The Clean Power Plan and Energy Efficiency – A Look at the EM&V Guidance for 111(d) Compliance

Julia Vetromile, DNV GL
Wendy Todd, DNV GL

ABSTRACT

When the U.S. Environmental Protection Agency (EPA) finalized the Clean Power Plan (CPP) in early August 2015, it simultaneously issued a draft version of Evaluation Measurement and Verification (EM&V) Guidance for Demand-Side Energy Efficiency. This Guidance establishes standards and methods for states seeking to incorporate energy efficiency into their compliance plans with the CPP.

Unlike supply-side policies, in which the amount of generation is indicated by a meter, energy efficiency policy must provide methods for estimating the resulting savings. The EM&V Guidance is designed to serve this need.

A detailed first review of the draft EM&V Guidance identified areas of ambiguity or potential issues needing resolution as states develop their compliance plans. As state compliance strategies are developed, states and stakeholders may want to address these issues with the EPA. These areas include baseline definitions, the utilization of comparison group methods, the application of deemed and other savings calculation methods, including strategic energy management, the applicability of independent factors in calculating savings, and persistence study timelines

This paper will contribute to an understanding of key EM&V issues associated with 111(d) compliance, and will provide suggestions for states and stakeholders to address in the compliance process.

Introduction

This paper focuses on the draft EM&V Guidance document for the Clean Power Plan (CPP). First, we present a brief introduction to the CPP and how energy efficiency and EM&V fits into compliance with the CPP. The bulk of the paper provides an assessment and discussion of several key evaluation topics and issues in the EM&V Guidance. The goal is to provide further context for these issues, based on experience evaluating energy efficiency programs.

Overview of the Clean Power Plan

Under CPP, the EPA regulates carbon dioxide emissions from existing energy generating units (EGUs). As with other sections of the Clean Air Act, which provides the authority for the CPP under section 111d, the EPA plans to require compliance on a state level. The EPA developed Emission Guidelines under the CPP that set requirements which apply mainly to state

plans. The EPA also developed a Draft Federal Plan and Model Trading Rule, which translate state plan requirements in the Emission Guidelines (EPA 2015) into presumptively approvable state plan provisions (Federal Register 2015).

Where does the draft EM&V Guidance fit into all of this (EPA 2015)? The Emission Guidelines set criteria for EM&V, and the EM&V Guidance functions as presumptively approvable implementation for these criteria. As states prepare their plans, the EM&V Guidance provides methods that states can use which will be acceptable as required in the Emission Guidelines. Similarly, the EM&V Guidance aligns with the proposed Draft Federal Plan and Model Trading Rule. This Guidance establishes best practices that states may use to estimate and verify energy savings from energy efficiency activities used in rate-based compliance plans.

States have a policy choice for demonstrating compliance: either a mass-based or a rate-based emissions reduction limit. Mass-based limits are measured in tons of CO_2 emissions. Each state will have a budget for emissions, reflected as a number of emission allowances. Each ton of CO_2 emitted must be matched with an allowance. Rate-based limits are measured in emissions per power generated (essentially weight of CO_2 per megawatt hour). Under a rate-based plan, power plants demonstrate compliance on a unit basis, showing that a given EGU is at or below the emissions standard. Units above the standard can undertake facility improvements or surrender Emission Rate Credits (ERC) to adjust their emissions rate. These credits can be created from energy efficiency and renewable investments, by shifts to nuclear or natural gas or affected EGUs that do better than their applicable rate. States can employ a wide range of activities to achieve energy efficiency ERCs, such as demand-side efficiency programs, codes and standards, non-program project-based energy efficiency, and product energy standards. Under both mass- and rate-based options, states can decide if they want to allow trading of ERCs with another state.

In the mass-based approach, any successful energy efficiency activity displaces electricity generation from fossil fuel-fired power plants; in turn, where energy efficiency results in fewer emissions, the demand for allowances decreases. As a result, the energy efficiency activities directly reduce the total mass of carbon emitted, and compliance can be determined from stack emissions.[1]

With the rate-based approach, states can get credit for demand-side energy efficiency projects and programs, with emission rate credits given for quantified and verified savings. Such projects and programs must meet the EM&V requirements established in the final CPP.

The February 2016 Supreme Court ruling on the CPP does not negate the relevance of the EM&V Guidance or necessarily delays the CPP enforcement. The CPP cannot be enforced until lawsuits against it are resolved. The nature of the ruling, a “stay” rather than an “injunction,” means that the EPA can continue to work on finalizing the Draft Federal Plan, the Model Trading Rule, and the EM&V Guidance. It will be up to the U.S. District Court for the District of

[1] States also have an option for participation in the Clean Energy Incentive Plan which provides additional emission rate credit allowances.

Columbia to determine if there will be any changes to the compliance timeline; however, history of similar legal actions with the EPA suggest the timeline may not be affected (The Hill 2016). In this scenario, states that choose not to plan for the CPP will need to scramble, since they are more likely to end up with federal models than a state-specific plan. The Draft Federal Plan includes energy efficiency and the EM&V Guidance.

EM&V Draft Guidance

As noted above, the CPP includes provisions for crediting energy efficiency savings in state plans. The CPP Emission Guidelines require demonstration of best practice EM&V to ensure that energy efficiency measures are verifiable and quantifiable. EPA developed draft EM&V Guidance to assist states in implementing EM&V for energy efficiency. While this draft EM&V Guidance is most relevant for states with rate-based plans, any state utilizing energy efficiency as a compliance mechanism will benefit from this draft Guidance – since states need an EM&V framework to track the effectiveness of their energy efficiency efforts; that is, if such a framework is not already in place to meet existing state regulatory requirements.

The draft EM&V Guidance seeks to describe the currently available best practices. It provides definitions, references, procedures, and information necessary for quantifying energy savings for many types of activities and programs. The information contained in the document is generally sufficient to help energy efficiency providers determine which EM&V methods are most appropriate for quantifying savings from a range of program offerings. Many states and jurisdictions have established EM&V practices; EPA's Guidance document does not negate or replace established EM&V frameworks, but directs them toward best practices.

The draft EM&V Guidance is expected to become final in June 2016, incorporating comments received from the public in January 2016 (NASEO 2015). At the time of writing of this paper, the draft is the most current document.

The draft EM&V Guidance document consists of three sections and appendices. Following an introductory section, the document focuses on 12 key topics applicable to energy efficiency activities that could be used to generate credits or reduce emissions. The final section describes types of activities that states could adopt or expand to demonstrate energy efficiency.

This paper focuses on several of the key topic areas, identifying issues associated with these topics to assist states in their planning efforts.

EM&V Key Topic Areas

The EPA chose key topic areas to address appropriate methods and considerations in developing energy efficiency savings estimates. The topics chosen reflect issues identified and addressed during the 35 years of energy efficiency program implementation and operation across the nation. Of course, the wisdom of many years of experience in the energy efficiency industry cannot be fully encompassed in this brief document. The Guidance document references many existing EM&V documents, and provides a relatively brief discussion of each area.

We selected seven topic areas to discuss in more detail, identifying ambiguities and opportunities that states may want to address in planning their own EM&V approach. These include deemed savings, effective useful life, comparison group methods, baseline methods, reporting timeframes, independent factors, and finally, accuracy and reliability.

Deemed Savings and Other Energy Efficiency Savings Calculation Methods

In many jurisdictions, regulating bodies approve a unit energy savings approach for measures with uniform specifications. This approach allows a simple computation for savings, multiplying the number of measures by the savings expected per unit. Commonly referred to as "deemed" savings, this approach provides a simple method that is appropriate when the savings associated with deemed measures are expected to be stable over the period allowed by the regulatory body. Many states, regions and even individual utilities compile deemed savings in technical reference manuals (TRMs).

For the CPP, the EPA provides the following guidance. Deemed savings are only intended for relatively simple, well-defined energy efficiency measures. Entities must indicate conditions for which value is applicable (e.g. climate, building type, etc.). The EPA acknowledges that the methods for estimating deemed saving values vary widely across states that use TRMs.

For states creating compliance plans, several resources are available to develop effective and meaningful deemed savings. Existing bodies have addressed the issue of when deemed savings are appropriate, and other methods that can be used when they are not. For example, the Regional Technical Forum in the Pacific Northwest has developed protocols for four energy savings methods: unit energy savings (deemed), standard protocol, custom protocol, and program impact evaluation (RTF 2012). The U.S. Department of Energy (DOE) developed the Uniform Methods Project protocols specifically to identify measure-specific methods (DOE 2016). These methods are then vetted and revised in a technical forum composed of experienced energy efficiency professionals, followed by a public comment period.

States and stakeholders will want to work with the EPA to allow collaborative determination of methods. The draft Guidance encourages the development of deemed savings values by independent third parties. In contexts where regional stakeholder groups develop deemed values, they are not developed by an independent party, but by independent parties and other stakeholders that jointly determine the values.

Further, stakeholders should address long-term strategies for standardizing the quality and methods for determining deemed savings of a given measure. The short-term approach of allowing states to use their existing TRMs is appropriate; however, ultimately all states should be held to a minimum quality level for deemed savings methods. Some broader language is needed to allow for these processes.

Effective Useful Life and Persistence of Savings

The EPA defines effective useful life (EUL) in Section 2.8 of the Guidance, and establishes valid criteria for estimating EUL. When an energy efficient measure is installed, the resulting kWh savings accrue for the entirety of the EUL of that measure. One of the ways to determine a deemed EUL value is to conduct a persistence study and periodically repeat it to verify that the deemed EUL value remains accurate. Savings can be counted as long as the verification activities indicate continued measure operation and performance. The Guidance notes that EUL can be verified using deemed EUL or persistence studies. For deemed EUL, documented best practices are determined by independent entities and public documents. Savings revert to zero at the end of the applied EUL. The Guidance recommends that persistence studies should be conducted by independent entities at least once every five years to determine values.

The EPA is recommending persistence studies, but this represents a departure from the common practice of relying on public sources for EUL/persistence values. States may want to provide more specificity on when and why a persistence study will be triggered. In many jurisdictions, the EUL is formally defined as median lifetime based on a survival analysis, but also could be defined and calculated in other ways. Since reporting means explicitly stating which units of past savings survive in each year, states need to consider the EUL definition and how it should be applied. For example:

- Should EUL always be interpreted as median life; that is, meaning median time the equipment remains in place and operational?

- Should EUL always be applied as a step function, or is exponential or other survival function-based decay acceptable or desirable for reporting surviving savings?

- Should equipment or savings degradation factors be used or not?

Comparison Group Methods

One approach to considering the impact of energy efficiency programs is to compare two groups: those who have the program available and choose to participate in the program versus those who do not have the program available or have the program, but choose not to participate. Savings can be derived by differences in energy consumption patterns between the two groups. The Guidance notes that comparison group methods may include randomized control trials using nonparticipants or quasi-experimental methods. Savings may be developed through regression modeling or simple differences.

Comparison group methods can be a useful evaluation method, but it is not universally appropriate, based on recent research. In a recent review for NEEP and the Regional EM&V Forum, researchers developed the following recommendations (DNV GL 2015):

- Whole-premise pre-post installation consumption analysis is an appropriate basis for evaluated savings in limited contexts, in which the pre-program consumption pattern is

the appropriate baseline for savings, and in which other changes in facilities can be accounted for. These contexts include:

- Retrofit programs for large homogeneous populations, with a valid comparison group capturing average changes for participants absent the program, or absent the program measures.

- Commercial retrofit programs, using an analysis of individual buildings in which non-program-related changes are known and their effects on consumption are reliably quantified.

- Large commercial sites or industrial processes are not likely to be well-addressed by these methods.

As shown in this research, when the conditions are right, a comparison group analysis can provide significant value and can do a good job of isolating program effects. On the other hand, when the proper conditions are not met, a comparison group analysis can be inconclusive in terms of the quantity of savings vs. "noise." The comparison group method also may become harder to implement. As more states develop similar programs under the CPP, fewer groups of nonparticipants may be available.

Electricity Savings Baselines

The EPA defines a common practice baseline (CPB) for replacement on failure, early replacement, building shell, and new construction in Section 2.2 of the Guidance. The CPB is used to estimate gross energy savings of energy efficiency activities under various types of measures and projects. In most cases, state or federal standards or "market average industry/consumer practice at time of implementation" is to be used for the baseline. The EPA recommends states select whichever approach results in a lower savings value. The Guidance focuses primarily on gross savings for reporting under the CPP, using market average baselines; however, net utility program savings may be an option when market average baselines are not available. The EPA recommends following the guidance found in the DOE Uniform Methods Project for estimating net savings (DOE 2016).

For states planning to implement the CPB concept, there are several pitfalls in this section of the draft Guidance. In the absence of an existing standard or code, determining what is an industry or consumer practice can be challenging. The energy use of office computers, for example, has changed with improvements in consumption per unit, as well as the transition toward laptops. In addition, few codes and standards exist for industrial equipment. Periodic research, which can be expensive, may be necessary to assess common practice baselines.

Further, the Guidance is confusing when it comes to the definitions of gross and net savings and how to measure program influence. States and stakeholders may want to request clarification on how to assess program influence. Certainly states will want to eliminate the ambiguity in their own plans. The Guidance explicitly states in Section 2.2 that most definitions of CPB "are consistent with common approaches defining gross savings for utility programs."

However, in the final paragraph of Section 2.2, net savings are discussed. The terms “market average baseline” and “standards” are introduced but not defined, leading to confusion on when net savings are appropriate. Apparently, net savings can be used when the evaluation method does not derive gross savings, only net. Stakeholders may want to work with the EPA to clarify the conditions in which net savings are appropriate. Net savings should be sufficiently defined to avoid wide differences in the meaning and application of this term in different jurisdictions.

The Guidance does not specifically address baselines for energy management continuous improvement programs, such as Strategic Energy Management (SEM) and DOE’s Superior Energy Performance program (SEP™). These programs have been generating significant energy savings (Burgess, et al 2015; LBNL 2015). States will want to consider including one of these types of program in their plans.

SEM programs consider energy intensity, such as energy per unit of manufactured product or energy per floor space area. SEP identifies energy performance improvements controlling for variations in production and other independent factors. In both types of programs, the baseline is developed from a regression analysis of energy consumption using key variables that drive energy usage at the facility. Although not explicitly identified in the Guidance, these types of programs are allowed. A body of literature on how to do this type of program exists through sources such as the Northwest Energy Efficiency Alliance (NEEA 2016) website and guidance from the Consortium for Energy Efficiency (CEE 2016). For SEP, the DOE has developed an EM&V protocol that provides methods for determining savings (LBNL 2012).

Reporting Timeframes and Considerations

States will want to consider how their reporting requirements under the CPP will fit in with current regulatory reporting requirements. In section 2.3, the Guidance discusses reporting annual savings for a reporting year and related cumulative savings, using the EUL of implemented measures in prior years. In most jurisdictions, the reporting cycle required by local authorities is already mandated. In cases in which the evaluation cycle is aligned with the program cycle, trying to impose another cycle for CPP reporting is problematic and could lead to evaluation results that are untimely or out-of-date. In instances in which the current reporting cycle is already defined, states will need to work with stakeholders and the EPA to minimize onerous requirements. For example, utilities may evaluate on a three-year cycle to coincide with a three-year program planning cycle, while the EPA might typically require a two- or a five-year cycle. States should coordinate efforts of local regulatory jurisdictions with the EPA to minimize administrative burden on utilities and program administrators already subject to the local reporting timelines.

Independent Factors Affecting Energy Consumption and Savings

The Guidance identifies common independent factors to be taken into account to isolate electricity savings resulting from energy efficiency activities in Section 2.5. The EPA defines independent factors as "variables that affect electricity consumption and savings and vary independently of the energy efficiency measure under study" (EPA 2015a). Common independent factors are weather conditions, occupancy rates, and manufacturing production rates. Baseline electricity consumption may be adjusted or normalized to account for independent factors, depending on the relevance of these factors.

States will need to supplement EPA guidance as currently written. The draft Guidance states that independent factors must be taken into account to isolate the electricity savings from a particular energy efficiency action. However, there is no discussion or guidance on circumstances in which the factors can safely be ignored. In planning EM&V for specific measures, states should consider whether conditions exist for which independent factors should be taken into account. Certain types of programs, such as project-based programs, may need to consider independent factors.

In the absence of guidance from the EPA, states will need to provide their own guidance on when independent factors must be considered and when it is acceptable to not include them in the analysis. Resources are available to states and stakeholders for this. For example, in the Superior Energy Performance Measurement and Verification Protocol, guidelines are provided to assess when factors or variables may be ignored in developing savings from energy performance improvements. This protocol specifies first what factors must be considered at a minimum, then these factors are tested for the extent the factor predicts energy consumption.

The Uniform Method Project also provides recommendations for factors to consider for specific measures. For example, evaluations of chillers serving HVAC loads need to include weather in the analysis. For chillers serving process loads, the savings analysis must consider the factors that determine the process load, such as production output.

Accuracy and Reliability of Quantified Savings

Accuracy and reliability are important aspects of EM&V. The current EPA guidance addresses potential sources of error in savings estimates and reporting requirements documenting those potential errors. However, there is little guidance on how to choose the levels of precision and accuracy for a given method. No minimum levels are specified, nor are conditions identified that would indicate how to determine what level of precision and accuracy is acceptable to the EPA. The Guidance only requires the *reporting* of the precision and accuracy. There is no guidance on when higher rigor is preferred or when lower rigor is acceptable. This becomes particularly problematic if a trading market were to arise: how would states address the potential discrepancies between the validity of savings and any issues of a threshold minimum for validity? Stakeholders and state planners will want to develop standards that apply for trading ERCs as well as consistent EM&V. One group attempting to address this issue is the Climate Registry, which seeks to create a national energy efficiency register.

Conclusion & Next Steps

The final CPP requires reductions of carbon emissions by more than 630 million tons per year. Low-cost energy efficiency through various types of demand-side energy efficiency approaches can contribute significantly to this goal while minimizing expensive infrastructure investments in new power supply.

Energy efficiency is expected to be a large part of states' compliance strategy, regardless of whether a mass-based or rate-based compliance option is chosen. States will want to develop their plans to minimize ambiguity in the EM&V of energy savings programs.

Some states have highly developed energy efficiency structures, including requirements and guidelines on how EM&V is conducted in their jurisdictions. Others have not been engaged much in energy efficiency. One challenge for the EPA will be to establish compliance mechanisms that allow effective and fair trading in energy efficiency credits despite these differences. States and stakeholders will want to engage with the EPA to fine tune concepts like application of baselines, addressing when independent factors need to apply, and the appropriate requirements for precision and accuracy in different scenarios.

The EPA's guidance recognizes the highly developed industry for estimating savings from energy efficiency measures. Compliance estimates of energy efficiency program impacts require detailed reporting and verification, as recommended in the EM&V Guidance. Although issues remain to be resolved and the Guidance is not final, a good framework has been developed. This framework is a valuable national resource – even if the CPP does not move forward. Although there are issues to work out, the EM&V Guidance does a good job at setting the stage for compliance using consistent methods and approaches, while allowing states flexibility to select among energy efficiency methods and activities.

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