# A Framework for Effective Collaboration on Transferable and Reliable Assessments of Emerging Opportunities for Broad Scale Program Consideration

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## ABSTRACT

The recognition of energy efficiency as a low cost resource has led to a number of jurisdictions establishing energy efficiency resource standards with rapidly expanding energy saving targets. This comes at a time when traditional, widget-based approaches are nearing their limits for energy savings potential—either due to increasing minimum standards or market transformation. To meet increasing goals, many efficiency programs agree that the energy efficiency program industry must "Formulate and launch … an integrated portfolio of proven, piloted, and emerging approaches to unlock the full potential of energy efficiency" (McKinsey 2009). As such, several efficiency program administrators have ramped up or added emerging technology assessment functions, with a focus on assessing recently commercialized or near market ready products, services, and approaches for potential incorporation into programs.

To enable leveraged collaboration of these assessments, the authors of this paper draw on their expertise facilitating program coordination at a national level to support the Emerging Technology Collaborative framework development. This framework provides a foundation for more effective and efficient transfer of assessment plans and results through the identification of key considerations, qualities, and reporting requirements. Voluntary adoption of the framework components will increase consistency in approach and enable program administrators to utilize others' assessment results in support of filling their own programs' pipelines. This in turn is expected to accelerate the successful adoption of emerging opportunities into efficiency programs and unlock this low cost resource. This paper outlines the value of the framework, status of its development, and intended next steps.

## Background

### The Traditional Program Approach and Results

The energy efficiency program industry is a growing and successful industry. According to the Consortium for Energy Efficiency (CEE) State of the Efficiency Program Industry report, the efficiency program industry is a $9.1 billion industry that delivered 124,000 GWh and over 1.3 billion therms of electric and gas savings, respectively, in 2010. This equates to approximately $13.3 billion in customer savings and 92.0 million metric tons of avoided $CO_2$ emissions from entering the atmosphere (CEE 2012a). Program administrators have achieved these impacts in large part due to the promotion of traditional, widget-based programs; programs that are designed around the savings achieved through the promotion of efficient options for individual end use technologies.

**The Changing Landscape**

Despite the success of these traditional program approaches, the efficiency program industry is facing a new era. Policy makers are recognizing that energy efficiency is the lowest cost resource for meeting energy and other social policy needs. In response, a number of states and provinces are establishing energy efficiency resource standards that call for substantial levels of energy savings and increasing energy efficiency program goals. Many states are requiring utilities to pursue energy efficiency as their first resource for meeting growing energy needs (ACEEE 2009). ACEEE notes that there has been a perfect storm of circumstances that have elevated the importance of energy efficiency, including: (1) fuel price increases and volatility, (2) dramatic increases in the cost of new power plants, (3) concerns about electric system reliability, (4) cost-recovery concerns for electric generation construction projects, and (5) concerns regarding global warming (ACEEE 2009). Currently, 34 states have energy efficiency resource standards, pending regulations, or other energy efficiency goals to meet.

The heightened emphasis on energy efficiency comes at a time when some traditional energy efficient equipment incentives are nearing their limits for savings potential due to increasing minimum standards and the estimated market penetration of high efficiency equipment. The US and Canadian governments issue Federal minimum efficiency performance standards for many products. While this is an ongoing process, the rate at which these governments are revising minimum standards has increased over the last few years. The US Department of Energy (DOE) alone has issued standards for almost 30 products since 2009, offering a projected savings of almost $400 billion through 2030. Prior to 2009, the US DOE developed standards considerably slower, so much so that several states brought a lawsuit against the US DOE for its failure to meet statutory deadlines to update more than 22 standards. In addition to the recent focus on standards, the US DOE has set goals to achieve 50 percent better building codes for increased energy savings by focusing on increased adoption and compliance (Hogan 2012).

Efficiency programs must take into account current codes and appliance standards when determining energy consumption baselines for their programs. As standards stringency increases, two factors reduce the opportunities for traditional programs: (1) the difference between the energy consumption of products meeting the federal minimum level and the best available products decreases, and (2) the incremental cost of pushing the widget technologies to even higher efficiency levels increases. Thus, programs have to pay more for less in savings. Program administrators must then choose between dropping program offerings and paying a higher price for achieving energy savings. This points to the need for continuous investment in emerging technology research and development. Examples from lighting, furnaces, and motor programs—considered core measures—demonstrate this challenging dynamic.

Lighting accounts for 63 to 92 percent of all reported residential energy savings, with a majority of those savings attributed to compact fluorescent (CFL) programs (ACEEE 2009). A number of programs, including those in California, Connecticut, states in the Northwest, and British Columbia, are finding it difficult to justify the promotion of bare spiral CFLs due to regulator perception that markets have been transformed to the point that CFLs are standard technologies for customers (CEE 2009a). While some jurisdictions have been able to make the case to promote these products in the near term, it is inevitable that market transformation will occur, making it unnecessary for program administrators to continue to promote these products.

Similar challenges are present in the residential furnace market. Effective in 2013, the minimum standard for natural gas furnaces in northern states will rise to 90 percent annual fuel utilization efficiency (AFUE) (DOE 2011). Regulators will likely require that program administrators use the new standard as the baseline efficiency for new equipment purchases, which in turn will challenge program administrators to identify new cost-effective furnace offerings and consider whether the furnace market has been transformed in their jurisdictions. At the end of 2009, the Energy Trust of Oregon moved away from traditional stand-alone measure furnace programs after concluding that the furnace market had been transformed in Oregon (Energy Trust 2009a). Between the impending change to the Federal minimum standard and market transformation across many jurisdictions, other programs may not be far behind. The need to replace these traditional furnace programs is a significant driver for assessments of emerging residential gas measures.

In addition to changing program baselines, more stringent minimum standards may also limit the number of technology options available for programs. If there are insufficient product choices that exceed a new baseline, programs are often less likely to pursue a measure due to regulatory challenges and concerns over customer satisfaction. For example, program administrators no longer include industrial motor technologies in their program portfolios because of the limited number of high efficiency technologies. The CEE 2009 Motors and Motor Systems Program Summary identifies approximately sixty members with prescriptive programs for NEMA Premium (now standard level) motors. The 2012 Summary shows only seven programs that promote motors with efficiency levels higher than the standard NEMA Premium kevel (CEE 2009b; CEE 2012b).

**Moving Beyond the Traditional**

To meet the challenges mentioned above, program administrators and governmental organizations have committed to fill their pipelines with a continuing stream of program opportunities. Program administrators are exploring opportunities that go beyond traditional, widget-based program designs towards system and platform approaches (examples include whole house retrofits, commercial building performance, commercial and industrial energy management, and behavior approaches). Additionally, several efficiency programs have ramped up or added emerging technology assessment functions, focusing on assessing recently commercialized or near market ready emerging products, services, and approaches for potential incorporation into programs.

## Importance of Assessing for Program Readiness

Developing a pipeline of future program opportunities requires careful planning and research, not only around the technologies themselves, but also related to timing and method of introducing these new technologies into the market. Insufficient assessment results in increased risk for efficiency programs and creates barriers to successful adoption. There are plenty of examples of products being prematurely introduced into the market and adopted by efficiency programs. In many cases, this has resulted in: consumers distrusting energy efficiency programs; market actors refusing to distribute, stock, or install these technologies; and program administrators not realizing expected energy savings.

CLFs are one commonly cited example of new efficient products being promoted prematurely. For example, the early CFLs were larger and had relatively poor performance (humming, buzzing, flickering, delayed start, poor color rendition, short lifetimes, and incompatibility with dimming) compared to the incandescent products they were meant to replace (DOE 2006). Customers were unhappy with these products and began to associate energy efficiency with poor performance. It has taken several years for programs to overcome this early customer perception and regain credibility with consumers and market partners (DOE 2006).

## Binational Collaboration on Emerging Technology Assessments

To address the challenges above and identify and incorporate new opportunities into efficiency programs, several program administrators across the US and Canada are starting to collaborate on assessing opportunities for future inclusion into programs. In 2011, these program administrators came together to form the Emerging Technology Collaborative (herein referred to as "the Collaborative"). This Collaborative includes individuals with the responsibility of filling their organizations program pipelines. The organizations represented include BC Hydro, the Bonneville Power Administration, Commonwealth Edison, DTE Energy, Duke Energy, the New York State Energy Research and Development Authority, Northwest Energy Efficiency Alliance, Pacific Gas and Electric, the Sacramento Municipal Utility District, Sempra Energy (representing San Diego Gas and Electric and Southern California Gas Company), Southern California Edison, the Tennessee Valley Authority, and Xcel Energy.

Collectively, the Collaborative participants have budgeted more than $60 million annually to assess emerging technologies (Collaborative 2011). The participants are actively assessing over 300 opportunities, including emerging technologies, system design, new services, and comprehensive program approaches. These opportunities cut across the residential, commercial, and industrial sectors and a variety of end uses (Collaborative 2012). Given the vast experience and number of assessment efforts, the Collaborative's primary goals are to identify areas of mutual interest, avoid duplication, and to accelerate the assessment and adoption of emerging technologies. To meet these goals, the Collaborative is facilitating the transfer of individual assessment plans and results. The Collaborative also aims to expand the dissemination of results beyond the participants in order to support broader potential adoption of these opportunities across the efficiency program industry. With the market share that the Collaborative represents, the participants hope that their work might help to influence manufacturers and other key stakeholders to accelerate the introduction and availability of quality, reliable emerging technologies.

## A Framework to Support Effective Collaboration on Emerging Technology Assessments

Recognizing that each organization has its own approach and considerations for emerging technology assessments, the Collaborative set out to develop a framework that would provide a basis for more effective and efficient information sharing. The primary goal of the framework is to increase the transferability of assessment plans and results across the Collaborative by (1) increasing consistency in emerging technology assessment approach and (2) defining common information that participants require in order understand and apply others' assessment results to their own programs. This will enable program administrators to more effectively screen for the

most promising opportunities and assess the readiness of emerging opportunities based on their individual program objectives.

The framework supports the Collaborative participants in the following aspects of their emerging technology assessment work: (1) recognition of qualities and dimensions that Collaborative participants believe are necessary for reliable and useful emerging technology assessments, (2) categorization of emerging technologies based on commonly defined program readiness criteria, and (3) assessment reporting for maximum transferability. Collectively, these are expected to enable more effective and efficient collaboration on emerging technology assessments.

**Defining the Qualities and Dimensions of Emerging Technology Assessments**

Based on their collective experience of assessing emerging technologies, the Collaborative participants developed the following principles for assessing opportunities for program readiness. These principles capture the qualities and considerations that they each seek in their own assessment efforts. By incorporating these common principles into their individual programs, the Collaborative participants are able to increase the consistency in the practice of emerging technology assessments across the group. They are also able to more reliably use each other's results for their own program objectives. The principles are not intended to be an exhaustive list, and they may be expanded over time based on the Collaborative's experience with sharing assessment results:

- A holistic approach that addresses technical, market, customer readiness, as well as non-energy benefits, will provide a greater basis for assessing program readiness. Technical readiness includes demonstration of energy savings, quality performance relative to the incumbent technology, and safety. Market readiness includes demonstration of sufficient product availability, existing market channels are in place, and training and other stakeholder outreach is identified. Customer readiness includes demonstration of customer desire for the opportunity and satisfaction with the measure during previous assessments.
- Providing a consistent minimum set of reliable information that is required for transferability will increase the comparability of the opportunity across programs. This will also increase the ability of Collaborative participants, and potentially other energy efficiency programs, to rely on the diligence of others to maximize the leveraging of results across the efficiency program industry and address a broader range of opportunities.
- Selecting and prioritizing opportunities based on the strategic fit, technical and market potential, relative ease of retrofit and level of business disruption, and existing program assets collectively will help to yield new measures that are more likely to be successfully adopted into programs. This in turn will support programs in achieving larger program goals.
- Being mindful of the relative program readiness of an opportunity, existing barriers, and proposed next steps during the planning will enable efficiency programs to better leverage existing resources during the assessment phase.

- Recognizing seasonal and other potential changes (e.g. manufacturing, operational, etc.) during the development of the assessment and data acquisition plans will yield stronger data.
- Detailing the timing of data collection, regional definitions for peak periods, duration and frequency of testing, and weather conditions at the time of assessment provide a basis for greater transferability of results.
- Clearly documenting the assumptions and conditions that went into assessment planning, testing, and reporting will enable others to responsibly compare data and relate the results to their own program goals.
- Documenting the measurement and verification plan enables others to determine whether the assessment meets their own requirements. This also allows others to effectively conduct additional assessments that will contribute to a broader base of knowledge around that opportunity.
- Being mindful of the timing of data collection, equipment use and operations, depth of data, primary sourcing from credentialed sources, and evidence bound assertions are important to a good assessment.
- Using certified, calibrated equipment for an assessment will provide a greater basis for others to rely on the data.
- Recording the assumptions for how equipment, controls, and people interact with the opportunity will enable a greater sense of reliability.

**Common Categorization of Opportunities Based the Relative Program Readiness**

With an understanding of the common principles in place, the Collaborative set out to catalog the various assessment activities across the group. This enables the Collaborative to identify areas of mutual interest and potential overlap. It also provides a way to track the progress of assessments, which the Collaborative participants believe provides a unique lens for understanding the relative readiness of these emerging opportunities.

While compiling the catalog, the Collaborative participants quickly realized the need to better indicate the status of each assessment effort. Emerging technology assessments take many forms, including activities such as lab tests, market studies, and technology field assessments. The assessment process can take many years as lessons are learned along the way, projects are revised, and opportunities are reassessed. Additionally, each program administrator has its own stage-gate (or internal process for advancing opportunities through a series of check-in points) that did not provide for easy translation across the group. To track the progress and better understand the relative readiness of each assessment effort, the Collaborative participants defined a common set of terms to characterize the status of each effort. The intention was to develop a set of terms that was straightforward enough to apply consistently, while ensuring sufficient differentiation to convey the relative readiness of an opportunity. Consistent use of these common terms will enable the Collaborative to relate another's efforts to their own process and decision points.

While still a work in progress, the Collaborative has defined four main "bins" as a starting place for capturing these efforts. These bins represent a collection of assessment efforts that are at a similar stage of program readiness.

**Idea.** Those opportunities that are the least program ready are ideas; opportunities that may be promising, but an efficiency program has committed little to no resource to screening or assessing it for potential program inclusion. The Collaborative sees value in capturing these ideas as a basis for identifying potential topics for future collaboration.

**Assessing.** Once an organization has committed resources to an opportunity, the effort moves into the assessing bin. This is a signal that the opportunity has passed initial screening and warrants consideration as having potential to fill their pipeline. As previously noted, there are currently over 300 active assessments across the Collaborative. Many of these fall into the assessing bin. Therefore, to enable better tracking of the opportunity and provide added context of its relative readiness, the Collaborative is working towards a means of further delineating the assessment type. Rather than attempting to define all potential assessment types, the Collaborative is working towards a minimum, yet meaningful set of common terms that will convey what is known and not known about a specific opportunity.

Two examples of this further definition are 1) a lab study and 2) a scaled field placement. A lab study focuses on understanding the technical performance of an opportunity in a laboratory setting based on a standard rating method. This will yield significant information about the performance compared to manufacturer claims. It will not, however, provide data on the savings based on actual use, impacts of human interaction, previously unknown aspects of installation or operation, or information about the customer satisfaction with the opportunity. On the other hand, a scaled field placement addresses more of those aspects of program readiness. Given the larger resource required and additional data being captured in scaled field placements compared to a lab study, an effort at this stage is likely to be relatively more ready for program adoption. Being able to quickly identify efforts at this stage, as well as track efforts as they move through assessment types, will help Collaborative participants prioritize and manage their own assessments around a similar opportunity.

**Completion of assessment or phase of assessment.** As an assessment moves forward, there are several stages when decisions are made and next steps are determined. Knowing that an opportunity has reached this bin enables efficiency programs to find that decision and the information that led to that decision. This information helps other efficiency programs to determine what, if any, resource they might put towards assessment of that opportunity, which is particularly important during the program administrator's ideation or planning stage.

The Collaborative is also working towards increased definition and consistency in representing the intended next steps for efforts in this bin. For example, once a phase of assessment is complete, program administrators will determine any next steps in advancing an opportunity. This could include abandoning an opportunity, holding off on further assessment, revising and defining a new set of research questions, or moving it over to programs for potential adoption. Having consistent terminology allows the Collaborative to quickly and more accurately understand the proposed next steps.

**In market.** The final bin describes an opportunity that is no longer in the emerging technology assessment program and has been transferred to the program designers and implementers. Tracking these efforts allows the Collaborative to quickly identify opportunities that have already demonstrated readiness for an individual program. While opportunities in this bin may not necessarily be ready for all efficiency programs across the US and Canada given the differing

program considerations across jurisdictions, knowing they are in the market for at least one program provides a strong signal that the opportunity may warrant further consideration by other programs.

**Making Emerging Technology Results Transferable**

With the ability to identify and track assessment efforts in place—and principles supporting confidence in the approach of those efforts—the Collaborative participants turned their interest to sharing assessment results. As is the case with other aspects of emerging technology assessments, the results are context sensitive. In order to effectively share results across the Collaborative, participants need sufficient product or concept definition to ensure that they can understand and apply the results to their individual program objectives. At the same time, not all information that a program administrator gathers during its assessment is valuable to other programs. This may be due to differences in strategic considerations, markets, climatic considerations, and program goals. Therefore, the Collaborative participants developed an assessment report template to support maximum transferability of results. As a first step in template development, the Collaborative participants identified the necessary information for sharing assessment results across the group based on their own experience. The participants chose to use an appendix to parse out information that they consider to be "nice to know," or information that adds context, but may be less reliable or relevant to another efficiency program's goals and considerations.

The concepts of defining common information needs and creating a template to compare emerging technologies are not new. For example, organizations such as the Federal Energy Management Program and the American Council for an Energy Efficient Economy have developed templates to compare emerging technologies. The unique value that the Collaborative participants are seeking in their template is the ability to share assessment results on a variety of emerging opportunities across a group of program administrators as a basis for accelerating the assessment and potential adoption of these technologies into not just one, but potentially several efficiency programs across the US and Canada. In addition to increasing the transferability of results, this template will also increase the consistency in reporting, which will allow the Collaborative participants to quickly locate the information that is relevant to them from another's assessment report. The following delves into specific sections of the assessment report template. As a next step, the Collaborative participants are actively using the template with existing efforts in order to ensure it supports their individual and collective needs.

**Clear description of the opportunity.** Providing sufficient description of the opportunity being assessed will allow Collaborative participants to quickly determine the potential relevance of an opportunity to their own strategic considerations and program goals. This includes a description of the opportunity, its expected performance, the target market and customer, the existing baseline, and how the opportunity is expected to improve over the baseline. When reporting on the target market, it is also important to speak to the market status and the ease to market entry, including identification of any known barriers to market introduction from the manufacturing of the opportunity to information on purchasing, installation, and servicing requirements. All of this provides context about the opportunity, as well as information on its relative program readiness.

**Basis for understanding assessment results.** Detailing the method of assessment protocol, the conditions for the assessment, and any assumptions that may impact the assessment results provides a basis for Collaborative participants to understand the results. Specifically, since saving energy at a certain time of day or year may be particularly important for a program administrator, capturing dimensions of time (time of use, duration of use, etc.) is critical for enabling others to assess whether the opportunity may have value for their own programs. This also creates consistency in approach and will support other Collaborative participants interested in conducting a complementary assessment, whether the desire is for coordination across jurisdictions or the need for an individual participant to conduct additional assessments in one's own territory in support of individual program considerations.

**Capturing results and next steps.** Program administrators always need to know several pieces of data to understand the results and apply it to their own jurisdiction, regardless of the assessment opportunity or type. The Collaborative is starting to define those information needs, and delineate reliability aspects for each. To date, the Collaborative has identified the following pieces information that must be included for maximum transferability: energy savings results, detailing the operating performance and any performance barriers identified, and providing simple customer payback—including costs, rates, and other assumptions used in the calculations. Additionally, explaining the analysis and data reduction process (what was included, excluded, and why) provides a basis for other Collaborative participants to best interpret the results. The final piece of information necessary for transferability is the result and recommended next steps. The Collaborative plans to incorporate the relevant "Completion of Assessment or Phase of Assessment" terms for added consistency in reporting. By using this common terminology, as well as the assessment experience, planned next steps, and the common data needs defined throughout the template, the Collaborative participants can more effectively transfer the assessment results and understand the relative readiness of the opportunity based on their individual program objectives.

## The Collaborative's Next Steps to Advance the Framework

The framework presented in this paper is based on the collective experience of a Collaborative of energy efficiency programs administrators, whose representatives bring expertise in planning, managing, and conducting emerging technology assessments for program readiness. Collectively, the principles, common bin terms, and assessment report template provide a foundation for greater definition around the emerging technology assessment process. While not yet complete, the framework has already enabled enhanced coordination across the group. For example, definition of the common principles has built confidence that others are approaching assessments with the same set of high-level qualities and considerations. Additionally, the cataloging of existing program efforts has helped participants to identify areas of mutual interest, duplication, and potential opportunities for future collaboration. The Collaborative plans to continually update this catalog to support the tracking of efforts as they progress towards program readiness. As a next step, the Collaborative is actively working to test and refine the template as a basis for sharing assessment results.

The Collaborative believes that voluntary adoption of this framework by program administrators will enable successful leveraging of each other's assessment results. The participants recognize that adoption of the framework may require some shift in their existing

practices, but they recognize the value of defining a common framework as a basis for binational coordination. The hope is that it will bring value beyond the Collaborative by providing a basis for collaboration with other program administrators. Increasing the transferability of results across the industry will better position program administrators to responsibly leverage others' work. Through effective collaboration on emerging technology assessments, program administrators may be better positioned to unlock the low cost resource of energy efficiency.

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