31. We would like to interview technology development actors (TDAs) such as EPIC, CalPlug, who have worked with you in the past for ET development and handoff to the EE program. Could you please share their name, contact information, and organization?

Section H: Closing

[ASK ALL]

32. Is there anything else that we didn't discuss regarding the ET handoff process that you would like to share?

Thank you for your time and feedback!

Appendix B. Interview Guide for TDs and TDAs

Overview

This discussion guide will be used to interview technology developers (TDs) and technology development actors (TDAs) to understand their experience/ perspectives working with IOUs on emerging technologies (ET), especially in the context of the technology handoff process. In this study, the term "handoff" is defined as transitioning the ETP technologies from "market-ready" into full-fledged programs and/or into relevant codes and standards programs.

Key objectives of the interview include:

- Providing a better understanding of the existing processes for passing technologies, approaches, and projects between ETP, the IOU ET Incentive Portfolio, Codes and Standards, technology development actors (TDA) such as EPIC, CalSEED, CalPlug, the four CA technology clusters, and external markets.
- Making recommendations primarily for the ETP, but also for other groups, to allow process improvements in the broader California technology development ecosystem.

The interview guide will also review emerging technology project opportunities beyond ETP (e.g., EPIC and third-party workpapers) to identify process streamlining opportunities.

Table 12 summarizes the proposed interview respondents, the target number of interview completes and no. of interview questions by each respondent; Table 13 outlines the research objectives and associated questions. This interview will take about 45 mins to one hour to complete.

Table 12. TDAs Interview Characteristics

Qualified Respondent [a]	Target Number of Completes	Number of questions in the interview guide
Technology Developers (TDs), including manufacturers, engineers	10-15	20
Other Technology Development Actors (TDAs) such as EPIC, CalSEED, CalPlug		

[an] IOU ETP PMs provided the list of TDAs and TDs for interviews.

Table 13. Research Objectives and Questions

Topic Area	Research Objective	Questions
A: Introduction	Understand interviewee's role and activities in the context of emerging technologies	1-3
B: Process Overview	Capture information regarding the current process of TDs/TDAs engagement with IOUs on emerging technologies including drivers and barriers	4-12
C: Workpaper Development	Understand TDs/TDAs current involvement and interest in workpaper development process	13-17

Topic Area	Research Objective	Questions
D: Communication and Coordination	Understand communication and coordination with IOU staff on emerging technologies	18-20
E: Closing	Wrap up the interview and give an opportunity for the interviewee to share any issues/concerns that were not discussed	21

Interview Guide

Table 14. TDAs Interviewee Information

Information	
Name	
Title	
Contact Phone	
Contact Email	
Today's Date & Time	
Other Attendees, if any:	
Notes	

Interview introduction

Guidehouse has been engaged by CPUC to understand the existing process and identify streamlining opportunities for passing emerging technologies into the utilities' emerging technology program and then subsequently to utility incentive programs and codes and standards,

We are currently in the process of conducting interviews with technology developers and technology development actors to understand their experience/ perspectives working with IOUs on emerging technologies (ET), especially in the context of technology handoff process. *In this study, the term "handoff" is defined as transitioning "market-ready" emerging technologies (ET) into IOUs incentive programs and/or into relevant codes and standards program.* On behalf of CPUC, we thank you for agreeing to spend this time with us.

Section A: Introduction

[ASK TDAS AND TDS]

1. What is your position and role at [COMPANY/ ORGANIZATION/ START-UP] as it relates to the Emerging Technologies (ET) development or transition to IOU programs?

[ASK TDAS AND TDS]

2. Which [UTILITY] and which department within the [UTILITY] did you collaborate with for developing or passing emerging technologies (ETs)?

[ASK TDA=CEC ONLY]

3. Do you think there are any overlaps between the activities of EPIC funded research projects and ETP? Please describe.

Section B: Process Overview

[ASK TDA=CEC only]

4. What are the typical sources of ETs that come to CEC for emerging technology research? (probe for ETCC, EPIC solicitations, any external sources)?

[ASK TDAS AND TDS]

5. What motivates your organization/company/start-up to work with the ETP/ IOUs for developing new ET?

[ASK TDAS AND TDS]

6. Describe the current process for engaging with the IOUs for developing new ETs?
    a. When and how do you engage with IOUs? How often?
    b. What aspects of engagement process has worked? What needs improvement?
    c. What are the challenges in engagement with IOUs/ ETP on ET?

[ASK TDAS AND TDS]

7. In your opinion, what are the primary challenges in bringing emerging technologies to market?
    a. Which challenges are <u>being met</u> with the type of support provided by IOUs?
    b. Which challenges are <u>not being met</u> with the type of support provided by IOUs?

[ASK TDAS AND TDS]

8. Are you aware that IOU have a formal process with well-defined stages/ gates/ criteria for screening technologies for consideration into IOU programs?
    a. If yes, are you familiar with the IOU process and ET selection criteria? Please describe briefly.
    b. Do the IOUs share information with you about this process, including data requirements?
    c. Any suggestions to improve the process?

[ASK TDAS AND TDS]

9. IOUs are putting together Technology Priority Maps (TPMs) to identify technology groupings that are relevant to IOUs research and where IOUs can provide support to their path to the market.

[IF TDS/ TDAS ASK FOR MORE INFORMATION ABOUT WHAT TPMS MIGHT INCLUDE, STATE "TPMS WILL INCLUDE INFORMATION SUCH AS TECHNOLOGY CATEGORY, SUBGROUP, TARGETED SECTOR AND TECHNICAL POTENTIAL."]

a. Will TPMs from IOUs be useful to you?

b. If you had access to TPMs or IOU's priorities for technology support, would you modify your research direction - would you develop different technologies or develop similar technologies but maybe with minor changes to focus on different target markets (sector, climate zone, building type, etc.), or in some other way just choose different types of projects?

c. What kind of information from TPMs would you be looking for to inform your technology research direction or technology development decisions or type of data collected?

[ASK TDS ONLY]

10. What Technology Readiness level(s) are the technologies that you submit to IOUs for review/ assessment?

[ASK TDA=CEC ONLY]

11. What TRL do EPIC funded projects typically fall in? [see Appendix if the interviewee needs any information on TRLs]

[ASK TDAS AND TDS, EXCEPT CEC]

12. What happens to an emerging technology after it is passed/ handed-off to IOUs (ETP or Incentive program)?

    a. What is your involvement after this step?

Section C: Workpaper Development

[ASK TDAS AND TDS]

13. Do you have clear information about CPUC workpaper requirements?

    a. Where do you get this information about CPUC workpaper requirements?

[ASK TDAS AND TDS]

14. Is there any interest to provide additional support to IOUs during workpaper development process or during the process of inclusion of an ET into the incentive program, particularly with research tasks and data collection?

    a. What type of support would you be interested in providing to IOUs?

[ASK TDAS]

15. Do you believe 3rd party workpapers should be allowed in CA? Why or why not?

    a. What advantages are there of allowing 3rd party workpapers or possible current missed opportunities by not allowing them?

    b. What should be minimum requirements or stipulations surrounding these workpapers?

c. What might a QA/QC process look like for these?
    i. What maybe a solution, considering that?
        1. TDs might be biased (can overestimate their savings)
        2. CPUC may not have a bandwidth
        3. IOUs might also be biased
d. Who should a third party submit workpapers to (IOUs, or CPUC)?

[ASK TDAS AND TDS, EXCEPT CEC]

16. If you were able to submit work papers to the CPUC directly, would you take advantage of this?
    a. Can you describe a situation where you would have taken advantage of this in the past or may in the future?

[ASK TDA=CEC ONLY]

17. What are your thoughts about submitting third party workpapers that could come out of EPIC projects that are energy efficiency-focused?
    a. If needed, would CEC be willing to revise EPIC project data collection requirements to fit the data needs of the IOUs?

Section D: Communication and Coordination

[ASK TDAS AND TDS]

18. How do you communicate and coordinate with IOUs on emerging technology activities, if at all? (e.g., regular meetings, emails, SharePoint sites)
    a. Who do you communicate with?
    b. What aspects of communication with IOUs can be improved?

[ASK TDAS AND TDS]

19. Is your feedback solicited on the process after your ET is passed to the IOUs incentive or codes and standards program? Please describe.

[ASK TDAS AND TDS]

20. Do you have any recommendations on how to improve your engagement with IOUs to eliminate any challenges and streamline the process of passing technology to the IOUs incentive program?

Section E: Closing

[ASK TDAS AND TDS]

21. Is there anything else that we didn't discuss that you would like to share regarding your experience working with IOUs on emerging technologies?

Thank you for your time and feedback!

Appendix C. Interview Guide for Best Practices Research

Overview

This discussion guide will be used to interview non-California IOU organizations to understand their emerging technology (ET) handoff process, including successes and challenges. In this study, the term "handoff" is defined as transitioning the ETP technologies from "market-ready" into energy efficiency full-fledged programs and/or into relevant codes and standards processes.

The key objective of the interviews is to understand the existing process for emerging technology handoff, best practices, and success factors.

Table 15 summarizes the proposed interview respondents, and the target number of interviews completes; Table 16 outlines the research objectives and associated questions. The interview will take about 45 mins to one hour to complete.

Table 15. Best Practice Interview Respondents

Shortlisted Respondent	Target Number of Completes
Nicor Gas	1
BPA	1
NYSERDA	1

Table 16. Research Objectives and Questions

Topic Area	Research Objective	Questions
A: Introduction	Understand interviewee's role and activities in the context of ETP program	1-2
B: Process Overview	Understand organization structure, ET intake process, ET handoff process, experience with third-party implementation and metrics to track program effectiveness	3-13
C: Engagement with external stakeholders	Understand engagement with external stakeholders, benefits and improvement opportunities	14
D: Recommendations and best practices	Obtain feedback on best practices and recommendations for an effective ET handoff	15-18

Interview Guide

Table 17. Best Practice Interviewee Information

Information	
Name	
Title	
Contact Phone	
Contact Email	
Today's Date & Time	
Other Attendees, if any	
Notes	

Interview introduction

Guidehouse has been engaged by the CPUC to understand the best practices in transferring emerging technologies from emerging technology programs (ETPs) to incentive programs, market transformation (MT) programs, and codes & standards programs.

We are currently in the process of conducting interviews with selected organizations to understand their existing process for emerging technology handoff. The goal is for us is to understand any successes and challenges better and identify best practices outside of California to recommend ways to streamline the California handoff processes to effectively accelerate emerging technologies into energy efficiency programs and the broader market. *In this study, the term "handoff" is defined as transitioning "market-ready" emerging technologies (ET) to energy efficiency programs, market transformation program and/or into relevant codes and standards program.*

On behalf of CPUC, we thank you for agreeing to spend this time with us.

Section A: Introduction

[ASK ALL]

1. What is your position and role at [UTILITY/ORGANIZATION] as it relates to the development of Emerging Technologies (ET) or transition of these technologies to energy efficiency (EE) incentive programs, market transformation (MT) programs, and codes & standards?
    a. Does your program only look at Energy Efficiency Technologies or consider other distributed energy resources (DERs) as well?

[ASK ALL]

2. Which other departments within [UTILITY/ORGANIZATION] do you collaborate with for developing and/or passing new technologies to EE incentive programs, MT programs, or to the codes and standards?

Section B: Overview

Organizational and governance structure

3. How is your organization structured as it relates to emerging technology program (ETP)/ Research, Development and Demonstration Program (RD&D), incentive programs, market transformation programs, and code & standards program?
   a. How these programs coordinate with each other for emerging technologies development and handoff?
   b. **[ASK, IF NOT ADDRESSED ABOVE] Does ET and MT programs coordinate, or does MT program pulls technologies/ measures only from the incentive program?**
   c. Are you familiar with how CA ETP works? If yes, how is your organizational structure similar to or different from CA?

Intake process into ETP and TPMs

4. What is the process for soliciting ET measures/ projects for review?
   a. Do you require a business case or other documentation for each project to intake/consider it for your ET program?

      Some California utilities have what they call "Technology Priority Maps (TPMs)" to identify and prioritize technology groups where the utility can provide research and market acceleration support.

      [IF INTERVIEWEE ASK FOR MORE INFORMATION ABOUT WHAT TPMS MIGHT INCLUDE, STATE "TPMS WILL INCLUDE INFORMATION SUCH AS TECHNOLOGY CATEGORY, SUBGROUP, TARGETED SECTOR, AND TECHNICAL POTENTIAL"]

   b. Have you developed similar technology roadmaps to communicate your high-priority research areas? If so, are these roadmaps shared with technology developers and other stakeholders?
      i. [IF YES, ASK] Do they find them useful?
      ii. [IF NO, ASK] Why don't they find them useful?
   c. [FOR BPA ONLY] We understand that your technology road mapping budget was cut, and the process was deemphasized.
      i. How has this affected your operations and the efficacy of program activities? What challenges have you encountered or anticipate?
      ii. What is the ideal road-mapping approach in terms of technological specificity, frequency of updates, sources of inputs, and other aspects?
      iii. What groups did/do you coordinate within this road mapping process?

Measure Development Process and Handoff

5. Please describe the measure development process.
    a. Do you have a program theory logic model or a process map to describe the measure development process (even if the role resides outside your department)? If yes, please share.
    b. What is the balance between shallow dive and deep dive evaluations/projects, and how is this balance determined?
    c. What are the key decision points?
    d. What processes and criteria are used to make Go / Hold / Terminate decisions?
    e. Who is involved in the process and in the decision making (e.g., program leads, internal staff, external advisors)?
    f. What aspects can be improved?
6. As part of the process, do you consider market barriers or market transformation framework when assessing emerging technologies?
7. (IF NOT ALREADY COVERED) Please describe the process of handing-off emerging technologies from ETP/ RD&D to EE incentive program. (IF NOT CLEAR, ASK - Once an ETP project is deemed successful, what is the process to include it in the EE incentive program)?
    a. What aspects of the handoff process are working well?
    b. What factors can accelerate or delay the handoff process (i.e., the process of passing ETs to EE incentive program)?
    c. Once an ET is recommended for inclusion in customer-facing programs, what is the average length of time for it to be added to that program?
    d. As part of handoff, do you make recommendations regarding what kind of program design will work best for the technology (e.g., upstream, midstream, downstream, and direct install program)?
8. [ASK IF APPLICABLE] Please describe the process of handing-off emerging technologies from ETP/ RD&D to MT programs.
    a. What aspects of the handoff process are working well?
    b. What factors can accelerate or delay the process of passing ETs to MT program?
    c. As part of handoff, do you make recommendations regarding what kind of program design will work best for the technology (e.g., education, incentives to distributors etc.)?
9. [ASK IF APPLICABLE] What is the process for bringing ETs to Codes & Standards program or actual code change?
10. Do you have a dedicated staff who facilitates and monitors the entire handoff process?

Third-Party Implementation

[ASK NICOR GAS ONLY]

We understand that GTI has been the third-party implementer for Nicor Gas since 2011.

11. Please describe the role of GTI as a third-party implementer, and to what extent they are integrated with Nicor Gas processes and staff?
    a. How is GTI involved in the broader program direction as well as specific technology selection, i.e., TPM related coordination? Also, who does the coordination to identify ETP, EE incentive program, or MT program needs?
    b. Please describe how and at which stage the ET handoff happens between GTI and Nicor Gas.
    c. What key performance indicators (KPIs) do you use to track third party implementation?
    d. Could you share a copy of the solicitation issued that ultimately led to GTI as your third-party implementer? [nice to have]

[ASK NYSERDA AND BPA]

12. Do you utilize third-party implementers for emerging technology program implementation?

[IF YES, ASK 12A-E]

    a. Who is the third-party implementer?
    b. Is the third-party implementer involved in the broader program direction as well as specific technology selection, i.e., TPM related coordination? Also, who does the coordination to identify ETP, EE incentive program, or MT program needs?
    c. Please describe how and at which stage the ET handoff happens between you and the third-party implementer.
    d. What key performance indicators (KPIs) do you use to track third-party implementation?
    e. Could you share a copy of the solicitation issued that to recruit your third-party implementer?

[IF NO, ASK 12F]

    f. Why not?

Metrics (SKIP NICOR GAS, IF ALREADY COVERED IN 10C)

13. How do you measure the effectiveness of your emerging technologies or the RD&D program?

    For example, do you track and report - the number of technology investigations that you completed in a given year, the number of technologies transferred to EE incentive or MT programs, and the adoption rates and savings of these technologies once they are transferred, etc.?

Section C: Engagement with external stakeholders

14. Do you engage or collaborate with other utilities, public and private R&D and RD&D organizations, and other stakeholders on various emerging technologies? (Yes/No)

[IF YES, ASK 14A-14E; PRIORITIZE BASED ON THE TIME LEFT FOR THE INTERVIEW]

    a. Who do you collaborate with frequently?
    b. Have you collaborated on dual fuel projects?

c. (PLEASE ANSWER IN YES/NO) Do you believe these collaborations
   i. allowed you to more cost-effectively assess promising technologies?
   ii. accelerated the assessment and transfer of promising technologies to energy efficiency programs and/or to the broader market?
   iii. increased your confidence in the technology recommendations that you make to energy efficiency programs?

d. In what other ways does your organization benefit from these collaborations?

e. How can these collaborations be improved?

Section D: Recommendations and Best Practices

15. Through your program, what you have found are the key characteristics of a successful handoff of emerging technologies from ETP to EE incentive or MT programs?
16. In your opinion, what are the best practices in the organizational and governance structure of the ETP team?
17. What do you feel could be improved about your ET program or utility ET programs in general?
18. To help provide us more context as we compile our findings, what is your approximate annual budget for your ET/RD&D program?

Thank you for your time and feedback!

Appendix D. Profiles of External Emerging Technology Programs

This appendix provides a summary of external emerging technology programs including BPA, Nicor Gas, and NYSERDA, who were interviewed for the best practices research. Table 18 shows that organizations selected for best practice interviews represent a mix of geographic areas, fuel type, population served, and budgets.

Table 18. Overview of External ET Entities

Category	Entity		
	BPA	Nicor Gas	NYSERDA
Fuel Type	Electric-only	Gas only	Both
Location	Portland, OR	Naperville, IL	Albany, NY
Region	West	Midwest	East
Service Area	300,000 sq. miles	17,000 square miles	54,556 square miles
Population Served	~12 million	2.2 million	888,993
Emerging Technology Budget	$1.4 million (previously $5M)	$1.2 million (3% of portfolio)	$10-12 million (Advanced Buildings only)
Market Transformation Budget	n/a	$2 million (5% of portfolio)	n/a

Sources: BPA, Nicor Gas, and NYSERDA home pages.

Bonneville Power Administration (BPA)

Organization Overview

Bonneville Power Administration, established in 1937, is a non-profit federal power marketing administration based in the Pacific Northwest. BPA markets wholesale electrical power from 31 federal hydroelectric projects in the Northwest, one nonfederal nuclear plant.

The energy efficiency segment in BPA sits in Power Supply, and within EE, there are several subgroups:

- Planning
- Engineering
- Programs
- Marketing

Unlike the structure in the CA IOUs, the Engineering team at BPA is responsible for both ET testing as well as measure workbook development, which is the equivalent of workpaper development in CA.

Emerging Technologies Overview

The mission of BPA's Emerging Technologies Program is to lead the development and adoption of energy-efficient technologies in the Pacific Northwest. In 2019, ET is $1.4 million program that evaluates emerging technologies with the potential to achieve savings across the wide range of electricity uses in their region.[70] There are two major activities under this program:

- Technology Research & Development[71]: Core components include project management, portfolio management, technology transfer, and road mapping.
- Emerging Technology Assessment: Assess promising new technologies to fill the pipeline for energy conservation programs. Data from ET assessments informs the E3T database.[72]

Measure Development Process

The planning department at BPA forecasts power obligations and existing resources to determine system needs over the planning horizon and then optimizes on the cost to determine the amount of EE from each end-use needed to cost-effectively fulfil system needs.[73] Using this information, the BPA's ET team (Engineering) seeks out technologies that best contribute to the savings requirements for each end-use. BPA staff obtains proposals for new technologies via the Energy Efficiency Emerging Technology (E3T) application portal[74] or through informal interaction with vendors and manufacturers.

The screening of technologies will initially be by E3T Technical Advisory Groups. Then BPA evaluates them for their robustness, technical potential and fit into BPA Programs. If the required criteria are met, the lead engineer checks the technology against building Codes and Standards, notes any apparent defects, and conducts a brief lab and/or bench test. If the technology looks promising, ET Field Tests are then developed to answer specific research questions.

Once the ET Field Test request has been submitted, the E3T Project manager will determine how the project fits into the research plan. A decision will be emailed to the requester within a few days of the request. The available number of ET Field Tests each technology will be updated monthly on the ET Field Test webpage.

Once the ET Field Test request has been approved, the Custom Project Proposal (CPP) needs to be submitted. A CPP template for the project will be sent to the requester. Most ET Field Test CPP's will be based on Engineering Calculation with Verification, with additional E3T-funded measurement and verification (M&V), so the incentive payment can be before the research is complete. BPA will finalize the measurement and verification plan for each site prior to CPP approval; pre-installation metering may be required. Once the

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[70] BPA's Electric Emerging Technologies Selection Process can be accessed at https://www.bpa.gov/EE/Technology/EE-emerging-technologies/Pages/Technology-Selection-Process.aspx

[71] BPA Technology Innovation Office Introduction and OVerview https://www.bpa.gov/Doing%20Business/TechnologyInnovation/Documents/2016/BPA%20TI%20Intro%20and%20Overview%20-%20Jun%2017%202016.pdf

[72] BPA's Energy Efficiency Emerging Technology (E3T) Program database can be accessed at http://e3tnw.org/Home.aspxhttp://e3tnw.org/

[73] BPA 2018 Resource Program can be accessed at https://www.bpa.gov/p/Power-Contracts/Resource-Program/Documents/2018%20Resource%20Program.pdf

[74] BPA's new ET submission form can be accessed at http://e3tnw.org/Home.aspxhttp://e3tnw.org/SubmitNewET.aspx

technology has been installed and the Completion Report is approved, the CPP incentive can be paid. A Completion Report template for the project will be sent to the requester. The E3T-funded research and analysis will be shared on Energy Smart Awareness calls. BPA will not publish the customer name without prior approval.

After approval of the Completion Report, the engineering staff develop measure assessment workbooks[75] to characterize the energy savings and costs of a measure. These workbooks are then submitted to the Regional Technical Forum (RTF) for approval before program staff finalizes program rollout decisions and logistics.

Throughout the entire process, a technology is evaluated for program, product, and market readiness using the levels shown below.

Table 19. RETAC Readiness Levels

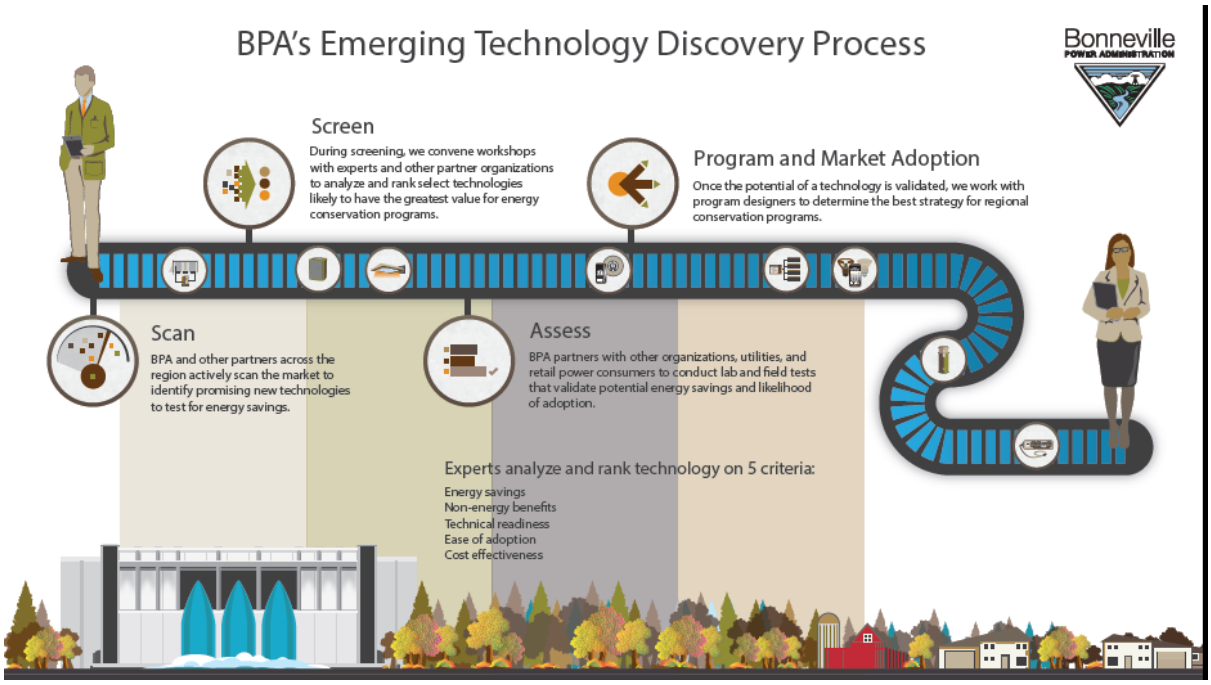
Category	Level Number	Level
Market/ Commercial	Level 1	Not commercially available or limited, pre-commercial availability.
	Level 2	Commercially available outside of Northwest (NW). Requires special order in NW.
	Level 3	Commercially available in NW from one manufacturer through standard channels.
	Level 4	Commercially available in NW from at least two manufacturers. Stocked throughout region.
	Level 5	Commercially available from 2+ manufacturers, well developed supply chain. Widely and easily available.
Product	Level 1	Concept not yet validated
	Level 2	Concept validated
	Level 3	Limited Assessment
	Level 4	Extensive Assessment
	Level 5	Comprehensive Analysis
	Level 6	Approved for Implementation
Program	Level 1	No program design. No risk assessment.
	Level 2	Not cost effective, but preliminary analysis shows a pathway to CE. Limited program design and risk assessment.
	Level 3	Not cost effective but shows pathway to CE with higher volumes, more competition, improved technology. Small scale pilots.

[75] Workbooks are equivalent to a workpaper

Category	Level Number	Level
	Level 4	Marginally at cost effective levels. Program design complete, larger scale pilots underway. Well-developed risk assessment.
	Level 5	Cost effective. Ready for full-scale programs. Periodic risk assessment process in place.

Source: Email communication with BPA contact.

Figure 5. Overview of BPA's Emerging Technology Process



Source: BPA Emerging Technology Website https://www.bpa.gov/EE/Technology/EE-emerging-technologies/Pages/Technology-Selection-Process.aspx

Collaborations

There are opportunities for regional and national stakeholders to partner with BPA to advance technologies while sharing the cost. This approach reduces duplication of efforts and frees up resources for other opportunities.

- Emerging Technology Field Tests
- Baseline Research
- Technology Innovation Research and Development Solicitation: Annual cycle of funding based on strategic needs identified in the agency's technology roadmaps

Research partners include the following:

Figure 6. BPA Research Partners

Source: BPA Collaboration Opportunities Website https://www.bpa.gov/EE/Technology/EE-emerging-technologies/Pages/Collaboration%20Opportunities.aspx

Regional collaboration is more important than ever before, and BPA's Energy Efficiency Emerging Technology (E3T) team and NEEA are leading the Pacific Northwest's efforts to coordinate regional emerging technology research. The goal of the agenda is to make sure common needs are clear, and there is a shared cost. The organizations involved in regional collaboration include the Emerging Technologies Coordinating Council, Electric Power Research Institute (EPRI), Northwest Energy Efficiency Alliance (NEEA), and Consortium for Energy Efficiency (CEE).[76] BPA also advises and prioritizes technology research with the US DOE, national labs, CEE, EPRI, and others to advance the Northwest's agenda for ET.[77]

Nicor Gas

Organization Overview

Nicor Gas is a regulated gas utility, Illinois' largest natural gas distributor, and the owner and operator of one of the largest natural gas aquifer storage systems in North America.

Emerging Technologies Overview

[76] BPA EE Action Plan can be accessed at https://www.bpa.gov/EE/Policy/EEPlan/Documents/2016-2021_BPA_EE_Action_Plan.pdf

[77] BPA EE Action Plan can be accessed at https://www.bpa.gov/EE/Policy/EEPlan/Documents/2016-2021_BPA_EE_Action_Plan.pdf

Since the initiation of Nicor Gas' Emerging Technology Program (ETP) in 2011, the Gas Technology Institute (GTI) has been the third-party implementer. ETP is a subset of the energySMART energy efficiency program.[78] ETP is an emerging technology initiative that aims to select and assess promising new technologies that have the potential to generate natural gas savings for Nicor Gas customers. This service seeks to introduce new energy-efficient technologies and practices to the market. It is the only gas ETP program of its kind in Illinois and the largest in the Midwest, and it received the 2018 Illinois Sustainability Award for its efforts to implement innovative and sustainable technologies.

Nicor Gas started Market Transformation (MT) efforts in 2018,[79] which is the process of strategically intervening in a market to create lasting change that accelerates the adoption of energy-efficient products, services, and practices. These activities are outsourced to Resource Innovations.

Measure Development Process

At Nicor Gas, ET activities are primarily outsourced to GTI, their third-party implementer. Ideas go through a stage-gate screening process called "Ready-Set-Go." If idea meets the initial application criteria, then the Nicor Gas ETP collaborates with GTI to develop a position paper that outlines how to test technology, identifies known market barriers, and builds a business case for testing. At this stage, it is determined whether a technology will need to go through market transformation (MT). If the budget is approved, then GTI conducts technology testing. Lab testing is usually done first since it tends to the lowest cost option, and field tests are conducted afterwards, usually to verify lab results. In some cases, data can be sourced directly from engineering white papers if the vendor has extensive data on the technology. However, in most instances, some sort of pilot is conducted. After testing is completed and the report developed, feedback is provided to the vendor.

[78] Nicor Gas ETP Brochure can be accessed at https://www.gti.energy/wp-content/uploads/2018/09/Emerging-Technology-Program-101-Brochure.pdf

[79] Market Transformation (MT) Panel Discussion deck can be accessed at http://ilsagfiles.org/SAG_files/Meeting_Materials/2018/November_7_2018_Meeting/SAG_Meeting_Nicor_Gas_MT_PPT_Panel-Overlay_Workshop_Slides_11-7-2018.pdf

Figure 7. Overview of Nicor Gas' Emerging Technology Process

Source: Nicor Gas ETP Program Overview flyer https://nicorgasrebates.com/-/media/Files/NGR/PDFs/ETP/ETP_ProgramOverviewFlyer.pdf

If technology shows promising results, ET works with the Operations team[80] to transition the technology either to incentive programs or market transformation, depending on the level of commercial adoptability. If the measure is recommended for a prescriptive program, then the equivalent of a workpaper is developed and submitted for inclusion into the Illinois Statewide Technical Reference Manual. If the technology is recommended for MT, then a comprehensive plan is developed, which outlines activities that utilities can do to address market barriers. After the technology is included in the program, education and outreach activities are conducted to familiarize customers to the new technologies.

Collaborations

NEEA staff have been supporting Nicor Gas as they consider undertaking a market transformation program for CRTUs. Coordinating market transformation programs between the Midwest and Northwest will lead to greater leverage with manufacturers and portfolio building owners (e.g., big box stores) and more opportunities for cost sharing.[81]

Nicor Gas also shares ET ideas and results with the Midwest MT Collaborative and MEEA (Midwest Energy Efficiency Association), and they collaborate with other utilities like ComEd and SoCalGas on technology pilots.

[80] Operations team manages implementation contractors and program activities (e.g. incentives, outreach)

[81] Natural Gas Advisory Committee Meeting Packet can be accessed at https://neea.org/img/documents/Q2-May-2019-NGAC-Meeting-Packet.pdf

New York State Energy Research and Development Authority (NYSERDA)

Organization Overview

NYSERDA is a public benefit corporation that offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA administers energy efficiency, renewable energy, environmental research, energy technology development and demonstration, market development, and workforce development programs.

Emerging Technologies Overview

The Emerging Technology/Accelerated Commercialization (ETAC) – Buildings program, which is a subprogram of Technology and Market Development (T&MD), seeks to accelerate the commercial introduction of emerging or underused building technologies and strategies. ETAC supports both ratepayer funded programs and non-ratepayer-funded market adoption.

ETAC's goal is to identify commercially available, under-used technologies and address market barriers preventing adoption. The ETAC Program will encourage commercial adoption of emerging technologies and strategies but will do so in a way distinct from incentive-based programs.

Core ETAC program activities include the following:

- Engage stakeholders
- Select technologies and strategies
- Fund demonstrations of emerging technologies and strategies
- Conduct M&V on demonstrations
- Conduct outreach and external technology transfer (e.g., Case studies, webinars, presentations at conferences, and press releases)

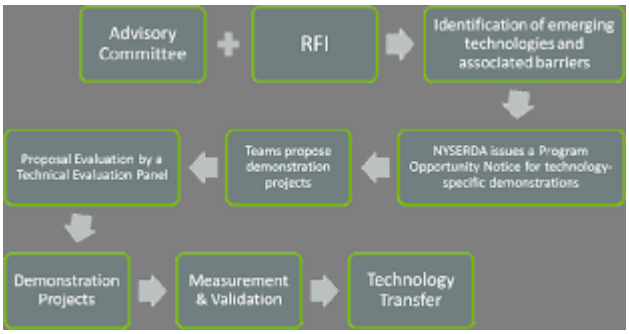
Measure Development Process

The Innovation team develops "Innovation Challenges," which seek very specific technology/cost needs. After screening the applications via a 2-step process and conducting evaluations, technologies are recommended to the market group, which then builds programs around successful technologies.

They use a stage-gate process to manage funded projects like ET tests. A scoring committee first reviews concept papers and full proposals, and these proposals can include recommendations that may span several project activities, which may include feasibility study, technology development, commercialization, etc. A Peer Review team evaluates the technology on strategic fit, impact, probability of commercial and technical success, and leverage,[82] and it also manages the technology as it moves through each project stage.

[82] Leverage encompasses other activities that can contribute to project success (e.g. external investments, partnerships)

Figure 8. Overview of NYSERDA's Emerging Technology Process



Source: NYSERDA website

Collaborations

NYSERDA collaborates with utilities, federal programs and offices (e.g. ARPA-E and BTO), national labs, and NY universities. Utilities may ask for more information on certain technologies, and NYSERDA can help with research and demonstrations.

Appendix E. Emerging Technologies Metrics

The following table lists the ETP Metrics Adopted in D.18-05-041.[62]

Table 20. ETP Metrics Adopted in D.18-05-041

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 codes and standards (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
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
ETP-M1	6* TPMs (gas and electric combined) initiated within the first 3 years (including 1 Technology-focused Pilot TPM identifying market barriers for a diverse range of high-impact technologies through studies, and subsequently breaking down identified barriers via cooperative projects initiated in coordination with WE&T, ME&O, and other relevant IOU programs) *This number will be updated once all third-party contracts have been awarded.	#
ETP-M2	3 TPMs updated within the first 3 years	#
ETP-M3	183* projects initiated within the first 3 years *This averages 61 projects per year; this number will be updated once all third-party contracts have been awarded	#
ETP-M4	Host 15 outreach events with technology developers with products <1 year from commercialization within the first 3 years, including new technology vendors, manufacturers, and entrepreneurs.	#

Metric Name	Metric Description	Unit of Measurement
ETP-M5	Host 6 outreach events with technology developers with products <5 years from commercialization within the first 3 years, including new technology vendors, manufacturers, and entrepreneurs.	#
ETP-M6	2* projects initiated with cooperation from other internal IOU programs associated with each Technology-focused Pilot *This number may be updated according to the results of the TPM development working group process	#
ETP-M7	ETP-M7: 3* Technology-focused Pilots initiated as part of the TFP TPM within the first 3 years *This number may be updated according to the results of the TPM development working group process	#

Appendix F. List of Suggestions from Interviewees

Per request from the CPUC, the evaluation team compiled a list of suggestions shared by interviewees (IOUs, TDs, TDAs, and external entities) that are not listed as recommendations or other considerations in Section 4. These are ideas that are possible for future program administrators to consider and were only mentioned by one or a few interviewees. As such, they do not represent the consensus across all interviewees, nor are they to be construed as an endorsement by the evaluation team.

Table 21. List of Suggestions

Source	Suggestion
TDA	Suggestion for PAs to reduce the number of handoffs as much as possible.
TDA	Suggestion for PAs to identify ways to better connect their needs with external expertise, for example by hosting fairs or posting project assistance needs online.
TDA	Suggestion for PAs to address contracting delays potentially caused by low staff engagement. PAs might consider educating staff who support billing and contracting about the importance of their work in meeting state policy goals and promoting sustainability.
TDA	Suggestion for PAs to address high barrier to entry for organizations without strong existing personal relations with ETP staff.
TDA	Suggestion for PAs work with relevant internal staff to modify processes and requirements that inherently disadvantage small organizations during the engagement process (e.g. contracting requirements, payment frequency).
TDA	Suggestion for CPUC and PAs to minimize redundant testing activities by allowing TDs to extrapolate results from one project in a certain territory to other ET projects.
TDA	Suggestion for PAs to consider sharing information on customer needs and obtaining customer feedback on emerging technologies (perhaps collected through surveys).
TDA	Suggestions for PAs and CPUC to consider a process whereby third parties would submit draft measures and workpaper ideas not to any individual IOU or to the CPUC directly, but rather to a central site, which would then be reviewed by a joint “Measure Review Committee” comprised of all staff from the IOUs, Cal TF, and other independent parties (e.g. labs, universities, CEC, etc.).
TDA	Suggestion for ETP to leverage modelling, lab tests, previous ET studies, and local market research more heavily as part of the upfront measure screening before conducting lengthy and resource-intensive field tests.
TDA	Suggestions for QA/QC for workpapers: ▪ Leverage the data dictionary and QA/QC guidelines developed by Cal TF, ▪ All workpaper developers undergo training on how to develop high-quality workpapers. ▪ Third parties to submit draft measures and workpaper ideas not to any individual IOU or to the CPUC directly, but rather to a central site, which would then be reviewed by a joint “Measure

Source	Suggestion
	Review Committee" comprised of all staff from the IOUs, Cal TF, and other independent parties (e.g. labs, universities, CEC, etc.).
IOU	Suggestion for CPUC to provide additional guidance resources for custom processes, especially about industry standard practices and free ridership.
IOU	Suggestion to develop additional guiding resources to inform how ET data can best contribute to workpaper development.
IOU	Suggestion for CPUC to consider streamlining EE and Demand Response (DR) ET program opportunities, especially for measures with joint EE-DR benefits. Different regulatory proceedings for EE, DR, and distributed generation (DG) programs have created funding silos that hinder coordination of IDSM projects and customer incentives.
External ETP Program	Best practice for ETP is to leverage data from other utilities if technology is too large or expensive to test in-house.
External ETP Program	Best practice for technology intake is to streamline application requirements for new technology ideas to facilitate an internal review.
External ETP Program	Best practices to reduce the measure development timeline include using approved measures from other states to develop workpapers and collaborating with other utilities to support manufacturers seeking to scale.
External ETP Program	Best practice for PAs is to have dedicated staff taking on ET responsibility.
External ETP Program	Best practice for coordination with external actors is to evaluate whether other organizations are already driving innovation on an emerging technology and if their contribution will have a meaningful incremental impact in that area.
External ETP Program	Suggestion for PAs to ensure that roadmaps are nimble, regularly updated, and streamlined, containing only the information which is essential to support decision-making.
External ETP Program	Suggestion for PAs to identify technology priorities in-house and outsource ET research, for example by collaborating with external research entities.
External ETP Program	Best practice is to provide energy savings estimates, Energy Savings Reliability (ESR), TAG rating, and in-depth assessment results for each technology in a database.
External ETP Program	Technologies with non-energy benefits (NEB), in addition to energy savings are most successful in MT programs. Suggestion for CPUC to value NEB benefits so that adoption of these new technologies could be accelerated.
External ETP Program	Opportunity for ETP to obtain information on market landscape, market barriers, and market engagement strategies from TDs during the intake process.

Appendix G. Interview Count Detail

The table below shows the number of interviews conducted for each utility and each role.

Table 22. Interview Count by Utility and Role

Role	PG&E	SCE	SCG	SDG&E
ETP	2*	2	1	2*
Incentive Program	2*	1	1	1
Product Development	1*	0	1	1
C&S	1	1	0**	1*
Total no. of interviews	**4**	**4**	**3**	**4**

*Denotes a situation where staff shared perspectives on multiple roles based on their current and prior experience.

** SCG did not have a staff member responsible for this role at the time of this study

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