Applying Gross Savings and Net Savings in an Integrated Policy Framework

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ABSTRACT

Each year, a number of states decide to revisit the role that Gross Savings (GS) and Net Savings (NS) estimates have in their overall energy efficiency (EE) framework and the methods used to produce the estimates. Estimating and determining the role of GS and NS in an EE policy framework is challenging. States need to assess whether their use of GS and NS is consistent with their goals and views regarding EE objectives. This is made more complex by the evolving interpretations of GS and NS, evolving methods of estimation, and the fact that how GS and NS estimates are used can be context dependent. One jurisdiction with one set of policies may use savings estimates differently than another jurisdiction, yet both can be appropriate and consistent given their respective overall EE policies and objectives.

State EE policies may include setting energy efficiency resource standards (EERS), decoupling of revenues, calculation of lost margins (aka lost revenues), and financial incentives tied to EE accomplishments. Also, regulators want to ensure ratepayers' monies are spent efficiently, i.e., that the EE programs are contributing to net impacts that would not have occurred if the program had not been offered, and that the value of these net impacts exceed the program costs. There is also concern about how the estimation and use of GS and NS might impact Program Administrator's ability to manage EE programs to meet performance objectives.

Introduction

States have to consider a number of policies when developing a view of the role energy efficiency should have in meeting energy needs. These policies include:

1) Setting EE targets and metrics
2) Tracking towards targets and EE metrics
3) Potential revenue erosion and lost margins
4) Performance incentives
5) Other Policies: Resource planning to manage revenue requirements, environmental goals and goals such as resiliency, resource diversification, and risk management.

Assessing policy choices requires an explicit (or implicit) decision about whether to use GS or NS, or both, and how to use these savings estimates. It is important to understand that decisions made by one jurisdiction may not represent what might be best for other jurisdictions. There are considerations unique to each jurisdiction such as legislative requirements for

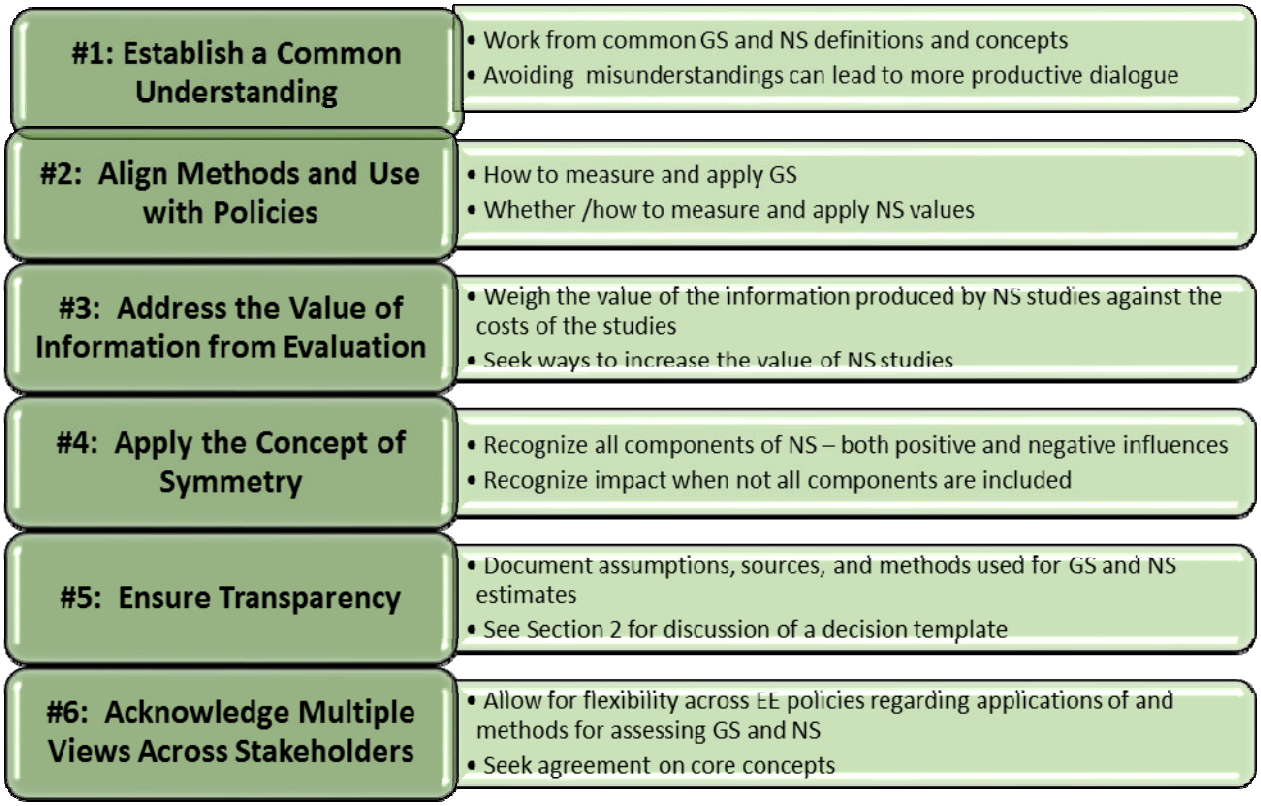
assessing the attainment of goals and targets, cost recovery, incentives, and the other policies listed above. Today, policies are not viewed separately, but are viewed as a mutually re-enforcing set of decisions to support goals. Also, policies change and evolve making it necessary to reassess past decisions to ensure current thinking and practice remains relevant and aligned.

There are three components to this policy framework: 1) a set of general principles that form the underlying analysis framework; 2) a series of implementation steps that are meant to assist regulators and stakeholders in approaching these policy issues with a consistent view; and, 3) a decision template that follows each step that can help bring forward key considerations and document interim views and decisions. Each of the three components is discussed below. One goal of this structure is help stakeholders develop a shared view of the issues. This does not necessarily mean agreement, but a shared understanding of the issues to allow for productive discussions and policy decisions. This paper is drawn from an ongoing effort at the Northeast Energy Efficiency Partnership (NEEP) to support regulatory and policy decision making.

Part I -- Guiding Principles – Gross Savings (GS) and Net Savings (NS) Policies and Estimation

Six general principles serve as a framework for decision-makers who are developing and reassessing policies around GS and NS concepts and applications. A summary of the framework principles is shown in Figure 1 below:

Figure 1: Framework Principles



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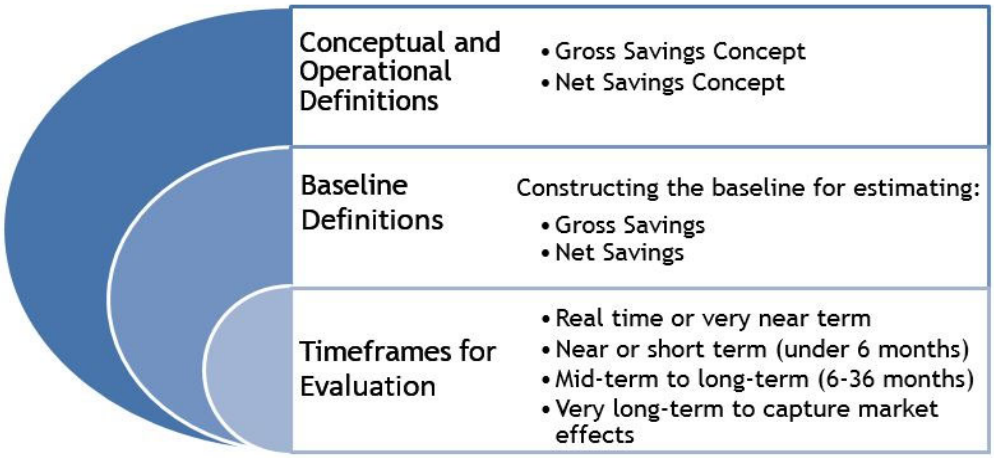
PRINCIPLE #1. Establish Common Understanding

This is a foundational principle. Common understanding of the concepts of GS and NS among stakeholders sets the stage for the five principles that follow. The fact that issues tied to GS and NS are often complex and nuanced creates the potential for misunderstanding or confusion.[1]

Figure 2 identifies the important high level components of a GS and NS framework for establishing shared view and further dialogue on GS and NS. Furthermore, it illustrates that the definitions, baselines and timeframes are interrelated. Each issue, individually and together, requires policymaker consideration. More detailed definitions and decision points related to these issues are included below to clarify what is needed to apply the principle of establishing common understanding.

Figure 2 - Common Understanding Issues: Components for Establishing a Shared View



A framework of common concepts and terms can be useful and productive for understanding and assessing GS and NS issues. The goal is to develop a practical framework. However, it is important that the issues not be over-simplified to the extent that misinterpretations occur.

Conceptual and Operational Definitions of Gross and Net Savings

One source of potential confusion is in the distinction between conceptual and operational definitions of GS and NS[2]. While some of the distinctions may seem subtle, a common understanding of definitions in the topic overall is essential for appropriate and productive discussion of GS and NS issues as well as methods.

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[1] An old adage that seems to apply here is that a question that is well asked is half answered. That seems to be the case when addressing issues around the policy applications and estimation methods for NS. Jonas Salk is credited with saying: "What people think of as the moment of discovery is really the discovery of the question."

[2] There are also are distinctions between the various methods available to estimate GS and NS, and these methods can overlap. See the Net Savings Appendix by Johnson Consulting Group for descriptions of methods and appropriate application along with comparisons and a discussion of pros and cons of NS estimation methods.

The energy efficiency community largely agrees on the conceptual definition of *net savings* – "the total change in energy use (and/or demand) that is attributable[3] to an energy efficiency program" (SEE Action 2012, p. 5-1). However, there are different approaches to making this and other conceptual definitions operational in terms of producing NS estimates across jurisdictions. Distinguishing between conceptual and operational definitions is also relevant for estimating GS. Therefore, a first step toward establishing common understanding of GS and NS is to recognize that distinctions can exist between conceptual and operational definitions.

1) **Conceptual Definition of Gross Savings (GS)** – A generally accepted definition across most of the literature-and across jurisdictions and program types is "the change in energy consumption and/or demand that results directly from program-related actions taken by participants[4] in an efficiency program, regardless of why they participated."[5]
2) **Operational Definition of Gross Savings (GS) –** This is the energy consumption savings from current post-participation equipment or sites minus the appropriate GS baseline. Since the GS baseline can vary across program types and jurisdictions, and it may include different elements (e.g., adjustments to equalize the level of energy services pre- and post-installation of the energy efficiency, the use of codes and standards as baselines, and adjustments made for early replacement of equipment), this definition should be supported with equations used, data input, and adjustment descriptions. This is important because NS is often (but not always) built up on adjustments to estimates of GS. In order to avoid double counting in producing NS estimates, it is critical to understand the adjustments made to GS.
3) **Conceptual Definition of Net Savings (NS)** – As noted earlier, there is general agreement on the conceptual definition of net savings, i.e., those savings that are "attributable" to the EE program or activity (SEE Action 2012, p. 5-1).
4) **Operational Definition of Net Savings (NS)** –Different jurisdictions translate this concept into different operational definitions based on the types of impacts or components of net savings, (free ridership, spillover, market effects) they include in quantitative estimates of net savings.[6] Therefore, it is important to have a clear

[3]Attributable savings are savings that would not have occurred if the program had not been offered, i.e., they are incremental savings that stem from the program being offered in the market.

[4] Participants in this definition may be direct participants such as those that receive rebates for certain actions, or participants in market-based programs where rebates are paid to buy down the price of a product. Upstream lighting programs are a good example where the price of certain CFLs or LEDs is brought down at the trade ally level and people that purchased the new lighting measure may not know they are participants. When this occurs, participant studies can still be done by point-of-purchase surveys, or other means of identifying which consumer has purchased a high efficiency product (See DOE, UMP, 2014).

[5] This conceptual definition of gross savings is used in SEE Action (2012), DOE UMP (2014), and both NEEP Net Savings Scoping Papers (2010 and 2012). The "why" in this definition focuses on the impact of the program on behavior – a key issue in estimating net savings.

[6]As noted in SEE Action (UMP Chapter 23, Net Savings), "Other factors (sometimes called net-impact factors) are generally considered as adjustments to gross impact estimates. These include rebound, snapback, and persistence of savings."

understanding of - and agreement on - the components of net savings. For clarity, this should be supported with an equation identifying the NS components or factors included.

A general operational definition of NS includes three factors that are used to adjust estimates of gross savings – free riders, spillover and market effects:

Net Savings = Gross Savings – Free ridership + Spillover + Market Effects (not already captured by Spillover)

The three NS adjustment factors each have their own definitions (*See Table 1 below*) and as illustrated in the equation above, spillover and market effects may overlap. In addition, some jurisdictions may not include all of these factors in their operational definition of NS. A further complication is the subcategories of these factors. More commonly, total or partial free ridership is included, participant spillover is often included, and market effects may not be included. When both spillover and market effects are included, care is needed to avoid overestimating the impacts of these two components in NS estimation. In summary, considerable work has been done on definitions of NS and the components that various parties may view as appropriate adjustments to GS to produce an estimate of NS.[7]

Table 1 - Definitions of Net Savings (NS) Factors[8]

Free ridership	Spillover	Market Effects
Free ridership is the program savings attributable to free riders (program participants who would have implemented a program measure or practice in the absence of the program). There are three types of free riders: • **Total free riders:** Participants who would have completely replicated the program measure(s) or practice(s) on their own and at the same time in the absence of the program.	**Spillover** refers to additional reductions in energy consumption or demand due to program influences beyond those directly associated with program participation.[9] There are generally two types of spillover: • **Participant spillover:** This represents the additional energy savings that are achieved when a program participant—as a result of the program's influence—installs EE measures or practices *outside* the efficiency program after having participated. Evaluators have further defined the broad category of participant spillover into the	**Market effects** refer to "a change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of energy efficiency products, services, or practices and is causally related to market intervention(s)" (Eto et al. 1996). For example, programs can influence design professionals, vendors, and the market (through product availability, practices, and prices), as well as influence product or practice

[7] Considerable work has been done on definitions of NS and the components that various parties view as appropriate adjustments to GS to produce an estimate of NS. The traditional approach of estimating net savings is to start with gross savings and make the necessary adjustments. However, there are methods using experimental designs with random control groups, and comparison groups that serve as a proxy for baseline consumption in the attribution calculation. These random or representative control groups are used to represent the actions that participants would have taken in the absence of the program. These methods produce direct estimates of net savings without first having to estimate gross savings. Still, there should be agreement about what net savings represents in terms of free ridership, spillover and market effects. (See DOE UMP 2014)

[8] These definitions draw heavily from SEE Action (2012), and (DOE UMP, 2014) on net savings.

[9] These program-induced savings are not included in the program tracking system used to produce initial estimates of savings at a site or for a specific EE measure. As a result, these may be referred to as "untracked savings" as they are outside the normal implementation accounting for the program. As spillover can refer to changes in the same technology category (e.g., lighting or motors), or a good experience with one EE investment can encourage a market actor to make EE investments in other end-uses.

• **Partial free riders:** Participants who would have partially replicated the program measure(s) or practice(s) by implementing a lesser quantity or lower efficiency level. • **Deferred free riders:** Participants who would have completely or partially replicated the program measure(s) or practice(s) at a time after the program timeframe.	following subcategories: o *Inside spillover:* Occurs when participants take additional program-induced actions at the project site. o *Outside spillover:* Occurs when program participants initiate actions that reduce energy use at sites that are not participating in the program. o *Like spillover:* Refers to program-induced actions participants make outside the program that are of the same type as those made through the program (at the project site or other sites). o *Unlike spillover:* Refers to EE actions participants make outside the program that are unlike program actions (at the project site or other sites) but that are influenced in some way by the program. • **Nonparticipant spillover:** This represents the additional energy savings that are achieved when a nonparticipant implements EE measures or practices as a result of the program's influence (for example, through exposure to the program) but are not accounted for in program savings.	acceptance and customer expectations. All these influences may induce consumers to adopt EE measures or actions (Sebold et al. 2001). Some experts suggest that market effects can be viewed as spillover savings that reflect significant program-induced changes in the structure or functioning of energy efficiency. As a result, care is needed to ensure that market effects include only those elements that are not already included in the spillover term.

Common Understanding – Other Issues: Baseline Definitions and Timeframe

Baseline Definitions -- The issue of what is appropriate as a baseline refers to potential confusion between the use of baselines in producing savings estimates and "attribution" which is at the center of NS estimation. The discussion above on the conceptual definitions of GS and NS estimates showed that baselines are necessary to produce both GS and NS values. However, the baselines used in estimating NS are designed to get at attribution and represent an "appropriate" counterfactual – the energy use that would have occurred had the EE program or activity not been undertaken. NS is then the difference between observed energy use and this "appropriate" counterfactual.

The term "appropriate" in discussing the counterfactual is used intentionally, as there may be counterfactual elements in baselines used to estimate GS. Program design often drives decisions about appropriate baselines for GS operationally, and program specified GS often serves as a benchmark calculation of NS impacts for that program. For example, if the activity is replacement on failure of HVAC equipment, the baseline for GS is what that customer would have installed given the current market and codes/standards for that equipment as that is the choice hey would be facing in the absence of the program. Another example might be new construction of a home. Since no home currently exists, the baseline for GS has a counterfactual element – the baseline would be the energy use in homes commonly built in that market at that

time. In any of these examples, NS might be viewed as any additional savings that occurred beyond this value attributable to the offering of an EE program.[10]

Timeframe Definition - The issue of timing and time-frame has an impact on how changes due to EE programs are assessed and how changes in the market are handled. These issues involve looking back in time to see how prior years' EE programs have affected today's market for energy efficiency. It is also important to look forward to see how today's activities are expected to influence markets in the future.

When assessing EE policies in a broad context, it might be argued that some current free riders might not have had the opportunity to adopt the EE measure or service were it not for the effects on the market from previous EE program year efforts. However, this context is problematic if you are viewing evaluation as an assessment of expenditures on EE from an investment perspective, i.e., spending ratepayers' monies on additional EE investments. From an investment perspective, the only benefits one counts are those that result from that year's expenditures. Impacts from programs in prior years, even if real, are not considered as they represent sunk costs.

From another perspective, it is becoming more important to take a longer term view in evaluating EE programs as there is a growing interest in upstream, market-based programs that by design are expected to have their largest impacts several years into the future. The near-term impacts are unlikely to be large, and the evaluation efforts must collect market data and track markets for a period of years to determine the actual impacts of the programs. This effort is being done in a few jurisdictions, but it is not a common practice.

Selecting a timeframe most directly influences NS by including or excluding longer term factors in the analysis, i.e., market effects. If market effects are to be included, the evaluation effort may need to track changes over a long period of time, i.e., 5 years or more. This can require the development of evaluation plans that track changes in market metrics beyond the year of program implementation.

Common Understanding – Summary

This first principle -- development of a common understanding – is viewed as being necessary for a productive dialogue on GS and NS issues. The questions and issues are nuanced and complex with many issues being interrelated with the other. Good policies require that time be spent upfront to ensure that the terms used and the problems addressed are well defined and examined from a common framework. Other framework principles are presented below, but they all depend upon on a common understanding of the issues and problem definition.

PRINCIPLE #2. Align Methods and Use with Policies

A core principle of this framework is that energy efficiency practices regarding net savings – whether to use net or gross impacts, as well as how to measure net impacts – should be aligned with the specific goal of the policy being implemented in the state. A number of jurisdictions have been revisiting their policies regarding NS research, the frequency with which

[10] Some of the issues in the development of baselines can be found in Hall (2013) and Ridge (2013, as well as in the DOE UMP (2014).

net savings are estimated, and the way in which NS results are used. A survey of State policies[11] towards the estimation of net savings indicated that EE policies are not viewed separately, but are viewed as a mutually re-enforcing set of decisions to support goals. For example, policies on cost recovery, EE targets, or incentives tended to influence the role net savings had in this overall set of policies. NS policy choices and considerations can include:

1) Frequency of estimation. Net savings studies have an associated cost and the frequency of performing these studies needs to be assessed in the context of the information provided and the manner in which net savings is seen to support other policy objectives – e.g., accurate cost recovery (e.g., lost margins), incentives, program design, and tracking towards appropriate resource goals.
2) Use of net savings estimates. A review of current practice shows there is a trend to use net savings estimates on a prospective versus retrospective basis. For example, metrics are set which track progress towards targets, on which incentives might be calculated, or recovery of certain lost revenues are made. These are set based on the best information at the time, and subsequent evaluations producing net savings estimates are not used to go back and retrospectively reset these values. Instead, evaluation findings are used prospectively to inform the next round of targets at the program or portfolio level.
3) Level of evaluation rigor. The selection of methods to be used in evaluation may change as policies require greater or less confidence or rigor to reach the needed comfort level for decision making.

PRINCIPLE #3. Establish or Judge the Value of Information from Evaluation

Value of information (VOI) refers to a decision-making process in which the costs of applying different types of methods are considered in context with the potential benefits of the information. This principle focuses on a more structured assessment of the value of information from evaluation efforts, including efforts for estimating NS. VOI is both a general approach and a type of tool. Structured VOI analyses can be performed where assumptions are documented regarding what the studies might produce and how the results can be used to produce value.

Considerable information and insight can be gained from organizing information in this manner. The VOI can be considered by assuming, in advance, different outcomes from a NS assessment, and whether differences in the outcomes influences EE policies in terms of targets, incentives, or planning. VOI structures and analyses have helped develop policies regarding the NS research agenda in terms of:

- Assessing whether updated GS and NS information is needed
- Planning the timing of GS and NS research
- Developing new views on the way research may be conducted, particularly in light of the availability of new data collected more frequently on larger groups of customers
- Using decision-analytic approaches to assessing the value of market research or the value of R&D investments.

[11] Insert Reference to the Survey of NS policies from Iowa NTG Stakeholders Report (2015)

Developing a formal approach to assessing the value of what might be learned can provide insights leading to better decisions.[12]

PRINCIPLE #4. Apply the Concept of Symmetry

This principle is important because the operational definition of NS involves multiple NS factors – free ridership, spillover, and market effects. There is widespread agreement that all three of these factors exist for most programs, but may have different magnitudes across programs. Furthermore, for various reasons, these factors can be difficult or impossible to quantify, to quantify independently, or they may be cost-prohibitive to estimate relative to their expected impact. In addition, it may be appropriate for empirical studies to focus more on one factor than another due to the expected influence of that factor on NS.

However, none of the factors influencing NS should be ignored, as ignoring them introduces bias and can skew policy decisions. Policies on EE investments, program designs, and implementation should use the best available information on all of these factors, even if some are somewhat judgmental and subject to uncertainty. At a minimum, sensitivity analyses should be conducted using a plausible range of values to assess the sensitivity of EE policies and programs to these values. Even if the available time and budget makes it difficult to directly estimate the value of some of these factors, a balanced view is needed that considers the potential influence of each factor on NS.

PRINCIPLE #5. Ensure Transparency

This fifth principle is to document and clearly state all the assumptions,[13] data sources, methodologies, and calculations that relate to the development of GS and NS estimates and their use in assessing or improving programs. The use of a decision template for organizing information is encouraged for this purpose. A decision template can provide immediate, consistent information for reviewing efficiency programs, and it facilitates comparisons. Furthermore, especially for NS, templates have the advantages of ensuring that the methods and results are conveyed together. This can help avoid any misunderstandings from taking information out of context. A Cost-Effectiveness guidance document (NEEP, 2015) takes transparency a step further than what has been commonly used to assess NS. In that guidance document, it was suggested that a standard template be used to "explicitly identify their state's energy policy goals and to document their assumptions and methodologies." A standard template could also be developed to consider NS issues in the context of an overall framework to ensure consistency with state policy objectives. A suggested template has been developed as part of this decision framework development for NEEP, and is discussed at the end of the paper.

[12] The authors know of two jurisdictions that have conducted formal VOI assessments of performing new GS and NS studies. This has been done as part of stakeholder processes in Iowa and Ontario. (cites and web links to be inserted)

[13] Assumptions go beyond those that underlie the methods used, but may also pertain to the value of the information produced, and comments/concerns about methods such that an appropriate record is developed that can be used to help make future decisions.

PRINCIPLE #6. Acknowledge that there will be Multiple Views across Stakeholders

Differences in dialogue around EE policies and the role of NS may stem from different views on the questions to be resolved. Reaching agreement on a problem statement can help clarify where actual differences lie, and can help move the dialogue forward.

While different stakeholders may hold different views on NS issues, these views can still be consistent, i.e., reflecting differences in basic beliefs. These beliefs may vary depending on:

1) How confident they believe NS values can be estimated at a level of accuracy to warrant the investment in the research, and this might vary by type.
2) Whether they view EE as a resource investment or as a wider market influencer. This may lead to different stakeholders supporting different NS research agendas and uses. This may depend on whether they are considering:
    - The entire energy efficiency portfolio
    - A particular program and subset of customers within that program
    - The type of program and how important it is to the overall portfolio.

On the other hand, there may be areas of common agreement. Reviews of common practices across net savings and evaluation research are showing increasing agreement regarding the need for market characterization research, and for trade ally/market actor interviews as programs become more market focused. This research is becoming important for determining market-based metrics for assessing how EE impacts the market.

In summary, each jurisdiction may have different perspectives leading to different policies that may all be consistent with a valid GS and NS framework. Choices will likely depend on perspectives broadly in terms of program portfolios, and specifically, regarding individual programs, time horizons, and other considerations. Also, political, regulatory, and financial realities will influence perspectives and choices. Identifying the different perspectives and understanding the views that underpin these perspectives using a common framework can be an important starting point for developing GS savings and NS research agenda, and determining how these estimated will be used in the overall policy framework.

Part II -- A Step-Based Decision Framework to Guide GS and NS Policy Decisions

A set of principles establishes a foundation to work from, but this needs to lead to a decision making framework based on actionable steps. For the NEEP GS and NS policy effort, a framework was developed to provide structure for stakeholder discussions. An eight step structure was developed to address this complex and nuanced decisions relating to the use of GS and NS in policy decisions. The steps are:

Step 1. Establish the common understanding of terms and definitions.
Step 2. Determine how GS and NS will be used.
Step 3. Determine whether GS or NS are applied retrospectively or prospectively.
Step 4. Determine method or methods for the GS and NS research.

Step 5. Determine the level of confidence needed in GS and NS estimates to make good decisions.
Step 6. Determine net savings research timeframe.
Step 7. Complete a value of information analysis – assess the costs of GS and NS research relative to the expected value of information.
Step 8. Ensure transparency by documenting net savings decisions.

This paper only allows for a listing of what are a self-defining set of steps based on the framework principles. A forthcoming report (NEEP, 2016) contains an explanation of actions to be taken in each step. In addition, a decision template was developed that links to each step in the framework to document decisions and rationale. This work will be available at NEEP.org.

Conclusion

Assessing appropriate estimation methods and uses of GS and NS in EE policies has become more complex over the years, and there can be important but occasionally overlooked nuances in these issues. This has given rise to hundreds of papers on estimation of GS and NS. This effort is an attempt to develop a decision framework based on a set of underlying principles, and a decision structure based on a set of actionable steps. This is supported by a decision template for each step that can help document key issues, decisions made, and the rationale for those decisions. There is no illusion that this effort will be the answer to the complex issues surrounding overall EE policies and the role that GS and NS might play in setting and implementing these policies. However, using this decision framework development can be a good starting point for jurisdictions seeking to address these issues and a workable decision template for organizing the required information and documenting the results of an integrated policy assessment that includes the role of GS and NS.

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