



Scoping the Certification of Energy Program Impact Evaluators

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About NEEP

Northeast Energy Efficiency Partnerships (NEEP) was founded in 1996 as a non-profit whose mission is to serve the Northeast and Mid-Atlantic to accelerate energy efficiency as an essential part of demand-side solutions that enable a sustainable regional energy system. Our vision is that the region will fully embrace next generation energy efficiency as a core strategy to meet energy needs in a carbon-constrained world. The Regional Evaluation, Measurement and Verification Forum (EM&V Forum or Forum) is a project facilitated by NEEP. The Forum's purpose is to provide a framework for the development and use of common and/or consistent protocols to measure, verify, track, and report energy efficiency and other demand resource savings, costs, and emission impacts to support the role and credibility of these resources in current and emerging energy and environmental policies and markets.

Disclaimer: NEEP verified the data used for this white paper to the best of our ability. This paper reflects the opinion and judgments of the NEEP staff and the project team, and does not necessarily reflect those of NEEP Board members, NEEP Sponsors, or project participants and funders.

This Study: The US Department of Energy requested and funded the study. It was carried out under contract with the NEEP EM&V Forum by a team of consultants recommended by the Board of Directors of the International Energy Program Evaluation Conference (IEPEC). Bobbi Tannenbaum of Btan Consulting, and Bob Wirtshafter of Wirtshafter Associates were the primary investigators. Anne Dougherty assisted and assistance and NEEP Senior Manager Elizabeth Titus coordinated the project. The project also wishes to acknowledge very substantial contributions of time and material volunteered by Bill Miller of LBNL and Mary Sutter of Grounded Research. In addition, the project team wishes to internal review provided by Ralph Prah and Bill Saxonis.

The process of developing this report was substantially aided by input from an Advisory Panel. As the report was developed, the members of the Advisory Panel were asked to provide commentary in order to obtain diverse perspectives about certification and the issues certification raises. The panel included members of the energy efficiency evaluation field and knowledgeable users of evaluation studies and results.

The following individuals agreed to provide input on certification in general and on specific issues addressed by this report. Their participation does not represent an endorsement of certification in general nor any of the report's contents. Their affiliations are indicated for identification purposes only and their participation does not represent any position of the indicated organization: Mimi Goldberg (Business Line Director, DNVGL); Michael Goldman (Supervisor of Evaluation, Eversource); John Hargrove (President and CEO, AESP); Ken Keating (Consultant); Steven R. Schiller (Principal, Schiller Consulting), Katie Rich (Director, Texas PUC), Carol Stemrich (former Assistant Administrator, WI PUC).



Executive Summary

In 2015, the U.S. Department of Energy (DOE) asked the IEPEC Board of Directors to propose a study to explore the development of certification for evaluators of energy efficiency program savings. DOE's motivation for initiating certification stemmed from an interest in transparency and validity in energy savings estimates. The project was funded and coordinated through NEEP. The research was completed by a research team, and reviewed by members of the IEPEC planning committee and an external advisory panel.

The purpose of this study is to determine a process through which evaluators' specialized knowledge would be recognized through certification. This investigation focused on if, at a high level, it is feasible to develop a certification for evaluators, and what is a path for possible certification. The focus of the investigation is on the pathway to entry level certification. However, it includes brief consideration of examples and issues pertaining to certification beyond entry level. Limited project funding constrained the scope of the research. These project limitations should not be viewed as limitations for evaluator certification. For example, the study focuses on energy savings, but, certification is not necessarily limited to that.¹

Informed by both secondary research and in-depth interviews with experts, the team completed the following activities: identifying the range of competencies required for impact evaluators; developing a preliminary list of competencies for entry-level evaluator certification; and developing a roadmap (in spreadsheet format) that addresses organizational structure and certification specific issues that must be addressed.

The research objectives evolved during the course of the project, in response to a combination of early findings, evolving needs from DOE, and a recognition of the importance of early decisions in the certification process. Thus, instead of identifying "two evaluator certification models for DOE's consideration that could be implemented", as initially proposed, the team developed a roadmap that identifies key decisions required for developing entry level certification as a starting point for impact evaluator certification and discusses options for implementing decisions. DOE decided to pursue next steps toward an entry level certification (or certificate) as a second phase project.

Definitions

Certification is a broad term with multiple meanings. For the purposes of this report we define what we mean by three terms:

Certification - Attainment of proficiency or competency in a profession, occupation or major job task. Initial certification based on knowledge, skills and abilities. On-going requirements to maintain proficiency or competency, otherwise certification is revoked. (We also use certification to mean certification or certificate, when discussing evaluator certification in general.)

Certificate - Document provided after completion of a training *and* accomplishment of learner outcomes (usually determined by an exam). Does not require on-going maintenance.

¹ The authors recognize that the organizations ultimately responsible for the certification may choose to broaden or narrow the focus of the certification, and that whatever is initially decided on may need to be revised as the evaluation field evolves.



Credentialing – This term is used to be synonymous with certification. The Green Business Certification Institute “certifies” buildings and “credentials” professionals.

Key findings from the research include the following:

Impact Evaluator Competencies

Key critical factors pertaining to impact evaluator competencies were identified, based on interviews with 19 experts in four core impact evaluation approaches (engineering review, metering, building simulation and billing analysis):

- Impact evaluations are usually completed by teams of evaluators (no individual has all the required expertise);
- Impact evaluations require professionals with different levels of expertise (i.e. even junior staff on projects must have some competencies);
- Most impact evaluations require experts across myriad disciplines (e.g. statistics, engineering);
- Foundational knowledge in evaluation (logic models/program theory) and experimental design, and energy programs are essential for impact evaluators at all levels;
- Impact evaluations also require staff with competencies in research planning, report writing and project management;
- No two impact evaluations are alike.

The research identified the following perspectives – benefits and challenges associated with certification:

- **Potential Benefits of Certification**
 - Identifying and promoting a code of ethics for impact evaluators;
 - Increased access to and utilization of training in energy efficiency impact evaluation;
 - Identifying requirements for evaluation reports to increase transparency.
- **Challenges for Evaluator Certification**
 - Balancing the objective of quality and credible certification with the reality of limited resources. (The number of impact evaluation professionals is limited, and may not be sufficient to sustain certification. For a certification of impact evaluation to be viable, DOE or some other entity will need to provide financial support for the foreseeable future);
 - The complexity and variety of competencies required;
 - Skepticism among evaluators that certification would achieve the desired outcomes and encompass the broad, non-formulaic, and evolving aspects of evaluation to ensure quality and defensible impact estimates.

Roadmap - Organizational Issues

- Certifications vary substantially in how they are defined, delivered and maintained. Many, though energy efficiency evaluation is not one of them, follow an established set of standards. Professional



certifications (e.g. engineers) are often subject to state requirements. Establishing and maintaining a certification requires one or more organizations to own the content, oversee the certification, and provide the training. Some certifications are controlled by a single organization, while others involve multiple organizations. ISO17024/ANSI certification has substantial requirements for organizational processes, structure, requirements, maintenance and other features. The requirements, in part, strive for impartiality from the certifying body.

- There are a limited number of organizations who are likely to be willing and capable of taking on a role in impact evaluator certification.
- The division of responsibilities across organizations playing a role in certification, as well as the organizations themselves, will have a large effect on how the certifications are handled.
- The organizational structure needs oversight to manage potential conflicts of interest and organizational conflicts; and to ensure that the many on-going tasks identified in the Roadmap are administered to and updated as necessary.

Recommendations

- Organizational structure decisions should be made with a longer term view of energy impact evaluator certification. A structure designed to deliver an entry-level certificate may not be the best one if the longer term objective is to develop a suite of certificates or a professional level certification.
- Organizations must be designated to fulfill four key roles: content ownership, certification, training, and oversight. It is possible (and likely) that an organization may be selected to handle two or more of the roles. However, no existing organization has all the required expertise, and the process would lack any checks and balance.

By following the roadmap and proceeding to the next phase in developing entry level certification for impact evaluators, DOE would be taking an informed next step in exploring certification as a potential resource for the evaluation community.



Introduction

In 2015, the U.S. Department of Energy (US DOE) asked the International Energy Program Evaluation Conference (IEPEC) Board of Directors to propose a study to investigate the development of certification for evaluators of energy efficiency program savings. The motivation for this study was DOE's interest in ensuring transparency and validity in energy savings estimates from efficiency programs. DOE included a recommendation in the Clean Power Plan (CPP) that states include in their CPP plans how the skills of workers performing the EM&V of efficiency programs will be certified by a third-party entity.²

The purpose of this study is to determine a process through which evaluators' specialized knowledge would be recognized through a process of certification. This investigation focused on if, at a high level, it is feasible to develop a certification for evaluators, and what is a path for possible certification. The focus of the investigation is on the pathway to entry level certification. However, it includes brief consideration of examples and issues pertaining to certification beyond entry level. Limited project funding constrained the scope of the research.

The research objectives evolved during the course of the project, in response to a combination of early findings, evolving needs from DOE, and a recognition of the importance of early decisions in the certification process³. Thus, instead of identifying "two evaluator certification models for DOE's consideration that could be implemented", as initially proposed, the team developed a roadmap that identifies key decisions required for developing entry level certification as a starting point for impact evaluator certification and discusses options for implementing decisions. DOE decided to pursue next steps toward an entry level certification (or certificate) as a in a second phase project.

Research Methodology

DOE reached out to the IEPEC as a source of evaluators with expertise to develop a scope of work to meet its objectives, and to NEEP as an organization to manage a contract and facilitate delivery of the project. NEEP obtained the services of a small team of expert evaluation consultants to complete the study. In addition, a small internal review team and an external advisory panel of seven people reviewed key documents developed by the research team to assure input from a wide range of perspectives.

The research involved in this project was divided into two stages. Stage 1 looked at the skills and expertise required to perform impact evaluations. Stage 2 developed a roadmap to guide DOE in developing an impact evaluation certification process, with particular focus on the development of an entry-level certificate or certification.

² See Federal Register/Vol.80, No. 205/Friday, October 23, 2015, page 64910 for full text

³ DOE chose to first investigate a path for possible certification and laid out two core objectives for this scoping study: (1) To assess the utility and feasibility of energy efficiency program gross impact evaluator certifications, and (2) To identify two evaluator certification *models* for DOE's consideration that could be implemented, should DOE or others pursue certification.



In Stage 1, the research team sought to determine the types of analysis done by impact evaluators and range of knowledge and skills needed to accomplish that analysis. The research team performed two main data collection activities to fulfill the objectives: 1) in-depth interviews, and 2) secondary data research.

In-depth-interviews (IDIs) were conducted with 19 evaluators considered to be experts in each of the four main methods employed to obtain gross impacts.⁴ IDIs are a qualitative research method that was employed to identify the range of competencies required for each method. The interviews addressed the steps involved in completing each evaluation method, and the required skills, knowledge or education to complete each of the steps successfully (competencies). Table 1, below, shows the distribution of interviews by impact approaches. The results of Stage 1 were provided in a memo to DOE.

Table 1. Expert Interviews by Impact Approach

Impact Approach	Interviews (#)
Engineering desk review	10
Metering/monitoring	
Building simulation	4
Billing analysis	5
Total	19

For numerous reasons⁵, following Stage 1, the project scope evolved. Stage 2 focused on development of a roadmap that would assist DOE in developing a certification process, with specific emphasis on initiating a certification for entry-level evaluators. Through secondary research and IDIs with representatives, the team obtained information to summarize objectives, organizational structures, procedures used, costs and other related characteristics for six different certifications currently in the market. The six examples were selected to provide a range of characteristics and because the certifications addressed topics with similar characteristics to those that might be included in energy program impact evaluator certification. Appendix 2 presents the detailed information from this effort.

It is important to highlight here that this scoping research is done from an objective perspective. As such, the study gathered informants' and reviewers' perspectives on the pros and cons of certification, as well as collecting information regarding core technical skills and knowledge (competencies) that are elements of energy program evaluation based on survey results. While the roadmap that was produced identifies key early stage decisions

⁴ These methods are: 1) Engineering assessments/ desk reviews; 2) metering/monitoring; 3) building modeling simulation (such as DOE-2) and, 4) econometric modeling (billing analysis). The team completed the interviews between December 7, 2015 and January 7, 2016. Interviews lasted between 30 and 90 minutes.

⁵ First, the IDI's brought forward many questions about the development process for certifications that merited further consideration and research than originally planned. Second, the research team determined that a "roadmap" identifying the types of decisions that would be needed to pursue evaluator certification would be of great value, if evaluator certification were to be pursued. Finally, DOE informed the research team that they wanted to move forward with the development of an entry-level certification, given that early research findings had not ruled out the feasibility of evaluator certification.



that are required to develop certification, making the decisions regarding certification or recommending specific organizations that could provide organizational structure for certification are beyond the scope of this research.

Organization of Report

This report includes the following technical chapters. In addition, a companion spreadsheet containing the roadmap was prepared.

- **Chapter 2:** A Brief History of Impact Evaluation Practice. This chapter provides a brief history of impact evaluation and current efforts to develop protocols.
- **Chapter 3:** Assessing Impact Evaluator Competencies. This chapter presents the results of the Stage 1 interviews.
- **Chapter 4:** Roadmap for Developing Impact Evaluator Certification
- **Appendix 1:** Content for Entry Level Energy Impact Evaluation Certification
- **Appendix 2:** Details on Six Certification Programs



A Brief History of Impact Evaluation Practice

Evaluation, measurement and verification (collectively called EM&V) of energy program impacts have been performed by evaluators for approximately 40 years, as long as there have been energy efficiency programs. Following efforts by the Federal government, utilities in the Pacific Northwest, California and the Northeast were among the first to initiate energy efficiency programs. To assess the impacts of these programs, social scientists and engineers adapted program evaluation practices to fit energy efficiency programs. Concepts such as “gross” and “net” impacts were created to align with the unique policy objectives of government directed energy efficiency programs⁶.

The number of evaluation practitioners⁷ has fluctuated with the expansion and reduction of energy efficiency programs. In the first two decades, evaluators were typically part of small businesses which allowed a relatively easy exchange of knowledge between newer and older practitioners - as well as sharing of methods between firms. Evaluators tended to interact with another relatively small group of practitioners - the individuals within utilities or regulatory agencies which procured their services.

As time progressed and energy efficiency programs grew in size and scope, interested parties created formal groups to address EM&V issues. For example, the National Energy Program Evaluation Conference (predecessor to IEPEC) was formed in 1983, as a way for

Energy efficiency evaluation began, along with energy efficiency programs, about 40 years ago. After relatively slow growth over 20 years, an explosion of programs brought about increased scrutiny and additional evaluation codification.

evaluators across the country to begin sharing knowledge and best practices through its biannual conferences. The California Demand Side Management (DSM) Measurement Advisory Committee was initiated in 1994 to create a forum for the presentation, discussion, and review of EM&V studies. Its goal was to facilitate the development of effective state-of-the-art protocols for measuring and evaluating the impacts of DSM programs in California. Two years later, Northeast Energy Efficiency Partnerships (NEEP) was the first of several regional energy efficiency organizations that have subsequently been formed to address energy efficiency program, policy, and market opportunities at a regional level.

While the knowledge, experience and labor force of early practitioners grew slowly through the 1990’s, since 2000 there has been a rapid growth of energy efficiency services as more and more states created energy efficiency portfolio standards, accompanied by increased spending.⁸ The number of programs increased with the

⁶ Program evaluators outside of energy efficiency do not use this differentiation. Outside of energy efficiency, evaluation of the impacts of a program is typically labeled ‘program effect’. For definitions and discussion of gross and net impacts in energy efficiency, see “Gross and Net Savings Principles and Guidance” (NEEP 2016): <http://www.neep.org/initiatives/emv-forum/forum-products#A> Look at New Products.

⁷ Because this report focuses on energy efficiency, we do not include the words “energy efficiency” in our label “evaluation practitioners”. However, note that there are thousands of evaluation practitioners outside of energy efficiency.

⁸ In 2007, there was ~\$2.5 billion in energy efficiency funding in the US (2010 ACEEE Scorecard). In 2013, that value has grown to ~\$7.7 billion (ACEEE (2015), “Energy Efficiency in the United States: 35 Years and Counting”, <http://aceee.org/research-report/e1502>



number of requisite evaluations also increasing and in many cases requiring tailored methods to fit particular program circumstances. This rise also brought in new practitioners and users of evaluation.

Rapid Growth in Efficiency Spurs Development of EM&V Protocols and Procedures

Following the increased need for evaluation, practitioners at all levels began codifying energy efficiency evaluation, with the pace increasing in the past decade. In 2004, the California Public Utility Commission published The California Evaluation Framework, a document covering both broad and detailed information on evaluation of energy efficiency programs. The Federal government's involvement, which began in 1991, accelerated after 2005.^{9 10 11 12} Since 2007, additional documents by state, regional, and federal organizations have been published. These include, for example, the Uniform Methods Protocols from the US Department of Energy (DOE), and draft EM&V Guidance from the US Environmental Protection Agency in support of the Clean Power Plan¹³.

What began as a relatively small set of evaluation practitioners and a limited group of evaluation users grew significantly after 2000. Large increases in efficiency budgets and the involvement of more states and statewide organizations brought new staff responsible for evaluation oversight, some who lacked evaluation or energy program expertise. Many had insufficient opportunity or time to learn and understand the intricacies of evaluation, but were responsible for the credibility of evaluation results. Evaluation procurers asked evaluators to fulfill their impact evaluation requirements using varied approaches, based on budgets and policy decisions made at the state level (e.g., impacts based on a Technical Reference Manual (TRM), or measured savings at the electrical meter). Third party evaluation firms added staff who had shorter apprenticeship periods due to higher workloads.

When energy efficiency became a large part of reducing greenhouse gas emissions, gross impact evaluation gained a wider use and audience.

Post 2005, the Federal and State governments turned to energy efficiency as an integral part of reducing greenhouse gas (GHG) emissions. Their efforts to use multiple reports to understand the level of savings occurring within a state or across the nation revealed a need to make energy impacts and the supporting evaluation documentation more accessible to a wider audience, including system planners and air regulators, for example. In addition, they realized the need to help ensure that energy efficiency program

⁹ Oak Ridge National Laboratory (1991), "Evaluation of Utility DSM Programs", (1991)<http://web.ornl.gov/info/reports/1991/3445603518334.pdf>

¹⁰ US Department of Energy, Energy Efficiency and Renewable Energy (2006), "Guide for Managing General Program Evaluation Studies" http://betterevaluation.org/resources/guide/eere_guide_managing_evaluation_studies

¹¹ US Department of Energy, Energy Efficiency and Renewable Energy (2007), "Impact Evaluation Framework for Technology Deployment Programs," https://www1.eere.energy.gov/analysis/pdfs/impact_framework_tech_deploy_2007_main.pdf

US Environmental Protection Agency, (2007) "Model Energy Efficiency Program Impact Evaluation Guide,"

https://www.epa.gov/sites/production/files/2015-08/documents/evaluation_guide.pdf¹³ For a listing of documents with links, please refer to Evaluator Resources section of the International Energy Program Evaluation Conference website, www.IEPEC.org.

¹³ For a listing of documents with links, please refer to Evaluator Resources section of the International Energy Program Evaluation Conference website, www.IEPEC.org.



impacts are credible to the relevant audiences. The strategy of codification has been one response to this need; it is summarized well in DOE’s introduction to the Uniform Protocols Project:

“Using a single measurement and verification protocol to calculate the energy savings from a particular measure or program will increase the credibility of the reported savings. This increased credibility will give electric utilities, their regulators, and other stakeholders a greater level of confidence about reported savings and reduce the risks of using energy efficiency as an electricity resource.”¹⁴

¹⁴ (<http://energy.gov/eere/about-us/ump-protocols>)



Assessing Impact Evaluator Competencies

This section provides a summary of findings from the first stage of research, which examined skills, knowledge and expertise (competencies) required to perform gross impact evaluations. The research focused on a core subset of impact approaches, as identified in Table 1. As described in the Introduction, the Research Methodology¹⁵ involved in-depth interviews with 19 experts. Interviews addressed the steps involved in completing the evaluation approaches and the required skills, knowledge, or education to complete each of the steps successfully. The interviewers also asked respondents to suggest ways to test competency and about their thoughts regarding pros and cons of impact evaluator certification.

The intent was to identify and characterize the range of competencies commonly needed for evaluations, rather than to develop an exhaustive list of competencies. By understanding the range required to complete impact evaluations, the team could better assess the suitability and challenges of certifying impact evaluators.

General Findings

Respondents indicated a number of factors critical to gross impact evaluation that must be considered for potential evaluator certification to be successful. These include:

- **Most impact evaluations require a team of researchers with varying types and levels of expertise.** To ensure a quality product, more experienced staff typically plan and oversee the work of more junior or specialized team members.
- **Varying competency levels are often needed within and across impact evaluations.** The same task may require different levels of expertise within a single evaluation. Determining at what level(s) and the required knowledge and experience to certify individuals is challenging.
- **Substantial expertise in multiple disciplines is required for nearly all impact evaluations.** Few, if any, evaluation practitioners have the skills and knowledge to complete all tasks required for a program impact evaluation.
- **Respondents think that a commitment to ethical behavior should be a component of any certification.** They recognize that methodological and other decisions can affect the evaluation results and want to codify ethical behavior.
- **Evaluation often requires analytical and interpretive skills not easily defined or testable.** These capabilities are used to develop research plans, solve problems, probe data, question results, and offer interpretations of findings.

¹⁵ Additional details are available in the Memo to DOE on Task 2.



While nearly all impact evaluations require senior staff (subject matter experts) with substantial expertise in cross-cutting topics, junior staff benefit from foundational knowledge in the following:

- Program evaluation and design
- Energy efficiency programs
- Analyzing energy usage in buildings and equipment
- Specific methodological skills (e.g. statistical billing analysis, engineering, sampling)
- Experimental and quasi-experimental design

The expert respondents (and internal reviewers and Advisory Panel members) identified multiple competencies at various levels of specificity, associated with desk reviews, billing analysis, building simulation, or metering and monitoring. The team consolidated them in **Error! Reference source not found.**

Table 2. Competencies Identified for Four Gross Impact Approaches

List of Common Competencies by Task Area
PLANNING TASKS
Understanding of program logic
Knowledge of costs and benefits of multiple evaluation designs and deployment methods
Technical knowledge of how building systems work and interact
Technical knowledge of how energy efficiency saves energy
Knowledge of pros and cons of multiple types of metering equipment
Thorough knowledge of fundamentals of energy measurement
Development of cost effective sampling designs to address a wide range of situations (from sampling within a building to across a portfolio of programs.).
Awareness of IPMVP, Uniform Methods, or other protocols
Understanding the pros/cons of applicable models
Identification of data needs
Accurate manipulation of large datasets
Knowledge and application of experimental and quasi-experimental design
DATA COLLECTION TASKS
Identification of ramifications for sample design implementation flaws and ability to recover from issues that arise



List of Common Competencies by Task Area

Accurate calibration, installation, and retrieval of metering equipment and data collected by the equipment

Safe and appropriate use of metering devices to capture specific parameters

Proficiency in reading building plans

Knowledge of appropriate human subject data collection (when included as part of task)

Knowledge of appropriate data available from secondary sources (e.g., weather), and pros/cons of different sources

ANALYSIS TASKS

Cleaning data for later use in analysis

Identification of and ability to work around data deficiencies and inconsistencies

Ability to develop baselines for equipment, practices or situations for which baselines are not established

Understanding of typical energy use and savings (specifics depend on what is being analyzed)) and appropriate treatment of outliers

Appropriate application of baselines

Understanding the effect on energy use of building operations, building controls and other factors (e.g. occupancy rates)

Proficient use of modeling software

Application of multiple statistical tests of validity

REPORTING TASKS

Documentation of results clearly, transparently, and thoroughly

In addition to the general factors that are critical aspects of impact evaluation discussed earlier, key technical expertise and specific knowledge are required to complete energy impact evaluations. The requirements vary across projects and across tasks within a project. It is important to note that most impact evaluations rely on a range of methods to establish verified gross energy saving; no two evaluations are identical. Moreover, there is overlap between many competencies required by evaluation approaches, and there is some overlap between “technical” versus “other” competencies.



Technical Competencies Required for Gross Impact Evaluators

Evaluators need to understand and consider key parameters that affect the approaches used and expertise required. These parameters include:

Evaluation budget - Lower budgets reduce primary data collection and increase reliance on desk reviews, secondary data, prior evaluations and existing assumptions.

Program type – Prescriptive programs tend to have large participation across a limited number of similar energy efficiency measures. Evaluations can be completed based on a representative sample. Custom projects (generally at commercial or industrial sites) often require site-specific approaches to estimate energy savings, which often include a mix of approaches and required skills.

Sector – Residential programs are relatively homogenous in terms of measures, building types and project size. Whole-house, home energy reports, and some other residential program evaluations can rely on billing analysis due to either high savings, or very large sample sizes. Commercial and industrial programs have large variations in project size, building types and measures and billing analysis is often inappropriate.

Technology - Common and consistent technologies can use basic algorithms or metering approaches to verify savings estimates. Less common technologies and specialized equipment may require more advanced engineering or specialized expertise.

The expert respondents (and internal reviewers and Advisory Panel members) identified multiple required competencies at various levels of specificity. The team consolidated them in **Error! Reference source not found.** These competencies range from the ability to use standardized methods, to applying concepts in new areas, to judging the value of information. They cover the range of tasks, from planning to reporting, demonstrating the breadth of required competencies.

The inconsistency in respondent specificity appears in multiple ways in **Error! Reference source not found.** For example, reporting is addressed as a single competency, which belies the expertise required to create a report that fulfills multiple criteria and remains clear, transparent, and thorough. Data collection addresses only a subset of data collected for impact evaluations. Finally, some identified competencies refer to substantially different knowledge requirements that are dependent upon the gross impact approach used. For example, “understanding pros/cons of different models” refers to building simulation models in one context, and statistical models in another. We advise the reader to keep these factors in mind when reviewing the list.

Other Impact Evaluation Competencies

While **Error! Reference source not found.** conveys the breadth in the range of skills and knowledge required to complete a gross impact evaluation, interviewees, internal reviewers and Advisory Panel members also identified other important competencies and requirements for successful impact evaluations. These include:

Skills: Project management (e.g. critical path scheduling, delegating, and oversight), time management, and communication (oral and written);

Foundational knowledge: Understanding of research approaches and energy programs;



Ethical standards: Multiple experts and panel members identified a need for a code of conduct for impact evaluators. A code of ethics would codify how an evaluator should act within the context of their work. They suggested that this should be incorporated into the certification process;

Proper documentation: Several experts also noted that evaluation reports lack complete documentation of the research and especially the analytics to estimate impacts. They pointed to a need for more detail in reports for transparency and validation of the results.

Content for Entry Level Impact Evaluation Certification

Informed by the assessment of competencies, and at the request of DOE, the team provided a high level outline of the recommended target audience, objectives, and core content appropriate for entry level evaluators. This outline is shown in Appendix 1. The outline proposes a *general understanding* of the following core topics:

- Energy programs
- Program evaluation
- Energy program impact evaluation overview and key issues and concepts
- Evaluation objectives
- Impact evaluation methods (applications, data sources, tests of validity, limitations, risks, identifying baseline and relative costs)
- Sampling and statistics basics
- Non-sampling errors
- Qualitative research
- Evaluation steps and plans;
- Reporting
- Ethical standards and considerations

Perspectives on Certification and Caveats to This Study

Many informants- interviewees and advisory panelists shared their thoughts regarding pros and cons to certification. The final question in the interview guide from Stage 1 asked respondents if they “have any thoughts about certification they want to share.” The following is from the memo for Task 2 submitted to DOE summarizing some of the statements on the pros and cons of certification. This summary of responses provides a sense of the range of thinking on certification from some leading practitioners, a small subset of all stakeholders. It is not comprehensive, nor does it reflect the thoughts of all evaluators, evaluation users or other stakeholders.

Some practitioners are positive about evaluator certification. These proponents see certification as a way to raise the standards by which impact evaluations are performed. Respondents recognize that certification will lead to increases in training as individuals seek certification and employers seek certified employees.

Other respondents expressed concern with increased training costs and certifications fees. Some respondents thought certifying evaluators would be complex, questioned whether it could be done well, or



questioned the value of certification. Some practitioners see certification as a means of improving evaluations in states that do not have strong independent oversight of their evaluation process. They note that assurances of energy savings claims are only obtained if strong vetting of evaluators and of their work products are done in concert.

While advisory panel members were not asked directly whether they have thoughts about certification, in their comments, they provided a similar range of opinions.” (Excerpt from Memo to DOE on Task 2)



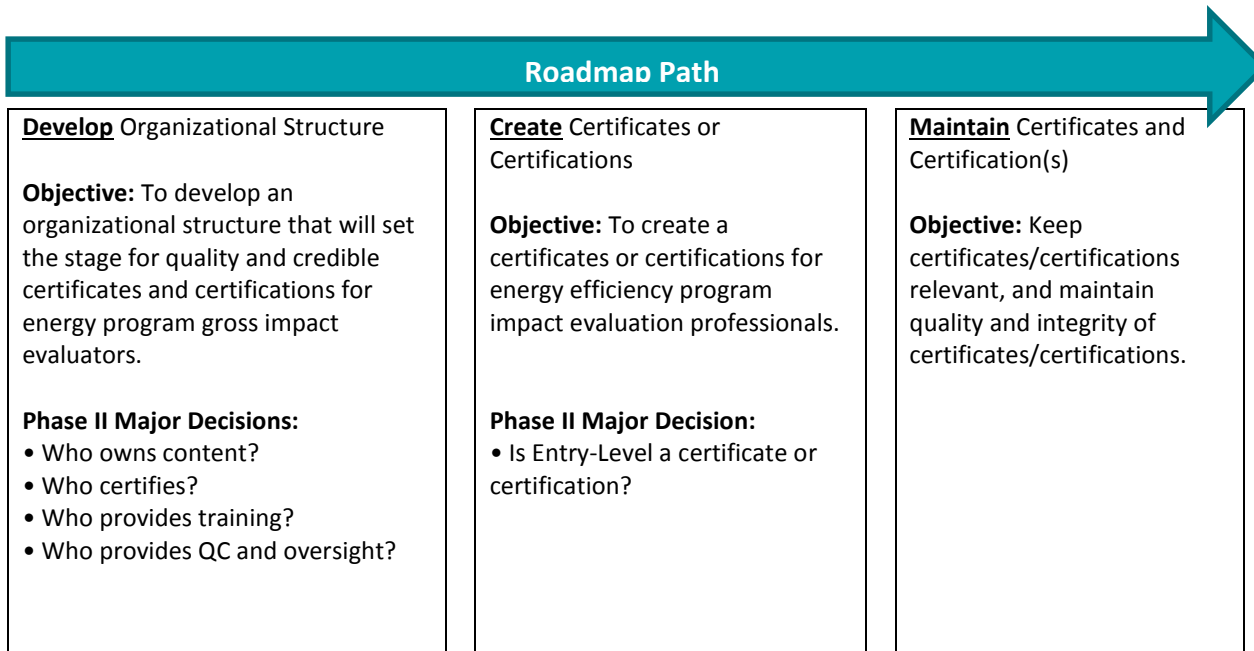
Roadmap for Developing Impact Evaluator Certification

Background and Overview of Roadmap

The early stages of research for this project revealed that there are myriad options, decisions, stakeholders and processes required to achieve evaluator certification pertaining to energy programs. To guide DOE in making decisions about whether or how to proceed with development of such certification, the team developed a roadmap, in the form of an excel spreadsheet. This section provides: 1) a high level summary of the roadmap components; 2) background that informed development of the roadmap and is essential for understanding the roadmap - including considerations identified by DOE or team members as well as insights and summaries from interviews with organizations conducted as part of the roadmap development; and 3) a presentation of findings to help focus the options that may be weighed in a second phase study. A second phase study is needed to address major decisions as well as to establish initial processes for developing certification.

The roadmap identifies the steps, processes and key decisions required to develop entry level certification. However, it includes brief consideration of examples and issues pertaining to certification beyond entry level; specifically it touches on maintenance and long term planning activities. The roadmap focuses on organizational structure and on the development of individual certifications. As shown below (Figure 1), the roadmap includes three main components.

Figure 1. Roadmap Path with Components





Organization of the Roadmap Spreadsheet

The five pages in the roadmap spreadsheet are as follows:

Overview--outlines the major steps in the roadmap.

- 1a. **Develop Organizational Structure**—describes the three major decisions on organizational structure: who owns the content, who certifies, and who oversees training.
- 1b. **Feasible Organization Combinations**—describes different combinations of owners, certifiers, and training overseers and recommends approach.
2. **Create Certifications**—describes the necessary steps to create a certificate or certification.
3. **Maintain Certifications**—describes the on-going tasks to keep certification current and maintain quality.

Early stage decisions are very important because they could have long lasting effects in development of certification. Developing an individual certification is relatively straight forward once the organizational structure and processes are in place. While the roadmap identifies the process of maintaining the certification as an important element, it follows after early stage decisions. The roadmap identifies two categories of early stage decisions: 1) Determining the organizational structure – how core responsibilities of content ownership, certifying, training, and oversight are assigned, the number of entities involved, and which organizations play a role; and 2) Whether the product should be a certificate or certification.

While the report until now refers to certification in a general sense to cover all types of practitioner qualification, there should be a distinction made between certificates and certification.

Certificate: Document provided after completion of a training and accomplishment of learner outcomes (usually determined by an exam). Does not require on-going maintenance.

Certification: Attainment of proficiency or competency in a profession, occupation or major job task. Initial certification based on knowledge, skills and abilities. On-going requirements to maintain proficiency or competency, or certification revoked.

Background - Roadmap Considerations and Information Sources

The team developed the roadmap with specific considerations in mind. Taken together, they provided direction, limited the potential options, or affected the depth of the Roadmap. We discuss these briefly below.

The following considerations are preferences DOE communicated to the team during the course of the project. They may affect future decisions about the organizational structure of certification:

Allow multiple organizations to deliver training. This affects the responsibilities of a designated “training” organization (if there is one).

Identify an organization other than DOE to “own the content.” DOE will continue to be a stakeholder in the evaluator certification and does not want explicit responsibilities beyond that. Depending upon whether and how the Clean Power Plan (CPP) proceeds, DOE and EPA policies could have an impact on the need for or content of impact evaluator certification.

First certification should be entry-level. DOE sees an immediate need for a certification that addresses basic impact evaluation principles and methods targeted for newer impact evaluators and regulators. This certification could serve as a starting point for potential additional certifications.



Certification should not be prohibitively expensive. The certification should be accessible to many evaluators, with the combined costs of training and certification being lower than \$1,000.¹⁶ (Certifications examined for this study, see Appendix 2, ranged from \$225 to \$485 for individuals. Without subsidization, this would likely limit training classes to two-days or less.)

Certification approach should be self-sustaining. DOE may offer early funding for specific tasks (e.g. developing a training course) in support of impact evaluator certification. DOE expects the evaluator certification, once developed, to be able to operate independent of DOE funding. This requires a structure that is relatively simple (e.g. fewer organizations, simple processes) in which organizations can recoup the costs associated with their roles. Potential income is derived from three activities: training, certification and recertification.

Financial Considerations and Other Limitations of this Study

Scoping the business case for certification models was beyond the scope of this study. However, financial considerations are a key factor that need to be considered and likely exert influence on the early stage organizational decisions required to develop certification. The current market for energy program evaluator certification is small, compared to other certifications,¹⁷ which suggests there is reason to expect that evaluator certification will have financial constraints. While this helps frame decisions regarding the certification structure and scope, it presents challenges to sustainability. There are currently no certification requirements in this field, and it is not clear whether evaluators and regulators will seek certification voluntarily. Energy program impact evaluation is a niche field practiced primarily in the US and Canada. An entry-level certificate is unlikely to be attractive to established professionals. (The count is unknown, but the authors find it difficult to see it attracting more than 100 applicants a year in the near term¹⁸). For context, background research on key features of six organizations delivering certifications, including information on market size and costs where available, are provided in Appendix 2.

The financial constraints – small target market and desire for low cost certification – put limitations on the certification structure and processes in several ways:

Reinforces the need for a simple (i.e. fewer players) organizational structure. This minimizes coordination (and thus costs).

Necessitates a heavy reliance on volunteers. This is not unusual and provides an opportunity for stakeholder engagement during various processes. On the other hand, some activities require subject matter experts, who may not be available for volunteering.

¹⁶ This expense does not include the costs of sending employees to a training session or the lost opportunities incurred while employees are at training and not working.

¹⁷ For example, CMVP training and certification is available in multiple countries and has been offered for 14 years. 10,000 people have been certified in that time.

¹⁸ As one reviewer noted 100 applicants a year raises at most \$50,000, which must cover at least \$10,000 in fix costs; leaving enough to pay an administrator salary of \$100/hour for at most 33 hours a month; or in the multiple organization structure, two administrators for 16 hours per month.



Favors organizations engaged in certification or training activities. Organizations with existing infrastructures or processes can more easily (and cost effectively) absorb additional responsibilities.¹⁹

Precludes ANSI/ISO accreditation. Both initial cost and ongoing costs of an ANSI accreditation would likely be barriers to development of a self-sustaining evaluator certification given the small market size. However, this is not a barrier in the short term to the certification process.

Additionally, the team's priority was to produce a roadmap that both communicated the complexity involved in developing a certification process and provided guidance to DOE as it moves to the next phase. We recognize the following limitations to the roadmap;

The roadmap is not comprehensive: The roadmap successfully addresses the major issues. It does not comprehensively address all issues. Additionally, not all potentially involved organizations (i.e. paid involvement in certification) are identified or discussed. Nor are all options or potential structures considered.

Recommendations are based on knowledge at-the-time of writing. Input from other stakeholders, certification organizations and other sources may provide additional insights not available to the team.

Information sources

Multiple sources informed development of the roadmap, including: examination of key features of six certifications (summarized in Appendix 2); articles related to evaluator certification;²⁰ web research to learn about certifications generally as well as energy related certifications; identification of the major requirements for ANSI/ISO accreditation; and informational interviews conducted with directors and administrators of the Association of Energy Engineers (AEE), Association of Energy Service Professionals (AESP), Efficiency Valuation Organization (EVO), International Energy Program Evaluation Conference (IEPEC), and US Green Building Council (US GBC).²¹

Table 3 outlines the background on each of the organizations for which interviews were conducted and summarizes their capabilities as they relate to certification of energy efficiency evaluators. They are candidates that could be considered to take on one or more of the key roles (content owner, certifier, or trainer) in evaluator certification.

¹⁹ One reviewer suggested that DOE might consider subsidizing existing training.

²⁰ REFERENCE AEA Journal

²¹ US GBC is the content owner for Leadership in Energy and Environmental Design (LEED). Certification of LEED is done by the Green Building Certification Institute (GBCI) who we did not interview.



Table 3: Organizations Interviewed

Organization	Gross Impact Certification Capabilities
<p>AEE is a non-profit membership organization with 18,000 members. It operates on revenue generated from membership fees, trainings and certifications. The organization has 19 FTEs and 22,000 active certifications. It established a separate training entity, AEE Energy Seminars as a non-profit training entity, which has ~20 FTEs. AEE offers over 30 certifications, two that meet ANSI requirements.</p>	<p>AEE is accredited by the International Association for Continuing Education and Training (IACET), which means that the classes they offer qualify for Continuing Education Units for PEs, CEM and other certifications. AEE has the staff and established processes to handle all aspects of certification. Their current certifications are focused on a range of energy engineering topics. None address impact evaluation. May impose AEE policies and procedures on impact evaluations. Limited evaluation contacts</p>
<p>AESP is a membership organization with members from all aspects of the industry in the U.S. and Canada. It operates on membership and conference fees. Its membership includes a large number of evaluators. AESP has a permanent staff of 11. They run multiple conferences per year and offer nine training courses in conjunction with conferences and elsewhere. They train 300-400 people per year. All participants get a Certificate of Completion.</p>	<p>AESP is IACET accredited, so participants who request it, can take a test and if they pass receive a certificate for the CEUs (no extra cost). AESP has no experience administering a certification process as described herein. AESP membership includes many evaluators Has experience offering energy impact evaluation courses</p>
<p>EVO is a non-profit organization that developed and maintains the IPMVP protocols. It operates on membership fees, website subscriptions, and revenue from certifications. EVO has a staff of three. Volunteers (all are CMVP trainers) develop the training materials. 1,000 professionals worldwide received IPMVP certification in 2015. Started in 2004, EVO's focus has been solely on IPMVP standards.</p>	<p>The organization does not have in-house broad evaluation expertise or easy access to a diverse set of energy program evaluators and users.</p>
<p>IEPEC is a non-profit organization that provides education - primarily through bi-annual conferences, conference publications, workshops and webinars. The organization operates from conference sponsorships, attendee fees and volunteer efforts by members of the Planning Committee. IEPEC is administered part-time by an independent consulting firm. The conference is the only event focused solely on energy program evaluation and attracts a large and diverse group of energy program evaluators and stakeholders (attendance has been around 500 for the last several conferences).</p>	<p>IEPEC is well situated to draw upon evaluation professionals and users to contribute to the development and maintenance of impact evaluation certifications. The IEPEC Board would have to determine whether some sort of involvement in a certification process is desired and if, so what would be required legally and organizationally. No experience with certification or managing certificates. Offers training in conjunction with conferences – substantial relevant expertise within volunteer organization.</p>
<p>The Green Building Certification Institute (GBCI) is a non-profit organization established by the US Green Building Council to credential professionals for LEED and other associated green building credentials. GBCI also administers LEED and other associated building certifications. GBCI has a staff of more than 140 experts that support project teams and professionals in over 160 countries. GBCI develops the ANSI 17024 accredited LEED professional credential exams, which include the LEED Green Associate and LEED AP with specialty credentials. A separate organization under contract with GBCI administers the credentialing exam.</p>	<p>The organization has experience with content, training, certification, and managing of certificates. It does not have in-house evaluation expertise or easy access to a diverse set of energy program evaluators and users.</p>



Roadmap to Certification – Findings and Recommendations

Organizational Structure The organizations selected to serve the key roles in certification can affect the direction that certification takes, its particular focus, the audience it attracts, and ultimately the certification’s impact on the evaluation industry. There is some flexibility in the specific responsibilities associated with these roles. Determining the responsibilities depends on two things, a) the capabilities of the organizations selected and b) establishing a viable structure that minimizes conflicts of interest. The responsibilities for each selected organization and relationships between the organizations must be formalized to minimize confusion and conflict. Although not directly addressed in the roadmap, the establishment of processes for stakeholder input and final decision-making are important for the credibility and success of evaluator certification.

- Because two organizations interviewed identified challenges due to early decisions that failed to consider longer term objectives, **the team recommends that organizational structure decisions should be made with a longer term view of energy impact evaluator certification.** A structure designed to deliver an entry-level certificate may not be the best one if the longer term objective is to develop a suite of certificates or a professional level certification.
- Organizations must be designated to fulfill four key roles: content ownership, certification, training, and oversight. **It is possible (and likely) that an organization may be selected to handle two or more of the roles.**

Who owns the content? The content owner is responsible for determining (or establishing processes to determine) what content applies to a certification. Content ownership is an early stage decision DOE must address. Among the organizations that were interviewed, IEPEC and AESP have sufficient expertise in energy efficiency impact evaluation but do not have proven records of developing and maintaining certification content. AEE and EVO have proven experience with developing and maintaining certification content but not the subject matter expertise.

One background note is that many certifications are based on a standard, such as federal requirements for a weatherization audit or LEED building requirements. Resulting personnel certifications (or accreditation) are based on competencies needed to meet the standard.²² The organization that sets the standards is the de facto owner of the content. Other certifications are developed by an organization independent of a standard to meet the organization’s objectives.

Who certifies? Basic responsibilities for the certifying organization are clear. This organization administers certification (and recertification): determining if applicants meet eligibility requirements, providing certification documentation to the applicant, and maintaining an active list of people certified. Certifiers sometimes assist in the development and beta-testing of certification exams.

- Given the small market expected for an Entry-level Impact Evaluator Certificate, it may be advisable to select an organization that has the staff and infrastructure in place.

²² An auditor must be able to successfully complete all audit tasks, a LEED accredited professional must demonstrate knowledge of LEED requirements



Who oversees training? ANSI requires that the certification exam is separate from the training,²³ in order to prevent teaching to the test and cheating. While this is a consideration, background research indicates that it is not essential. It may, however, enhance the credibility of the certification or provide the content owner an appropriate role in the certification process. In practice, some certifying organizations create a separate legal entity to provide training and maintain a firewall between these two responsibilities for ANSI accredited classes.

Who provides quality control and oversight? These functions are important for many reasons, ranging from dispute resolution to ensuring quality and timeliness of content or training. Who provides these functions depends somewhat on the combination of organizations selected and the specific divisions of responsibilities.

- The team recommends that checks and balances be part of written working agreements between organizations, or there should be an explicit designee to oversee QC.

Feasible Organization Combinations. Table 4 (and Sheet 1b of the roadmap spreadsheet) identifies the possible combinations of roles (with one, two or three organizations) and discusses pros and cons of possible combinations.

Table 4. Organizational Management: Structural Combinations

Options	Concerns	Pros	Cons
Three organizations	Limited expected revenue may be insufficient to support engagement of three organizations	<ul style="list-style-type: none"> • Takes advantage of each orgs strengths • Creates checks and balances • Independent certifier - increased credibility 	<ul style="list-style-type: none"> • Adds complexity and costs • Substantial coordination required • Increases political tensions
One organization	Lacks checks and balances	<ul style="list-style-type: none"> • Simplest structure • Facilitates coordination of functions • Economy of scope. Revenue more likely to cover all costs 	<ul style="list-style-type: none"> • No org has all required skills and expertise • Lacks third-party independence • No checks and balances
Two organization combinations			
<ol style="list-style-type: none"> 1. Content owner is certifier 2. Training oversight 		<ul style="list-style-type: none"> • Strong connection between content and certification requirements • Provides revenue source for content owner • Separates trainers from certification process 	<ul style="list-style-type: none"> • No org has expertise in evaluation content and certification
<ol style="list-style-type: none"> 1. Content owner oversees training 		<ul style="list-style-type: none"> • Content owner most familiar with subject • Independent certifier - increased credibility • More likely to use variety of trainers 	<ul style="list-style-type: none"> • Certifier may not generate sufficient revenue to cover expenses.

²³ Trainers cannot be involved in developing exam questions, proctoring exams, or otherwise have knowledge of the questions



Options	Concerns	Pros	Cons
2. Certifier		<ul style="list-style-type: none"> Facilitates separation of trainers from exam questions 	
1. Certifier oversees training 2. Content owner		<ul style="list-style-type: none"> Leverages expertise of some existing orgs May minimize coordination 	<ul style="list-style-type: none"> Content owner may have less control over content Content owner has no direct source of revenue to cover costs
1. Certifier oversees training (firewall) 2. Content owner		<ul style="list-style-type: none"> Maintains separation of certifier and trainers Leverages expertise of some existing orgs Best compromise for expediency and credibility. Most viable option 	<ul style="list-style-type: none"> Firewall (between trainers and exam questions) may be breached Content owner may have less control of content

Recommendations

- **A single organization should not assume all three roles.** No existing organization has all the required expertise, and the process would lack any checks and balance. We also ruled out having three organizations, with each assuming one role (and no firm for QC and oversight). The potential revenue is likely insufficient to support three organizations and the costs associated with the requisite coordination.
- **Two organizations is optimal for evaluator certification.** The team recommends that DOE select a content owner and a different trainer; and that one of those organizations takes on the certifier role.

Developing Certificates and Certifications. The roadmap lists the steps required to develop a certificate or certification, identifying general options and providing examples from other certifications. The final column addresses the steps for the Entry-level Certificate. Table 4 compares the two approaches and below, we discuss pros and cons of the two options.

Table 5: Certificate and Certification Comparison

Factor to consider	Certificate	Certification
Costs to applicant	\$	\$\$-\$\$\$
Revenue	One-time	On-going revenue stream
Prerequisites	None or minimal	Substantial
Recertification	None	Every 2-3 years



Pros and Cons of Certification vs. Certificate. There are several reasons to opt for certification. The required on-going training and recertification required of certifications increases the revenue stream and provides a stronger on-going distinction between certified and un-certified professionals. However, a certificate probably better fits an entry-level qualification;

Consider Certificate/certification Objectives. Is the certification a minimum requirement for all professionals working in the field or is it a means of recognizing newer professionals who have achieved a basic understanding of the field. The decision will affect content included and prerequisites.

Align the Choice of Certificate or Certification with Appropriate Content Breadth and Depth. What topic areas should be covered and how deeply should they be covered. There is a trade-off between the breadth and depth and the practical limits imposed by a finite length of training time. The deeper the dive the longer the training and the higher the fees. The shallower the dive, the less the training and the less meaningful the certificate/certification.

- The team makes no explicit recommendations for a certificate versus a certification as this choice will be made during the next phase.

Maintain Certificates or Certifications. Once a certification is in place, it must be maintained and improved. The roadmap identifies only areas where on-going maintenance is required. The selected organizations must address these tasks. Most importantly, content and training must be kept current as the industry changes. Tests need to be changed regularly to keep up with changing content. The need to maintain financial stability requires that the organizations track finances, recruit applicants, and balance fees with program expenses.

Next Steps

Phase II of DOE's certification efforts will concurrently address organizational structure and the development of an entry-level certification. This phase may establish initial processes for developing certification (including stakeholder involvement).

In summary, if or when certification of energy efficiency program evaluators is developed, it might represent a shift in how the community of energy efficiency program evaluators is organized. It is recognized as one strategy that could make the evaluator's basic skill and knowledge set transparent and establish a process that validates those competencies. As energy efficiency program results are used not just in meeting state energy program goals, but for other policies, users of the program results could have greater confidence in evaluators' results.

By following the roadmap and proceeding to the next phase in developing entry level certification, DOE would be taking an informed next step in exploring certification as a potential resource for the evaluation community.



Appendix 1: Content for Entry Level Energy Impact Evaluation Certificate

Establish a certificate for professionals new to energy program evaluation that demonstrates foundation knowledge in energy program impact evaluation.

Target Audience: Staff at evaluation firms, regulatory bodies, and utilities, generally with fewer than 3 years of evaluation experience, or little formal training.

Learner Objectives

- Understand the why and how of energy programs;
- Understand basic evaluation types and purposes;
- Understand the context and purpose of energy program impact evaluations;
- Ability to list gross impact evaluation methods, and associated
 - Uses
 - Limitations
 - Risks
 - Relative costs;
- Understand key evaluation steps;
- Understand key evaluation concepts and definitions;
- Understand evaluation code of ethics;
- Understand basic sampling concepts, terminology and uses;
- Be able to access program evaluation research standards;
- Be able to access energy program evaluation protocols;
- Awareness of key energy program evaluation resources within topic areas.

Course Topics

Energy Programs

- Why?
- Who delivers
- Types of programs

Program Evaluation

- Why evaluate?
- Types of energy program evaluations
- Energy Program Impact Evaluation Overview
- Why?
- Difference from verification and measurement?
- Key issues and concepts
- Gross and net
- Baselines and how they are determined
- Effective useful life
- Benefit cost testing
- Demand reduction



Evaluation Objectives

- Identifying/understanding impact evaluation objectives
- To address multiple issues (see also Evaluation Design)
- Stakeholders
- Regulatory requirements and policies
- Evaluation design – mixed methods

Impact Evaluation Methods

For each method: when and how used, data sources, tests of validity, limitations, risks, identifying baseline and relative costs.

- Engineering review and analysis
 - Algorithm review
 - Metering/monitoring
 - Building simulation
 - Building usage analysis (single building)
- Billing/usage analysis (population)
 - Randomized controlled experiments
 - Quasi-experimental design – (selecting comparison groups)
- Applications using market or sales data
- Applications using “Big data”

Sampling and Statistics Basics

- Why and when to sample
- Basic sampling approaches
- Simple and stratified random
- Two-stage
- Sample unit - unit of analysis
- Terminology: population, sampling frame, sample
- Sampling error
- What does 90/10 mean, and when does it apply.
- Accuracy versus precision



Non-sampling Errors

- Measurement errors
 - Survey or question non-response
 - Question wording or type
 - Analytical mistakes
 - Coverage (sampling error not accounted for in statistics)
 - Equipment error
- Bias
- When is non-sampling error a problem?
- How to mitigate or otherwise address sampling and other errors

Qualitative Research

- What it is
- Difference from quantitative
- When and why use
- Sampling approaches
- How to use (and what not to do)

Evaluation Steps and Plans

- Importance and uses, timing and budgets
- What to include
- Basic evaluation research steps
- Planning
- Sampling
- Data collection
- Analysis
- Reporting

Reporting

- Focus on what documentation of methodology needed
- Standardized

Ethical Standards and Considerations

- Impartiality
- Data confidentiality
- Respondent confidentiality



Appendix 2: Details on Six Certification Programs

Information on Certification Programs – CMVP, CEM, BPI GoldStar Contractor

N	Parameter	Certified Measurement and Verification Professional (CMVP)	Certified Energy Manager® (CEM)	BPI GoldStar™ Contractor Program
1	Administering Agency (Certifier)	Association of Energy Engineers (AEE) in cooperation with the Efficiency Valuation Organization (EVO)	Association of Energy Engineers (AEE) AEE is accredited by ANSI (ANSI/ISO/IEC 17024) for this certificate	Building Performance Institute, Inc.
2	URL	http://www.aeeprograms.com	http://www.aeeprograms.com	http://www.bpi.org/goldstar.aspx
3	Type	Certification	Certification	Quality Assurance Program for Contractors with 12 embedded Credentials possible
4	Year first available	2002	1981	2000 for first two certificates and ongoing since then
5	Count of current certificate holders	~770 in US ~3,500 worldwide	~10,970 in the US ~12,400 worldwide	457 GoldStar Contractors in US 12,925 Certified Individuals in US
6	Reason for certificate creation	To recognize the most qualified professionals and raise the overall professional standards within the measurement and verification field.	To raise the professional standards of those engaged in energy management To improve the practice of energy management by encouraging energy managers in a continuing program of professional development To identify persons with acceptable knowledge of the principles and practices of energy management related disciplines and laws governing and affecting energy managers through completing an examination and fulfilling prescribed standards of performance and conduct To award special recognition to those energy managers who have demonstrated a high level of competence and ethical fitness for energy management	GoldStar Contractor Program - To provide confidence to contractors that quality is profitable and to set their company apart in the marketplace. Certificates – to provide quality work with a good return on investment.



N	Parameter	Certified Measurement and Verification Professional (CMVP)	Certified Energy Manager® (CEM)	BPI GoldStar™ Contractor Program
7	Time between considering certification and actual certificate process in place	Unknown	Approximately one year	Unknown
8	Who decides on attainment of competence	Not stated, but assume there is a CMVP Exam Development committee that is analogous to the CEM committee since both run by AEE.	There is a CEM Exam Development committee. The test is updated at least once a year.	Unknown
9	Modality to convey competency	In-person seminar with written exam (see qualifications, below)	In-person seminar with written exam (see qualifications, below) OR Online seminar with exam	Online test
10	Levels	Yes – two levels of certification Certified Measurement and Verification Professional (CMVP) CMVP – In Training (CMVP-IT)	Yes – two levels of certification Certified Energy Manger (CEM) Energy Manger in Training (EMIT™)	GoldStar program has three tiers with different opportunities and obligations in each tier Embedded in the GoldStar program are 12 certificates in two areas Eight Core Certificates Building Analyst Heating Professional Envelope Professional AC & Heat Pump Manufactured Housing Multifamily Air Leakage Control Installer Infiltration & Duct Leakage Four Home Energy Performance Certificates Energy Auditor QC Inspector Retrofit Installer Crew Leader
11	Qualification Requirements	CMVP Attend preparatory 2.5-day training seminar, AND Pass 4-hour proctored open book exam (minimum 70%), AND	CEM Attend preparatory training seminar by approved trainer, AND Pass 4-hour proctored open book exam (minimum 70%), AND	GoldStar Contractor Be a company or legal entity Have one (1) staff member BPI certified as a Building Analyst or Energy Auditor



N	Parameter	Certified Measurement and Verification Professional (CMVP)	Certified Energy Manager® (CEM)	BPI GoldStar™ Contractor Program
		<p>4-year degree from an accredited university or college in science, engineering, architecture, business, law, finance or related field AND 3 years of verified experience in energy or building or facility management, or M&V, OR</p> <p>Registered Professional Engineer or Registered Architect AND 3 years of verified experience in energy or building or facility management, or M&V, OR</p> <p>4-year non-technical degree from an accredited college or university in a field not specified above AND 5 years of verified experience in energy or building or facility management, or M&V OR</p> <p>2-year technical degree AND 5 years of verified experience in energy or building or facility management, or M&V OR</p> <p>No educational experience AND 10 years of verified experience in energy or building or facility management, or M&V OR</p> <p>Current status of Certified Energy Manager®</p> <p>CMVP-IT</p> <p>Attend preparatory 2.5-day training seminar, AND</p> <p>Pass 4-hour open book exam (minimum 70%),</p>	<p>4-year degree in engineering or architecture AND 3+ years of experience in energy engineering or energy management, OR</p> <p>Registered Professional Engineer or Registered Architect AND 3+ years of experience in energy engineering or energy management, OR</p> <p>4-year degree in technology, environmental science, physics, or earth science AND 4+ years of experience in energy engineering or energy management, OR</p> <p>4-year degree in business (or related field) AND 5+ years of experience in energy engineering or energy management, OR</p> <p>2-year energy management associate's degree AND 6+ years of experience in energy engineering or energy management OR</p> <p>2-year technical associates degree AND 8+ years of experience in energy engineering or energy management OR</p> <p>No educational experience AND 10+ years of experience in energy or building or facility management, or M&V</p> <p>EMIT</p> <p>Same qualifications as the CEM, but with less experience. Any 4-year degreed person or a person with a 2-year degree in energy management must simply have less than the requisite years described above.</p> <p>If person has a 2-year technical associate's degree, they must have at least 2 years of experience.</p>	<p>Have general liability insurance in the amount of \$1 million</p> <p>Have workers compensation insurance (as state law requires)</p> <p>Licensing and bonding as required by governing jurisdiction</p> <p>Have a customer dispute resolution policy</p> <p>Maintain annual records of calibration of diagnostic equipment</p> <p>Maintain records on data collection</p> <p>Perform work according to BPI national standards</p> <p>Provide job specific information electronically to BPI upon request</p> <p>Has ability for a company representative to receive electronic notifications from BPI</p> <p>When required, agrees to pay a standardized fee for in-field Quality Assurance inspections on per inspection basis</p> <p>Certificates</p> <p>Vary, not included here</p>



N	Parameter	Certified Measurement and Verification Professional (CMVP)	Certified Energy Manager® (CEM)	BPI GoldStar™ Contractor Program
			If a person has no post-high school degree, they must have at least 4 years of experience	
12	Renewal Required	Yes – every three years for CMVP CMVP-IT good for six years and is not renewable	Yes – every three years for CEM EMIT good for six years and is not renewable	Yes - annually
13	How to renew	10 renewal credits can be obtained through any of the following: 1) continuing education courses, 2) membership in a professional organization, 3) continued employment in energy management or energy engineering field, 4) attending specified energy conference, 5) presenting and publishing professional awards or papers, 6) holding office in professional organization	Same as CMVP (All AEE Certified Professionals have same renewal requirements)	Pay fee within 30 days of invoice Provide insurance proof with BPI as Certificate Holder
14	Certificate cost	Seminar \$1450 - \$1550 (higher price if not AEE member) Initial Application and Exam Fee \$400 - \$500 (higher price for remote testing) Retesting Fee \$200 - \$300 (higher price for remote testing) Certification renewal \$300	Initial Application and Exam Fee \$400 Certification renewal \$300 Preparatory training costs vary depending on locale: <u>AEE Energy Seminars</u> (4 or 5 day in person for \$1,895 - \$1,995; 2 day in person for \$1,350 - \$1,450; 12 hours online for \$1,050 - \$1,150) <u>Salt Lake Community College</u> (~\$8,700 and 18-24 months); <u>UC Davis Extension</u> (unable to find online); <u>Universidad del Turabo</u> , Puerto Rico (50 hour or a 100 hour training program, but unable to find costs online), <u>Western New England College</u> (17.5 hours for \$379 - \$679, depending on alumnus status, 2011 costs which were the only items online)	Annual Fee - \$1,200 plus payment for any required in-field quality assurance inspections Embedded in the three tier system are costs that the team cannot quantify. However, to move up a tier level, contractors must demonstrate training attendance and successfully complete a test specific for each tier. Additionally, company must add one more BPI certified person for something other than Building Analyst or Energy Auditor to get to Tier 2 (Advanced Level) and a BPI certified Quality Control Inspector to reach Tier 3 (Master level). While within a specific tier, contractor must complete companywide self-assessment survey on specific topics, develop skills enhancement plan and actively engage in training specific to this plan.
15	How is the certification	Not stated, but assume the same as CEM since both run by AEE.	Certification fees	Assume annual fees as BPI is a 501(c)3 non-profit



N	Parameter	Certified Measurement and Verification Professional (CMVP)	Certified Energy Manager® (CEM)	BPI GoldStar™ Contractor Program
	process maintained?			
16	Exam included	Yes	Yes	Yes, for GoldStar Program to move up in Tier system
17	Examination Administrator	AEE Executive OR and educator OR a testing expert OR agency, OR whomever the certification body deems appropriate	One of five approved trainers listed above in the cost parameter	Unknown
18	Exam Format	Multiple Choice and True/False questions	130 Questions, multiple choice	Unknown
19	Exam Content	Reasons for M&V Current M&V Projects IPMVP Developing an M&V Plan Current Issues in M&V Emission Trading Baseline Adjustments Key Elements of Success: Theory & Examples of IPMVP Options Selecting Options: Which One Is Best Suited for My Project? Adherence with IPMVP	17 topic areas: 1. Codes and Standards 2. Energy Accounting and Economics 3. ENERGY AUDITS AND INSTRUMENTATION 4. ELECTRICAL SYSTEMS 5. HVAC SYSTEMS 6. MOTORS AND DRIVES 7. INDUSTRIAL SYSTEMS 8. BUILDING ENVELOPE 9. CHP SYSTEMS and RENEWABLE ENERGY 10. FUEL SUPPLY AND PRICING BUILDING AUTOMATION AND CONTROL SYSTEMS 11. HIGH PERFORMANCE BUILDINGS 12. THERMAL ENERGY STORAGE SYSTEMS 13. LIGHTING SYSTEMS 14. BOILER AND STEAM SYSTEMS 15. MAINTENANCE AND COMMISSIONING 16. ENERGY SAVINGS PERFORMANCE CONTRACTING 17. MEASUREMENT AND VERIFICATION	Unknown
20	Available Continuing Education Units as pursue certification	Yes – for seminar 2.0 CEU 4.0 AEE Credits toward re-certification	Yes, for renewal only	No
21	Are there disciplinary or Quality Assurance	Yes. CMVP suspension or revocation may be due to violation of AEE’s ethical standards or CMVP Competence. CMVP	Yes, CEM can be revoked or suspended by a 2/3’s vote of the certification board. Suspension or revocation may be due to	Yes – GoldStar Agreement may be revoked if contractor fails to pay fees, commits a deliberate material breach of the Agreement, repeats breach on 3



N	Parameter	Certified Measurement and Verification Professional (CMVP)	Certified Energy Manager® (CEM)	BPI GoldStar™ Contractor Program
	processes once certified?	may be suspended if the individual falls below the required professional credits.	violation of AEE’s ethical standards or CEM Competence.	occasions in a year, fails to make corrective actions for breach within 45 business days, or ceases to conduct business.

Table 4. Information on Certification Programs – Credentialed Evaluator, Certificate in Evaluation Practice, GHG Validation/Verification

N	Parameter	Credentialed Evaluator (CE)	Certificate in Evaluation Practice	Greenhouse Gas Validation / Verification
1	Administering Agency (Certifier)	Canadian Evaluation Society (CES)	The Evaluators Institute	ANSI (Under ISO 14065)
2	URL	http://evaluationcanada.ca/ce	http://tei.cgu.edu/	http://www.ansi.org/accreditation/environmental/greenhouse-gas-validation-verification/Default.aspx
3	Type	Credential	Certification	Accreditation for Third-party Validation / Verification services for the reduction and removal of greenhouse gasses (GHG)
4	Year first available	2010	2004	2011 (Public Policy GHG-PL-701)
5	Count of current certificate holders	312 in Canada	Unknown	24 Verifiers
6	Reason for certificate creation	To define, recognize, and promote the practice of ethical, high-quality, and competent evaluation in Canada.	To enhance the role of, the practice of, and the impact of evaluation. To provide high quality learning experiences to professionals in an off-campus environment.	The program was determined necessary by the ANSI board.
7	Time between considering certification and actual certificate	4 years	Uncertain, but appears less than a year	Unknown



N	Parameter	Credentialed Evaluator (CE)	Certificate in Evaluation Practice	Greenhouse Gas Validation / Verification
	process in place			
8	Who decides on attainment of competence	Credentialing Board made up of experts in the field (e.g., recognized CES Fellows and National Award winners)	Academic professors and highly regarded experts in the field. These same individuals teach the courses required to obtain the certificate.	A group of two or more Greenhouse Gas Validation / Verification Body Accreditation Committee (GVAC) volunteers
9	Modality to convey competency	Bundling past experience to provide evidence of competence in specific broad topic areas (see qualifications, below)	In-person course work with classes ranging from one to five days on a topic (see qualifications, below)	Written application, desk review of provided documentation, and on site audit both for assurance of organizational structures and individual ability to perform the work
10	Levels	No	Yes – four certificates Master Evaluator Certificate™ Certificate in Evaluation Practice™ (CEP) Certificate in Advanced Evaluation Practices™ (CAEP) Certificate in Analytic Evaluation Methods™ (CAEM)	No
11	Qualification Requirements	Evidence of graduate level degree or certificate related to evaluation (e.g., a Prior Learning Assessment and Recognition, PLAR) AND Evidence of two years (full-time equivalent) evaluation-related work experience within the last 10 years AND Indicators of education and/or experience related to 70% of the 49 competencies in each of the five domains of Competencies ^a	Master Evaluator Completion of two course-based certificates (CEP and CAEP) AND Portfolio of Experience developed with guidance of mentor AND Actively working in the field of evaluation or evaluation-related activity CEP 30 days of instruction as follows: 15 days of instruction in Evaluation Foundation courses AND 9 days of instruction in Design or Analysis courses AND 6 days of instruction in Evaluation Practice and Inquiry courses CAEP Completion of CEP AND	Two Stage Process: Preliminary Application Written description of compliance across these six areas: 1) Confirmation of third party status 2) Description of legal entity status 3) Proof of publically available documents describing the program 4) Description of the management system for validation / verification activities 5) Identification of any GHG programs, registries, or emissions trading schemes that the entity currently participates in and intends to participate in Final Application has a written component, a ‘witness’ assessment, and an on-site assessment The written component has the following:



N	Parameter	Credentialed Evaluator (CE)	Certificate in Evaluation Practice	Greenhouse Gas Validation / Verification
			<p>30 additional days of instruction within four topic areas (courses for CEP do not count)</p> <p>Topic areas are: 1) Evaluative Inquiry, 2) Design, 3) Analytic Approaches (Quantitative Analysis or Qualitative Analysis), 4) Outcome and Performance Assessment, 5) Evaluation Practice</p> <p>CAEM</p> <p>Additional 30-days of coursework, some courses may overlap with CEP or CEAP. Must include four hours of instruction in quantitative evaluation approaches and four hours of instruction in qualitative evaluation approaches</p> <p>Must include Basics of Program Evaluation (3 days) and Evaluation Research Methods (3 days)</p>	<ol style="list-style-type: none"> 1) Listing of all office locations, personnel and activities conducted by site 2) Description of applicant main activities and experience conducting validation / verification (V/V) activities 3) Documentation of program procedures 4) Number of employees 5) Current recognitions / accreditations 6) Type of activity for which applicant is seeking accreditation 7) List which of 12 different GHG programs applicant seeks to provide services to 8) List which of six project level sector groups and 10 organization level sector groups application seeks to provide services to <p>Within the witness assessment, ANSI staff observes the applicant as they perform tasks related to GHG V/V. For the on-site assessment, ANSI conducts a two- to three-day assessment at the main office to confirm operational capability.</p>
12	Renewal Required	Yes –every three years	No	Yes – every three years
13	How to renew	Must accumulate at least 40 hours of Continuing Education Credits over	Not applicable	Similar to initial assessment except experience gained will be taken into account
14	Certificate cost	<p>Application Fee \$485</p> <p>PLAR application if required \$550</p> <p>Maintenance Fee \$50 plus regular annual CES membership fees that range from \$71.25 to \$195 depending on student or professional status and membership in American</p>	<p>Master Evaluator Application Fee - \$225</p> <p>Mentoring Fee - \$1,365</p> <p>Courses for CEP, CAEM, and CAEP</p> <p>Varies based on the number days for a course. As of Feb 2016, regular fees are as follows:</p> <p>One-day course - \$570</p> <p>Two-day course - \$980</p> <p>Three-day course - \$1,365</p>	<p>Two stage process: Preliminary application has zero cost. The full application cost is \$5,000 plus a daily rate of \$1,250 plus expenses for onsite visits.</p> <p>Annual fee thereafter based on preceding calendar year revenue attributable to GHG V/V activities. Minimum is \$1,500 and maximum is \$55,000. After the minimum</p>



N	Parameter	Credentialed Evaluator (CE)	Certificate in Evaluation Practice	Greenhouse Gas Validation / Verification
		Evaluation Association (AEA) or AES (Australasian Evaluation Society)	Four-day course - \$1,722 Five-day course - \$1,950	level, the cost is 0.4% of the GHG V/V revenue up to a max.
15	How is the certification process maintained?	Volunteer time from professionals in CES AND Application fees AND Annual maintenance fees	Unknown	Fees associated with the certification
16	Exam included	No	No	No
17	Examination Administrator	Not applicable	Not applicable	Not applicable
18	Exam Format	Not applicable	Not applicable	Not applicable
19	Exam Content	Not applicable	Not applicable	Not applicable
20	Available Continuing Education Units as pursue certification	Not applicable	Not applicable	Not applicable
21	Are there disciplinary or Quality Assurance processes once certified?	Unknown	No	Yes – accredited organizations undergo surveillance during the first and second year after receiving initial accreditation or reaccreditation. The team could not ascertain if there is a cost associated with the surveillance assessment.