



Northeast Energy Efficiency Partnerships

MODEL EM&V METHODS STANDARDIZED REPORTING FORMS FOR ENERGY EFFICIENCY

Version 1.0

A project of the Regional Evaluation, Measurement and Verification Forum

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Facilitated and Managed by Northeast Energy Efficiency Partnerships

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PREFACE

Background

These *Model EM&V Methods Standardized Reporting Forms* were prepared by the Regional Evaluation, Measurement and Verification Forum ('the Forum'). The Forum, established in 2008, is a regional project facilitated and managed by Northeast Energy Efficiency Partnerships (NEEP) representing states in New England¹, New York, Maryland, Delaware, and the District of Columbia.

As the Forum region continues to increase its investment in energy efficiency as resource and strategy to meet a range of public policy goals (energy and economic), as well as newly proposed federally mandated regulations for greenhouse gases under US EPA's Clean Air Act 111(d) proposed regulations, the need for understanding and documenting the EM&V practices used by states to support efficiency program savings is as important as ever.

Program administrators in the Forum region conduct a range of evaluation activities to determine savings from their programs, including impact evaluations, market assessments and characterizations, and process evaluations to identify changes and improvements to program design. Since its inception in 2009, the Forum has been working to develop greater transparency and consistency in EM&V practices to support the inclusion of energy efficiency as a resource or key strategy in meeting state, regional and ultimately, national energy and environmental goals and/or markets. To date, the Forum has developed [Regional EM&V Methods Guidelines](#) (adopted by the Forum Steering Committee in 2010), which document recommended impact evaluation and savings calculation methods intended for use/referencing by program administrators and 3rd party evaluators when conducting evaluations to determine gross energy/demand savings, and for state regulators in reviewing evaluations. The extent to which this Forum guidance document or other recently developed EM&V guidance documents (e.g., the US DOE [Energy Efficiency Savings Protocols](#) which are consistent with the Forum's Guidelines but more detailed) are being used or referenced in the Forum region is limited or unclear².

Anecdotally, many of the evaluation practices in the Forum region are considered 'best practice' and likely align with the Forum's *Regional EM&V Methods Guidelines* or US DOE Savings Protocols, however it is very difficult, if not impossible, to confirm either way absent better documentation of such practices. EM&V practices used by the states are not readily transparent because the methodologies used to evaluate a program or savings parameter are typically described in the specific evaluation studies or appendices, and as such are "buried" in a multitude of documents that makes it difficult for interested stakeholders to readily determine and understand what EM&V practices are used, why they are used, and how they compare to methods use for different programs within and across states.

As such, the Forum embarked in 2013 to create a model template that supports greater transparency of program administrator/state EM&V practices used to calculate EE savings via a straightforward,

¹ Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont.

² While 2-3 states reference the Forum *Regional EM&V Methods Guidelines*, the extent of such referencing is limited and static, and not necessarily reflected or cited in completed impact evaluation studies. In one case, a Forum state indicated general concern that existing regional and national evaluation guidance documents tend to prescribe the "lowest common denominator" in EM&V practices, which may not be aligned with a state's actual practices. Anecdotally, both the Forum *Regional EM&V Methods Guidelines* and US DOE *EE Savings Protocols* largely provide guidance consistent with best practices in EM&V methods, and are aligned with acceptable methods set forth in ISO/RTO forward capacity market M&V manuals, although do not prescribe specific levels of rigor on savings results.

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Standardized EM&V methods ‘check list.’ This type of document is intended to help energy and environmental policy and market players readily understand and compare EM&V approaches used to estimate reported EE program savings to inform their specific needs. In fact, such a model template is likely to be useful for, and could be referenced by, the US EPA to support its Clean Air Act 111(d) proposed rule on carbon for existing power plants, in which energy efficiency is identified as a major building block, and EPA will be developing associated EM&V requirements to support its rule³. For the Forum/RGGI states, where a mass-based model is being pursued in which energy efficiency is an ‘observed’ impact (*that contributes to delta total emissions from power plants relative to a baseline*) and where demonstration of EM&V to EPA would not be required, the model standardized reporting forms herein would be nonetheless valuable to supporting state EM&V plans submitted to EPA as part of their compliance plans, and to help track progress towards RGGI states carbon cap goals using consistent, standardized tools across the states. For states in the US that pursue a rate-based approach under CAA 111(d), where energy efficiency is a *calculated emission reduction (i.e., x amount of EE savings translates to y avoided emissions)*, the standardized EM&V methods forms herein could be helpful to EPA as a model for state reporting of EM&V practices used to determine efficiency savings. Such standardized reporting can also inform the Forum/RGGI states of EM&V practices used by states outside the region.

Objectives and Audiences

The key objectives of the *Model EM&V Methods Standardized Reporting Forms* are to identify EM&V approaches used to determine energy and demand savings impacts from programs in order to:

- Make state/program administrator **EM&V practices more readily transparent** to interested parties, and provide supporting information to increase basic understanding of approaches;
- Provide for **standardized comparability of EM&V practices** through the use of a simple, model template/reporting format with supporting consistent definitions;
- Help to **reduce administrative costs associated with presenting and reviewing EE program impacts** by having a consistent format for reviewing results; and
- Support ability for interested parties to **compile data and analyze common practices and associated impacts**.⁴

The primary audiences these standardized forms can support include:

- State Public Utility Commissions
- State Air Regulators
- State Energy Offices
- US DOE and US EPA
- ISO/RTO system planners
- Program evaluators and implementers
- Researchers (e.g., LBNL, ACEEE, NGOs, etc.)

The specific types of questions the forms can address to support the above audiences interests are:

³ See EPA Technical Support Document - State Considerations on EM&V requirements for Energy Efficiency pgs 36-60). <http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-state-plan-considerations.pdf>

⁴ Examples of such analyses include review of state’s savings impacts and evaluation approaches and reported reliability of such impacts; analyses of all states (common practice) use of certain evaluation approaches; the type of EM&V approach used for different kinds of programs and quantity of savings per each approach; etc.

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1. **What EM&V methods(s) was used to estimate savings** for a program or input parameter? How was the baseline, verification of installations, measure life and persistence of savings determined? How were gross and net energy and demand savings calculated (deemed savings, engineering desk review, M&V, large-scale billing analysis)?
2. **How reliable are the reported energy or peak demand savings?** How was certainty/rigor addressed for a particular study or around reported savings for a program? What was the validity of the results in terms of data quality, how the data was collected (sampling methods), statistical confidence and precision of the results, and appropriateness of the measurement methods to address bias?
3. **How do the EM&V approaches used compare to other state practices for similar programs?** Is it the EM&V methodology, program design, or something else that drives differences in savings assumptions when study results and TRM values are compared across states?
4. **How do the EM&V approaches used align with any existing state, regional or national EM&V protocols?** The standardized reporting forms do not prescribe a certain EM&V method or protocol, but allow a program administrator or 3rd party evaluator to reference existing protocol(s) that align with the methods/practices used.
5. **Where should an interested party focus his/her attention on EM&V review?** The standardized forms provide sufficient information to address the above questions that can point a reviewer to where they may want to better understand the details of a study (or group of studies), without having to review every study. This helps to streamline the evaluation review process and reduce costs.

Description of the Standardized EM&V Methods Reporting Forms

The standardized EM&V methods reporting forms provided herein provide two levels of reporting, each with a discrete but complementary purpose:

- 1) An **Impact Evaluation EM&V Summary Form** - intended to accompany individual energy efficiency impact evaluation studies that summarize the impacts and document the EM&V method(s) used *in that study*; and
- 2) A **Program EM&V Summary Form** - intended to accompany program administrator Annual Energy Efficiency Program Reports submitted to their regulatory commission that summarizes the EM&V methods and level of rigor around the reported savings *for that program* (which may include a number of supporting studies).

The intended purpose, use and audiences for these forms, as well as likely responsible entity to complete the forms, are summarized in Figure 1 below:

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Figure 1.

Impact Evaluation Study – EM&V Summary Form

- Accompanies evaluation study – completed by evaluator / contractor
- Summarizes objectives, methods, rigor, results, and application of results
- Responds to need for quick digestion and comparison of EM&V methods used across studies.
- **Primary audiences: PAs, EE Program regulators/consultants, regional system planners**

Program EM&V Summary Form

- Accompanies annual reports submitted to PUCs – completed by PAs/evaluators
- Documents EM&V methods used for range of studies that inform savings for program
- Summarizes general methods, rigor, alignment with any existing EM&V protocols
- Responds to need for basic information about EM&V practices and high-level summary of EM&V rigor for reported savings
- **Primary audiences: energy and air quality regulators, regional system planners, EPA/DOE**

Attachment A presents the standardized template of the *Impact Evaluation Study EM&V Summary Form*. Attachment B presents the standardized template of the *Program EM&V Summary Form*. The forms are supported by a **User Guide and Glossary (Appendix 1)**, and are also available to be downloaded in a web-based (filemaker) format.

Stakeholder Process for Developing Standardized EM&V Methods Forms

The standardized forms provided in Attachments A-B were developed by the project contractor, Cadmus Group, in consultation with NEEP and the Forum project subcommittee, which provided extensive comment on several versions of the draft forms. Representative entities on the project subcommittee are provided below in Table 1.

Table 1. EM&V Methods Project Subcommittee Represented Agencies/Entities	
State	Organization
CT	CT Department of Energy & Environmental Protection, Connecticut Light & Power, Consultant to CT EEB, Northeast Utilities
DE	Delaware Department of Natural Resources and Environmental Control
MA	Northeast Utilities, Massachusetts EEAC, Advisor, National Grid, Massachusetts Department of Energy Resources, Massachusetts Department of Environmental Protection, Massachusetts Department of Public Utilities
MD	Baltimore Gas & Electric, First Energy, Maryland Energy Administration, Maryland Public Service Commission, PEPCO Holdings
NH	Public Service New Hampshire, New Hampshire Public Utilities Commission
NY	Con Edison, New York Department of Public Service, New York Power Authority, New York State Energy Research Development Authority (NYSERDA), Rochester Gas & Electric, NYSEG
RI	National Grid, Rhode Island Public Utilities Commission
VT	Efficiency Vermont / VEIC, Vermont Public Service Department
Regional/Nat'l	ISO New England, US DOE, US EPA, EPA (Region 1)

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Considerations and Recommendations

As the first of its kind to be developed in the country, these standardized EM&V methods reporting forms are considered to be an effective solution to creating transparency and providing basic understanding of EM&V practices used by the Forum states, with the caveat that this is a work in progress. The forms herein are **Version 1.0** of what is likely to be an evolving product that improves with time and use. On-going refinements will be made to the forms in consultation with the project subcommittee, in coordination with US DOE and with US EPA.

Recommended areas for Forum work to support implementation and use of the standardized forms for 2015-16 include:

- 1) Refinements to the standardized forms
- 2) Development of a supporting on-line database that allows for uploading/downloading the standardized forms (currently in a web-based format), with capability for users to query data in order to compare/aggregate methods used across programs or studies
- 3) Integrate the on-line EMV Methods Form database with the Regional EE Database (REED), for ready access to supporting EM&V practice associated with reported EE savings data in REED
- 4) Support state needs for inclusion of EE in state compliance plans for national ambient air quality standards and forthcoming greenhouse gas regulations, in coordination with Northeast States for Coordination Air Use Management (NESCAUM), the Regional Greenhouse Gas Initiative (RGGI), and other key organizations, using the above tools.

State Use of the Standardized EM&V Methods Forms

Forum Steering Committee adoption of these standardized EM&V Methods reporting templates indicates the states' intent to encourage the use of the forms in the respective Forum states, with the understanding that the forms will be refined and improved with guidance from representative state members on the project subcommittee, and that each state will determine how best to incorporate the use of standardized forms into its own required reporting process.



Attachment A. Program EM&V Summary Form

Program Administrator:		Program Name:	
State:		Program Sector:	Program Year:

1. PROGRAM YEAR SUMMARY

1.1. Program Year Savings Summary

Indicate the program performance for the reported program year by providing the reported values for each savings parameter.

Select “Not Reported” if the program does not report savings for a savings parameter.

Savings Type	Electric Energy	Electric Demand	Natural Gas
Units	<input type="checkbox"/> kWh <input type="checkbox"/> MWh <input type="checkbox"/> Not reported	<input type="checkbox"/> kW <input type="checkbox"/> MW <input type="checkbox"/> Not reported	<input type="checkbox"/> Therms <input type="checkbox"/> MMBTU <input type="checkbox"/> CCF <input type="checkbox"/> Not reported
Adjusted Gross Annual Savings			
Net Annual Energy Savings			
Adjusted Gross Lifetime Savings			
Net Lifetime Savings			

1.2. Capacity Market Participation

Indicate whether the program reports savings to any of the capacity markets.

Demand Resource for Capacity Market	<input type="checkbox"/> ISO-New England <input type="checkbox"/> PJM	<input type="checkbox"/> Not Reported <input type="checkbox"/> Other: _____
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1.3. Program Year EM&V Summary

Describe any new EM&V activity compared to previous reporting years.

- A. Are there any new evaluation results that influence program savings from the previous reporting year?
- Yes
 No
- B. If you answered “Yes” to the previous question, describe new EM&V activity that influences savings for this year compared to the previous year.
- C. Describe any ongoing or planned EM&V activity that will affect program savings estimates in future years.
- D. Describe any changes in the EM&V approach compared to previous years.



2. Program EM&V Methods Summary

2.1. Are EM&V activities performed at the program level? Indicate "Yes" if EM&V activities are performed at the program level.		
<input type="checkbox"/> Yes <input type="checkbox"/> No		
2.2. Are EM&V activities conducted by independent, 3rd party evaluation contractors? Indicate "Yes" if evaluations are conducted by 3 rd party, independent evaluation contractors.		
<input type="checkbox"/> Yes <input type="checkbox"/> No		
2.3. Indicate EM&V Methods used to evaluation program savings. For each savings category, indicate ALL methods used to estimate program performance for the reported program year.		
Methods for Estimating Baseline	Methods for Verifying Installation	Methods for Determining Energy and Demand Savings
<input type="checkbox"/> Stipulated baseline <input type="checkbox"/> Building Code or Federal/State Standard <input type="checkbox"/> Standard Practice (Market Baseline) <input type="checkbox"/> Existing Conditions <input type="checkbox"/> Dual or Dynamic Baseline <input type="checkbox"/> Other: _____	<input type="checkbox"/> None <input type="checkbox"/> Document Review <input type="checkbox"/> Survey <input type="checkbox"/> On-Site Inspection <input type="checkbox"/> Other <input type="checkbox"/> N/A: _____	<input type="checkbox"/> None <input type="checkbox"/> Deemed Savings <input type="checkbox"/> Engineering Desk Review <input type="checkbox"/> Measurement & Verification <input type="checkbox"/> IPMVP Option A <input type="checkbox"/> IPMVP Option B <input type="checkbox"/> IPMVP Option C <input type="checkbox"/> IPMVP Option D <input type="checkbox"/> Large Scale Consumption Data Analysis (billing analysis) <input type="checkbox"/> Randomized Control Trial <input type="checkbox"/> Quasi-Experimental Methods <input type="checkbox"/> Top Down <input type="checkbox"/> Other: _____
Net Savings Estimation	Measure Life	
		Persistence Estimation



<p>Adjustments include:</p> <ul style="list-style-type: none"><input type="checkbox"/> N/A<input type="checkbox"/> Free-ridership<input type="checkbox"/> Participant spillover<input type="checkbox"/> Non-participant spillover<input type="checkbox"/> Other: _____	<p>Methods:</p> <ul style="list-style-type: none"><input type="checkbox"/> None<input type="checkbox"/> Stipulated NTG ratio<input type="checkbox"/> Top-down<input type="checkbox"/> Self-reporting surveys<input type="checkbox"/> Enhanced self-reporting surveys<input type="checkbox"/> Large-scale consumption data analysis<input type="checkbox"/> Cross-sectional study<input type="checkbox"/> Market sales data analysis<input type="checkbox"/> Structured expert judgment<input type="checkbox"/> Historical Tracing (Case Study)<input type="checkbox"/> Other: _____	<ul style="list-style-type: none"><input type="checkbox"/> Stipulated value, program-level<input type="checkbox"/> Stipulated value, measure-level<input type="checkbox"/> Project-specific values	<ul style="list-style-type: none"><input type="checkbox"/> None<input type="checkbox"/> Degradation<input type="checkbox"/> Rebound<input type="checkbox"/> Other<input type="checkbox"/> Not applicable
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3. Program EM&V Rigor Summary

3.1. Describe the overall EM&V strategy for the program including how EM&V targets the major sources of uncertainty.

3.2. Characterization of EM&V Rigor

The following four questions aim to provide information on the overall rigor of the evaluation. In the context of this form, we define “rigor” strictly in terms of the validity of the results, based on (1) the quality of the data, (2) appropriateness of the way the data was collected, (3) statistical confidence and precision of the results, and (4) appropriateness of the measurement methods. *For general information about interpretation of this information, see the instructions, glossary, and user guide (include link to instructions page)*

Select one:	Describe your selection as needed:
<p>A. Data Quality</p> <ul style="list-style-type: none"> ○ All program components are recent and based on primary research. ○ Most program components are based on recent and secondary research. ○ Program EM&V components savings are not based on recent research. 	
<p>B. Sampling Methods</p> <ul style="list-style-type: none"> ○ All program components use census or random sampling methods. ○ Most program components use census or random sampling methods. ○ Program components use non-random sampling methods. 	
<p>C. Confidence and Prevision</p> <ul style="list-style-type: none"> ○ All program components achieve the planned level of confidence and precision. ○ Most program components achieve the planned level of confidence and precision. ○ Program components did not achieve the planned level of confidence and precision. ○ EM&V does not quantify program EM&V confidence and precision levels. 	
<p>D. Measurement Methods</p> <ul style="list-style-type: none"> ○ Measurement methods address all major sources of bias. ○ Measurement methods address some major sources of bias. ○ Measurement methods do not address potential sources of bias. 	



4. Relevant EM&V Documents

4.1. The EM&V studies supporting the reported program savings reference the selected national, regional, and state-specific protocols.

Identify any specific EM&V Methods standards, protocols or guidance documents with which the EM&V methods used to inform the reported savings for this project are consistent and briefly describe.

National Protocols

- US DOE Uniform Methods Project (UMP): Energy Efficiency Savings Protocols for Gross Savings ([link](#))
- US DOE Uniform Methods Project (UMP): Energy Efficiency Savings Protocols for Net Savings ([link](#))
- International Performance Measurement and Verification Protocol® (IPMVP) ([link](#))
- North American Energy Standards Board (NAESB) - Wholesale/Retail Electric Quadrant Energy Efficiency M&V Standards
- ASHRAE Guideline 14, Measurement of Energy and Demand Savings
- Federal Energy Management Program (FEMP) M&V Guidelines
- U.S. DOE Superior Energy Performance Measurement and Verification Guide for Industry
- SEE Action, Energy Efficiency Program Impact Evaluation Guide
- Other (describe below)
- Don't Know

Regional/State Protocols

- NEEP Regional EM&V Methods and Savings Assumptions Guidelines ([link](#))
- ISO New England Manual for M&V of Demand Reduction Value from Demand Resources ([link](#))
- PJM Manual 18B: Energy Efficiency Measurement & Verification ([link](#))
- State-specific EM&V Protocols or guidance documents (provide link)
- Other (describe below)
- Don't Know

Provide additional information for selected protocols:

Provide additional information for selected protocols:

4.2. Relevant EM&V Studies

List the TRM and EM&V impact evaluation studies relevant to the estimated program performance for the reported program year.



Attachment B. Impact Evaluation Summary Form

Study Title:	
Study Date (Month YYYY):	Study Author(s):

1. GENERAL INFORMATION

1.1. Provide Information to describe the program(s) studied (check all that apply):			
Program Name(s)			
Program Year(s) or Time Period			
State			
Program Administrator(s)			
Sector	<input type="checkbox"/> Low Income <input type="checkbox"/> Residential	<input type="checkbox"/> Multifamily <input type="checkbox"/> Commercial/Industrial	
Program Type (Market)	<input type="checkbox"/> Lost Opportunity - Prescriptive <input type="checkbox"/> Lost Opportunity - Custom	<input type="checkbox"/> Retrofit - Prescriptive <input type="checkbox"/> Retrofit - Custom	
Program Delivery Method(s)	<input type="checkbox"/> Upstream <input type="checkbox"/> Midstream	<input type="checkbox"/> Prescriptive Rebate <input type="checkbox"/> Direct Install	<input type="checkbox"/> Implementer <input type="checkbox"/> Custom
1.2. Provide information to describe the measure(s) studied (check all that apply):			
Measure End-Use	<input type="checkbox"/> Lighting <input type="checkbox"/> HVAC <input type="checkbox"/> Refrigeration	<input type="checkbox"/> Water Heating <input type="checkbox"/> Motors/Drives <input type="checkbox"/> Process	<input type="checkbox"/> Appliances <input type="checkbox"/> Whole-Facility <input type="checkbox"/> Other: _____
Measure Type(s)	<input type="checkbox"/> Equipment <input type="checkbox"/> Controls <input type="checkbox"/> Motors/Drives	<input type="checkbox"/> Weatherization <input type="checkbox"/> Energy Reports <input type="checkbox"/> New Construction Design	<input type="checkbox"/> Custom <input type="checkbox"/> Other: _____
Fuel/Resource Type	<input type="checkbox"/> Electric Energy <input type="checkbox"/> Electric Peak Demand <input type="checkbox"/> Natural Gas	<input type="checkbox"/> Heating Oil <input type="checkbox"/> Water/Wastewater <input type="checkbox"/> Non Resource Benefits	<input type="checkbox"/> Other: _____ <input type="checkbox"/> Not applicable
Demand Resources	<input type="checkbox"/> ISO-NE FCM <input type="checkbox"/> PJM	<input type="checkbox"/> Not reported <input type="checkbox"/> Other: _____	



2. STUDY SUMMARY AND RESULTS

2.1. Study Objective

Describe the study objectives including studied savings parameters and study population.

2.2. Study Results

Describe the key evaluation findings related to program savings, including increase or decrease from previous or existing results.

Parameter	Value	Units	Relative Precision (%)	Confidence (%)	Savings Type	Parameter Type
					Select type.	Select type.
					Select type.	Select type.
					Select type.	Select type.
					Select type.	Select type.
					Select type.	Select type.



3. EM&V METHODS FOR GROSS SAVINGS

3.1. Methods for Estimating Gross Impacts

Describe and characterize the methods for estimating gross and adjusted gross impacts.

Select method(s) for gross impact analysis.

- N/A (gross savings not estimated)
- Deemed Savings
 - Stipulated deemed savings value
 - Deemed savings calculation
- Engineering Desk Review
- Measurement & Verification
 - IPMVP Option A
 - IPMVP Option B
 - IPMVP Option C
 - IPMVP Option D
 - Other: _____
- Large Scale Consumption Data Analysis (i.e., billing analysis)
 - Randomized Control Trial (RCT)
 - Quasi-Experimental Methods
 - Pre/Post Energy Use
 - Matched Control Group
 - Other: _____
 - Other:
- Top-Down (macro-consumption)
 - Indicate the level of aggregation:
 - Sector
 - Utility
 - State
 - Region
 - Other:

Provide additional description:

Select sampling method(s) for the gross savings analysis.

- Census
- Sample
- Not applicable

Sampling Details

- Sampling Unit: _____
- Participant sample size (units): _____
- Non-participant sample size (units): _____

Provide additional description:

Select method(s) for installation verification.

- None
- Documentation review
- Survey

Survey details:

- Mail
- E-Mail
- Telephone

Provide additional description:



<input type="checkbox"/> On-Site Inspection <input type="checkbox"/> Not applicable	<input type="checkbox"/> In-person <input type="checkbox"/> Other:	
Select data collection method(s) for gross impact analysis.		
<input type="checkbox"/> None <input type="checkbox"/> Utility consumption data (“billing data”): PRE <input type="checkbox"/> POST <input type="checkbox"/> Interval whole-building building data: PRE <input type="checkbox"/> POST <input type="checkbox"/> On-Site Metering Data: PRE <input type="checkbox"/> POST	<i>Provide additional description:</i>	
Indicate method(s) for estimating baseline.		
<input type="checkbox"/> Stipulated <input type="checkbox"/> Building Code or Federal/State Appliance Standard <input type="checkbox"/> Standard Practice (market baseline) <input type="checkbox"/> Dual or Dynamic Baseline <input type="checkbox"/> Existing conditions (including pre-installation metering) <input type="checkbox"/> Not applicable <input type="checkbox"/> Other	<i>Provide additional description:</i>	



4. EM&V METHODS FOR NET SAVINGS

4.1. Methods for Estimating Attribution		
Describe and characterize the methods for estimating net savings or measuring attribution.		
Indicate method(s) for NTG analysis.		
<ul style="list-style-type: none"> <input type="checkbox"/> N/A (study does not measure attribution) <input type="checkbox"/> Combined with impact evaluation (i.e., can't separate net and gross) <input type="checkbox"/> Stipulated net-to-gross ratio <input type="checkbox"/> Self-reporting surveys <ul style="list-style-type: none"> <input type="checkbox"/> Customer <input type="checkbox"/> Trade-Ally <input type="checkbox"/> Enhanced self-reporting surveys <input type="checkbox"/> Panel of trade allies <input type="checkbox"/> Large-scale consumption data analysis <input type="checkbox"/> Cross-sectional studies <input type="checkbox"/> Top-down evaluations (or macro-economic models) <input type="checkbox"/> Market sales data analysis <input type="checkbox"/> Structured expert judgment approaches <input type="checkbox"/> Historical Tracing (or Case Study) Methods <input type="checkbox"/> Other 	<p><i>Provide additional description:</i></p>	
Indicate sampling method(s) for NTG analysis.		
<ul style="list-style-type: none"> <input type="checkbox"/> Census <input type="checkbox"/> Sample <input type="checkbox"/> Not applicable 	<p><i>Sampling details:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Sampling Unit: _____ <input type="checkbox"/> Participant sample size (units): _____ <input type="checkbox"/> Non-participant sample size (units): _____ 	<p><i>Provide additional description:</i></p>



5. Program EM&V Rigor Summary

5.1. Characterization of EM&V Rigor

The following four questions aim to provide information on the overall rigor of the evaluation. In the context of this form, we define “rigor” strictly in terms of the validity of the results, based on (1) the quality of the data, (2) appropriateness of the way the data was collected, (3) statistical confidence and precision of the results, and (4) appropriateness of the measurement methods. *For general information about interpretation of this information, see the instructions, glossary, and user guide (include link to instructions page)*

Select one:	Describe your selection as needed:
<p>A. Data Quality</p> <ul style="list-style-type: none"> ○ All study components are recent and based on primary research. ○ Most study components are based on recent and secondary research. ○ Study EM&V components savings are not based on recent research. 	
<p>B. Sampling Methods</p> <ul style="list-style-type: none"> ○ All study components use census or random (incl. stratified) sampling methods. ○ Most study components use census or random (incl. stratified) sampling methods. ○ Study components use non-random sampling methods. 	
<p>C. Confidence and Prevision</p> <ul style="list-style-type: none"> ○ All study components achieve the planned level of confidence and precision. ○ Some study components achieve the planned level of confidence and precision. ○ Study components did not achieve the planned confidence and precision levels. ○ The study does not quantify confidence and precision levels. 	
<p>D. Measurement Methods</p> <ul style="list-style-type: none"> ○ Measurement methods address all major sources of bias. ○ Measurement methods address some major sources of bias. ○ Measurement methods do not address potential sources of bias. 	



6. EVALUATION PROTOCOLS

6.1. EM&V Protocols and Guidance Documents

Identify any EM&V standards, protocols or guidance documents that the EM&V methods used to inform the reported savings. For selected protocols, indicate how the protocol was used.

<p>National Protocols</p> <ul style="list-style-type: none"> <input type="checkbox"/> US DOE Uniform Methods Project (UMP): Energy Efficiency Savings Protocols for Gross Savings (link) <input type="checkbox"/> US DOE Uniform Methods Project (UMP): Energy Efficiency Savings Protocols for Net Savings (link) <input type="checkbox"/> International Performance Measurement and Verification Protocol® (IPMVP) (link) <input type="checkbox"/> North American Energy Standards Board (NAESB) - Wholesale/Retail Electric Quadrant Energy Efficiency M&V Standards <input type="checkbox"/> ASHRAE Guideline 14, Measurement of Energy and Demand Savings <input type="checkbox"/> Federal Energy Management Program (FEMP) M&V Guidelines <input type="checkbox"/> U.S. DOE Superior Energy Performance Measurement and Verification Guide for Industry <input type="checkbox"/> SEE Action, Energy Efficiency Program Impact Evaluation Guide <input type="checkbox"/> Other (describe below) <p>Don't Know</p>	<p>Regional/State Protocols</p> <ul style="list-style-type: none"> <input type="checkbox"/> NEEP Regional EM&V Methods and Savings Assumptions Guidelines (link) <input type="checkbox"/> ISO New England Manual for M&V of Demand Reduction Value from Demand Resources (link) <input type="checkbox"/> PJM Manual 18B: Energy Efficiency Measurement & Verification (link) <input type="checkbox"/> State-specific EM&V Protocols or guidance documents (provide link) <input type="checkbox"/> Other (describe below) <input type="checkbox"/> Don't Know
<p><i>Provide additional information for selected protocols:</i></p>	<p><i>Provide additional information for selected protocols:</i></p>



7. RECOMMENDATIONS

7.1. Study Recommendations and Response

Complete the table below to describe the study recommendations and (if possible) The Program Administrator's response.

#	Recommendation	Response	Description of Response
1	[Insert evaluation contractor recommendation]	Select response.	[Describe PA response.]
2	[Insert evaluation contractor recommendation]	Select response.	[Describe PA response.]
3	[Insert evaluation contractor recommendation]	Select response.	[Describe PA response.]
4	[Insert evaluation contractor recommendation]	Select response.	[Describe PA response.]

APPENDIX 1. Instructions and Glossary for EM&V Summary Forms

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IMPACT EVALUATION STUDY SUMMARY FORM

PURPOSE

This summary form provides summarized information about the EM&V activities completed for the specified impact evaluation study. The form provides information about the program or parameter studied, the impact evaluation results, and the EM&V methods used to achieve those results. This form should be completed for each impact evaluation study, or any study that may affect the reported savings values for energy-efficiency programs.

INSTRUCTIONS

Accessing the forms:

The form is available using a web link:⁵

http://23.99.21.98/fmi/webd#NEEP_EMV_REPORTS&lay=CoverPage&viewstyle=form&record=1&mode=browse

Upon opening the online form, the user can select the Impact Evaluation Summary Form and open a blank template.

Completing the Forms:

In the header section at the top of the form, complete the following fields to identify the program to which the form applies:

- Study Title,
- Study Date, and
- Study Author(s)

The user should then complete the form in each of the tabs:

- General Information
- Study Summary and Results
- EM&V Methods for Gross Savings
- EM&V Methods for Net Savings
- EM&V Rigor
- EM&V Protocols
- Recommendations

⁵ The form requires relatively recent internet browser and operating systems. It has been tested and works on Internet Explorer (8 or higher), Mozilla Firefox, and Google Chrome. In some cases, if hyperlink does not work, simply cut and paste link into your browser. Should the link not work, please check the EM&V Forum website at www.neep.org/emv-forum



1. GENERAL INFORMATION

This section characterizes the parameter(s) studied in this report so that the methods can (1) be connected to specific program results and (2) be compared to similar programs and/or measures.

Provide information to describe the specific program(s) studied.

- **Program Name** refers to the specific program(s) on which the evaluated results are based or apply.
- **Time Period Covered by Evaluation** refers to the population of projects, measures, or participants on which the study results are based.
- **State** refers to the states included in the evaluation study.
- **Program Administrators** refers to the PA(s) who participated in the study.

Fill in all of the blank fields by checking off all boxes that apply to the study for each of the following categories.

- **State** refers to the state(s) in which the projects take place.
- **Program Administrators** refers to the Program Administrator that is involved in the specific program(s) on which the evaluated results are based or apply.
- **Sector** refers to the type of building on which the evaluated results of the specific program(s) are based or apply.
- **Program Type** refers to the type of specific program(s) on which the evaluated results are based or apply.
- **Delivery Method** refers to the method of delivery used for the specific program(s) on which the evaluated results are based or apply.

Provide information to characterize the studied parameters.

Fill in all of the blank fields by checking off all boxes that apply to the study for each of the following categories.

- **Measure End Use** refers to the specific measure(s) used in the program(s) on which the evaluated results are based or apply.
- **Measure Type** refers to the type of measure(s) used in the program(s) on which the evaluated results are based or apply.
- **Fuel Resource or Type** refers to the type of fuel or resource used in the program(s) on which the results are based or apply. If none of the listed fuels or resources was used select "Not Applicable."
- **Demand Resource** refers to whether the program(s) reports savings to any of the capacity markets.



2. STUDY SUMMARY AND RESULTS

2.1. Study Objective

Describe the study objectives, including studied savings parameters and study population.

2.2. Study Results

Describe the key evaluation findings related to program savings, including increase or decrease from previous or existing results.

2.3. Table of Results

Complete the table to summarize the final study results and associated precision. This table should reflect the key results from the report. No additional calculations are necessary.

- **Parameter:** Describe the relevant parameter
- **Value:** Enter the final evaluated result for the studied parameter
- **Units:** Indicate the units associated with the final evaluated result (e.g., kWh for a deemed annual energy savings result, % for a realization rate, kW/kWh for a loadshape factor)
- **Relative Precision:** Indicate the relative precision level for the final evaluation result.
- **Confidence Interval:** Indicate the relative confidence interval for the final evaluation result.
- **Savings Type:** Use the menu to indicate the type of savings impacted by the studied parameter.
- **Parameter Type:** Use the menu to indicate the type of parameter studied.

The table below provides samples of completed rows for three types of impact evaluations:

#	Parameter	Value	Units	Relative Precision	Confidence Interval	Savings Type	Parameter Type
E1	Hours of Use	1,958	hours	9%	90%	Annual kWh	Engineering input parameter
E1	Summer CF	15	%	8%	90%	Peak kW	Coincidence Factor
E2	Annual kWh RR	95	%	9%	90%	Annual kWh	Realization Rate
E2	Annual therms RR	70	%	26%	80%	Annual NG	Realization Rate
E3	NTG for prescriptive measures	93	%	6%	90%	Attribution	NTG Value
E3	NTG for custom measures	104	%	11%	90%	Attribution	NTG Value

E1: example for a residential lighting hours-of-use study

E2: example for an SBDI electric and gas program impact evaluation

E3: example for a NTG study for C&I programs

3. EM&V METHODS FOR GROSS SAVINGS

This section characterizes the methods used to characterize gross impacts. For each savings category, describe the methods for estimating gross impacts and adjusted gross impacts.

3.1. Select method(s) for gross impact analysis:

- Indicate all of the EM&V methods used for the gross savings analysis by checking all applicable boxes. Check the “Not applicable” box if the study does not evaluate gross savings.
- In the space provided, describe the EM&V methods for the gross savings analysis. If multiple methods are used, describe how each method is used.

3.2. Select sampling method(s) for gross impact analysis:

- Indicate all of the sampling methods used for the gross savings analysis by checking all applicable boxes and indicate the sampling unit and sample size.
- In the space provided, describe the sampling method for the gross savings analysis. If multiple methods were used, indicate why and how each method was used.

3.3. Select method(s) for installation verification:

- Indicate all of the installation verification methods used for the gross savings analysis by checking all applicable boxes.
- In the space provided, describe the installation verification methods used for the gross savings analysis. If multiple methods are used, describe how each method is used.

3.4. Select data collection method(s) for gross impact analysis

- Indicate all of the data collection methods used for the gross savings analysis by checking all applicable boxes.
- In the space provided, describe the data collection methods for the gross savings analysis. If multiple methods are used, describe how each method is used.

3.5. Indicate the method(s) for estimating baseline:

- Indicate all of the approaches used to estimate the baseline by checking all applicable boxes.
- In the space provided, describe the methods used to modeling the baseline.

4. EM&V Methods for Net Savings

This section characterizes the methods used to estimate net savings or measure attribution.

4.1. Indicate EM&V Method(s) for NTG

- Indicate all of the EM&V methods used to determine the estimated net savings by checking all applicable boxes. If the study did not address attribution, please check the “Not Applicable” box.
- In the space provided, describe EM&V methods for estimating net savings. If multiple methods are used, describe how each method is used.

4.2. Indicate sampling method(s) for NTG analysis:

- Indicate the sampling method used to estimate the net energy savings by checking all applicable boxes. Also indicate the sampling unit and final sample size.



- In the space provided, describe the evaluation methods used to verify net savings or measure attribution. If multiple methods were used, indicate why and how each method was used.

5. EM&V RIGOR

In this section, provide a qualitative discussion of the level of EM&V rigor for the program savings by describing the overall EM&V strategy, sources of uncertainty, and the specific factors listed below.

Characterization of EM&V Rigor

The following four characterizations aim to provide information on the overall rigor of the evaluation. In the context of this form, we define “rigor” in terms of the validity of the results, based on (1) the quality of the data, (2) appropriateness of the way the data was collected, (3) statistical confidence and precision of the results, and (4) appropriateness of the measurement methods. See the user guide for general information about interpretation of this information.

5.1. Data Quality

Data quality is judged primarily in terms of vintage and relevance of the data used in the evaluation. For the purpose this form, data quality is assessed in terms data vintage and whether data on various components of the evaluation came from primary or secondary sources.

Indicate whether the EM&V results are based on recent research (w/in 5 years) resulting from primary or secondary research. If the data has not been collected from results within the last 5 years indicate “EM&V results are not based on recent research.” Describe your selection in detail in the space provided as needed.

5.2. Sampling Methods

Sampling method is an additional criterion for rigor. In the context of this form, it is assumed that random sampling is the only acceptable method for data collection. Levels of rigor are simply defined in terms of the fraction of evaluation components where random sampling was applied.

Describe whether all, most, or none of the program components were collected using census or random sampling methods. Describe your selection in detail in the space provided as needed.

5.3. Confidence and Precision

Confidence and precision are defined in terms of the statistical probability (confidence) and standard error of the data used in various components of the evaluation. Because of the variations in local guidelines for confidence precision, this form does not set any specific criteria. Rather, rigor is defined in terms of whether the evaluation components actually met the planned criteria for confidence and precision.



Describe whether all or some of the program components achieved the planned level of confidence and precision. If the program precision was not quantified select “No quantification of program EM&V precision.” Describe your selection in detail in the space provided as needed.

5.4. Measurement Methods

Describe whether the measurement methods address all, some, or none of the potential sources of bias. Describe your selection in detail in the space provided as needed.

6. EM&V PROTOCOLS

Measurement method related to the internal validity of the results and is a measure of whether the methods used in measurement of data such as surveys, on-site data collection, metering, etc. were applied in a manner to avoid bias in the data collection process.

In this section, indicate the use of any national or regional EM&V protocols and provide any necessary additional information for these protocols. Links for each protocol are provided in the table below.

Web Links for Protocols
National Protocols
U.S. DOE Uniform Methods Project (UMP) Protocols (link)
International Performance Measurement and Verification Protocol® (IPMVP) (link)
Federal Energy Management Program (FEMP) M&V Guidelines (link)
ASHRAE Guideline 14, Measurement of Energy and Demand Savings (link)
NAESB Wholesale/Retail Electric Quadrant Energy Efficiency M&V Standards (contact NAESB)
SEE Action Energy Efficiency Program Impact Evaluation Guide (link)
U.S. DOE Superior Energy Performance (SEP) Measurement and Verification Protocol for Industry (link)
Regional or State-Specific Protocols
NEEP Regional EM&V Methods and Savings Assumptions Guidelines (link)
ISO New England Manual for M&V of Demand Reduction Value from Demand Resources (link)
PJM Manual 18B: Energy Efficiency Measurement & Verification (link)

6.1. National Protocols

Identify any national EM&V standards, protocols or guidance documents with which the EM&V methods used to inform the reported savings for this program are consistent.

Provide additional information about how the selected protocols are used in the text box below and check list.

6.2. Regional and State-Specific Protocols

Identify any regional or state-specific EM&V standards, protocols, or guidance documents with which the EM&V methods used to inform the reported savings for this program are consistent.

Provide additional information about how the selected protocols are used in the text box below and check list.



6.3. Relevant EM&V Studies (provide name and links to studies)

List the relevant EM&V studies relevant to the estimated program performance for the reported program year. Include both the name and a link to each study.

7. RECOMMENDATIONS

Complete the table to describe the study recommendations and (if possible) The Program Administrator's response.

- Complete the table by filling in the list of recommendations from the study and indicating the appropriate response.
- Use the menu to indicate one of the following options for the Program Administrator for each recommendation:
 - Plan to incorporate
 - Under Consideration
 - Not Adopted
 - NA
- For the description of response, State whether the recommendation is actionable. If actionable, describe the changes that the PAs are considering including timeline for action.

Completing the form:

Upon completing all sections of the form, the user may click the "PRINT PDF" button to create a PDF. The PDF will present all the inputted data in a single document. The user may save the PDF directly or provide an e-mail address to e-mail the document to one or multiple parties.



PROGRAM EM&V SUMMARY FORM

PURPOSE

The Program Administrator will complete this form for each program in each program year to summarize program savings and EM&V activity. The form provides a high-level summary of the EM&V methods, rigor, and protocols that support the reported program savings.

For detailed information about the savings methods and assumptions, the reader should see the appropriate Technical Reference Manual and other supporting documentation.

For detailed information about the EM&V studies supporting the program savings, the reader should reference the appropriate impact evaluation studies and Impact Evaluation EM&V Study Summary forms.

INSTRUCTIONS

Accessing the forms:

The form is available using a web link:⁶

http://23.99.21.98/fmi/webd#NEEP_EMV_REPORTS&lay=CoverPage&viewstyle=form&record=1&mode=browse

Upon opening the online form, the user can select the Program Portfolio EM&V Summary Form and open a blank template.

Completing the Forms:

In the header section at the top of the form, complete the following fields to identify the program to which the form applies:

- Program Administrator,
- Program Name,
- State,
- Program Sector, and
- Program Year.

The user should then complete the form in each of the tabs:

- Program Year Summary
- Program EM&V Methods Summary
- Program EM&V Rigor Summary
- Relevant EM&V Documents

⁶ The form requires relatively recent internet browser and operating systems. It has been tested and works on Internet Explorer (8 or higher), Mozilla Firefox, and Google Chrome. In some cases, if hyperlink does not work, simply cut and paste link into your browser. Should the link not work, please check the EM&V Forum website at www.neep.org/emv-forum



1 PROGRAM YEAR SUMMARY

1.1 Program Year Savings Summary

Indicate the program performance for the reported program year by providing the reported values for each savings parameter. Select “Not Reported” if the program does not report savings for a savings parameter.

1.2 Capacity Market Participation

Indicate whether the program reports savings to any of the capacity markets.

1.3 Program Year EM&V Summary

Describe any new EM&V activity compared to previous reporting years.

- A. Are there new evaluation results that influence program savings from the previous reporting year?
 - a. Select “Yes” if there are any new evaluation results compared to the previous program year that impact the savings category.
 - b. Select “No” if there are no new evaluation results compared to the previous program year.
- B. Describe any ongoing or planned EM&V activity that will impact program savings estimates in future years.
- C. Describe any changes in the EM&V approach compared to previous years.

2 PROGRAM EM&V METHODS SUMMARY

In this section, describe and characterize the EM&V activity that supports the reported program savings for this program.

2.1 Are EM&V activities performed at the program level?

- Select “Yes” if evaluations are performed at the program level.
- Select “No” if evaluations are performed for program components.
- Select “N/A” if the program does not use evaluation results.

2.2 Are EM&V activities conducted by independent, 3rd party evaluation contractors?

- Select “Yes” if evaluations are conducted by independent, 3rd party contractors.
- Select “No” if evaluations are conducted in-house.
- Select “N/A” if the program does not use evaluation results.

2.3 Indicate EM&V methods used to evaluate program savings estimates.

The remainder of this section request EM&V information for the following six key savings components:



- **Methods for Estimating Baseline** refers to the methods used to model baseline (or pre-retrofit) consumption.
- **Methods for Verifying Installation** refers to methods used to verify implementation of program measures.
- **Methods for Determining Energy and Demand Savings** refers to methods used to verify the gross and adjusted gross savings estimates for the program.
- **Methods for Estimating Net Savings** refers to the methods used to estimate program attribution.
- **Measure Life** refers to the methods used to estimate the lifetime of measures implemented through the program.
- **Persistence Estimation** refers to the persistence factors considered in the savings estimates.

For each savings category, indicate all applicable methods used to estimate program performance for the reported program year. See the Glossary for descriptions and examples for each EM&V method.

3 PROGRAM EM&V RIGOR SUMMARY

Characterization of EM&V Rigor

The following sections aim to provide information on the overall rigor of the evaluation. We ask for an open-ended description of the overall EM&V strategy followed by four questions for which the user must select a single response.

In the context of this form, we define “rigor” in terms of the validity of the results, based on (1) the quality of the data, (2) appropriateness of the way the data was collected, (3) statistical confidence and precision of the results, and (4) appropriateness of the measurement methods. See the User Guide for general information about interpretation of this information.

3.1 Describe the overall EM&V strategy for the program including how EM&V targets the major sources of uncertainty.

In this section, provide a qualitative discussion of the level of EM&V rigor for the program savings by describing the overall EM&V strategy, sources of uncertainty, and the specific factors listed below.

3.2 Data Quality

Data quality is judged primarily in terms of vintage and relevance of the data used in the evaluation. For the purpose this form, data quality is assessed in terms data vintage and whether data on various components of the evaluation came from primary or secondary sources.

Indicate whether the EM&V results are based on recent research (w/in 5 years) resulting from primary or secondary research. If the data has not been collected from results within the last 5 years indicate “EM&V results are not based on recent research.” Describe your selection in detail in the space provided as needed.



3.3 Sampling Methods

Sampling method is an additional criterion for rigor. In the context of this form, it is assumed that random sampling is the only acceptable method for data collection. Levels of rigor are simply defined in terms of the fraction of evaluation components where random sampling was applied.

Indicate whether all, most, or none of the program components were collected using census or random sampling methods. Describe your selection in detail in the space provided as needed.

3.4 Confidence and Precision

Confidence and precision are defined in terms of the statistical probability (confidence) and standard error of the data used in various components of the evaluation. Because of the variations in local guidelines for confidence precision, this form does not set any specific criteria. Rather, rigor is defined in terms of whether the evaluation components actually met the planned criteria for confidence and precision.

Indicate whether all or some of the program components achieved the planned level of confidence and precision. If the program precision was not quantified select “No quantification of program EM&V precision.” Describe your selection in detail in the space provided as needed.

3.5 Measurement Methods

Measurement method related to the internal validity of the results and is a measure of whether the methods used in measurement of data such as surveys, on-site data collection, metering, etc. were applied in a manner to avoid bias in the data collection process.

Describe whether the measurement methods address all, some, or none of the potential major sources of bias. Describe your selection in detail in the space provided as needed.

4 RELEVANT EM&V DOCUMENTS

In this section, indicate the use of any national or regional EM&V protocols and provide any necessary additional information for these protocols. Links to the protocols are provided in the table below.



Web Links for Protocols
National Protocols
U.S. DOE Uniform Methods Project (UMP) Protocols (link)
International Performance Measurement and Verification Protocol® (IPMVP) (link)
Federal Energy Management Program (FEMP) M&V Guidelines (link)
ASHRAE Guideline 14, Measurement of Energy and Demand Savings (link)
NAESB Wholesale/Retail Electric Quadrant Energy Efficiency M&V Standards (contact NAESB)
SEE Action Energy Efficiency Program Impact Evaluation Guide (link)
U.S. DOE Superior Energy Performance (SEP) Measurement and Verification Protocol for Industry (link)
Regional or State-Specific Protocols
NEEP Regional EM&V Methods and Savings Assumptions Guidelines (link)
ISO New England Manual for M&V of Demand Reduction Value from Demand Resources (link)
PJM Manual 18B: Energy Efficiency Measurement & Verification (link)

4.1 National Protocols

Identify any national EM&V standards, protocols or guidance documents with which the EM&V methods used to inform the reported savings for this program are consistent.

Provide additional information about how the selected protocols are used in the text box below and check list.

4.2 Regional/State-Specific Protocols

Identify any regional or state-specific EM&V standards, protocols, or guidance documents with which the EM&V methods used to inform the reported savings for this program are consistent.

Provide additional information about how the selected protocols are used in the text box below and check list.

4.3 Relevant EM&V Studies (provide name and links to studies)

List the relevant EM&V studies relevant to the estimated program performance for the reported program year. Include both the name and a link to each study.

Completing the form:

Upon completing all sections of the form, the user may click the “PRINT PDF” button to create a PDF. The PDF will present all the inputted data in a single document.

The user may save the PDF directly or provide an e-mail address to e-mail the document to one or multiple parties.



Table 1. Methods Mapping for EM&V Rigor

Rigor Category	Savings Category				
	Baseline	Install Verification	Gross Savings	Net Savings	Lifetime
Low <i>Results are not based on current, primary research</i>	Stipulated baseline	None Document Review	None Deemed Savings (no EM&V)	None Stipulated NTG ratio	Calculation Single value for program Source Stipulated Persistence Factors None
Medium	Code or Standard Common Practice	Participant Survey	Top-Down Engineering Desk Review	Top-down (or macro-economic models) Structured expert judgment approaches Historical Tracing (or Case Study) Methods	[None]
High <i>Results are based on primary research that is specific to the program or measures</i>	Existing Conditions Dynamic Baseline	On-Site Inspection	Measurement & Verification Large Scale Consumption Data Analysis	Self-reporting surveys Enhanced self-reporting surveys Large-scale consumption data analysis Cross-sectional study Market sales data analysis	Calculation Measure-level lifetimes Source Project-specific Persistence Factors Degradation Rebound

GLOSSARY

The glossary provides definitions for key terms used in the Impact Evaluation Summary Form. We use definitions from two primary sources:

- Regional EM&V Forum Glossary of Terms, Version 2.1, July 2011 ([link](#))
- SEE Action Energy Efficiency Evaluation Program Impact Evaluation Guide ([link](#))

Term	Definition
Adjusted Gross Savings	The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated. It adjusts for such factors as data errors, installation and persistence rates, and hours of use, but does not adjust for free ridership or spillover. Can be calculated as an annual or lifetime value. (NEEP)
ASHRAE Guideline 14	American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Guideline 14, <i>2002 Measurement of Energy and Demand Savings</i> (www.ashrae.org). (SEE Action)
Attribution	Ascribing or establishing a causal relationship between action(s) taken by an entity and an outcome. (NEEP)
Baseline	Conditions, including energy consumption and related emissions, that would have occurred without implementation of the subject measure or project. Baseline conditions are sometimes referred to as “business-as-usual” conditions and are used to calculate program-related efficiency or emissions savings. Baselines can be defined as either project-specific baselines or performance standard baselines (e.g. building codes). (NEEP)
Bias	The extent to which a measurement or a sampling or analytic method systematically underestimates or overestimates a value. Some examples of types of bias include engineering model bias; meter bias; sensor placement bias; inadequate or inappropriate estimate of what would have happened absent a program or measure installation; a sample that is unrepresentative of a population; and selection of other variables in an analysis that are too correlated with the savings variable (or each other) in explaining the dependent variable (such as consumption). (NEEP)
Billing Analysis	An analytic methodology used to estimate program savings. It compares billing data from program participants over a period of time before the energy efficient measures are installed at customer sites to billing data for a comparable period of time afterward. Commonly, monthly billing data are gathered for the year before and the year after installation. Also common is to compare the before-after difference for the group of participating customers to the corresponding before-after differences in bills for a comparable group of non-participants. (NEEP)



Term	Definition
Calibration	In economic, planning, or engineering modeling, the process of adjusting the components of the model to reflect reality as best as possible, in order to prepare for the model's use in future applications. The term also applies to the process whereby metering and measurement equipment is periodically adjusted to maintain industry measurement standards. (NEEP)
Coincidence Factor	The ratio of the average hourly demand during a specified period of time of a group of electrical appliances or consumers to the sum of their individual maximum demands (or connected loads) within the same period. Can be expressed as a numerical value or as a percentage. (NEEP)
Common Practice	The predominant technology(ies) implemented or practice(s) undertaken in a particular region or sector. Common practices can be used to define a baseline. (SEE Action)
Confidence	An indication of how close, expressed as a probability, the true value of the quantity in question is within a specified distance to the estimate of the value. Confidence is the likelihood that the evaluation has captured the true value of a variable within a certain estimated range. Also see Precision. (NEEP)
Control Group	A selected group of individuals or organizations that have not had the opportunity to receive program benefits and that has been selected because its characteristics match those of another group of individuals or organizations that have had the opportunity to receive program benefits. The characteristics used to match the two groups should be associated with the action or behavior that the evaluation is trying to examine. The comparison group is used to isolate program effects from other factors that affect energy use. (NEEP)
Cross-Sectional Data	Observations collected on subjects or events during a single period of time. (NEEP)
Custom Program	An energy efficiency program intended to provide efficiency solutions to unique situations not amenable to common or prescriptive solutions. Each custom project is examined for its individual characteristics, savings opportunities, efficiency solutions, and often, customer incentives. (NEEP)
Deemed Savings	An estimate of energy or demand savings for a single unit of an installed energy efficiency measure that (a) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose, and (b) is applicable to the situation being evaluated. Individual parameters or calculation methods can also be deemed. (NEEP)
Demand	The time rate of energy flow. Demand usually refers to the amount of electric energy used by a customer or piece of equipment at a specific time, expressed in kilowatts (kW - equals kWh/h) but can also refer to natural gas usage at a point in time, usually as Btu/hr, kBtu/hr, therms/day or ccf/day. (NEEP)
Demand Savings	The reduction in electric or gas demand from the baseline to the demand associated with the higher efficiency equipment or installation. This term is usually applied to billing demand to calculate cost savings or to peak demand for equipment sizing purposes. (NEEP)



Term	Definition
Direct Install Program	An energy efficiency program design strategy involving the direct installation of measures in customer premises by a contractor sponsored by the program. Such programs generally involve one-for-one replacement of existing equipment with more efficient equipment and may include a customer rebate. Financing is sometimes part of the program offering, to facilitate the customer's contribution to the cost of the project; some programs also buy down the interest rate. (NEEP)
End-Use	General categories of energy efficiency measures, usually including lighting, HVAC, motors, and refrigeration. (NEEP)
Energy Efficiency Measure	An installed piece of equipment or system, or modification of equipment, systems, or operations on end-use customer facilities that reduces the total amount of electrical or gas energy and capacity that would otherwise have been needed to deliver an equivalent or improved level of end-use service. (NEEP)
Engineering Methods	The use of standard formulas or models based on those formulas, typically accepted by ASHRAE, as the basis for calculating energy use. (NEEP)
Evaluation	The conduct of any of a wide range of assessment studies and other activities aimed at determining the effects of a program, understanding or documenting program performance, program or program-related markets and market operations, program-induced changes in energy efficiency markets, levels of demand or energy savings, or program cost-effectiveness. Market assessment, monitoring and evaluation (M&E), and measurement and verification (M&V) are aspects of evaluation. (NEEP)
External Validity	The condition in which an impact estimate that is internally valid for a given program population and time frame can be generalized and applied to new situations (e.g., new populations, future years). (SEE Action)
FEMP M&V Guidelines	U.S. Department of Energy Federal Energy Management Program's 2008 M&V Guidelines: Measurement and Verification for Federal Energy Projects. (SEE Action)
Gross kW	Expected demand reduction based on a comparison of standard or replaced equipment, and equipment installed through an energy efficiency program. (NEEP)
Gross kWh	Expected kWh reduction based on a comparison of standard or replaced equipment, and equipment installed through an energy efficiency program. (NEEP)
Gross Savings	The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated and unadjusted by any factors. (NEEP)
Impact Evaluation	An evaluation of the program-specific directly induced quantitative changes (e.g. kWh, kW, and therms) attributable to an energy efficiency program. (NEEP)
Inspections	Site visits to facilities treated under an efficiency program that document the existence, characteristics, and operation of baseline or reporting period equipment and systems as well as factors that affect energy use. (NEEP)



Term	Definition
Internal Validity	Refers to how well an evaluation was conducted (e.g., design, how variables were measured, what was/wasn't measured) and how confidently one can conclude that the observed effect(s) were produced solely by the independent variable and not extraneous ones. For impact evaluations, this is related to whether the savings impacts are valid for the specific program being evaluated, the given program participant population, and the given time frame of the evaluation. This is often compared to <i>external validity</i> . (SEE Action)
International Performance Measurement and Verification Protocol (IPMVP)	A guidance document with a framework and definitions describing the four M&V approaches; a product of the Efficiency Valuation Organization (www.evo-world.org). (SEE Action)
Kilowatt (kW)	A measure of the rate of power used during a preset time period (e.g. minutes, hours, days or months) equal to 1,000 watts. In the abbreviation, the W is capitalized because the unit was named to honor one of Scotland's great inventors, James Watt, who coined the term "horsepower." (NEEP)
Kilowatt-Hour (kWh)	A common unit of electric energy; one kilowatt-hour is numerically equal to 1,000 watts used for one hour. (NEEP)
Lifetime Energy Savings	The electric or gas energy savings over the lifetime of an installed measure(s), calculated by multiplying the annual electric or gas usage reduction associated with a measure(s) by the expected lifetime of that measure(s). (NEEP)
Lost Opportunity Program	A program that captures energy efficiency opportunities at the time of a naturally-occurring market event, such as when a customer constructs, expands, renovates, or remodels a home or a building or makes an initial purchase of equipment, or replaces failed equipment.
Measure Life	The length of time that a measure is expected to be functional. Measure Life is a function of equipment life and measure persistence (not savings persistence): 1) Equipment Life means the number of years that a measure is installed and will operate until failure; 2) Measure Persistence takes into account business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued. Measure Life is sometimes referred to as expected useful life (EUL). (NEEP)
Measure Persistence	The duration of an energy consuming measure, taking into account business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued. (NEEP)
Measurement and Verification (M&V)	A subset of program impact evaluation that is associated with the documentation of energy savings at individual sites or projects using one or more methods that can involve measurements, engineering calculations, statistical analyses, and/or computer simulation modeling. (NEEP)
Measurement Error	In the evaluation context, a reflection of the extent to which the observations conducted in the study deviate from the true value of the variable being observed. The error can be random (equal around the mean) or systematic (indicating bias). (NEEP)



Term	Definition
Net Savings	The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of free drivers, free riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand. (NEEP)
Net-to-Gross Ratio (NTGR)	A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts. The factor itself may be made up of a variety of factors that create differences between gross and net savings, commonly including free riders and spillover. Other adjustments may include a correction factor to account for errors within the project tracking data, breakage, and other factors that may be estimated which relate the gross savings to the net effect of the program. Can be applied separately to either energy or demand savings. (NEEP)
Non-Energy Effects or Non-Energy Benefits (NEB)	Also referred to as Non-Energy Impacts (NEI). The identifiable and sometimes quantifiable non-energy results associated with program implementation or participation. Some examples of NEBs include: reduced emissions and environmental benefits, productivity improvements, jobs created, reduced program administrator debt and disconnects, and higher comfort and convenience level of participant. The effects of an energy efficiency or resource acquisition program that are other than energy saved. The value is most often positive, but may also be negative (e.g. the cost of additional heating required to replace the residual heat no longer available from incandescent lamps that have been replaced by CFLs). (NEEP)
Non-Participant	Any consumer who was eligible but did not participate in the subject efficiency program in a given program year. (NEEP)
Peak Demand	The maximum level of hourly demand during a specified period. The peak periods most commonly identified are annual and seasonal (summer and winter). (NEEP)
Persistence	See Savings Persistence Rate and Measure Persistence.
Portfolio	(a) A collection of similar programs addressing the same market (e.g. a portfolio of residential programs), technology (e.g. motor efficiency programs), or mechanisms (e.g. loan programs), (b) the set of all programs conducted by one or more organizations, such as a program administrator (and which could include programs that cover multiple markets, technologies, etc...). (NEEP)
Precision	The indication of the closeness of agreement among repeated measurements of the same physical quantity. Precision is a measure of how statistically confident evaluators can be that the estimated impact of a program is close to the true impact of a program. An estimate with a smaller confidence interval is said to be more precise. It is also used to represent the degree to which an estimated result in social science (e.g., energy savings) would be replicated with repeated studies. (SEE Action)
Prescriptive Program	An energy efficiency program focused on measures that are one-for-one replacements of the existing equipment and for which fixed customer incentives can be developed based on the anticipated similar savings that will accrue from their installation. (NEEP)



Term	Definition
Program Administrator (PA)	Those entities that oversee public benefit funds in the implementation of energy efficiency programs. This generally includes regulated utilities, other organizations chosen to implement such programs, and state energy offices. (NEEP)
Program Participant	A consumer that received a service offered through an efficiency program in a given program year. The term “service” can be one or more of a wide variety of services, including financial rebates, technical assistance, product installations, training, energy efficiency information or other services, items, or conditions. (NEEP)
Project	An activity or course of action involving one or multiple energy efficiency measures, at a single facility or site. (NEEP)
Qualitative Data	Information expressed in the form of words. (NEEP)
Quantitative Data	Information expressed in the form of numbers. (NEEP)
Randomized Controlled Trial (RCT)	A type of experimental program evaluation design in which energy consumers in a given population are randomly assigned into two groups: a treatment group and a control group. The outcomes for these two groups are compared, resulting in program energy savings estimates. (SEE Action)
Rebound Effect	Also called Snap Back. A change in energy-using behavior that yields an increased level of service that is accompanied by an increase in energy use and occurs as a result of taking an energy efficiency action. The result of this effect is that the savings associated with the direct energy efficiency action is reduced by the resulting behavioral change. (NEEP)
Realization Rate	The term is used in several contexts in the development of reported program savings. The primary applications include the ratio of project tracking system savings data (e.g. initial estimates of project savings) to savings: 1) adjusted for data errors, 2) that incorporate evaluated or verified results of the tracked savings, and 3) that account for free ridership and/or spillover. (NEEP)
Reliability	The quality of a measurement process that would produce similar results on: (1) repeated observations of the same condition or event; or (2) multiple observations of the same condition or event by different observers. (NEEP)
Retrofit Isolation	The savings measurement approach defined in IPMVP Options A and B, as well as ASHRAE Guideline 14, that determines energy or demand savings through the use of meters to isolate the energy flows for the system(s) under consideration. IPMVP Option A involves “Key Parameter Measurement” and IPMVP Option B involves “All Parameter Measurement.” (SEE Action)
Rigor	The level of effort expended to minimize uncertainty due to factors such as sampling error and bias. The higher the level of rigor, the more confident one is that the results of the evaluation are both accurate and precise. (NEEP)



Term	Definition
Sample	In program evaluation, a portion of the population selected to represent the whole. Differing evaluation approaches rely on simple or stratified (based on some characteristic of the population) samples. (NEEP)
Savings Persistence Rate	Percentage of first year energy or demand savings expected to persist over the life of the installed energy efficiency equipment; developed by conducting surveys of installed equipment several years after installation to determine presence and operational capability of the equipment. (NEEP)
Spillover	Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program. There can be participant and/or non-participant spillover. Participant spillover is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy saving practices after having participated in the efficiency program as a result of the program’s influence. Non-participant spillover refers to energy savings that occur when a program non-participant installs energy efficiency. (NEEP)
Technical Reference Manual (TRM)	A resource document that includes information used in program planning and reporting of energy efficiency programs. It can include savings values for measures, engineering algorithms to calculate savings, impact factors to be applied to calculated savings (e.g., net-to-gross values), source documentation, specified assumptions, and other relevant material to support the calculation of measure and program savings. (NEEP)
Upstream Program	A program that provides information and/or financial assistance to entities in the delivery chain of high-efficiency products at the retail, wholesale, or manufacturing level. Such a program is intended to yield lower retail prices for the products. (NEEP)
Verification	An independent assessment of the reliability (considering completeness and accuracy) of claimed energy savings or an emissions source inventory. (NEEP)
Whole-Building Calibrated Simulation Approach	A savings measurement approach (defined in IPMVP Option D and ASHRAE Guideline 14) that involves the use of an approved computer simulation program to develop a physical model of the building in order to determine energy and demand savings. The simulation program is used to model the energy used by the facility before and after the retrofit. The pre or post-retrofit models are developed by calibration with measured energy use and demand data and weather data. (NEEP)
Whole-Building Metered Approach	A savings measurement approach (defined in the IPMVP Option C and ASHRAE Guideline 14) that determines energy and demand savings through the use of whole-facility energy (end use) data, which may be measured by utility meters or data loggers. This approach may involve the use of monthly utility billing data or data gathered more frequently from a main meter. (NEEP)