Enhancing the Value of Evaluation Research for Industrial Energy Efficiency Efforts

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ABSTRACT

Industrial energy efficiency programs are increasingly challenged to deliver greater savings and go deeper into the facility while remaining cost-effective. Given the nature and complexity of industrial projects, however, it is not unusual for program staff to be surprised when Evaluation, Measurement and Verification (EM&V) studies indicate lower than expected realization rates. Furthermore, tapping into deeper and broader savings opportunities requires new intervention strategies that frequently differ from the traditional measure-based approach, adding perceived risk related to the evaluability of the effort. Designing, launching and implementing a program with an evaluation ready mindset can help reduce these risks, improve cost-effectiveness and increase customer satisfaction.

Unfortunately, many implementation teams have come to consider evaluators as overzealous auditors or "out-of-touch" academics. This fear, coupled with an insufficient understanding of the purpose, needs, tools and approaches used by evaluators has led to gross inefficiencies and less credible research results, which in turn hamper innovation in program design and delivery. This paper discusses key disconnects between implementers and evaluators and identifies some common problems in industrial program delivery. Using two case studies, the paper illustrates the benefits of using typical evaluation tools and processes (e.g., logic models) and effectively engaging evaluators early in the program cycle.

Introduction

Industrial energy efficiency programs are increasingly challenged to remain cost-effective while delivering greater savings and reaching deeper into the facility. The nature and complexity of industrial programs can present challenges for implementers and evaluators alike. For example, it is common for implementation staff to be surprised when EM&V studies and impact/summative evaluations indicate lower than expected realization rates. Furthermore, tapping into deeper and broader savings opportunities requires new intervention strategies that frequently differ from the traditional measure-based approaches, adding perceived risk related to the evaluability of the effort. Also, many implementation teams have come to consider evaluators as overzealous auditors or "out-of-touch" academics. This fact, coupled with insufficient understanding of the purpose, needs, tools and approaches used by evaluators, can lead to inaccurate or less credible research findings.

Closing the disconnect between evaluators and implementers is a well-known and long-discussed issue within the demand side management (DSM) community. There are many reasons why this disconnect persists. First, within the program cycle, program implementation and evaluation are designed to achieve different objectives. Program implementation focuses on developing and bringing to market effective and innovative solutions capable of delivering energy efficiency and/or demand response savings. Evaluation, meanwhile, is tasked with estimating program impacts and supporting program improvements. Another issue is the time that passes between implementation and evaluation, which has historically been performed at the end of the program cycle, after implementers and utilities have moved on to next generation programs. Given the complexity of industrial projects, this creates a significant challenge to evaluators who must excavate the right information or, in the cases where the information does not exist, reconstruct the record. This is further complicated by the inherent diversity of the industrial segment: the tremendous scope of product manufacturing across infinite institutional configurations that vary by size, geographical influence, competitive pressures and business cycles and models, each with an enormous, yet highly site-specific set of energy efficiency opportunities. This diversity strains the statistical tools of evaluators and challenges implementers promoting higher energy efficiency. Worse, it is often difficult for evaluators to extract the full story behind a project and understand what kinds of technical options were (or could have been) considered.

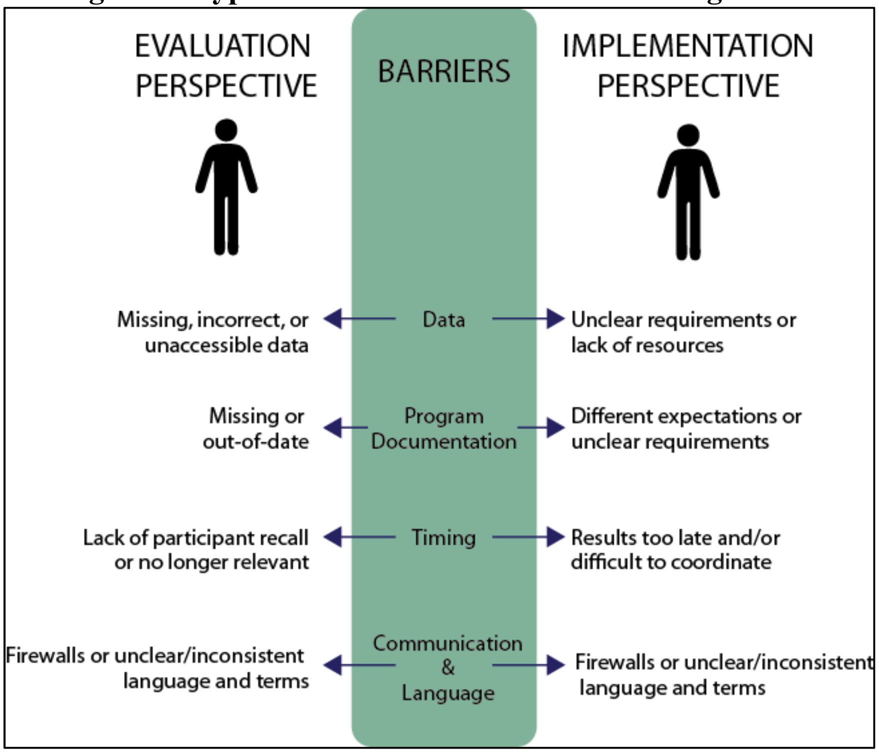
As utility industrial programs continue to mature, both evaluation and implementation become increasingly complex, yet programs need to achieve more with less funding. To contend with these challenges, more and more programs are finding additional savings by using increasingly layered program approaches with a variety of measures and operation and maintenance (O&M) activities. Meanwhile, the number of funding sources and market actors continues to expand—all of which complicates savings attribution (Skumatz et al., 2009). As a result, in order to address issues related to attribution and net savings, evaluation has become more complex while also being confronted with smaller budgets (Skumatz et al., 2009).

Leveraging previous writings and real-world experience in identifying challenges and possible solutions to these problems, this paper contends that designing, launching and implementing an industrial program with an evaluation ready mindset can help reduce utility risks and improve cost-effectiveness and customer satisfaction. The first section of the paper, which uses and expands upon the framework developed by C. Wong and K. Rock in 2012, provides an overview of key disconnects between implementation and evaluation teams. This is followed by two case studies of utilities that have successfully integrated best practices approaches into their industrial programs. While tailored to address each utility's unique situation and experience, both case studies provide examples of how program implementers, working together with evaluators at the onset of the program, have seen smoother program launches and more credible, predictable and actionable evaluation findings. Finally, we will discuss lessons learned and recommendations for future applications.

The Disconnect Between Implementation and Evaluation

While specific challenges and problems vary, the majority of issues between implementers and evaluators are related to the availability and quality of data, program documentation, timing and communication (Wong C., and Rock K. 2012).

Figure 1. Typical Barriers To Effective Working Relationships



Source: Wong C. and Rock, K. 2012

Data

The fact that implementers do not have the same data collection objectives as evaluators is a long-standing issue. As a result, implementers may not collect all the data necessary for an accurate evaluation (West & Bronfman, 2009). Good data are essential for evaluators to verify program measures, confirm program performance and have an effective point of contact. In addition, it is common for implementers to lack a full understanding of data requirements or fail to anticipate or properly understand evaluation needs. They often do not have the necessary time or budget to collect data at the level of detail or frequency desired by evaluators. In addition, implementation records may not be clear or easy for evaluators to reconcile, as the evaluators were not involved in project implementation (Wong C. and Rock K. 2012).

Program Documentation

Documentation of the program framework (e.g. logic model[1]), or lack thereof, frequently creates a barrier for both evaluators and implementers. In the absence of an existing logic model or program theory, evaluators often extract these details through staff interviews and compile the information to develop an evaluation framework. This process can lead to knowledge gaps or misunderstandings. In addition, the individuals who designed the program may not be the ones who ultimately oversaw its implementation. Finally, program design documentation may not always reflect how the program was actually implemented (Wong C. and Rock K. 2012).

[1] For more information on logic models, refer to https://www.bja.gov/evaluation/links/WK-Kellogg-Foundation.pdf

Timing

The amount of time that elapses between implementation and evaluation is another significant hurdle (Collins & Bishop, 2009). Evaluations attempt to review what happened in order to reconcile previous program results, with a goal of informing future programs. In many cases, evaluation occurs too long after implementation to fully address either purpose. Evaluation reports may not provide recommendations that can be realistically implemented or may not present values that can facilitate future program improvements (Wong C. and Rock K. 2012).

Communication & Language

Communication breakdowns between evaluators and implementers can also be a barrier. In some cases, firewalls[2] prevent conversation. In other cases, it is apparent that communication barriers are caused by a difference in backgrounds. Divergent academic or professional experiences can shape how the two groups think about programs, data collection and analysis, and applicable success indicators, as well as the vocabulary they use to discuss these topics (Wong and Rock, 2012).

Wong and Rock (2012) argue that evaluators are more likely to hail from academic backgrounds including economics, statistics or mathematics, while implementers tend to come from operations or industry, with a focus on business or other related topics. Many evaluation reports (especially those for impact evaluations) are voluminous, highly technical and academic in nature. While it is necessary to document in detail the assumptions, methods and data used to develop the evaluation, many reports lack an accessible summary written for audiences who do not have an in-depth knowledge of statistics, sampling or verification approaches. The complexity of reports, coupled with implementer time constraints, frequently results in limited readership of draft or final reports, which leads to missed opportunities for program improvements (Wong C. and Rock K. 2012).

Case Study: Bonneville Power Administration

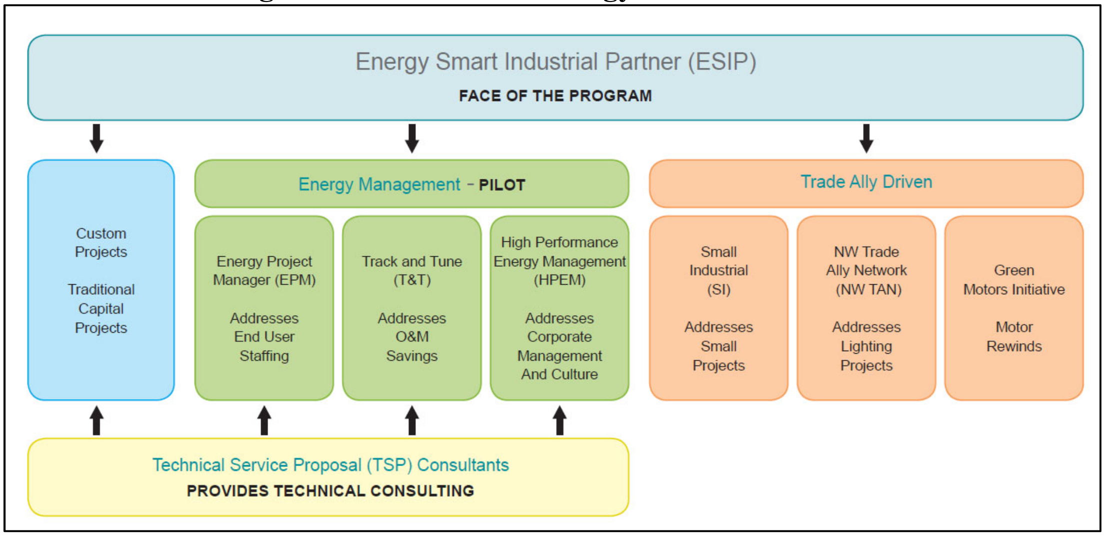
Established in 1937, the Bonneville Power Administration (BPA) is a Federal Power Marketing Agency and part of the United States Department of Energy. In addition to generating 8,000 average megawatts (aMW) annually, BPA markets and transmits power generated by the Federal Columbia River Power System. BPA has been running industrial energy efficiency programs for over 30 years. Ninety percent of BPA's approximately 140 public utility customers have opted into the Energy Smart Industrial Program (ESI), representing an industrial load of 2,411 aMW of public power.

In 2008, due to weak performance meeting annual targets, BPA conducted a review of ESI. The review consisted of interviews with end users, Bonneville's public utility customers, and service providers, as well as process reviews and a national benchmarking study of industrial programs. Based on the review's findings, BPA decided that the program needed to be

[2] Evaluators and implementers must uphold specified rules regarding the nature and frequency of communication and interactions to avoid situations that may compromise the independence of the evaluation findings.

redesigned. BPA and its program partner began this process in June 2009, with a four-month deadline to complete the work.

Figure 2. Overview of Energy Smart Industrial



Source: Eskil J., Gage, L., 2012

While ESI shares common components with other industrial programs, it is innovative in several ways. Among more traditional offerings, ESI also includes custom projects and various technical services. The program uses Energy Smart Industrial Partners (or ESIPs), who are dedicated engineers assigned to utility accounts. ESI also offers several components driven by trade allies for lighting projects, small industrial projects and motor rewinds. ESI also includes an Energy Management Pilot with three offerings: Energy Project Managers, Track and Tune (which addresses O&M savings), and High Performance Energy Management (HPEM), which addresses corporate management and culture. ESI was designed to be a comprehensive, one-stop-shop program that allows utilities to offer industrial customers a full array of options, including custom projects, O&M, incentives, lighting experts, small industrial project support, program-related administrative staff and in-house technical support.

Planning in advance for the evaluation process was an important part of the program redesign. BPA and its program partner recognized that the program design and industrial project tracking data had to be robust enough to support planned process and impact evaluations. To that end, they hired a third-party EM&V contractor to conduct an evaluablity assessment. Specifically, the BPA implementation team sought answers to the following questions:

- Do program components accomplish their intended purpose?
- How should program data be tracked and analyzed to best support evaluation efforts?
- How should energy savings be measured for the Energy Management pilot?

In a period of only four months, the team designed the new ESI program, developed implementation manuals, established incentives and designed and launched all back-office processes and procedures. Of key importance at this stage was the integration of a third-party evaluation team (Evaluator A) whose primary objective was to articulate and document the program theory in the form of logic models and indicator tables. BPA discovered that the process of engaging the entire program planning and implementation team into this effort proved invaluable; the creation of logic models forced the team, in a formal way, to consider *all* the details during the planning stages. Based on the insights and observations gained throughout this process, BPA adapted and augmented several program aspects to address previously unnoticed issues and shortcomings. It is also important to note that the development of logic models required significant forethought about which measures the program would implement and how to track the data, which proved very beneficial to the development of the program database.

Finally, the evaluation addressed the question of how to best develop a framework for measuring energy savings from the largely behavioral energy management components of the program. Specifically, ESI's Track and Tune offering is focused on no-cost/low-cost O&M measures while HPEM targets strategic energy management for the organization and requires sustained practices to acquire energy savings. While BPA has a long history of conducting robust measurement and verification (M&V) for all types of capital projects, BPA had never measured energy savings from behavior-based programs. At the request of Evaluator A, the implementation team developed a detailed guide and decision tree on how to conduct M&V for all components of the ESI program.

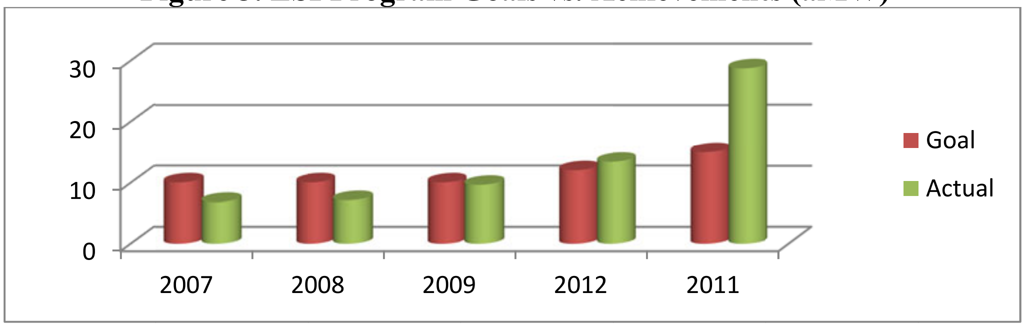
In fall 2009, BPA launched the new ESI program. One year after the initial launch, BPA hired a second third-party evaluator (Evaluator B) to conduct a process evaluation. In addition to reviewing whether the various program elements were being implemented to plan, the evaluation team also completed a detailed review of the program tracking database in an effort to understand what data would be available for future evaluation purposes. The team further considered what data should be tracked to effectively measure progress. Completing this study was not without challenges, which, to some extent, represented classic differences between evaluators and implementers. For example, from the implementation team's perspective, the evaluators requested a large amount of detailed data without fully articulating the reasoning behind the request, leaving the implementation staff to wonder whether the evaluators were functioning under the motto "more is better."

To date, BPA has successfully completed both a process evaluation of the full ESI program and an impact evaluation of its Energy Management Pilot. The process evaluation was positive about the efforts conducted on the front end of the program launch. Specifically, the evaluation found the logic models very useful in developing the evaluation objectives and survey instruments, and that the program was operating in accordance with the intended program theory as documented in the program logic models. Additionally, the results found that the program tracking databases were working effectively. The impact evaluation of the Energy Management Pilot credited BPA with being able to support the evaluation efforts by providing detailed, timely and comprehensive data sets for each project, as well as extensive documentation on energy savings methodologies (decision tree and MT&R guide). The impact evaluation established a 92 percent realization rate for electrical capital and O&M savings for the first program year. The evaluations jointly established the following:

- The ESI Program drove high levels of participation
- The Energy Management Pilot was successful in both delivering savings and increasing end user energy focus
- The program was designed around sound strategic planning
- The program is effective at developing the market for increased program participation

In the end, BPA's ESI Program achieved the targeted objectives and outperformed savings expectations. BPA credits this success in large part to the early engagement of evaluators, and specifically to the development of logic models and input on the data tracking system and processes. Figure 3 below shows the annual goals and program achievements in aMW by fiscal year.

Figure 3. ESI Program Goals vs. Achievements (aMW)



Source: Eskil, J.; Gage, L. 2012

Case Study: PG&E

PG&E is an Investor Owned Utility (IOU) serving about 450 thousand non-residential customers in California. Industry uses about 18 percent of the electricity and 24 percent of the natural gas sold by PG&E, and accounts for 10-15 percent of PG&E's electric and 75-80 percent of the natural gas annual savings claims of about 1.5 TWh, 200 MW, and 20 MTherms.

PG&E offers a variety of programs that provide information, audits, technical support, energy management and financial incentives to promote energy efficiency in the industrial sector. The programs are carried out by PG&E and their implementation contractors, third party implementers and partnerships with local and state governments.

Evaluation plays a crucial role in enabling PG&E to continue to garner energy efficiency savings in the challenging industrial sector. Through evaluation, PG&E provides unbiased information that enhances the design, implementation and cost-effectiveness of industrial energy efficiency interventions. The following elements have helped PG&E enhance the usefulness of its industrial segment evaluation effort:

- Early evaluation of project energy saving estimates
- Setting aside a budget that can only be used for evaluation
- Having a dedicated in-house evaluation group

Early Evaluation of Project Energy Savings

The complexity and heterogeneity of this market segment makes evaluating the impact of industrial energy projects and programs very difficult. Gross savings impacts are estimated by reviewing all large projects in combination with a sample representative of smaller projects. Given that it is difficult to predict the ultimate composition of projects in a program cycle, evaluators have typically waited until the cycle is complete to decide which projects to review and what technologies to include in their review; using these for the savings estimates.

The primary problem with traditional impact evaluation, especially with multiyear cycles, was the prolonged period of time between project inception and implementation, and project evaluation. This was one of the main criticisms of the California 2006-2008 evaluations whose credibility was hampered by customer's difficulty to recall details, changes in corporate dictums, facility operations, and ongoing upgrades to the production equipment.

Cognizant of these challenges, PG&E's evaluation team reached out to both internal groups and the California Public Utilities Commission's Energy Division (CPUC-ED) to develop a process whereby evaluators would become participant-observers of new industrial projects. The CPUC-ED and Administrative Law Judge, in conjunction with the IOU's technical review teams, developed the "Ex-Ante Parallel Review" process. Key features of the process are:

- IOUs provide the CPUC-ED a list of upcoming potential projects
- IOU personnel develop an estimate of the project savings
- The CPUC-ED and their evaluation consultants pick a random assortment of projects for review, ideally picking all of the largest projects
- The CPUC-ED and their evaluation consultants examine the project and offer an assessment of the savings and, if necessary, ask for more or different data to be collected for estimating savings
- The CPUC-ED, their evaluation consultants and the IOU project savings estimators, discuss and reach agreement on the savings
- Once the project is installed and commissioned, a new estimate of savings is derived
- Projects that are not picked by the CPUC-ED for review automatically get credited 90 percent of the IOU's savings estimate

This process is helping to improve communication between the CPUC-ED, their evaluation consultants and the IOU's project savings estimators. Specifically, this interaction is helping them reach common ground on how to determine baselines, which methods are perceived to be more accurate, what types of data need to be collected and how to improve documentation of IOU portfolio interventions.

Because the parallel review happens while the project is being developed and installed, CPUC-ED's evaluation consultants have access to timelier, more relevant data. To some degree, this mitigates sources of inaccurate energy savings estimates, but more work remains to improve the current practice. For example, disagreements arise over savings estimates for specific industrial projects. Many projects are quite complex, with various technical options to consider for baselines, incremental costs and estimating savings. Many of these disagreements stem from policy dictates on savings counting processes that were developed in a simpler past and whose applicability to today's projects is contentious. As disagreements are identified during the review of projects, they are brought to the attention of the CPUC-ED and IOU's policymaking groups. The parallel review process is still relatively new, but as more projects are reviewed, understanding grows between evaluation consultants, regulators overseeing their work and the implementation teams.

Two other important improvements are further enhancing communications and building a shared understanding between evaluators, regulators and implementers: industry standard practice (ISP) studies and a mid-cycle impact evaluation feedback report for custom projects (Itron 2013). The impact of these two improvements is described briefly below.

The ISP studies were first introduced in 2009 by Southern California Edison with the blessing of the CPUC. They were risk mitigation studies whose purpose was to clarify if an energy efficiency measure still merited incentives to customers adopting it. The ISPs were done quickly, focusing on interviewing a few experts familiar with the technology and/or market where it was being applied. Recently, PG&E and the CPUC have begun to carry out new ISPs that provide real-time assessment of the practices of specific measures, potentially reducing incentive payments where they are no longer needed.

The second improvement was the CPUC-ED's mid-cycle report to expedite feedback to program implementation teams on measures that were saving a lot less or more than programs believed and insights on where project documentation was found to be in need of enhancement. PG&E requested and got agreement from the CPUC to return to a previous best practice of having evaluation and implementation teams converse on projects where ex-ante savings claims differed significantly from ex-post evaluation savings assessments. The purpose was two-fold: to improve the accuracy of the current savings assessments and to clarify sources of remaining discrepancy to inform future implementation and evaluation estimates. This process is leading to upgrades to PG&E's training of implementation teams and processes to enhance project documentation. It has also clarified what project identifiers PG&E needs to receive from evaluators to facilitate faster and fuller responses on evaluator's data requests. Actions being taken by both PG&E and the CPUC-ED's evaluation consultants are expected to lead to reduced discrepancies between ex-ante and ex-post savings estimates.

All of these recent changes to evaluation processes and increased exchanges between evaluators and implementation teams have not been without challenges. Increased times for review of projects and, at times, project partial or total disallowance by the CPUC-ED has impacted customer satisfaction. The increased level of communication also takes time away from all parties' additional professional obligations.

The understanding between the teams is still evolving and the value and benefits of this evolution are hard to determine at this time. The full value of these enhancements to the accuracy and timeliness of the evaluation effort will be more evident as the results of the impact evaluation of custom projects for the 2013-2014 programs come in.

Evaluation-Specific Budgets

The CPUC has traditionally approved a separate budget for evaluation, which has been crucial to ensure a stable, long-term evaluation budget that extends beyond a specific portfolio implementation cycle. By remaining separate from the rest of the portfolio, evaluation resources are inviolate. Portfolio administrators cannot dip into evaluation funds to cover other needs. This budget is also not subject to a specific end-date, which allows evaluation spending to continue as needed beyond the end of a specific implementation cycle.

Since 2006-2008, the amount available to spend on evaluation has been 4 percent of the total energy efficiency portfolio. Of this amount, 72.5 percent is for the CPUC-ED to spend primarily on impact and market assessments. The IOUs are given the remaining 27.5 percent for process evaluations and research on market assessments and characterizations.

Dedicated In-house Evaluation

All California IOUs (and many other energy efficiency programs) have in-house evaluation groups that are crucial to the success of the programs. Key roles played by these internal evaluation groups are discussed briefly below.

Aligning research with needs. The internal evaluation groups become part of the implementation team and learn their business and issues. They do so by shadowing internal implementation personnel in their daily work, attending meetings with customers and joining the conversation on market segments. This enables the internal evaluation team member to develop research that aligns with the implementers' needs for successful implementation. Given that most California IOU industrial energy efficiency programs are relatively mature, most recent efforts focus more on market assessments and establishing ISPs, rather than process evaluations of specific programs (2013-14 EM&V Plan – section on industrial roadmaps).

Advocating for relevant research. The internal evaluator also works with the CPUC-ED and their evaluation consultants to encourage relevant and accurate research. Proximity to the implementation teams (and at times customers) allows the internal evaluator to highlight areas where more impact, ISP and/or market assessment research is needed.

Help enhance the accuracy of the research. The internal evaluator can advise implementation teams on data they should capture and track and facilitate the evaluation team's access to this data. For example, it is common for internal evaluators to respond to customers who want validation of an evaluator's credentials. The internal evaluator can review research instruments, data collection and analysis methods, and results and recommendations for validity and applicability. The internal evaluator is a crucial intermediary, enabling CPUC-ED and their consultants to access the data they need from the implementation teams. Internal evaluators regularly explain evaluation and its processes to implementation teams to improve project documentation and collaboration with the evaluation effort.

Making the evaluation results useful and clear. Internal evaluators play a crucial role in explaining the results of recent research. Typically, meetings are held to allow key internal and external parties to hear the results of the research from the evaluation consultant and internal evaluator. Another key component is to ensure that the evaluation reports are palatable and understandable for their intended audience: the implementation teams. To this end, PG&E has developed a guidance document for evaluation firms to follow (PG&E 2013). One common request is a succinct executive summary that highlights key findings and next steps. PG&E is considering re-instating a requirement for a separate, two-page report summary as well. The internal evaluators always review reports to ensure appropriate language is used for the intended audience. When applicable, short memos with key findings are sought, expediting adoption of implementation enhancements.

Options for Closing the Gap

While the existence of a disconnect between implementers and evaluators is hardly news to industry veterans, changes in utility program environments, including larger goals and tighter budgets, are exposing the costs of allowing the disconnect to continue. As illustrated by these two case studies, two tactics appear to be most helpful in overcoming the divide between evaluators and implementers: involving evaluators early on and adapting some of the key evaluation tools for the purposes and ongoing use of implementers.

Involve the Evaluators Early

Early evaluation or evaluability assessments prepare program implementers for evaluation and can help them identify and respond to problems early in the implementation process. Early evaluation, or evaluation concurrent to the program cycle, encourages timely feedback. Past studies on evaluability assessments found insufficient interaction and a lack of understanding of each party's purposes and realities. This, combined with partial follow-through on recommended program changes, limits potential benefits of such efforts (Bronfman et al., 2008). Involving evaluation early can take several forms:

- Establish or actively leverage internal EM&V staff within the utility or program administrator
- Engage third party EM&V contractors as part of program design or program launch to conduct evaluability assessments

While both options require forethought, planning and allocation of budget, the potential benefits in addressing these barriers are significant and can result in more effective, agile programs, increased customer satisfaction and more cost-effective program delivery.

Utilities and program administrators now have the option of engaging with third-party program implementers who offer evaluation-ready program planning and implementation frameworks. For a comprehensive overview and lessons learned from an implementation contractor's efforts to integrate EM&V into day-to-day program implementation see Wong and Rock, 2012.

Adapt EM&V Tools to Needs of Implementers

Even if early evaluator involvement may not be possible for some, industrial program managers can still gain great value from adopting and institutionalizing typical EM&V tools and processes, such as logic models. Evaluators use logic models as a tool to help identify key performance indicators and to design an appropriate process evaluation plan.

While it might seem obvious that program implementers should create logic models, many evaluators know that this practice is uncommon. The lack of a clear value proposition for creating and using logic models is a common barrier to program staff actively using them. A logic model offers three key benefits to industrial program managers. First, it supports program design and provides a clear picture of how specific program activities lead to the targeted outcomes. Second, completing logic models and a corresponding indicators table provides program teams with important, relevant data to track in addition to the usual program indicators (kWh, kW, Therms and number of measures). Third, it provides a systematic approach for teams to discuss the program framework and come to an agreement on how the program should be implemented to achieve its goals (Wong C. and Rock K. 2012). Given some assistance, templates and the right value propositions, implementers can and will be able to effectively use logic models to their, and the evaluator's, benefit.

Despite their different backgrounds and processes, implementers and evaluators share a common interest: creating effective and efficient programs that address real needs and generate real "hard" savings. As we've shown, it's clear that by working together, both parties stand to gain significant benefits.

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