Northeast Energy Efficiency Partnerships

Gross Savings and Net Savings: Principles and Guidance

April 2016

About NEEP

NEEP was founded in 1996 as a non-profit whose mission is to serve the Northeast and Mid-Atlantic to accelerate energy efficiency in the building sector through public policy, program strategies, and education. Our vision is that the region will fully embrace energy efficiency as a cornerstone of sustainable energy policy to help achieve a cleaner environment and a more reliable and affordable energy system.

The Regional Evaluation, Measurement, and Verification Forum (EM&V Forum or Forum) is a project facilitated by Northeast Energy Efficiency Partnerships, Inc. (NEEP). The Forum's purpose is to provide a framework for the development and use of common and/or consistent protocols to measure, verify, track, and report energy efficiency and other demand resource savings, costs, and emission impacts to support the role and credibility of these resources in current and emerging energy and environmental policies and markets in the Northeast, New York, and the Mid-Atlantic region.

About Navigant Consulting

Navigant is a leading Demand Side Management consultant company in smart grid and energy efficiency research, planning and evaluation, providing services to program administrators across North America.

About Tetra Tech

Founded in 1966, Tetra Tech is a leading provider of consulting, engineering, program management, construction, and technical services addressing the resource management and infrastructure markets. Staff in Tetra Tech's Madison office have been directing evaluation, measurement and verification (EM&V) studies for electric and natural gas utilities throughout the United States for over two decades.

Acknowledgements

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This project also benefited by industry expert review, both inside and outside of NEEP. These efforts are greatly appreciated and provided new insights and expanded thinking about the challenges and issues related to gross and net savings estimation. However, the project team bears the responsibility for the contents of the report.

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Two supplemental documents were prepared as part of these efforts. They are:

- Supplemental Document #1: Current and Evolving Policies, Issues and Methods Pertaining to Gross and Net Savings
- Supplemental Document #2: Decision-Framework for Determining Net Savings

Preface

This Gross and Net Savings Principles and Guidance document was prepared for 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). The Forum supports the development and use of consistent and transparent protocols to evaluate, measure, verify, and report the savings, costs, and emissions impacts of energy efficiency and other demand-side resources. The Guidance emerged out of recognition among Forum member states of the importance of understanding how states define, estimate, and apply gross and net savings across the region.

This effort is meant to provide a set of principles to inform states' decisions regarding their applications of gross and net savings based on policy goals, and it provides a framework and tool for making and documenting these discussions and decisions. This document does not present arguments for specific regulatory policies nor does it advocate for the use of specific evaluation methods. The goal of this effort is to provide a framework that can be used or adapted to help stakeholders assess gross savings (GS) and net savings (NS) issues in the context of overall EE policy decisions.[1] It presumes that stakeholders have some familiarity with energy efficiency programs, impact evaluation, and related needs and issues but are not necessarily evaluation practitioners, as it is intended to diverse stakeholders.

The goal of this effort is to provide a framework that can be used or adapted to help stakeholders assess gross savings and net savings issues in the context of overall EE policy decisions.

EE policy is in the midst of dynamic evolution, as utilities are transitioning to a 'next generation' in which EE becomes more integrated with other distributed resources and where technologies and advanced analytical software make customer data more available. These principles and guidance is designed to be useful in assessing policy decisions in this changing industry context.

[1] There are many nuances that will come up in any GS and NS policy discussion. It is not possible to anticipate and address each of these within this guidance paper. The authors are keenly aware of many additional points and concepts that could have been addressed. This guidance document attempts to establish an appropriate compromise by providing a useful overall framework without becoming a technical paper.

1. Introduction

Estimating and determining the role of GS and NS in an energy efficiency (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. The use of GS and NS estimates can be context dependent.[2] That is, 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 sets of EE policies and objectives.

State EE policies impacted by decisions around GS and NS include setting energy efficiency resource standards (EERS), decoupling of revenues, calculation of lost margins (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.[3] Program Administrators are also concerned about how the estimation and use of GS and NS might impact their ability to manage EE programs to meet savings goals and other performance objectives.

Recently evolving EE policies continue to foster discussion and debate about the estimation and uses of GS and NS. These policies include components of the New York's Reforming the Energy Vision (NY REV) proceeding,[4] the Clean Power Plan EM&V Guidance,[5] and the general trend among many utilities toward incorporation of new "smart" technologies, meters, and advanced analytics, which may lead to development of new estimation approaches or methods. (See Supplemental Document #1 Current and Evolving Policies, Issues and Methods Pertaining to Gross and Net Savings for additional information).

The principles and guidelines in this document are not meant to advocate for specific GS or NS estimation methods or the application of estimation results. Rather, they are intended to promote a better understanding of key issues and considerations that can impact the credibility and value of energy efficiency GS and NS results and to support policy makers' decisions regarding their use to support energy policy.

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[2] To illustrate, three examples in the literature discuss consequences that may arise from evaluation rules about free-ridership adopted by policymakers: 1) Ignelzi, P. et al., "Are Free-Riders Actually a Good Thing? "International Energy Program Evaluation Conference, Rome, Italy, 2012; 2) Wirtshafter, R. et al., "The Regulatory Relationship between Free Ridership and Equity for Public Goods Programs." ACEEE Summer Study, Pacific Grove, 2012; and 3) Mahone, D., "Free-Ridership as a Way to Kill Programs – How Evaluation Policies Can Frustrate Efficiency Goals", International Energy Program Evaluation Conference, Boston, 2011.

[3] The NEEP Cost-Effectiveness Manual sets out a process to assess whether benefits of a program or portfolio of programs outweigh the costs. (NEEP 2014. Synapse Energy Economics, Inc. "Cost-Effectiveness Screening Principles and Guidelines," prepared for Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, November 2014.)

[4] See NY PSC 2015b. State of New York Public Service Commission, "Staff Proposal: Distributed System Implementation Plan Guidance," October 15, 2015

[5] EPA 2015a. Environmental Protection Agency, "The Clean Power Plan," October 22, 2015

This document builds on prior Forum work,[6] specifically:

1) Net Savings Scoping Paper (11/2010)

2) Regional Net Savings Research, Phase 2: Definitions and Treatment of Net and Gross Savings in Energy and Environmental Policy (12/2012)

3) Model EMV Methods Standardized Reporting Forms (7/2014)

Two supplemental documents[7] were prepared along with this Guidance document to provide additional detail on selected issues. Links and brief descriptions are provided on the following page. These are:

- Supplemental Document #1: Current and Evolving Policies, Issues and Methods Pertaining to Gross and Net Savings
- Supplemental Document #2: Decision-Framework for Determining Net Savings

This is considered a living document that may be revised periodically to reflect new policy and program developments, lead to additional chapters to address other key issues of priority to Forum members to support improving net savings estimation methods, and incorporate or build upon other net savings efforts across the country.

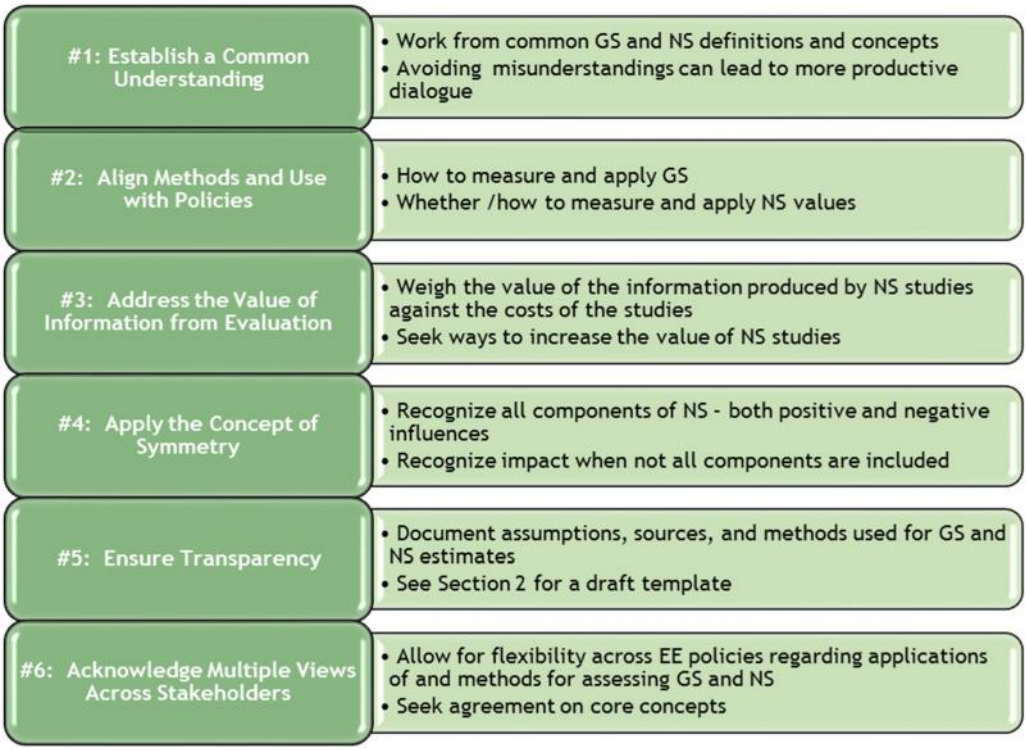
Organization of this Document

Chapter 2 presents and discusses six guiding principles for decision-makers who are developing and reassessing policies around GS and NS concepts and applications. A summary of the six principles is shown in Figure 1-1 below.

[6] These Forum Products are available at www.neep.org: 1) NEEP 2010. NMR Group, Inc. and Research Into Action, Inc., "Net Savings Scoping Paper," prepared for Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, November 13, 2010; 2) NEEP 2012. NMR Group, Inc. and Research Into Action, Inc., "Regional Net Savings Research, Phase 2: Definitions and Treatment of Net and Gross Savings in Energy and Environmental Policy," prepared for Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, December 4, 2012; and 3) NEEP 2013. Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, "Model EM&V Methods Standardized Reporting Forms," 2013.

[7] Two webinars were presented as this document evolved covering issues and the development of content. These can be found at NEEP (2015a) and NEEP (2015b).

Figure 1-1. Six Guiding Principles for Considering a Net Savings Framework



Chapter 3 presents a Gross and Net Savings Policy Decision Framework to assist policymakers when determining whether or not NS should be estimated, and how GS and NS will be measured and applied within their jurisdictions. It concludes with a Gross and Net Savings Policy Decision Framework Template to document the GS and NS policy decisions; the template is a tool that can help to promote a better understanding of how savings estimates are defined and applied. Taken together, the framework and template provide a step-by-step process that enables decision-makers to apply the principles.

As mentioned above, two supplemental documents to the Guidance were also prepared:

1) "Current and Evolving Policies, Issues, and Methods Pertaining to Gross and Net Savings," provides a summary of current and evolving polices in the US with a focus on those regions and states that are actively assessing the role of EE programs in state energy policy, infrastructure reliability and resiliency planning, and emission reduction strategies, including the NY REV and the EPA Clean Power Plan (CPP) Section 111d. Of particular interest for this paper is how NS are considered within these various contexts. Also discussed are evolving methods for estimating NS, including discussions on the common practice baseline methods, market effects modeling, top-down macro-economic modeling, and the expanding role of the random control trial method.

2) "Decision-Framework for Determining Net Savings Approach" presents a high level summary of the methods and approaches used to estimate net savings parameters and their pros and cons, and programs where methods are suitable. The material in the appendix is largely based on and adapted from the DOE Uniform Methods Project chapter on Net Savings (DOE UMP, 2014).

2. Six Guiding Principles: Gross Savings (GS) and Net Savings (NS) Policies and Estimation

Evaluators develop GS and NS estimates for a wide range of EE program types, from direct resource acquisition programs with known participants to midstream promotion strategies where the participants are unknown and may not know that their purchases may have been influenced by an EE program. Given the breadth of the application of GS and NS concepts, estimates, and methods across different programs and across different policy objectives, inconsistencies can confound interpretations and applications of EE program impacts. The intent of the guiding principles is to assist decision-makers by providing a better understanding of terms and definitions and choices for addressing decisions with the public interest in mind. The principles were constructed in recognition that EE programs and policies are evolving; thus, decisions regarding the way GS and NS are estimated and how results are used will also need to evolve, and this process can be enhanced when guided by core principles.

A first step toward establishing common understanding of GS and NS is to recognize that distinctions can exist between conceptual and operational definitions.

2.1 Principle #1: Establish a Common Understanding

This is a foundational principle. Common understanding of the concepts of GS and NS sets the stage for the five principles that follow. The fact that issues tied to GS and NS are often complex and nuanced creates opportunities for misunderstanding or confusion.[8]

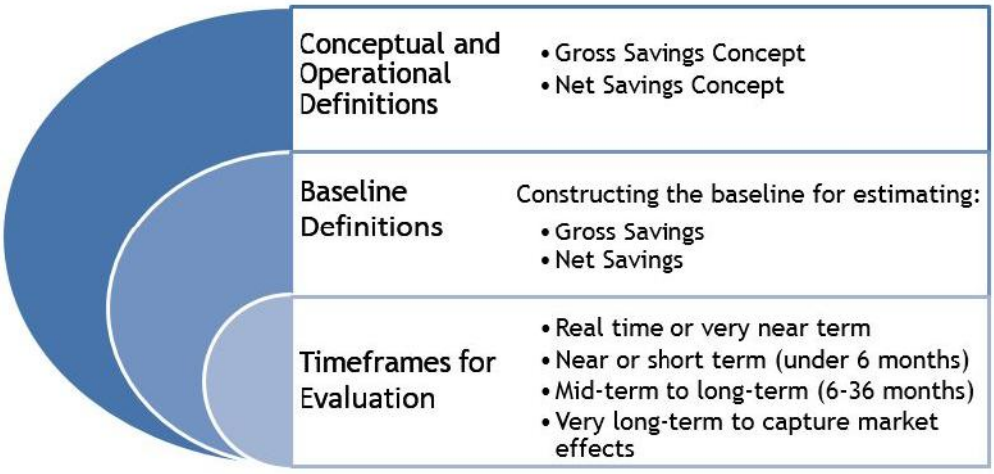
[8] An old adage that seems to apply here is that a question that is well asked is half answered. That seems to be the case when addressing issues around the policy applications and estimation methods for NS. Jonas Salk is credited with saying: "What people think of as the moment of discovery is really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

One source of potential confusion is in the distinction between conceptual and operational definitions of GS and NS.[9] 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.

As pointed out in the Energy Efficiency Program Impact Evaluation Guide, 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 to an energy efficiency program."[10] 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 to estimating GS. **A first step toward establishing common understanding of GS and NS is to recognize that distinctions can exist between conceptual and operational definitions.**

Figure 2-1 identifies the important high level components of a GS and NS framework for establishing a shared view and facilitating 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 2-1. Common Understanding Issues: Important Components for Establishing a Shared View



[9] There are also are distinctions between the various methods available to estimate GS and NS, and these methods can overlap. See the Decision Framework for Determining Net Savings Approach (Johnson Consulting Group, September 2014) for descriptions of methods and appropriate application along with comparisons and a discussion of pros and cons of NS estimation methods. This is provided as a supplement document to this white paper.

[10] SEE Action 2012. Schiller Consulting, Inc., "Energy Efficiency Program Impact Evaluation Guide," prepared for State & Local Energy Efficiency Action Network, December 2012.

2.1.1 Conceptual and Operational Definitions of GS and NS

1) **Conceptual Definition of Gross Savings (GS):** A generally accepted definition that appears 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[11] in an efficiency program, regardless of why they participated."[12]

2) **Operational Definition of Gross Savings (GS):** This is the energy consumption savings from post-participation equipment or sites minus the appropriate GS baseline. 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 EE measure, 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 inputs, 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.** The term adjusted gross savings is sometimes also used to refer to GS estimates which include modifications such as the adjustments identified above.

Adjusted GS in the operational definition of gross savings: EE evaluations often start with verification of the initial estimate of GS. The ratio of the GS estimated through evaluation to the initial estimate is the realization rate (RR). Examples of adjustments to GS include data errors, installation and persistence rates and hours of use, but not free ridership or spillover.

[11] 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) and supplemental document #2 to this Guidance: "Decision-Framework for Determining Net Savings Approach".

[12] This conceptual definition of gross savings is used in SEE Action (2012) and DOE UMP (2014). The "why" in this definition focuses on the impact of the program on behavior – a key issue in estimating NS. The U.S. EPA's draft guidance document (EPA 2015b. Environmental Protection Agency, "Draft Evaluation, Measurement and Verification Guidance for Demand-Side Energy Efficiency," August 3, 2013) for evaluating energy efficiency programs uses a simple conceptual definition, i.e., gross savings = "savings calculated with respect to a defined baseline." In this definition, the selection of the baseline is critical and an appropriate baseline needs to be selected not any random baseline. This definition does, however, illustrate the importance of the baseline in developing estimates of gross savings. The EPA EM&V Guidelines does present a number of different baselines that can be used to develop gross savings estimates for different applications.

3) **Conceptual Definition of Net Savings (NS):** As noted earlier in this section, there is agreement on the conceptual definition of net savings, i.e., those savings that are "attributable" to the EE program or activity (SEE Action 2012).

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 NS, (free ridership, spillover, and market effects) they include in quantitative estimates of NS.[13] Therefore, **it is important to have a clear understanding of – and agreement on – the components of NS. This should also be supported with an equation identifying the components or factors that are viewed as components of NS, whether they are specifically estimated or not.**

   One operational definition NS produces an equation shown below that includes three adjustments to GS — 1) free riders, 2) spillover and 3) market effects not otherwise accounted for in estimates of spillover:

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

   Jurisdictions may not include all of these factors in their operational definition of NS. To further complicate these adjustments, there are 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.[14,15] Table 2-1 provides definitions for each factor and sub-factor. The definitions of these factors are consistent with those contained in the Energy Efficiency Program Impact Evaluation Guide (SEE Action 2012) and in the chapter on Estimating Net Savings: Common Practices for The Uniform Methods Project (DOE UMP 2014).

[13] As noted in SEE Action (DOE UMP 2014), "Other factors (sometimes called net-impact factors) are generally considered as adjustments to gross impact estimates. These can include rebound, snapback, and persistence of savings." Snapback (also known as Rebound or Takeback) can occur when the individual reduces the cost of heating or cooling their homes through energy efficient actions and, due to this lower cost, they now decide to change their thermostat setting to a more comfortable level essentially taking back some of the savings in the form of comfort.

[14] 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)

[15] See supplemental document #1 to this Guidance report, "NS and GS -- Current and Evolving Policies and Issues" for information on trends in the inclusion of these NS factors across different states.

Table 2-1. Definitions of Net Savings (NS) Factors

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. • **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.	**Spillover** refers to additional reductions in energy consumption or demand due to program influences beyond those directly associated with program participation.[16] 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. Participant spillover subcategories include: 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.	**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 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.

[16] 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

2.1.2 Baseline Definitions

Given that the identification of the correct baseline is essential for accurately estimating GS and NS, **an understanding of the underlying assumptions used in baseline determination is important for assessing gross and net savings estimation methods.** In many cases, the fundamental question is attribution – does the baseline separate out changes in energy use that would have happened even if the program had not been offered?

> *"Baseline: Conditions, including energy consumption and demand, which would have occurred without implementation of the subject energy efficiency activity."*
> *(SEE Action 2012, p. A-2)*

One of the many challenging features in defining baselines is that, by definition, baselines are unobservable.[17] The discussion below describes some of the concepts and nuances pertinent to this discussion.

a. **GS baseline** is meant to bring the baseline and reporting periods to the same set of conditions (rather than a simple subtraction of pre- and post-installation energy use).[18] The pre-condition energy use might be adjusted for factors such as weather, operational hours between pre- and post-installation conditions, and possibly interaction effects, e.g., the interaction between lighting and heating energy use. GS adjustments also typically account for installation of currently available equipment if the replaced equipment are no longer available or are no longer the standard choice. This will often reflect current codes and standards. The common denominator in developing the GS baseline is that it is based on the resulting savings of the installation of the technology without the participant behavioral factors that comprise the additional net savings adjustments.[19]

b. **NS baseline** takes into account those factors that are related to behavior and choice. This can result in additional factors needed to enable defensible estimates of attributable savings, i.e., savings that would have occurred in the absence of program intervention. These considerations include the "natural adoption" of efficiency, i.e., adoption not influenced by the program,

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.

[17] The fact that the baseline against which EE savings are estimated is unobservable is not just an evaluation issue for EE, but for the evaluation of any policy or investment decision including those related to health, education, agricultural, and business policies decisions (among other policy areas). The development of an appropriate baseline is a dominate theme across the evaluation literature spanning many fields.

[18] Another discussion of this view of gross savings can be found in IESO/OPA, "*Evaluation, Measurement and Verification (EM&V) Protocols and Requirements* (EM&V Protocols v. 2.0)", Ontario, Canada, April 2015) where it states gross savings adjustments account for "independent variables that are beyond the program implementer or participants' control. Adjustments are meant to bring the baseline and reporting periods to the same set of conditions (rather than a simple subtraction of pre- and post-installation energy use). Common independent variables that are adjusted for include: 1) Weather normalization, 2) Occupancy levels and hours (i.e. hours of operations), and 3) Production levels (i.e., operating cycles, shifts)" page 70.

[19] Gross savings are also adjusted for the replacement on failure of equipment or the early replacement of equipment. This discussion can become complex and, for the balance in the information in this guidance, readers are referred to DOE UMP chapters on equipment replacement.

decisions to install additional measures outside the program (spillover), and effects on the market.

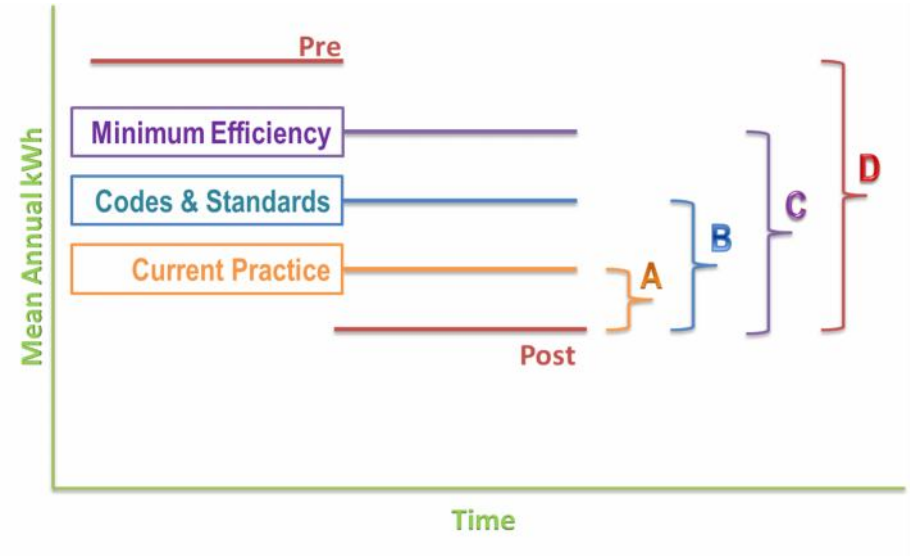
What distinguishes a gross savings baseline from a net savings baseline? A useful perspective is that gross savings reflect the savings that are due to the installation of the technology offered by the program,[20] while net savings, in general, takes into account additional behavioral and choice options that define free riders, spillover, and broader changes in the market. As an example, NS can account for the fact that the program influenced some individuals who took the program action, but not necessarily all of the individuals who installed measures or took actions that were part of the program.

Figure 2-2 below illustrates, in a simplified way, that **there are several ways in which a GS baseline can be defined, leading to different GS estimates** (A, B, C and D). In this example, A&C illustrate savings from measures replaced on failure where there are no applicable codes or standards. B illustrates a measure – either new construction or a measure replaced on failure - that has applicable codes or standards. D illustrates the retrofit example of measures that are either replaced prior to failure or are controls, where preexisting usage patterns inform the baseline.

As shown below, one candidate for the GS baseline is based on "current practice" (also termed common or standard practice) in the market. For example, if the activity is replacement on failure of HVAC equipment, the baseline for GS can be defined as what that customer would have installed given the current market for that equipment. Another example might be new construction of a home. Since no home currently exists, the baseline for GS could be the energy use in homes currently or commonly built in that market at that time. In either of these examples, NS estimation depends on, and starts with, the gross savings estimation and baseline in mind. **There are attribution aspects in a gross baseline established on the basis of *what customers would have installed or built*. This is the underpinning for the use of common practice baselines to estimate net savings. There is some attribution built into gross savings, and other aspects of attribution contained in the NS adjustment factors. This can be a source of confusion and potential double counting. *This re-enforces the need for transparency in the conceptual and operational definitions*.**

[20] The authors believe that this is a generally useful distinction, i.e., the view of GS as being savings based on the technology and NS being savings that takes into account additional behavioral and selection factors, but there always seems to be exceptions to every general statement. That is why it is important to set out the conceptual and operational definitions of GS and NS, and the associated baselines used in their estimation.

Figure 2-2. Baseline Comparisons[21]



Where:

- Pre = Pre-installation mean annual energy of a representative sample of participants
- Minimum Efficiency = Minimum efficiency available in the market
- Code & Standards = Efficiency level compliant with codes and standards (C&S)
- Current Practice = is based on the efficiency of current equipment commonly purchased in the market. This is also termed standard practice or "business-as-usual" (BAU) for that market
- Post = Post-installation mean annual kWh for the same random sample of participants

There is ongoing discussion and debate regarding the appropriate baseline approach for both GS and NS. As summarized in DOE UMP (2014), some analysts and policymakers believe use of the common practice baseline produces results that are more akin to net than gross impacts and that this determination is best made on an ex ante basis.[22]

These differences underscore the importance of the principles in this guidance, starting with common understanding of operational definitions and assumptions used when defining GS and NS. Making transparent "under what conditions [jurisdictions] use current practice as the baseline and how they interpret the results" can help inform this situation. For decision-makers, "ultimately what one does is

[21] This chart is adapted from Ridge (Ridge, R, et al., "Gross Is Gross and Net Is Net: Simple, Right?", International Energy Program Evaluation Conference, Chicago, 2013).
[22] For some perspective on issue, see Rufo, Mike (2015), "Ew Gross! Cleaning Up Gross Baselines," International Energy Program Evaluation Conference, Long Beach, 2015.

affected by the policies in a given jurisdiction regarding the required level of accuracy, confidence and precision, i.e., what counts as credible evidence will vary." (Ridge, et al. 2013)

2.1.3 Timeframes for Evaluation

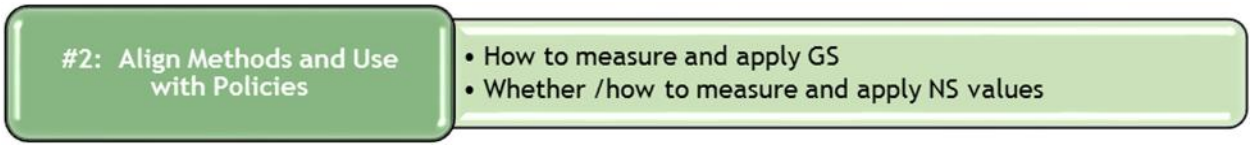
The timeframe for which the estimates of GS and NS apply is important, as the issue of timing and time-frame has an impact on how changes due to EE programs are assessed and how changes in the market are handled. The time perspective can influence the way energy savings are measured. It is often important to design programs that are expected to influence markets in the short term and longer term future. Thus, **evaluators must estimate expected impacts, as well as assessing how prior years' EE programs have affected current conditions.**

One example concerns free ridership. Free riders estimated in a current year for an EE program may be free riders due to the market effects of programs from prior years. Perfect evaluation would solve this problem as every evaluation would account for the impacts in the near term (e.g., under a year) for addressing free ridership and short term (e.g., one to three years) for addressing spillover; and, it would take into account long term market effects that influence customer choices in the future. However, many operational definitions of net program savings do not examine longer-term market impacts (also termed market transformation). Given that these longer-term program impacts are viewed to exist, but have typically not been quantified, some argue that these past omitted benefits should somehow be considered in evaluations of current year EE programs.

From a baseline perspective, "if past programs have material spillover and market effects, these effects may contribute to higher efficiency common practice baselines than would otherwise be the case. Many jurisdictions do not include spillover and market effects in estimates of net savings. If these are not accounted for in attribution studies of past or current programs, then the cumulative long-term benefits of programs will be underestimated." (Rufo, 2015)

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 Energy Protection Agency's "Retail Products Platform" is one example of such a program. **The contributors to this guidance paper on evaluation methods for these market-based programs caution that near-term impacts are unlikely to be large; a focus on first-year net savings is restrictive and not well-aligned with the goals of these types of programs, and the evaluation efforts must consider logic models, collect market data and track market indicators for a period of years to determine the actual impacts of these programs.**

2.2 Principle #2. Align Methods and Use with Policies



An overarching principle of this document is that energy efficiency practices regarding NS – 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. Jurisdictions review their GS and NS policies on a periodic basis[23] regarding NS research, the frequency with which NS are estimated, and the way in which NS results are used. A recent survey of State policies towards the estimation of NS 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 NS had in the overall set of policies. Over time, policies evolve and circumstances change; therefore, there is a need to periodically review the role of NS as part of the overall EE framework.[24]

Gross and net savings policies can be adapted in terms of the following considerations:

Over time, policies evolve and circumstances change; therefore, there is a need to periodically review the role of net savings as part of the overall EE framework.

1) Frequency of estimation. NS 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 NS is seen to support other policy objectives** – e.g., accurate cost recovery, incentives, program design, and tracking towards appropriate resource goals.

2) Use of NS estimates. Per the survey of State policies cited above, there is a trend to use NS estimates on a prospective versus retrospective basis. For example, metrics are set which track progress towards targets, on which incentives might be calculated. These are set based on the best information at the time, and are used to inform the next round of targets at the program or portfolio level. NS estimates are not used to go back and retrospectively reset these values. **See Table 3-3 for further guidance on pros and cons of prospective and retrospective applications.**

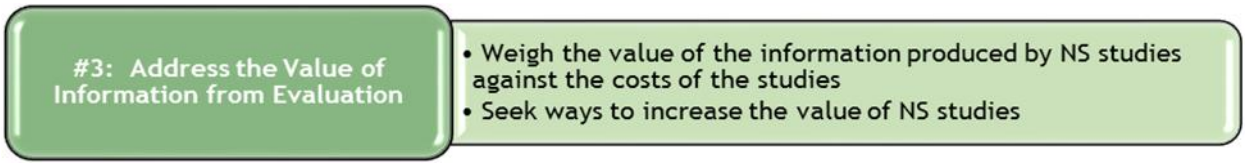
3) Level of evaluation rigor. The selection of methods to be used in evaluation may change as policies require greater or less confidence or rigor, or more or less consideration of all sources of error, to reach the needed comfort level for decision making. The costs of research can increase exponentially as the stated requirements are increased. **In some cases, the targets for the rigor of**

[23] Two reports that address NS assumptions used in EE policies as they pertain to cost-effectiveness and incentives are: 1) "Navigant Consulting, "Custom Free Ridership and Participant Spillover Jurisdictional Review," Prepared for the Sub-Committee of the Ontario Technical Evaluation Committee, Ontario, Canada, May 2012, and 2) Violette et al., "Final Report: Iowa Energy-Efficiency Net-to-Gross Report, Prepared for: Iowa Utility Association and the Oversight Committee," by Navigant Consulting, June 2015. In addition, Maryland through its Empower state-wide programs has adopted a policy to assess cost-effectiveness of EE programs based on net savings, and us GS to track accomplishments against EE goals. (Communication with EE evaluation manager).

[24] Research on current practice shows links between overall EE policy and evaluation methods (see supplemental document #1 to this Guidance report, "NS and GS -- Current and Evolving Policies and Issues" .

the research is beyond what the data can reasonably support and care should be taken to balance out research requirements, particularly as the industry moves toward more market-based programs that are expected to produce longer-term market effects.

2.3 Principle #3. Address the Value of Information from Evaluation



Value of information (VOI) is a decision-making process in which the potential value, or benefits, of the research results are considered in context of the costs of the research. To assess the VOI, the assumptions are documented regarding what the studies might produce and how the results can be used to produce value. A VOI analysis can help develop policies regarding the GS and NS research agenda in terms of:

Value of information (VOI) is a decision-making process in which the potential value, or benefits, of the research results are considered in context of the costs of the research.

- 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.

Whether VOI is established using a formal approach or more informally, **incorporating both cost and information value criteria into the decision-making can provide insights leading to better decisions.** Developing a formal approach to assessing the value of what might be learned can be part of a stakeholder process.[25] Questions to facilitate a VOI assessment specific to NS research include:

[25] The authors know of two jurisdictions that have conducted formal VOI assessments of performing new GS and NS studies as part of stakeholder processes in Iowa and Ontario. Also, an example of an approach which prioritizes measures for evaluation based on value of information, is found at http://www.cpuc.ca.gov/General.aspx?id=4137 where the California PUC targets "sufficiently uncertain" measures defined as those measures for which the Commission believes the net lifetime savings of the current DEER or non-DEER savings estimate may be as much as 50% or more under- or over-estimated for evaluation. See CPUC (2015).

Question 1. Should research be conducted or can past research or secondary research be used?

Some factors for assessing the usefulness of additional GS or NS research include:

- What is the likelihood that a GS or NS study would produce information that is different enough from the current assumptions to result in changes in policies, incentives, or program planning and implementation?
- What actions might be taken if the estimated NS value is outside the expected range? Would it influence policy and actions taken with respect to planning, design, and program implementation?
- Are there other methods that could be used to monitor program metrics that do not require NS calculations?

Question 2. If NS primary research is to be conducted, how much is needed, how often should it be done, and how can it be prioritized for maximum value?

The following considerations can help prioritize evaluation research to increase the value of the information provided and may lower the costs of the research:

- The value of conducting NS studies may be higher for some programs than for others. For example, larger programs with greater expected impacts are likely candidates for NS research.
- Program designs that have demonstrated higher free ridership rates or that show increasing free ridership over time may warrant more attention. Programs that are showing high spillover may suggest a different type of primary research be conducted to measure program impacts and market effects.
- Different stages of a program can merit different level of concentration on net savings; for example, a program that incentivizes new technologies may have less concern for free-ridership than a program that incentivizes technologies that are considered widely known and available.
- There might be a few participants that account for a large portion of the savings in every program year, as can be the case for C&I programs.
- If there is a lot of uncertainty in the NS values of some programs, or customer groups in certain programs, then the value of refining these estimates may have greater value in ensuring the programs are cost-effective and well designed.
- If incentives or certain cost recovery such as any lost revenues are tied to program impacts, fresh estimates of NS may be needed.

Question 3. What NS research methods balance requirements for rigor, or expectations for confidence in the results within the available evaluation budget?

These additional questions will help in answering Question 3. Also, note that **it is quite likely that regulators or other stakeholders will determine that different methods are better for different programs** based on responses to these questions as well as those in Question 2.

- What data and information is available to support method decision making?
- Would deemed savings values based on secondary research meet the current needs?
- Are participant survey methods appropriate, and if so, which one is most appropriate? Are participants (end users and trade allies) known, or tracked? Or are program participants unknown, such as for upstream program designs?
- Is high-frequency consumption data available from smart meters which can be combined with other customer data to support random control trial or quasi-experimental design methods?
- Are stakeholders most interested in the overall effects of a portfolio within a region (possibly a multi-state region) over time rather than program-level impacts for a specific service territory which might suggest a top-down approach?
- Does a combination of methods for a 'preponderance of evidence' approach through triangulation seem most appropriate?

The Uniform Methods Project (DOE UMP 2014) provides a summary table of NS research approaches along with an idea on the associated cost and complexity (see

Table 2-2). Also **refer to Supplemental Document #2: Decision Framework for Determining Net Savings Approach (NEEP 2014) prepared 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.** This table provides decision-makers with information that can help inform the VOI; however, as discussed, there are many factors (such as data and information availability and quality) that can influence the cost and complexity of each method.[26]

[26] See NEEP 2014 ibid.

Table 2-2. Summary of Methods Applicable to Different Conditions (Source: DOE UMP, 2014)

Net Savings Method	Surveyed Group	Applicability				Typical Cost or Complexity	Special Requirements
		Custom Measures	Measures with few, diverse participants	Large number of similar participants	Measures with substantial upstream influence invisible to consumers		
RCTs using DiD	None necessary, but could be conducted to help validate the baseline as an appropriate counterfactual	Poor	Poor	Good	Poor	Low	Random assignment and controls
Quasi-experimental Design	None necessary, but could be conducted to validate or develop better baselines	Poor	Poor	Good	Poor	Low	Matched nonparticipant comparison group
Regression models-billing data analysis with control variables AND Linear Fixed Effects Regression (LFER)	Participating consumers and comparison group consumers	Poor	Poor	Good if there is a valid comparison	Good if there is a valid comparison	Low	Need control variables that influence energy use across participants and nonparticipants
Survey based-participants, nonparticipants, and market actors	Participating end-users	Good	Good	Good	Poor unless combined with retailer or contractor surveys	Medium	Counterfactual baseline based on survey responses
	Participating and nonparticipating end-users	Poor	Poor	Good	Poor unless combined with retailer or contractor surveys	Medium-high	Nonparticipant must be representative of participants
	Retail store managers and contractors	Good	Good	Medium	Good	Medium	
Survey based-qualitative sales and counterfactual scenario	Retail store managers and contractors	Poor	Poor	Good	Good	Low	

Net Savings Method	Surveyed Group	Applicability				Typical Cost or Complexity	Special Requirements
		Custom Measures	Measures with few, diverse participants	Large number of similar participants	Measures with substantial upstream influence invisible to consumers		
Structured expert judgment	Experts	Depends on quality of input methods				Low	
Market sales data (Cross-sectional studies)	None	Poor	Poor	Good	Good	Low if data are available; high or not possible if data must be developed	
	Manufacturers and regional buyers and distributors	Poor	Poor	Good	Good	Low	
	Retail store managers and contractors	Good	Good	Medium	Good	Medium	
Common practice baseline	Participating and nonparticipating end-user surveys or Market sales data are used	Poor	Poor	Good	Good	Medium to high	Defined market segment
Top-down methods for regional application	None	Requires data on aggregate energy consumption and information on EE effort for a large or cross-sectional observations over a period of time				Depends on the cost of compiling the initial dataset	Aggregate data available on geographical cross-sections

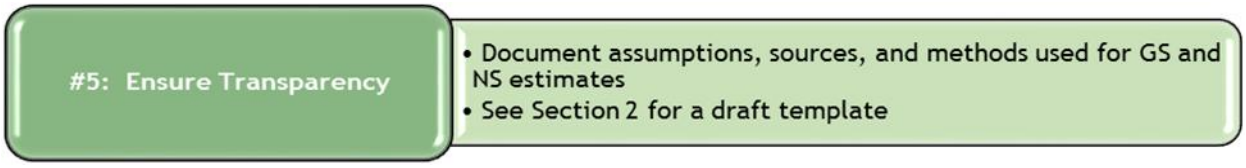
2.5 Principle #4. Apply the Concept of Symmetry

This principle is important because the operational definition of NS involves multiple NS components – free ridership, spillover, and market effects. There is widespread agreement that all three of these components exist for most programs, but may have different magnitudes across programs.[27] Furthermore, for various reasons, these components can be difficult or impossible to quantify, 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, **the fact that all these components influence NS should not 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 components, even if some are based on judgment and subject to more uncertainty. **For example, 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.**

Symmetry also applies to how GS and NS are used in cost-effectiveness tests to ensure alignment. **If NS is used, then the equipment costs attributed to the program should be adjusted for the fact that some of the equipment would have been installed even if the program had not been offered.** Appropriately aligning costs and benefits to the use of GS or NS is an area where some attention is often needed.[28]

2.6 Principle #5. Ensure Transparency



[27] As noted in The Uniform Methods Project (DOE UMP 2014), rebound and snapback are indirect effects on usage which are also identified as NS components. However, uncertainty around measurement methods for these components is lower than for free ridership, spillover, and market effects.

[28] Standard references to cost-effectiveness and how GS and NS fits into the different tests are CPUC (2002 and 2007), National Energy Action Plan (2008), and IESO (2015).

The fifth principle, Ensure Transparency, speaks to **the importance of documenting and clearly stating all the assumptions,[29] data sources, methodologies, and calculations that relate to the development of GS and NS estimates and their use** in assessing or improving programs. As with the transparency guideline contained in NEEP's Cost-Effectiveness Screening Principles and Guidelines (NEEP 2014), transparency ensures that all stakeholders understand what was used to estimate both gross impacts and net impacts.

Policies on EE investments, program designs, and implementation should use the best available information on all NS components, even if some are based on judgment and subject to more uncertainty.

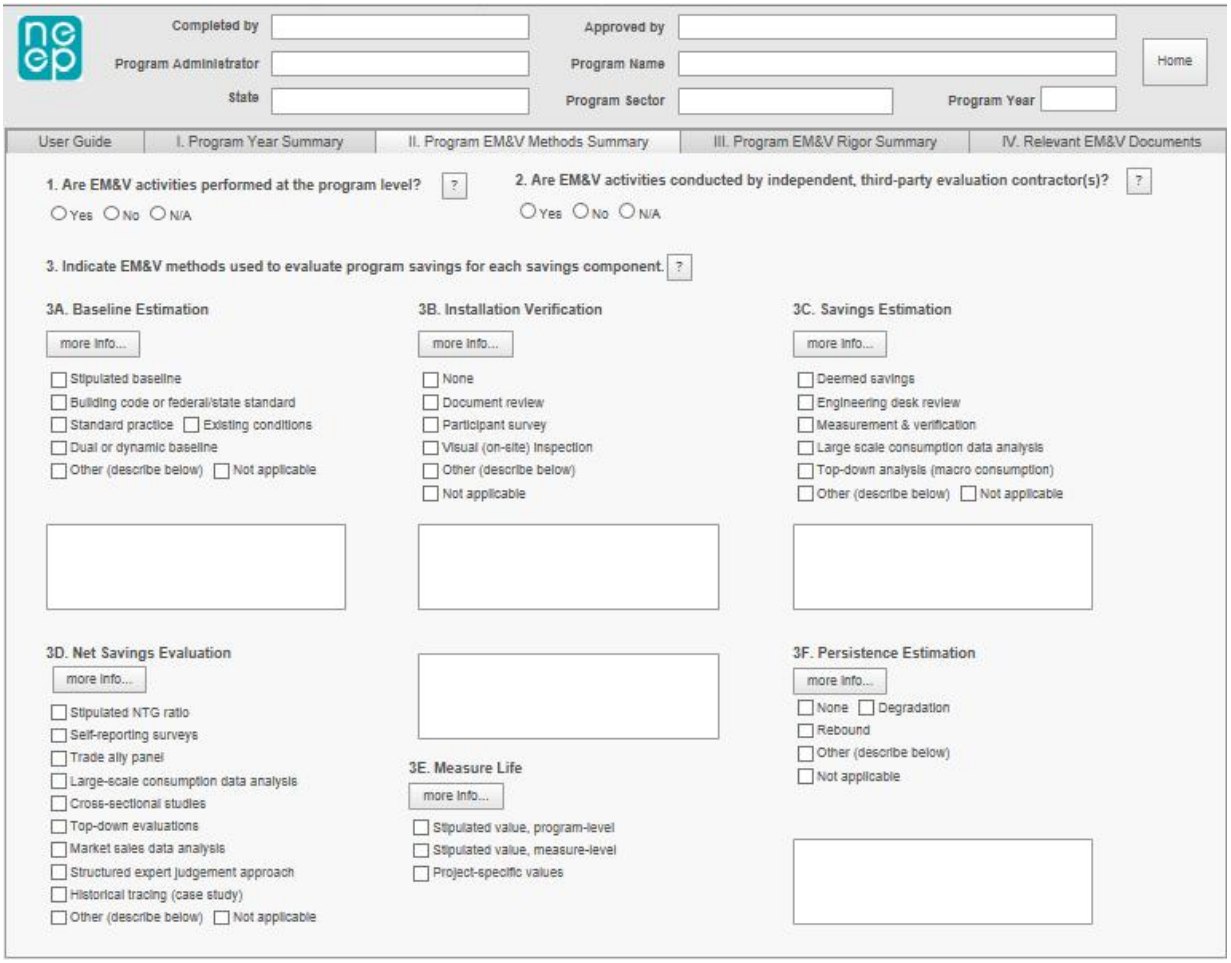
The authors concur with recommendations in other Regional EM&V Forum projects[30] that **standardization in reporting on methods and results of programs can help encourage transparency.** A standardized template can provide immediate, consistent information for reviewing EE programs, and it facilitates comparisons across programs. Furthermore, especially for NS, templates have the advantage of ensuring that the methods and results are conveyed together. This can help avoid misunderstandings by taking information out of context. Finally, a standard template could also be used to consider NS issues in the context of an overall framework to ensure consistency with state policy objectives.

The EMV Forum's model EMV Methods Standardized Reporting Forms (Figure 2-3) provides a good starting point and example for a practice that EE evaluators could follow. Based on that work, Chapter 3 of this document presents a Gross and Net Savings Policy Decision Framework Template v1 to facilitate the decision-making process and to document the overall decision as well as the decisions regarding key questions.

[29] 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.

[30] See NEEP (2014).

Figure 2-3. EM&V Reporting Program EM&V Methods Summary Form Snapshot



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

Although "best practice" and consistency are two criteria that are commonly cited as high value strategies which increase and ensure credible energy efficiency impacts, **when it comes to NS, leaving room for flexibility is an especially important component of guidance as it helps states to make informed, thoughtful, and balanced decisions.** Often, differences in dialogue around EE policies and the role of GS and NS come 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.

For example, different stakeholders may hold different views on NS issues. These views can still be consistent with core principles yet reflect 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; this might vary by type of program or research method.
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 GS, NS, 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.[31] This research is becoming important for determining market-based metrics for assessing how EE programs impact 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 a GS and NS research agenda, and uses for these estimates.**

2.8 Summary and Conclusion – Guidance Principles

While each of the six guidance principles presented in this section are important, the first principle – *Establish a Framework for Common Understanding* – is a prerequisite for productive dialog, particularly across different programs, policies, or jurisdictions. Common understanding of core concepts as well as operational applications are necessary for an appreciation of the nuances and complexities in the definitions, applications, and methods related to GS and NS, for any variations from jurisdiction to jurisdiction, and for discussions regarding the evolving nature of programs in a next generation of EE.

[31] A review of GS and NS policies among stakeholders in Iowa encompassing the State Commission, Consumers' Counsel, and other stakeholders developed areas of common views and areas where the underlying views and beliefs differed. See: Violette et al., "Final Report: Iowa Energy-Efficiency Net-to-Gross Report, Prepared for: Iowa Utility Association and the Oversight Committee," by Navigant Consulting, June 2015.

Therefore, it is useful to set out a framework with a common set of definitions and vocabulary. In addition, the questions and goals need to be clearly set out as part of the process to attain a consistent EE framework that supports jurisdictional policy objectives; and, appropriately incorporates GS and NS within that framework. The subsequent five principles are designed to provide guidance in advancing and discussing key issues within the framework, while resting upon the platform of a common understanding.

- Differences between jurisdictions' policies and priorities will continue to influence EE EM&V. However, the core principles provided in this section can lead to informed decisions in various ways, including:
- Considering what counts as credible evidence of program performance in various contexts
- Achieving more clarity and potentially consensus on which influences and effects should be considered when determining net savings, and how those influences are defined.
- Improving the efficiency with which resources are allocated so that program administrators can best achieve society's interests.

The way GS and NS are defined, estimated, and used in an EE framework is evolving as programs, methods, and objectives for EE evolve. In recognition of the second principle, *Align Methods and Use with Policies*, this Guidance should be revisited over time and updated to reflect new policy and program developments.

3. Tools to Guide GS and NS Policy Decisions

The consideration of the six principles from Chapter 2 will help foster informed, thoughtful decisions about gross and net savings, how GS and NS will be measured, and how they will be applied within jurisdictions.

> *Like most policy decisions, the most appropriate choice when considering all factors and stakeholder perspectives will not be without trade-offs and compromises.*

This section was developed with Principle #6, Acknowledge That There Will Be Multiple Views Across stakeholders in mind. Not all decision-makers can be expected to hold the same views on GS and NS issues; however, there may be areas of common agreement and common practice. Like most policy decisions, the most appropriate choice, when considering all factors and stakeholder perspectives, will not be without trade-offs and compromises. Also, it is likely that a good decision for one jurisdiction may not be the best choice for a different jurisdiction due to different existing policies and circumstances. However, a common framework that can be used to identify and understand the views that underpin these different perspectives can be an important starting point for developing a GS and NS research agenda, and uses for these estimates.

The tools presented in this section are intended to help guide decision-makers on how to apply the core principles to their situation and to help document the results to lend clarity to further discussions as well as to comparisons of similarities and differences across programs, policies, and/or jurisdictions.

This section provides two related tools:

1. A step-by-step Framework[32] to guide GS and NS policy decisions (presented in Section 3.2)
2. A Policy Decision Framework Template (presented in Section 3.3) for documenting decisions to help ensure transparency in the decision-making processes that many stakeholders face.

3.1 What Energy Policies Influenced GS and NS Decisions?

Understanding the energy program practices within a jurisdiction along with policy goals (*the drivers* of the energy programs) will help determine the appropriate decisions for policymakers regarding both GS and NS estimation and application. The following table lists some of these policy considerations.

[32] This framework builds on NEEP Regional Forum Model EM&V Reporting Forms for Energy Efficiency (See NEEP 2013. Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, "Model EM&V Methods Standardized Reporting Forms," 2013). In addition to the summary forms, more detailed forms document additional information such as how the gross savings and net savings are estimated and the rigor of the impact evaluation.

Table 3-1. Energy Policy Decisions that can be influenced by GS and NS

Example Policies	Related Issues
Setting EE targets and metrics	• Set by legislative mandate (e.g., 20% reduction by 2025) • Policy-driven variable targets (e.g., all cost-effective EE) • Prospective or Retrospective application of GS and NS
Determining measure or program cost-effectiveness	• Selecting benefit-cost test • Defining inputs and outputs
Tracking towards targets and EE metrics	• Assessing progress towards multi-year goals • Feedback for program/portfolio modifications • Prospective or Retrospective application of GS and NS
Potential Revenue Erosion and Lost Margins	• Addressing lost revenues – Lost margin recovery due to EE – Decoupling – Other options
Incentives	• Performance targets for EE • Shared benefit incentives
Planning	• Resource planning to minimize/manage revenue requirements • Meeting environmental goals • Other goals – resiliency, resource diversification, risk management

As noted in Principle #2, Align Methods and Use with Policies, decisions regarding the application of GS and NS, as well as methods for estimating parameters, should be made in the context of the energy policies within a jurisdiction.

3.2 A Framework to Guide GS and NS Policy Decisions

Building on the Guidance Principles in Section 2, this section presents a Framework that identifies elements to consider when making policy decisions along with important process factors to consider. The eight steps presented in more detail within this section are summarized here:

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 overall confidence or rigor 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

Step 8. Ensure transparency by documenting net savings decisions

3.2.1 Step 1. Establish the common understanding of terms and definitions

Principle 1. Establish Common Understanding and Framework helps to ensure that all parties are working within a common framework, where:

1. The definitions of key terms are set out in advance.
2. There is an understanding of the estimates of different EE savings components.
3. There is a top level understanding of what the different net savings estimation methods produce (e.g., gross and net savings estimates, or a direct estimate of net savings with gross savings embedded in the estimation process but not specifically presented).

The table below identifies key terms to define along with questions to consider. Setting this up at the front of the decision making process will help ensure subsequent decisions are based on this common understanding.

Table 3-2. Key Terms, Definitions, and Questions

Term	Definition	Question Examples
Conceptual 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.	1. How is the gross savings baseline defined? This can be based on policy, on how savings are calculated within the tracking system, or both. a. replacement on failure b. early replacement c. Installation of new less efficient equipment, e.g., average market stock, such as in new construction, or new equipment purchases not for replacement of like products d. other method(s)
Operational Gross Savings	Energy consumption savings from current post-participation equipment or sites minus the appropriate gross savings baseline.	1. Are all adjustments documented (in Technical Reference Manual, for example) and reflected in tracking system?
Conceptual Net Savings	1. The difference between energy consumption with the program in place and that which would have occurred absent the program. 2. The change in energy consumption and/or demand that is attributable to a particular energy efficiency program.	1. How is this definition operationalized to align with regulation and policy?
Operational Net Savings	Changes in energy use that are attributable to a particular EE program which may implicitly or explicitly include the effects of free ridership, spillover, and induced market effects.	1. Which components of net savings are to be included – FR, SO, and ME? 2. Does this vary by the type of program?
Market Effects	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).	1. If spillover is assessed, does it overlap with the market effects assessment? Can these components be clearly separated for the specific effort?

Term	Definition	Question Examples
Appropriate Baselines	Net savings is the difference between observed energy use and the "appropriate" counterfactual baseline. The baselines used in estimating net savings are designed to get at attribution and represent an "appropriate" counterfactual.	1. Are the assumptions embedded in baselines understood? 2. Are adjustments for free ridership, spillover, and market effects appropriateness?

3.2.2 Step 2. Determine how GS and NS will be used

The way in which savings estimates will be used is the next consideration as this will influence the research methods. When considering the possible applications, *Principle 2. Align Methods and Use with Policies*, should be at the forefront. The following discussion outlines the uses of NS research for consideration.

1. Cost effectiveness and programmatic design

Cost effectiveness is by design a net concept. When examining the benefits of an EE program/portfolio, only those benefits actually attributable to the program should be counted against costs. Issues within these benefit costs tests and how they are applied vary across jurisdictions. In general, NS is the value used in most tests to develop estimates of avoided costs in the tests (see CPUC 2002 and 2007). Another issue is the treatment of incremental costs when net savings are used. NEEP (2014) points out that in applications of the total resource cost or societal cost-benefit tests, incremental measure cost should be treated consistently with savings, i.e., adjusted by the same net-to-gross ratio that is applied to savings. On a side note, when deciding on appropriate incentives, such as rebates, as part of program design, net savings are also important because use of net savings in this context works to maximize savings attributable to the program.[33]

2. Tracking towards goals: portfolio level, program level, budget

GS or NS can be set as EE targets. When NS is used for tracking towards goals, it is important that NS components are considered during goal setting and that the budget to achieve goals considers whether GS or NS are used for target compliance. Success is unlikely if there is a disconnect between the goals, what metrics are tracked for meeting goals, and the forecasted budget to achieve the goals. For instance, consider a case in which a resource acquisition program has a gross savings goal of 100 MWh in first year savings and the budget is set at an acquisition cost of $150 per MWh. If net-to-gross research indicates that free ridership and spillover result in a 50% NTG ratio, then the acquisition cost doubles to $300 per MWh in order to achieve the 100 MWh of net savings. In this case, there is a clear disconnect between the goal, the budget, and how results are tracked and reported

[33] Net savings research done at the measure level is recommended when assessing the effectiveness of the rebate, or incentive, to drive program participation (see NEEP, 2014).

3. Performance Incentives and lost revenue recovery

Financial incentives for overall energy program performance can be set based on a variety of metrics with GS the most common metric. However, as noted above (1), NS are required in cost effectiveness analyses to assess the benefits and costs of the EE effort.

Lost revenue recovery is meant to make the utility indifferent between selling electricity and promoting EE. By selling less electricity, the utility loses revenues and the margins that would have accompanied those revenues. A lost revenue recovery mechanism addresses this disincentive for aggressively pursuing EE. Decoupling can also reduce this disincentive, but it will adjust for changes in revenues from all causes, not just those due to EE. The debate between appropriate ways to handle the lost revenue disincentive is ongoing with different jurisdictions choosing different methods. However, if lost revenues is the approach used, NS may be more important to estimate to count those revenues that have been lost due to the savings from the programs. There are still issues regarding whether you apply NS on a prospective or retrospective basis.

4. Resource planning, load forecasting

Resource planning focuses on the need for new resources to meet future energy needs, whether they come from demand-side or supply-side resources. When assessing demand-side resources as part of a portfolio of resources, it is important to look at NS as that is the amount of savings that are additional resources contributed by EE, i.e., resources that can be used to defer the need for other resources (e.g., supply-side) in the portfolio. Appropriately incorporating EE in resource plans can be challenging. It is important that the baselines used to estimate EE savings are appropriately reflected in the forecasts of future electricity demand. For example, demand forecasts should be designed to incorporate naturally occurring adoption of EE if net savings are used as the resource value of EE. In general, the assumptions used to produce the EE savings values should be appropriately aligned with the assumptions used in the resource plan. The principles of symmetry and transparency in EE savings estimation and cost-effectiveness analyses can help ensure internally consistent resource plans and demand forecasting that appropriately address EE.

5. Integrating EE resources into distributed energy resources (DER)

Incorporating EE into the broader set of DER is growing in importance as we see larger penetration of different DER. EE is a distributed resource itself and it can work in combination with other types of DER, such as demand response, renewable energy sources, and storage, to provide peak load reductions in congested areas and help the distribution system operate efficiently. Permanent load reductions in specific areas will have benefits to the distribution system and help efficiently integrate different types of DER. It will be increasingly important to look at penetration of DER at scale and examine the role of each type of DER, including EE. Each resource that is on the customer-side of the meter will allow for changes in loads on the systems. A broader set of tools will be needed to appropriately analyze portfolios of DER implemented at scale to assess the synergies (positive and

negative) across different mixes of resources in different locations. NS will be the important value for EE in this process as this is a resource valuation process.[34]

3.2.3 Step 3. Determine whether GS and NS results are applied retrospectively or prospectively

A common choice for policymakers is whether to use GS and NS estimates on a retrospective basis or on a prospective basis. As the names suggest, retrospective net savings refers to "the process of estimating net savings and NTG ratios from data from past programs and applying them to a past period for the program in question. In contrast, prospective net savings refers to the process of estimating net savings and NTG ratios from data from past program years and applying these results to planning and targets on a going-forward based to upcoming program years.[35]

As shown in the table below, the decision regarding when to apply impacts can influence various aspects of energy efficiency programs.

Table 3-3. Decision Framework for Using GS or NS Prospectively versus Retrospectively

SELECT POLICY APPLICATIONS	ADJUSTED[36] GROSS SAVINGS (GS) ESTIMATES		NET SAVINGS (NS) ESTIMATES	
	Prospective	Retrospective	Prospective	Retrospective
1. Setting EE Targets	Increases planning certainty	Not Applicable: Setting targets is a forward-looking process	Increases planning certainty	Not Applicable: Setting targets is a forward-looking process
2. Tracking Towards Targets	Creates opportunity for real-time tracking of impacts and program performance rather than waiting for post-hoc adjustment	Allows for look back comparisons of planned vs actual measure and program performance	Creates opportunity for real-time tracking of impacts and program performance	Allows for look back comparisons of predicted vs evaluated customer behavior or market effects
3. Lost Revenue Recovery – Lost Margins	Reduces the risk associated with	This is not an issue for utilities	Reduces the risk associated	This is not an issue for utilities

[34] As a note, EE will have different locational values in a system with other DER. Market transformation programs are important for establishing the overall efficiency of the system, but it may not help address locational specific system issues.

[35] The application of savings estimates that may be different form values agreed to among stakeholder during program planning and target setting are also discussed in the NEEP Regional Net Savings Research (NEEP 2012),

[36] Most EE evaluations have a first step that verifies the initial estimates of GS used in the EE program planning process and documented through the program tracking system. Typically, infield research is conducted to validate these initial GS estimates. A realization rate (RR) is produced that is the ratio of the GS found in the field work to the initial GS values. The estimated RR is applied to the initial GS to produce "adjusted GS" value.

SELECT POLICY APPLICATIONS	ADJUSTED[36] GROSS SAVINGS (GS) ESTIMATES		NET SAVINGS (NS) ESTIMATES	
	Prospective	Retrospective	Prospective	Retrospective
	lost margins by reducing the likelihood of after the fact, unexpected adjustments in the calculation of lost revenues and margins.	that have decoupling of revenues. It is relevant for utilities that have other methods in place for lost margin recovery. This can result in lost margins being higher or lower than expected when programs were planned and targets set.	with lost margins by reducing the likelihood of after the fact, unexpected adjustments.	that have decoupling of revenues. It is relevant for utilities that have other methods in place for lost margin recovery. This can result in lost margins being higher or lower than expected when programs were planned and targets set
4. Incentives – Performance or shared savings	No surprise adjustments	There is a risk that surprise adjustments can act as a disincentive and adversely impact planning	No surprise adjustments; may increase consistency between program planning and delivery	There is a risk that surprise adjustments can act as a disincentive and adversely impact planning

The following points summarize recent discussions around the use of evaluated GS and NS prospectively versus retrospectively.

1. Prospective values provide more planning certainty for program administrators.
    - There is not a surprise adjustment made retrospectively; they know how they will be judged on both gross and net if prospective values are used.
    - Utilities receiving lost margins want to plan and do not want the values changed in what may seem like an arbitrary process.
2. There is a general move to use evaluated GS and NS prospectively to adjust programs and targets going forward, and not using these values to adjust prior years EE targets.

Where the jurisdiction allows for lost net revenues, regulators may not want utilities to be compensated for revenues that were not actually lost. This is not an issue for jurisdictions that use decoupling rather than lost revenues to treat the disincentive for a utility pursing EE due to load kWh sales on which they would have earned revenues and margins. Per Principle #4, "Apply the concept of symmetry," policymakers should consider both GS and NS in their decision of retrospective vs prospective application of impacts. Managing uncertainty is an issue in evaluations of both impacts.

The evaluation of gross savings algorithm assumptions, such as hours-of-use or other technology and use factors, can introduce risk and uncertainty for program administrators when these results are applied retrospectively, particularly if these assumptions vary substantially from what was used for program planning; and, used for the initially estimated targets, metrics, and incentives. NS decisions involve a parallel construct. A prospective application will use the NS results and in particular, the *reasons* for the NS results, to inform program design going forward. The standardized benefit-cost tests and in particular the Total Resource Cost test presented in the National Energy Action Plan (2008) calls for the use of net savings. Avoided costs are only accrued on NS values. Going forward, planning for cost effective programs can use the most current information on NS and programs based on prior best NS assumptions are not penalized. The NS values are only used on a going-forward basis.

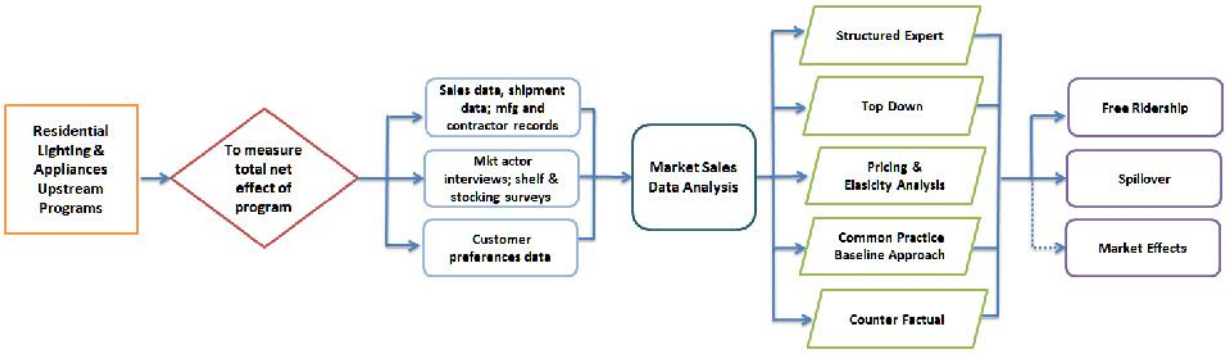
3.2.4 Step 4. Determine method or methods for NS research

Step 4 also considers Principle 3, *Align Methods, and Use with Policies*. Once the decisions are made on how NS research will be used, the methods to assess NS and the NS components can be determined. The Uniform Methods Project *Estimating Net Savings: Common Practices*, Section 4 points out that, "Programs operate in a particular context and choosing the appropriate evaluation methods requires balancing the advantages and disadvantages of each method. Thus, the UMP does not list recommendations for a preferred method for a given situation. Rather, it indicates which of the available methods are applicable to programs with specific features" (DOE UMP 2014). Further, how the NS research will be used should be considered, and often this research is not limited to a single use; that is, results may be intended to inform program design, assess cost effectiveness, and estimate portfolio level net savings to inform performance incentives and resource planning efforts. Therefore, it may be necessary to conduct NS research using different methods that produce different types of information.

To illustrate how context can impact methods used, the following figure from the supplemental section "Decision-Framework for Determining Net Savings" *(NEEP, 2014)*[37] provides a process flow for assessing net savings for an upstream residential lighting and appliances program. It would be quite costly to fully implement this approach, and often times not all data is available to support this robust of an analysis (such as sales and shipment data). However, given that upstream residential lighting program can provide a substantial contribution to the overall portfolio savings. Different methods for estimating NS will have different costs and timelines. Rather than try to collect primary data on participants and purchases, an approach that uses interviews with trade allies to develop market-based NS estimates may be used due to its lower cost and relatively easier application.

[37] See supplemental document #2 to this Guidance: "Decision-Framework for Determining Net Savings" Approach.

Figure 3-1. Net Savings Approach for Upstream Residential Lighting and Appliances Programs



Other alternative approaches may involve estimates of free ridership and spillover based on secondary research. *Principle 4. Apply the Concept of Symmetry* is also a consideration. As policymakers and stakeholders assess the various NS methods and components to be researched, it may be reasonable to determine that assessing only free ridership and not spillover or market effects is necessary, or prudent, for the current research effort. This may be due to limited funds available for research, or the timeframe in which research is to be conducted, or other factors. Focusing research on partial assessments can produce biased results. All available information, even if only based on judgment and subject to uncertainty, should be considered.

The table below lists questions to consider when assessing NS research methods.

Table 3-4. NS Research Methods, Uses, and Questions

Method	Typical Use	Question Examples
Stipulated, or deemed, values (NTG, FR, SO)	• Low impact programs that do not warrant much time and expense • During years in which the program or measure is not being assessed	1. How important is the program or measure to the portfolio? 2. Is the measure or program design new or 'standard'?
Survey-based approaches (including trade ally interviews)	• To provide individual estimates for FR, SO, and to some extent ME when used with other methods • Obtain program and measure level information	1. How will the research be used to inform program design? 2. Is participant contact data available? 3. Is it useful and prudent to research all components of net-to-gross? 4. If not all components will be included, how will excluded components be recognized?
Structured expert judgment, or Delphi panel	• Consolidating results from multiple methods to develop a consensus estimate • Programs with diverse and complex end uses or practice	1. What other research will be conducted in conjunction with this method? 2. How will confidence and precision requirements be addressed?

Method	Typical Use	Question Examples
Random Control Trials (RCTs) and quasi-experimental designs	• Programs with large treatment and control groups, such as behavioral-type programs	1. Was program implemented with RCT method in mind; that is, were treatment and control groups well designed? 2. Is high quality data available for treatment and control groups? 3. How will nonparticipant spillover be recognized or assessed?
Historical tracing, or case study	• Attribution analysis of major events, such as adoption of new building codes or policies and for very large custom projects • Market level or upstream EE programs	1. Are good project or program records available? 2. How will confidence and precision requirements be addressed?
Common practice baseline methods	• Upstream and market transformation programs	1. How will self-selection bias tackled? 2. How will nonparticipant spillover be recognized or assessed?
Top-down evaluations	• National or large regional (i.e., multistate) assessments	1. What information will be produced by these top-down models? 2. Are there a large number of cross-sections with varying levels of EE investment for estimation? 3. How does this information compare to what is produced by other methods?
Market sales data analysis, or cross-sectional studies	• Market level or upstream EE programs	1. Are applicable comparison area(s) available? 2. Is quality market data available? 3. Are additional methods needed to provide a full view?

3.2.5 Step 5. Determine the level of rigor required in the GS and NS research

The uses for the GS and NS estimates can impact the rigor required by policymakers. In this context, rigor is viewed as the overall accuracy of the estimate, i.e., how close is it to the true value.[38] The costs of research can increase exponentially as the confidence and accuracy requirements are increased. And, the targets for the rigor of the research can sometimes be beyond what the data can cost-effectively support. Therefore, establishing the level of rigor required can be tackled by considering the following questions:

[38] Rigor refers to the overall accuracy of the resulting GS and NS estimates. This overall accuracy is broader than assessing statistical confidence and precision from a designed study. It would also consider potential biases in the estimates and is meant to assess the needed reliability in the accuracy of the information to allow stakeholders to make good decisions regarding the application of GS and NS estimated values. For example, SEE Action (2012) defines accuracy as: A concept that refers to the relationship between the true value of a variable and an estimate of the value.

1. Applying Principle 2, *Aligning Methods and Use with Policy*, are there regulatory requirements for confidence and precision or other reliability statistics?
2. Does the type of research being conducted support sampling-based calculations of confidence and precision?
3. How important is the program to the portfolio: does the program contribute significantly to portfolio level savings?
4. Are program impacts large enough to support higher degrees of confidence and precision and accuracy?
5. Considering Principle 3, *Establish or Judge the Value of Information from Evaluation*, does a higher level of rigor warrant the additional cost to achieve the additional degree of accuracy and certainty?

3.2.6 Step 6. Determine the research timeframe

Principle 1. *Establish Common Understanding and Framework* includes discussion on the issue of timing and time-frame (short versus longer term) as this has an impact on how changes due to EE programs are assessed and how changes in the market are handled. For example, 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. On the other hand, program free ridership components might best be assessed close to the participants' decisions to participate in a program. Accurate assessment of spillover may require a bit of time to pass a bit later (perhaps a year) after the participants have had opportunities to make additional energy savings choices.

Consider the following questions when determining the research timeframe:

1. Is it possible that cumulative effects from multi-year programming exist and are substantial?
2. Is there baseline data and information, or interactive data and information, available than can inform the research?
3. Is it worth assessing free-ridership in the near term (a rapid feedback timeframe) and assessing spillover at a later point in time (for example, in 6 months to a year following actions under evaluation) to allow time for participants to take additional energy efficient actions?

3.2.7 Step 7. Complete a value of information analysis

Assess whether the value of estimating net savings exceeds the cost. Each of the prior steps are factors in assessing the value of the information as each decision has an associated cost – unless it is decided that research is not required. For example, setting confidence and precision targets based on the importance of the program or program components within a portfolio or even at an overall portfolio level can ensure evaluation budgets are allocated more meaningfully. More evaluation resources should be allocated to programs which are relatively more important to a portfolio and around which there is greater uncertainty. Also, considering at what level (program, portfolio, regional, etc.) the information is most useful based on how results will be used can help inform the cost versus value discussion and assessment. Table 3-5 summarizes several issues that can impact the cost of the NS research.

Table 3-5. Impacts to Cost of Research and Questions to Consider

Impacts to Cost of Research	Question Examples
The validity of the research results	1. Given the data available and funding set aside for research, is the research likely to yield defensible and reliable results?
The reasons for conducting the research	1. Is there flexibility in whether or not research is required? 2. Does the research support planning goals and cost effectiveness testing? Will results affect measures and programs offered? 3. Does the research inform performance contracts and incentives? Tracking towards goals? 4. Does it support lost revenue recovery assessments? 5. Does the research inform resource planning?
The level and type of research to be conducted	1. At what level is research needed…measure, program, portfolio, and/or region? 2. What type of research will provide the desired information? 3. Will the data available to support the type of research desired?
The level of rigor for confidence and reliability	1. What is the required or desired confidence and precision? Are there other statistical requirements? 2. Will the data available to support the research effort support the required or desired level of rigor? 3. If at measure or program level, what is the importance of the measure or program within the portfolio? Does it contribute significantly to savings in current evaluation or future evaluation planning period? 4. If at measure or program level, will the measure or program continue to be offered or is it scheduled for decommissioning?
The historical performance of the measure or program	1. Where is the program or measure in the expected 'life-cycle' - is the program or measure a new offering, has the program matured, or is it somewhere in-between? 2. Has the program or measure demonstrated high free ridership or is free ridership trending up?

3.2.8 Step 8. Ensure transparency by documenting GS and NS decisions and results

To document the choices and decisions in developing the NS research policy, the following Gross and Net Savings Policy Decision Framework Template v1 has been developed (see Section 3.3). This is a preliminary version designed to facilitate application of the principles in this guidance. While it can help ensure that there is a common understanding of the concepts and terms, development of a more

complex framework that brings forward key considerations for specific decisions or policies is beyond the scope of this document.[39]

3.3 Gross and Net Savings Policy Decision Framework Template, v1

This section presents a GS and NS decision framework template that can be used to document assumptions and decisions, supporting the Principle 5, Ensure Transparency. Additionally, it is designed to facilitate the consideration of the other five principles set out in Chapter 2.

Portfolio/ Program/ Other		**Date of template completion**	
		Assessment completed by	

Step 1. How are key terms defined?			
Term	**Definition**	**Question**	**Response**
1a. Conceptual gross savings			
1b. Operational gross savings		What adjustments are used?	
1c. Conceptual net savings			
1d. Operational net savings		Is free ridership included?	
		Total free riders?	
		Partial free riders?	
		Deferred free riders?	
		Is spillover included?	
		Like participant spillover?	
		Unlike participant spillover?	
		Inside participant spillover?	
		Outside participant spillover?	
		Nonparticipant spillover?	
		Are market effects included?	
		Are ME clearly distinguishable from SO?	
1e. Operational gross baseline		What adjustments are made to gross baseline?	
		Are adjustments included in the tracking system?	
1f. Operational net baseline		Are adjustments to gross baseline identifiable and tracked?	
1g. Other?		Are there other factors pertinent to the jurisdiction that require a common definition?	

[39] Development of a more complex framework template would benefit from input from a committee of policymakers and other stakeholders involved in each key decision point. The current product could serve as a starting point for further development.

Step 2. Will GS and NS results be applied retrospectively or prospectively, and to what savings value(s)?			
Savings Value	**Retrospective**	**Prospective**	**Reason or Context for Decision**
Gross savings, unverified			
Gross savings, verified			
Net savings, ex ante			
Net savings, ex post			

Step 3. Will NS research be used for:		
Application	**Response**	**Reason or Context for Decision**
2a. Programmatic design		
2b. Cost effectiveness testing		
2c. Tracking towards goals		
2d. Lost revenue recovery		
2e. Performance incentives		
2f. Resource planning and load forecasting		
2g. Integrating EE resources into distributed energy resources (DER)		
2h. Other?		

Step 4. What is the method for determining NS?			
Method	**Question**	**Responses**	**Reason or Context for Decision**
Stipulated, or deemed, values (NTG, FR, SO)	1. How important is the program or measure to the portfolio? 2. Is the measure or program design new or 'standard'?		
Survey-based approaches (including trade ally interviews)	1. How will the research be used to inform program design? 2. Is participant contact data available? 3. Is it useful and prudent to research all components of net-to-gross? 4. If not all components will be included, how will excluded components be recognized?		
Structured expert judgment, or Delphi panel	1. What other research will be conducted in conjunction with this method? 2. How will confidence and precision requirements be addressed?		
RCTs and quasi-experimental designs	1. Was program implemented with RCT method in mind; that is, were treatment and control groups well designed? 2. Is high quality data available for treatment and control groups? 3. How will nonparticipant spillover be recognized or assessed?		
Historical tracing, or case study	1. Are good project or program records available? 2. How will confidence and precision requirements be addressed?		
Common practice baseline methods	1. How will self-selection bias tackled?		

Step 4. What is the method for determining NS?			
Method	**Question**	**Responses**	**Reason or Context for Decision**
	2. How will nonparticipant spillover be recognized or assessed?		
Top-down evaluations	1. What information will be produced by these top-down models? 2. Are there a large number of cross-sections with varying levels of EE investment for estimation? 3. How does this information compare to what is produced by other methods?		
Market sales data analysis, or cross-sectional studies	1. Are applicable comparison area(s) available? 2. Is quality market data available? 3. Are additional methods needed to provide a full view?		

Step 5. Determine net-to-gross research level of rigor required	
Question	**Response**
1. Are there regulatory requirements for confidence and precision or other reliability statistics?	
2. Does the type of research being conducted support sampling-based calculations of confidence and precision?	
3. How important is the program to the portfolio: that is, does the program contribute significantly to portfolio level savings?	
4. Are program impacts large enough to support higher degrees of confidence and precision?	
Decision	
Reasoning	

Step 6. Determine NS research timeframe	
Question	**Response**
1. Is it possible that cumulative effects from multi-year programming exist?	
2. Is there baseline data and information, or interactive data and information, available than can inform the research	
3. Have there been changes to the program design, delivery, and/or market that might have affected prior net savings estimates?	
Decision	
Reasoning	

Step 7. Value of Information Assessment		
Impacts to Cost of Research	**Question**	**Response**
The reasons for conducting the research	1. Is there flexibility in whether or not research is required? 2. Does the research support planning goals and cost effectiveness testing? Will results effect measures and programs offered? 3. Does the research inform performance contracts and incentives? Tracking towards goals? 4. Does it support lost revenue recovery assessments? 5. Does the research inform resource planning?	
The level and type of research to be conducted	1. At what level is research needed…measure, program, portfolio, and/or region? 2. What type of research will provide the desired information? 3. Will the data available to support the type of research desired?	
The level of rigor for confidence and reliability	1. What is the required or desired confidence and precision? Are there other statistical requirements? 2. Will the data available to support the research effort support the required or desired level of rigor? 3. If at measure or program level, what is the importance of the measure or program within the portfolio? Does it contribute significantly to savings in current evaluation or future evaluation planning period?	

Step 7. Value of Information Assessment		
Impacts to Cost of Research	**Question**	**Response**
	4. If at measure or program level, will the measure or program continue to be offered or is it scheduled for decommissioning?	
The historical performance of the measure or program	1. Where is the program or measure in the expected 'life-cycle' - is the program or measure a new offering, has the program matured, or is it somewhere in-between? 2. Has the program or measure demonstrated high free ridership or is free ridership trending up?	
Decision		
Reasoning		

4. References

CPUC 2002. California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects, July 2002. http://www.calmac.org/events/SPM_9_20_02.pdf.

CPUC 2007. SPM Update -- Standard Practice Manual, Energy Efficiency Policy Manual, Version 3.1 (Updated December 20, 2007) Docket: R.06-04-010. http://www.calmac.org/events/Policy_Manual_V3_1.pdf.

CPUC, 2015. "Uncertainty Analysis to Support the 2016 ESPI Uncertain Measures List," October 29, 2015. See Document Memo at http://www.cpuc.ca.gov/General.aspx?id=4137 .

DOE UMP 2014. National Renewable Energy Laboratory (NRLEL), "The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, Chapter 23: Estimating Net Savings: Common Practices," September 2014. http://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

EPA 2008a. Energy Efficiency Program Impact Evaluation Guide: A resource of the National Action Plan for Energy Efficiency (NAPEE), 2008. https://www.epa.gov/energy/model-energy-efficiency-program-impact-evaluation-guide.

EPA, 2008b. *National Action Plan for Energy Efficiency: Understanding Cost-Effectiveness of Energy Efficiency Programs, 2008. EPA/DOE. https://www.epa.gov/energy/understanding-cost-effectiveness-energy-efficiency-programs*.

EPA 2014. Environmental Protection Agency, "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units," June 18, 2014. https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating.

EPA 2015a. Environmental Protection Agency, "The Clean Power Plan," October 22, 2015. http://www2.epa.gov/cleanpowerplan.

EPA 2015b. Environmental Protection Agency, "Draft Evaluation, Measurement and Verification Guidance for Demand-Side Energy Efficiency," August 3, 2013. http://www2.epa.gov/cleanpowerplantoolbox/draft-evaluation-measurement-and-verification-guidance-demand-side-energy.

Eto, J.; Prahl, R.; Schlegal J. A Scoping Study on Energy-efficiency Market Transformation by California Utility DSM Programs. Lawrence Berkeley National Laboratory, 1996. http://emp.lbl.gov/sites/all/files/lbnl%20-%2039058.pdf .

IESO, 2015. Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide, Independent Electricity System Operator, March 2015. http://www.powerauthority.on.ca/sites/default/files/conservation/CDM-EE-Cost-Effectiveness-Test-Guide-v2-20150326.pdf.

IESO/OPA 2015. Ontario Power Authority, "*Evaluation, Measurement and Verification (EM&V) Protocols and Requirements* (EM&V Protocols v. 2.0)", Ontario, Canada, April 2015. http://www.powerauthority.on.ca/sites/default/files/conservation/Conservation-First-EMandV-Protocols-and-Requirements-2015-2020-Apr29-2015.pdf.

Ignelzi, P. et al. (2012). "Are Free-Riders Actually a Good Thing? "International Energy Program Evaluation Conference, Rome, Italy, 2012. http://www.iepec.org/conf-docs/papers/2012PapersTOC/papers/099.pdf.

Mahone, D., "Free-Ridership as a Way to Kill Programs – How Evaluation Policies Can Frustrate Efficiency Goals", International Energy Program Evaluation Conference, Boston, 2011. http://www.iepec.org/conf-docs/papers/2011PapersTOC/papers/054.pdf.

National Energy Action Plan (2008). "Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers," A Resource of the National Action Plan for Energy Efficiency, U.S. EPA and U.S. DOE, November 2008. https://www.epa.gov/sites/production/files/2015-08/documents/cost-effectiveness.pdf.

Navigant Consulting (2012), "Custom Free Ridership and Participant Spillover Jurisdictional Review," Prepared for the Sub-Committee of the Ontario Technical Evaluation Committee, Ontario, Canada, May 2012. http://www.ontarioenergyboard.ca/documents/TEC/Evaluation%20Studies%20and%20Other%20Reports/Ontario%20NTG%20Jurisdictional%20Review%20-%20Final%20Report.pdf.

NEEP Net Savings Webinar (2015a), "Net Savings Part 1: Fundamentals, Current Practice, Issues, & Challenges", June 25, 2015. http://www.neep.org/sites/default/files/Webinar-%20Net%20Savings%20Part1-%20Fundamentals%2C%20Current%20Practice%2C%20Issues%20and%20Challenges.pdf.

NEEP Net Savings Webinar (2015b), "Net Savings Part 2: Trends & Case Studies", July 7, 2015. http://www.neep.org/sites/default/files/Microsoft%20PowerPoint%20-%20Regional%20EMV%20Forum%20Webinar2__v02_TOTAL_0.pdf.

NEEP 2010. NMR Group, Inc. and Research Into Action, Inc., "Net Savings Scoping Paper," prepared for Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, November 13, 2010. http://www.neep.org/net-savings-scoping-paper-1.

NEEP 2012. NMR Group, Inc. and Research Into Action, Inc., "Regional Net Savings Research, Phase 2: Definitions and Treatment of Net and Gross Savings in Energy and Environmental Policy," prepared for Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, December 4, 2012. http://www.neep.org/net-savings-research-phase-2-0.

NEEP 2013. Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, "Model EM&V Methods Standardized Reporting Forms," 2013. http://www.neep.org/initiatives/emv-forum/model-emv-methods-standardized-reporting-forms.

NEEP 2014. Synapse Energy Economics, Inc. "Cost-Effectiveness Screening Principles and Guidelines," prepared for Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, November 2014. http://www.neep.org/file/2873/download?token=f4VbVWAH.

NEEP 2016. "NS and GS -- Current and Evolving Policies and Issues", April 2016.

NMR 2014b. NMR Group, Inc., "Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs," prepared for the Massachusetts Electric and Gas Program Administrators, November 2014.

NEEP, 2014. Johnson Consulting, "Decision Framework for Determining Net Savings Approaches," prepared for Northeast Energy Efficiency Partnerships Regional Evaluation, Measurement and Verification Forum, September 2014.

NY PSC 2015. State of New York Public Service Commission, "Order Adopting Regulatory Policy Framework and Implementation Plan," February 26, 2015. http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={0B599D87-445B-4197-9815-24C27623A6A0}.

NY PSC 2015b. State of New York Public Service Commission, "Staff Proposal: Distributed System Implementation Plan Guidance," October 15, 2015. http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={F3793BB0-0F01-4144-BA94-01D5CFAC6B63}.

Ridge, R, et al., "Gross Is Gross and Net Is Net: Simple, Right?", International Energy Program Evaluation Conference, Chicago, 2013.

Rufo, Mike (2015), "Ew Gross! Cleaning Up Gross Baselines," International Energy Program Evaluation Conference, Long Beach, 2015. http://www.iepec.org/wp-content/uploads/2015/papers/106.pdf.

Sebold, F.D.; Fields, A.; Skumatz, L.; Feldman, S.; Goldberg, M.; Keating, K.; Peters, J. (2001). A Framework for Planning and Assessing Publicly Funded Energy Efficiency, 2001. www.calmac.org/events/20010301PGE0023ME.pdf.

SEE Action 2012. Schiller Consulting, Inc., "Energy Efficiency Program Impact Evaluation Guide," prepared for State & Local Energy Efficiency Action Network, December 2012. http://www4.eere.energy.gov/seeaction/system/files/documents/emv_ee_program_impact_guide_0.pdf.

Violette et al., "Final Report: Iowa Energy-Efficiency Net-to-Gross Report, Prepared for: Iowa Utility Association and the Oversight Committee," by Navigant Consulting, June 2015.[40] **https://efs.iowa.gov/cs/groups/external/documents/docket/mdax/mjax/~edisp/1201492.pdf.**

[40] Other links to this work including the Commission Order and comments by parties can be found at:
Commission Order:
https://efs.iowa.gov/cs/groups/external/documents/docket/mdax/mziy/~edisp/1322686.pdf
Comments by Parties:
https://efs.iowa.gov/cs/groups/external/documents/docket/mdax/ndy3/~edisp/1467318.pdf
https://efs.iowa.gov/cs/groups/external/documents/docket/mdax/ndy3/~edisp/1467085.pdf

Wirtshafter, R. et al., "The Regulatory Relationship between Free Ridership and Equity for Public Goods Programs." ACEEE Summer Study, Pacific Grove, 2012. http://aceee.org/files/proceedings/2012/data/papers/0193-000366.pdf.

https://efs.iowa.gov/cs/groups/external/documents/docket/mdax/ndy2/~edisp/1466889.pdf.