

The Power of Ten: A Decade of Growth for Emerging Technologies Programs in California

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ABSTRACT

In 2005, the *Emerging Technologies Whitepaper* by CEC Commissioner Art Rosenfeld and colleagues launched an expansion and refinement of the California statewide Emerging Technology Program (ETP) that continues today. In this paper we review noteworthy ETP accomplishments by California utilities, examine opportunities for improvement and lessons learned over the past decade, and highlight current and planned ETP initiatives that promise further success in accelerating market uptake of cost-effective, energy saving products and services in the decade ahead.

Among the noteworthy ETP technical initiatives over the past ten years are projects focused on automated demand response, efficient lighting solutions, zero net energy, and innovative gas measures.

The ETP has also supported and helped to launch influential partnerships and collaborative organizations. In addition, the ETP has provided input, encouragement and inspiration for many new ET programs across North America.

Current ETP technical initiatives, including assessments of advanced controls, integrated energy efficiency solutions and applications of big data, promise to sustain a pipeline of new measures and program concepts for the years ahead.

In parallel, the ETP is charting its future with new organizational paradigms, studies of technology development culture and other strategic initiatives to ensure its continued success via collaborations that accelerate the movement of innovations from the lab to the marketplace.

Background

In the Beginning: Origins of the ETP and ETCC

The Emerging Technologies Program (ETP) is a California statewide effort that accelerates the deployment through utility programs of energy efficient products, practices and integrated systems that are new to the market or underutilized. As efficiency measures become widely adopted and the “low hanging fruit” becomes sparse, finding new measures becomes increasingly important. The ETP’s role is to help fill the pipeline of new energy efficiency (EE) measures by supporting technology advancement, validating the performance of emerging technologies (ETs) and conducting field demonstrations.

The ETP evolved from new technology pilots aimed at supporting the IOUs’ EE market transformation (MT) efforts in the late 1990s. These pilots were initially funded as part of broad MT programs. The onset of California’s 2000–2001 electricity crisis led to reduced ET project

funding and activity levels—along with termination of most utility market transformation activities. In response to spiking energy costs, regulators and utilities redirected all available energy efficiency resources to initiatives expected to produce immediate energy savings and demand reductions.

In early 2002, the California Public Utilities Commission (CPUC) authorized the relaunch of a post-MT portfolio of statewide EE programs, including the first dedicated program funding for each IOU's portion of the statewide ETP (CPUC 2002).

That same CPUC decision included the first formal regulatory recognition of the Emerging Technologies Coordinating Council (ETCC), a collaborative working group made up of individual utility ETP staff and CEC Public Interest Energy Research (PIER) staff. The ETCC traces its origins back to February 2000, when IOU ET leaders began meeting quarterly with PIER program representatives.

The ETCC has since evolved from an organization focused on hosting informal quarterly member-only meetings to one that incorporates public ET-focused meetings and events including the biennial ET Summit, the ETCC website (<http://www.etcc-ca.com>) and the ETCC Insight newsletter. The ETCC Leadership Team currently includes representatives of the California IOUs, Sacramento Municipal Utility District (SMUD), and the California Energy Commission, with oversight from the CPUC.

How Art Rosenfeld Weighed In – and What Happened Next

The publication of the *Emerging Technologies Whitepaper* early in 2005, authored by CEC Commissioner Art Rosenfeld and his colleagues, laid the foundation for growth and evolution of the ET paradigm in California. The Whitepaper presented the ETP as the nucleus of a network of linked activities that bring EE innovations to the marketplace and create value. It proposed increasing the ETP's effectiveness by adding new programmatic elements to broaden and deepen its ability to accelerate the commercialization of new EE technologies.

It also proposed that California regulators rethink the scale of ETP activities, challenging them to increase ETP funding levels by three to six-fold to align with standard practice for technology transfer funding in other fields (Rosenfeld et al. 2005). The CPUC responded positively to the Whitepaper's call for a more robust ETP, allocating increased funding and reaffirming regulatory support for the ETP.

As ETP has grown and refocused its course in the years since the *Emerging Technologies Whitepaper* was published, the ETP project portfolio has responded to changing market needs. Originally a technology assessment and validation program, the ETP has evolved to support EE program portfolios with a balance of technology push and market pull.

Recent years' ETP project portfolios have included a diverse combination of technology performance assessments, Scaled Field Placements, Demonstration Showcases, business outreach efforts, market and behavioral studies, symposia, tools, and outreach. Thus, the ETP may touch a technology repeatedly at different stages of its development and adoption process before a rebate is offered, making it difficult to attribute specific energy efficiency savings to any one ETP project.

One thing that has not shifted since the publication of the *Emerging Technologies Whitepaper* is the regulatory status of the ETP. Unlike EE rebate programs with measureable energy savings impacts, the ETP is classified as a "non-resource" program having no energy savings targets. Instead, the ETP's contributions have been and continue to be intrinsically tied to the success of California EE programs.

In a recently completed evaluation, the CPUC concluded that “ETP is demonstrating clear value to both the IOU EE portfolio and the broader California Energy Efficiency Strategic Plan (CEESP) goals” by addressing technologies most likely to yield measures and solutions to customers across multiple market segments (CPUC 2013).

The following sections of this paper discuss the impact of California’s ETP over the past decade and the potential impact of current and future strategies and solutions.

Noteworthy Technical Initiatives 2005 - 2014

Over the past decade, California’s ETP has initiated well over 300 Technology Assessments and more than two dozen Demonstration Showcases. The most successful ETP assessments have validated technologies that are now delivering savings through a combination of incentives, education, and codes and standards requirements.

Following is an overview of some significant technical developments in which the ETP has played an instrumental role.

AutoDR and OpenADR

In 2002, Lawrence Berkeley National Laboratories (LBNL) developed a specification for automated demand response (AutoDR) aimed at developing a cost effective way to communicate pricing signals to commercial buildings for demand response. In 2005, PG&E’s ETP staff started to engage with LBNL through a Technology Assessment project on AutoDR; SCE and SDG&E later joined as ETP partners in this effort.

LBNL also developed OpenADR with support from this ETP group, resulting in development of a non-proprietary, open standardized DR interface that allows electricity providers to communicate DR signals directly to existing customers using a common Internet protocol.

PG&E reinforced these developments by offering an AutoDR incentive beginning in 2006 for improved DR response through enhanced automation, leading to lower customer operating costs and increased participation in DR events.

The first wave of advances was labeled “OpenADR 1.0,” and all three California IOUs providing electric service have offered customer incentives and associate eligibility requirements on a statewide basis for on OpenADR-compliant technologies.

As a next step, the requirements and use cases developed from LBNL’s research and pilots led to the formulation of a next generation of OpenADR standards through a consensus process with key stakeholders such as CEC, the California IOUs, LBNL, energy consultants and standards development organizations. Both PG&E and SCE were very engaged in supporting development of OpenADR 2.0 and with SDG&E the three utilities are now in the process of upgrading their programs to the latest OpenADR 2.0b specification.

The OpenADR specification has helped expand its technology offerings and increase the number of qualified products that the utilities incentivize. The continued success of AutoDR and OpenADR are reflected in California-based EM&V studies and in the spread of the OpenADR standard throughout the world. A 2014 AutoDR process evaluation pointed to 224 unique enrolled customers at 1,119 sites as of 2012 (Opinion Dynamics 2014). And in mid-February 2014, the International Electrical Committee (IEC) adopted OpenADR 2.0 as an international DR Publicly Available Specification (PAS).

The California IOUs intend to continue their leadership in expanding AutoDR throughout the industry.

LEDs Lighting the Way

The ETP has played an integral role in accelerating commercialization and market adoption of LEDs in a wide range of applications, including streetlights, high bay fixtures, retail display, refrigerated cases and general lighting. The ETP's ongoing role in LED lighting Technology Assessments and market partnerships has helped drive improved lamp performance, increased energy savings and product cost reductions, resulting in increased adoption rates across all market sectors.

In 2007, the ETP undertook one of the first U.S.-based performance assessments of LED-based streetlights. PG&E ETP staff and consultants led a series of LED streetlight field Technical Assessment projects in collaboration with the City of Oakland and the Department of Energy's Gateway Solid State Lighting commercialization program.

This multi-phase ETP project eventually expanded to two other Bay Area cities - San Jose and San Francisco – and encompassed evaluations of LED streetlights and networked controls. Initial performance results were good; however product costs were still high.

The results of these studies were widely disseminated and discussed throughout the industry, influencing manufacturers to reduce LED streetlight costs and improve performance. For instance, in response to these initial results, within one year, a manufacturer developed a new product line that was 34% less expensive and reduced energy consumption by 25% from the previous model, while delivering comparable luminaire performance.

These ETP studies served as the basis for development of PG&E LED streetlight programs that continue to attract broad participation today. The number of city and third-party owned streetlights converted to LED since the program began represents 20 percent of the total in PG&E's service territory, roughly 114,000 out of 560,000 – for a total of 27.8 MWh savings since 2010 (J. Sofranac, Manager, Street and Outdoor Lighting, PG&E, pers. comm., March 7, 2014).

In addition, PG&E has requested CPUC authorization to begin converting all 180,000 utility-owned streetlights to LED this year. This development can be traced back to the success of the original ETP streetlight assessment projects in Oakland, San Jose and San Francisco. The success of these groundbreaking ETP studies has encouraged other utilities and municipalities across the North America to engage in their own large-scale LED streetlight trials and installations.

The ETP also played an important role in advancing LEDs in a wide range of interior applications including retail displays and refrigerated displays. For example, SDG&E conducted an assessment of retail lighting in 2009. The project goals were to validate manufacturer's claims on energy savings, light levels and light characteristics; perform a comparison of new LED luminaires; and incandescents; and determine customer acceptance levels of the new LED technologies.

This assessment project demonstrated that a complete retail showroom "makeover" could be accomplished. Significant energy savings (67% overall), improvement in customer comfort, enhanced lighting and consistency of product appearance are possible while maintaining the desired light intensity, correlated color temperature and color rendering index throughout the showroom area.

Zero Net Energy

The ETP has provided strong support to ZNE efforts, especially in the area of project monitoring. It has become increasingly clear that high-resolution end-use monitoring is essential to ensuring ZNE performance: as is the case with nearly any construction project, “as built” differs to some degree from “as planned.”

Absolute ZNE performance requires that building systems work well, without problems commonly associated with installation, controls and operations. Through end-use monitoring, utility ET staff are able to diagnose and, in most cases, correct problems with operations, improving end-use performance and documenting ZNE performance.

It is worth pointing out the need to “commission” the monitoring system itself: some degree of troubleshooting and correction has been necessary to confirm that monitoring systems function properly and collect the data needed. Once commissioned, end-use monitoring systems have played a key role in getting ZNE design to become ZNE operation.

California Advanced Lighting Controls Training Program

Another example of a holistic approach ETP has taken to advancing ETs is SCE’s ETP’s participation in the development of the California Advanced Lighting Controls Training Program (CALCTP). Successful CALCTP program participants receive an IOU-recognized certification in Advanced Lighting Controls (ALC) technology. This certification permits General Electricians to work on ALC projects, which are then eligible for IOU incentive programs. Recognizing the value of CALCTP, the new 2013 Title 24 Building Code requires CALCTP participation for State Certified General Electricians who work on lighting controls. A further indicator of its success is that widespread interest in CALCTP has inspired the development of the national ALCTP, which ETP staff remains active in.

The ETP’s engagement in CALCTP exemplifies how the ETP’s flexible portfolio approach to advancing ETs can have a greater impact than focusing exclusively on ET Technical Assessment Projects. The ETP’s leadership and participation in contractor training, design assistance and standards development in conjunction with CALCTP has received recognition from the U.S. Department of Labor, the California Energy Commission, the California Public Utilities Commission and others for its effectiveness in increasing the workers’ skill and employment opportunities as well as reducing energy use.

Innovative Gas Measures

ETP staff at all three California IOUs providing natural gas service work collaboratively to identify and assess new and underutilized gas EE technologies. Here we highlight five gas ETP initiatives – boiler controllers, tankless hot water heaters, a finned cooking pot, mechanical vapor recompression, and ozone laundry.

SoCal Gas’s ETP staff conducted an evaluation and Scaled Field Placement for a controller for use in mid-sized boilers servicing combined hydronic and domestic hot water (DHW) systems in multi-family residential buildings. The controller is designed for an underserved market of legacy as well as new installations of a combined service configuration that has fan coils and DHW taps on the same single loop. This market is substantial in Southern California, but has remained underserved due to a lack of targeted incentives and trade ally engagement. SoCal Gas estimates approximately 4.8 million therms per year in recurring and

technical savings potential in their service territory, based on 60-80 therms per apartment dwelling unit per year - with an average payback of 5 years (IES 2011).

A second technology that SoCal Gas's ETP staff is evaluating is tankless water heating systems that provide both domestic hot water and hydronic heating, the two highest consuming gas end-uses in single family residences. While these systems have been available for some time, advances in the integration of space and water heating systems has improved effectiveness and reduced thermal delivery problems of previous designs. Extrapolating from preliminary results of demonstrations and pilots in the cold climates suggest energy savings may reach about 60 therms per year per household in warmer climates like those of SoCal Gas territory (estimates extrapolated from DOE 2014), if systems are sized right and appropriate control strategies are in place. Final results from the SoCal Gas demonstrations and pilots are expected in 2015.

A third emerging technology investigated by SoCalGas ETP staff is a cooking pot for full-service restaurants that uses a finned base for maximum stove heat utilization. The fins on the base of the pot increase heat transfer effectiveness, thereby reducing total heating and boiling times and the amount of fuel needed to maintain a desired temperature. Estimated savings is 44 therms per pot per year (Kirchhoff 2010). This represents a technical savings potential of nearly 1.5 million therms per year if deployed in restaurants across SoCalGas service territory.

California's tomato processing industry converts more than 13 million tons (CDFA 2013) of raw tomatoes into tomato products – one-third the world's supply. This includes tomato paste production, which requires the removal of water through evaporation. This process uses approximately 105 million therms of natural gas per year in California. A 2007 PG&E ET Program study showed that a mechanical vapor recompression (MVR) evaporation system consumed an average of 49.35 Btu per pound of evaporated water for tomato processing – 89 percent less than the 476.5 Btu for a triple effect evaporation system (HMG 2007). Based on these ET study findings, PG&E launched a successful incentive via its Customized Agricultural Program for tomato, juice and dairy processors who switch to MVR for making tomato paste, juice concentrate and dairy products.

The California hospitality industry also offers significant energy savings opportunities. Many hotels and motels have on-premise laundries that use hot water for washing and natural gas to dry linens and towels. In several ETP studies conducted by PG&E and SoCal Gas, ozone laundry systems were evaluated for their potential to reduce energy costs via reduced hot water usage and shorter drying times. Based on study results confirming the effectiveness of cold, ozonated water in place of hot water, both PG&E and SoCal Gas launched ozone laundry system incentives in their respective EE Portfolios. PG&E also launched a third party program and together, the deemed incentive and third party program savings have accounted for approximately 354,000 therms in PG&E's gas energy savings portfolio since 2010.

Noteworthy Collaborations and the Growth of ET Programs 2005 - 2014

In addition to performing ETP Technology Assessments, Demonstration Showcases, and market and behavioral studies, creating a lasting impact requires the development of strong partnerships and institutions. To this end, the ETCC member utilities have played a central role in the formation and operation of the West Coast Utility Lighting Team, have served as key advisors on the Western Performance HVAC Alliance Fault Detection and Diagnostics Committee, and are long-standing supporters and partners in the Western Cooling Challenge. The ETCC's involvement in these institutions has accelerated the development and adoption of advanced, climate appropriate technologies. In addition, the ETCC's meetings, events and its

web-based library of ET and CEC research studies have played an instrumental role in the formation and expansion of utility ET programs and related initiatives across North America.

West Coast Utility Lighting Team

One of the most dynamic ET categories over the past 10 years has been the area of solid-state lighting. To address both the challenges and the significant potential that lighting presents, lighting experts from the CA IOUs and SMUD who were regularly attending quarterly ETCC meetings launched a separate collaborative forum to discuss emerging, underutilized and unproven lighting technologies and market challenges.

The participants named this forum the West Coast Utility Lighting Team (WCULT) and have met on a regular basis since 2007 to share innovative ideas, collaboration proposals and local program successes that can accelerate the adoption of advanced lighting technologies. WCULT has expanded to include Bonneville Power Administration, BC Hydro, the California Institute for Energy and the Environment, UC Davis's California Lighting Technology Center, Pacific Northwest National Laboratory, the Design Lights Consortium (DLC) and others, thereby further expanding the group's impact.

On the Technology Assessment side, the WCULT team is coordinating their efforts regarding testing advanced lighting controls systems, among other things. WCULT members have partnered to author a research guideline to ensure that ETP field assessments and pilots will be conducted in a manner ensuring that results are rigorous, comparable and readily applied to facilitate EE program development and new lighting measure adoption.

On the market side, the group works closely with partners like the DLC and Energy Star to ensure that viable new products are properly vetted for and included in energy efficiency incentive programs. One of WCULT's noteworthy related accomplishments has been its support for the development and operation of the California Advanced Lighting Controls Training Program (See the CALCTP section on page 5 for more information).

Western HVAC Performance Alliance - Fault Detection and Diagnostics

The Western HVAC Performance Alliance (the "Alliance") is an advisory group formed to support implementation of the HVAC portion of the CEESP. Its specific role is to provide the California Investor Owned Utilities with subject matter expert (SME) guidance from across the heating, ventilation and air-conditioning (HVAC) industry. The volunteer HVAC SME members meet with professionals in the energy efficiency community to jointly tackle key HVAC energy efficiency issues and opportunities.

The ETP has been providing leadership and support to the Alliance from its inception. For example, the ETP has engaged with the Alliance to address industry gaps including developing rigorous and standardized methods, enhancing customer pull and creating validated tools. For instance, SCE's ETP staff utilized the company's laboratory for the development of a FDD laboratory test method for residential split systems and commercial packaged units, which included evaluating products and quantifying effects of multiple faults.

The Alliance's FDD Committee, with the support of the ETP, has taken a leadership position in the national dialogue on developing FDD requirements. Through this effort, the ETP has made a quantifiable impact by getting FDD adopted and/or considered in both state and national codes and standards efforts. By defining common goals and objective evaluation

methods, the FDD Committee has enabled the industry to accelerate technology maturation and development marketable products.

Another direct impact the ETP has had on CA IOU HVAC programs via its collaboration with the WHPA is through the Commercial Quality Maintenance (C-QM) sub-committee of the WHPA. ETP resources have been deployed to run lab and field testing of rooftop units to evaluate the effectiveness and persistence of maintenance measures like refrigeration charging. C-QM sub-committee feedback and recommendations on the results of these and similar evaluations have and will continue to make their way into IOU HVAC programs in the form of improved maintenance measure mix and technician training initiatives.

Western Cooling Challenge Partnership

The Western Cooling Challenge (WCC), hosted by the Western Cooling Efficiency Center (WCEC) at the University of California Davis, is a competition that encourages HVAC manufacturers to develop climate appropriate packaged Roof-Top Unit (RTU) air conditioning equipment that will reduce electrical demand and energy use in Western climates by at least 40% compared to DOE 2010 standards. The WCC was formed in response to the CEESP's call for fundamental changes to the HVAC industry, including widespread adoption of climate-appropriate HVAC.

The ETP supported various aspects of the WCC including laboratory testing of WCC entries, outreach and education, organization and management of numerous field demonstrations, and analysis and evaluation from both laboratory and field studies. As a result of these efforts, two products have been WCC-certified and others are in the pipeline resulting in advancement and market adoption of climate-appropriate EE technologies.

New ET Programs across North America

In addition to partnering with research institutions and advisory groups such as those discussed above, the California utilities have provided advice, encouragement and inspiration for the development and enhancement of utility-sector emerging technology programs across North America. The past decade saw the emergence of numerous new ET programs, including:

- BC Hydro's Technology Innovation
- Bonneville Power Administration's Energy Efficiency Emerging Technologies program (E3T)
- Nicor Gas' ETP
- Gas Technology Institute's National ETP
- Xcel Energy' Emerging Energy Efficiency Partnerships
- New York State Energy Research and Development Authority's Emerging Technologies and Accelerated Commercialization (ETAC) program
- Los Angeles Department of Water and Power's ETP

The Next 10 Years: Charting the Future of the ETP

Building on more than a decade of successful technical and organizational initiatives and an understanding of the critical role the ETP plays in achieving California's "big bold" strategic goals, the utilities have embarked on a number of forward-looking initiatives. These initiatives

include the development of programmatic and strategic roadmaps as well as the formation of an Advisory Council for the ETCC. In addition, efforts are underway to elaborate the role of the ETP inside the utility and the role of the ETP and utilities in product development processes at research labs and in private industry.

Programmatic, Strategic and Organizational Enhancements

In 2013, the IOUs began development of a roadmap to characterize the role of the ETP on the path to ZNE. The roadmap will serve as a process-oriented document for the statewide IOU ETP team, identifying the evolving role of the ETP through 2020. The document focuses on making the strategic case for the ETP including how to align its efforts post 2013-2014 to support the “big bold” strategic goals identified in the CEESP, both for new construction and retrofits.

Separate from the statewide ETP ZNE roadmap, Southern California Edison developed an internal ETP roadmap. The SCE ETP roadmap describes market and portfolio gaps and drivers, as well as specific technologies that SCE ETP staff are exploring in their efforts to fill the efficiency pipeline and meet stakeholder needs and regulatory direction. The cornerstone of SCE’s internal ETP roadmap is a series of technology-specific maps that visually depict product areas and elements that enable the ETP to achieve its mission.

To complement the statewide and utility-specific ETP roadmaps, the ETCC undertook its own strategic planning initiative in 2013. The ETCC Leadership Team performed a formal review of the organization’s governance and membership policies with the goal of making the ETCC’s impact in the emerging technology domain more efficient and effective. The specific objectives for this project were to increase ETCC stakeholder engagement, leadership, impact and collaboration.

A key outcome was the ETCC’s decision to formalize its collaborative relationships across a range of R&D and ET institutions by inviting key organizations to join an Advisory Council. Given its history of realizing the benefits of coordination through collaboration on projects, events and information sharing, the ETCC believes that the Advisory Council will produce significant benefits for the ETCC and the advisors, including reducing duplication of efforts, lowering ET project costs, and increasing access to ET assessment sites.

Advanced Controls, Integrated Energy Efficiency Solutions, and Big Data

For California’s energy efficiency programs to continue extracting deep energy savings, they have to continue innovating and attracting innovations. Opportunities in the areas of advanced controls, integrated energy efficiency solutions and big data are linked as they all contribute to emerging systems-based comprehensive solutions. California’s ETP has the opportunity to accelerate technology development and commercialization in all three areas by breaking down the silos in which independent groups of market actors previously operated.

A recent example is the support the ETP provided in developing protocols and standards around the use of Energy Management and Information Systems (EMIS) tools for commercial whole building energy efficiency. PG&E, in partnership with the other California IOUs, brought together leading industry practitioners, the research and development community, the regulatory community, technology vendors and the evaluation community to form a technical advisory group.

The final work product was a test protocol and specifications on how to test EMIS tools for use in baselining building energy usage for whole building energy efficiency programs. This effort is meant to accelerate the deployment of advanced building controls, behavioral measures and directly support comprehensive/deep retrofit projects, especially for those hard to reach customers that may not have typically participated in EE programs. This protocol is now being used in PG&E's Commercial Whole Building pilot program.

Additional ETP projects in these connected domains will address energy end use disaggregation and continuous commissioning, the water-energy nexus, and comprehensive zero net energy approaches that integrate energy efficiency and demand response with distributed generation, storage and electric vehicle charging.

Through a blend of collective and individual efforts, the California Statewide ETP and SMUD's Customer Advanced Technologies Program are developing their vision and tactics for addressing these promising ET areas. The ETCC serves as a common platform for leveraging strategic bundles of assessment projects to drive regional pilot programs and standards development that will accelerate these innovations into the marketplace.

Advances in Evaluating ETP Success

As the ETP has evolved, so have measurement and evaluation protocols for gauging its success. Initially, evaluators attempted to apply models and methodologies previously developed for evaluating publicly funded RD&D to the ETP, with limited effectiveness.

The 2005 *Emerging Technologies Whitepaper* made a clear distinction between R&D and ETP activities, stating that "One of the key determinants for successful innovation is 'institutions for collaboration' that effectively link upstream R&D with commercial deployment" (Rosenfeld et al. 2005).

Efforts are now underway to clarify the context in which the ETP operates, including its role in enabling collaboration between the research community and commercialization activities such as market-based demand-side management programs. Two IOU-initiated studies are currently underway; they are aimed at better understanding the role of the ETP within the utility, and the role of the ETP and the utility in product development processes at research labs and in private industry.

The first study is a utility internal measure development study, aiming to elucidate the California utilities' process of deciding which technologies are suitable for inclusion in incentive programs. The ETP does not make these decisions; instead, they are made across multiple functions within each utility.

The second study is a technology developer landscape analysis that is intended to answer the following questions: 1) what unique role does the ETP play in the technology development and commercialization process that no other technology development entity can fulfill? And 2) which external technology development roles—if any—is the ETP duplicating?

Together, these studies are intended to produce a better understanding of the ETP's value to the California utilities within the context of existing DSM measure offerings, and the ETP's unique value to the development of new DSM technologies.

Success Factors and Opportunities for Improvement

In its first decade, the ETP has evolved and expanded significantly. Along the way, it has confirmed significant success factors and identified opportunities for improvement.

Success Factors

Utilities have unique challenges and opportunities when it comes to extracting deeper energy savings across California. With disparate product markets and technology development actors that generally do not share information with each other, utilities hold a unique position to support technology innovation and commercialization as non-aligned stakeholders that can bring the pieces together.

One major factor enabling the ETP's success is its status as a non-resource program. As such it does not impact the cost-effectiveness of the utilities' EE program portfolio. Instead, ETP success metrics include the number of new measures transferred to programs. Classification as a non-resource program is crucial for the ETP because it enables up-front, intelligent risk-taking, thus reducing risk for EE programs and end-use customers.

Another success factor is that California's emerging technology programs are backed by focused, dedicated resources, ensuring the long-term stability needed to identify, assess and support technologies for successful program deployment. This stability stems from policy and regulatory support dating back to Art Rosenfeld's 2005 *Emerging Technologies Whitepaper*.

A third success factor is the ETP's adaptability. The ETP expanded from its original focus on technology assessments to providing multiple types of support along the path from lab to marketplace. The ETP has been able to make a much deeper and broader impact than its initial charter allowed by broadening its scope from technology assessments to also include projects that aim to facilitate market adoption and market transformation. These include developing test protocols, engaging early stage technologies as well as commercial products that are underperforming, conducting collaborative efforts and supporting market and behavior studies.

Because the ETP's boundaries are not rigidly prescribed and allow for flexibility and evolution, the ETP is able to adjust its parameters to keep pace with the requirements imposed by changing market and technical developments.

Opportunities for Improvement

As the ETP has helped support technology development and evolution, the ETP itself has evolved over the past decade by seeking out and incorporating organizational and process improvement opportunities into its activities. This includes leveraging collaboration and process standardization as means to address resource constraints and reduce duplication. By embodying an organizational culture that blends adaptability, as mentioned above, with standardization, the ETP responds to changes in the technology development and commercialization environment efficiently and effectively.

Throughout its history, the statewide ETP and the ETCC have developed and shared a variety of templates, processes and methodologies. For example, the ETCC's Idea Proposal Form provides a standardized, web-enabled platform for entrepreneurs and technology developers to present their technology ideas to ETCC members. The form provides consistency, enables efficient information sharing and helps reduce duplicative work.

Another opportunity for ETP improvement is the perception by some stakeholders is that the ETP is a silver bullet and the only path to new measure creation. This is, in essence, a communication challenge. To address this, the ETP must continually educate its partners and stakeholders on a key distinction: the ETP is not a research and development platform, but rather, an element within the "system of linked activities" as described in Art Rosenfeld's *Emerging Technologies Whitepaper*.

In other words, the ETP is a key link in the EE technology and system development and commercialization value chain, but it is neither the beginning nor the end of the chain. The ETP's role is to provide the data needed to reduce market risk and technology risk for EE programs and indirectly, for end-use customers. It is an important channel for creating and delivering this risk-reducing data, but it is not the only channel.

As the ETP works collaboratively as a statewide team to share and optimize the value of ET projects, it is always looking for ways to deepen and improve engagement with EE program staff to ensure that the results from ETP initiatives connect with and deliver optimum value to the next link in the value chain: EE programs.

Conclusions

Looking back over the past decade of activities and forward to 2024, the California ETP can access a wealth of opportunities to build on what has been accomplished so far. Originally launched as a technology assessment and validation initiative, the ETP has grown to include a much broader range of activities. The program has successfully recalibrated itself several times, and the ETCC is becoming increasingly effective as the outward-facing channel and catalyst in realizing the ETP's role as an institution for collaboration.

The ETP's advances and successes reflect the combined effects of the *Emerging Technologies Whitepaper* with its impact on ETP scope and funding, the influence of the ETP's leadership over the years, and the important contributions of ETP partners and collaborators.

Looking forward to the next decade, the ETP aims to build on existing and new partnerships with future-oriented industry leaders including technologists and market researchers, enhanced collaborations enabled by the ETCC's newly-constituted Advisory Council, and advances by the EM&V community in assessing and valuing the ETP's role on its own terms.

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