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STATE OF IOWA
DEPARTMENT OF COMMERCE
BEFORE THE IOWA UTILITIES BOARD

IN RE: INTERSTATE POWER AND LIGHT COMPANY	DOCKET NO. EEP-2012-0001
MIDAMERICAN ENERGY COMPANY	DOCKET NO. EEP-2012-0002
BLACK HILLS/IOWA GAS UTILITY, LLC, d/b/a BLACK HILLS ENERGY	DOCKET NO. EEP-2013-0001

FINAL REPORT

The Office of Consumer Advocate ("OCA"), a division of the Iowa Department of Justice submits this Final Report with the consent of Interstate Power and Light Company ("IPL"), Black Hills Energy ("BHE"), MidAmerican Energy Company ("MEC"), and the Iowa Environmental Council and the Environmental Law and Policy Center (collectively "Environmental Intervenors") pursuant to Iowa Utilities Board ("Board") orders approving settlements in the above-captioned dockets.

The Iowa Administrative Code requires utilities to "estimate gross and net capacity and energy savings, accounting for free riders, take-back effects, and measure degradation." (199 IAC 35.8(2)"*c*"). Historically, utilities have met this requirement in energy efficiency plans by relying on a deemed ratio of 1.0. The Board, in its most recent orders approving the latest electric and natural gas energy efficiency plans, agreed that a report about net-to-gross ("NTG") policy would be beneficial to the Board, the utilities, and stakeholders by providing a more

complete and accurate analysis of whether it is beneficial, given Iowa's regulatory regime and the design of energy efficiency plans and possible implementation framework.

In MidAmerican Docket No. EEP-2012-0002, the Board stated in its final order:

> The Board finds the approach outlined in Appendix 1 of the Settlement Agreement (M&V Plan, p.6) is reasonable and will ultimately provide more complete and accurate information regarding net-to-gross in Iowa. . . . The settlement provisions on net-to-gross that include a collaborative process are reasonable and will be approved. Under settlements reached in the various energy efficiency plan dockets, all investor-owned utilities will participate in the net-to-gross collaborative, which should result in a better product than if each utility proceeded independently.

In Interstate Power & Light Docket No. EEP-2012-0001 and Black Hills Energy Docket No. EEP-2013-0001, the IUB found the settlement provisions providing for a collaborative report of net-to-gross to be similarly reasonable.

Accordingly all three investor-owned utilities, the OCA, and the Environmental Intervenors participated in a collaborative process resulting in the attached Final Report from Navigant Consulting which provides information to help make informed decisions on the future application of NTG in energy efficiency programs in Iowa.

The collaboration involved a process that began by forming an Oversight Committee that included the investor-owned utilities, the OCA, and the Environmental Intervenors and outlining the Oversight Committee's desired study outcomes. These were included in a Request for Proposals ("RFP") and issued by the Iowa Utility Association ("IUA") on behalf of the Oversight Committee. The Oversight Committee received and reviewed a total of seven proposals, and interviewed three finalists in October, 2014. The Oversight Committee awarded Navigant the contract, and Navigant began work on the report in December 2014. The IUA participated in the Oversight Committee discussions and managed the contract with Navigant on

behalf of the Oversight Committee. In the first half of 2015, the Oversight Committee held several in-person and teleconference meetings with Navigant to manage the direction of the project.

Navigant provided the Oversight Committee with an initial draft report in July 2015 and members of the collaboration have discussed their opinions about Navigant's recommendations and initial plans for pursuing those recommendations. In particular, the Oversight Committee agrees with Navigant's recommendation that energy efficiency programs be divided into the following three categories: (1) programs that continue with a deemed NTG value of 1.0 due to low benefits and net savings, and where previous research suggests that the NTG value would be close to 1.0; (2) programs for which secondary research will be conducted to establish deemed values other than 1.0 because previous research indicates that 1.0 is not likely to be an accurate NTG value, but the expense of primary research is not justified; and (3) programs that contribute large savings to the utilities' energy efficiency portfolio and warrant the expense of primary NTG research. The Final Report identifies which programs fall into each of these categories for each of the utilities based on the cost-effectiveness of conducting primary research. The Final Report suggests that NTG can be addressed by adjusting net savings from gross savings with a ratio other than 1.0, as appropriate, as well as through adjustments in the savings calculation baseline for many programs or measures.

Throughout the process, participants focused on balancing the benefits of accurate NTG values with the cost-effectiveness of obtaining those values. The Oversight Committee continues to discuss strategies for researching and applying NTG values and hopes to arrive at a mutually agreeable method for a new and more accurate approach to NTG in Iowa.

WHEREFORE, OCA submits this Final Report with consent Interstate Power and Light Company, Black Hills Energy, MidAmerican Energy Company and the Environmental Intervenors for the Board's information and consideration.

Respectfully submitted,

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OFFICE OF CONSUMER ADVOCATE

ATTACHMENT

Final Report

Iowa Energy-Efficiency Net-to-Gross Report

Prepared for:
Iowa Utility Association and the Oversight Committee

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Executive Summary

A deemed net-to-gross (NTG) value of 1.0 for all energy efficiency programs has been in place in Iowa for more than a decade, supported by periodic secondary research efforts. The Iowa Utilities Board (Board) in its most recent orders approving the Alliant Energy, Black Hills Energy and MidAmerican Energy 2014-2018 Energy Efficiency Plans, also approved a collaborative process to "provide more complete and accurate information regarding net-to-gross in Iowa."[1] The collaborative process included an Oversight Committee that included representatives from the three investor-owned utilities (MidAmerican, Alliant Energy, and Black Hills Energy), the Iowa Office of Consumer Advocate, the Iowa Energy Center, the Environmental Law and Policy Center, and the Iowa Environmental Council.

The Iowa Utility Association contracted with Navigant Consulting, Inc. and Apex Analytics (the Navigant team) to conduct a new NTG study in 2015. The Navigant team's role was to provide the Oversight Committee with the information and context needed to make an informed choice on the future of NTG research and values in the state, and provide guidance and recommendations for developing an Iowa approach to applying NTG.

This study describes the landscape of NTG estimation methodologies currently in use across the country, provides context and guidance on which methods are most appropriate to Iowa programs, reviews the current state of NTG policies around the country, particularly in relation to Iowa's regulatory landscape, examines NTG research cost-benefit issues with a focus on potential net research benefits for specific Iowa utility programs, and provides options and recommendations for Iowa stakeholders in developing an Iowa-specific NTG approach .

The Navigant team conducted literature reviews, including NTG research reports, white papers, academic works, regulatory and legal filings. Additionally, the team conducted in-depth interviews with all three Iowa investor owned utilities, Alliant Energy, Black Hills Energy and MidAmerican Energy, in order to obtain the most current data and information on their energy efficiency and demand-side management (DSM) portfolios and programs. Navigant also developed an analytical tool for estimating the net benefits of conducting NTG research for specific Iowa programs under varying real-world scenarios.

Alternative NTG Research Perspectives

Navigant identified three central perspectives on NTG research while gathering and analyzing information for this Iowa NTG research report. These perspectives, which are briefly summarized below, influence the views—and the desired NTG research agenda—of all industry professionals and policymakers working on this topic. Understanding these perspectives and how they are associated with the views of the various Oversight Committee members, provides important contact for our findings and recommendations.

[1] State of Iowa Department of Commerce Utilities Board, MidAmerican Energy Company Docket Number EEP-2012-0002, Final Order, issued December 16, 2013; State of Iowa Department of Commerce Utilities Board, Interstate Power and Light Company Docket Number EEP-2012-0001, Final Order, issued December 2, 2013; State of Iowa Department of Commerce Utilities board, Black Hills/Iowa Gas Utility, LLC, dba Black Hills Energy, Order Approving Settlement, December 17, 2013.

What we term a *deemed perspective* is the first of these three views and most closely represents a viewpoint historically held by Iowa utilities. From a deemed perspective, the uncertainty associated with primary NTG research often outweighs its benefit, and adoption of deemed values based on secondary research is considered sufficient. Iowa utilities have used a portfolio wide deemed ratio of 1.0.

Another viewpoint, which has historically been held by Iowa's environmental and consumer advocacy stakeholders, is represented by what we refer to as the *resource perspective*. According to this perspective, primary research on net savings and NTG research – focusing on free ridership and spillover – is necessary to ensure the reliability of energy efficiency and DSM programs as a resource, to confirm they are generating the expected returns on investment for ratepayers, and to increase actual savings caused by the programs by informing program design and implementation changes.

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The *market perspective* is a final viewpoint. It holds the determination of specific net savings / NTG component values such as free ridership and spillover are of secondary importance to understanding how utility programs operate and affect markets over time. The focus of this perspective is improved program designs and performance rather than NTG component values, though overall program-specific net savings and NTG values may still be obtained via market research. A market approach supports the development of a common practice baseline, an approach to NTG supported in the recently released Clean Power Plan (CPP)[2], which is discussed further below. Many Iowa stakeholders and members of the Oversight Committee find aspects of the market view appealing and most agree on the importance of understanding how utility programs operate and affect markets over time. The market perspective provides the common ground for developing an Iowa-specific NTG research agenda that would not necessarily be burdensome for Iowa utilities, nor a point of contention between utilities and other stakeholders, and would tie NTG research directly to CPP compliance through the potential to develop common practice baselines.

Findings and Recommendations for Consideration by the Oversight Committee

The Navigant team's research reveals that conducting primary NTG research will generally be cost-effective and appropriate for most of the larger energy efficiency programs, but there are many smaller programs where maintaining deemed a NTG value of 1.0, or other values based on secondary research, would be appropriate. Additionally, the findings suggest a flexible, common-sense approach which considers the perspectives described above as complementary rather than mutually exclusive. This "blended" view is most likely to facilitate cooperation and compromise between the various parties in agreeing upon a common NTG approach for Iowa.

Table 1 presents findings on the cost-effectiveness of conducting primary NTG research for various Iowa utility EE/DSM programs. Green rows indicate programs where primary NTG research is cost-effective across a range of scenarios. Orange rows reflect the opposite case, where primary NTG research is not cost-effective across a range of scenarios, and yellow rows reflect program where primary NTG research is generally not cost-effective, but may be cost-effective or nearly cost-effective, under certain specific scenarios. While the analysis behind these calculations is described in detail in Section 6, the overall finding is that the cost-effectiveness of conducting NTG research varies by program depending on the size of the program and its importance in terms of savings, the size of the utility, the variability of NTG values exhibited by different types of programs, and the potential for program design or implementation improvements based on better NTG information:

[2] Clean Power Plan, U.S. Environmental Protection Agency website: http://www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants

- For the larger utilities (MidAmerican and Alliant), this analysis shows that under most realistic scenarios, NTG research will be cost-effective for a large number of programs, though some programs rarely if ever warrant primary NTG research.
- By contrast, for small utilities (Black Hills) primary NTG research may not be cost effective for most programs under most realistic scenarios, unless coordination of research with larger utilities makes primary research more cost-effective.

It is important to note that even from a deemed perspective, programs that exhibit only marginally positive net research benefits may be candidates for assigning deemed values based on other jurisdictions' findings, which may can differ from 1.0, along with infrequent NTG research to validate or calibrate these values.

Table 1. Summary of High and Low Net Research Benefit Outcomes by Program

Alliant	Low Value of Primary NTG Research	High Value of Primary NTG Research
Commercial New Construction	$1,267,610	$3,813,441
Custom Rebates	$2,132,920	$7,316,725
Nonresidential Prescriptive Rebates	$290,280	$1,183,585
Residential Prescriptive Rebates	$142,990	$748,572
Appliance Recycling	$53,950	$259,222
Change-a-Light	($84,170)	$124,714
Home Energy Assessments	($67,730)	($51,548)
Black Hills Energy		
Residential Prescriptive	($56,730)	$76,637
Nonresidential Prescriptive	($89,270)	($4,885)
Residential New Construction	($55,330)	($12,505)
Nonresidential Custom	($54,610)	($25,766)
Nonresidential New Construction	($61,480)	($45,533)
MidAmerican		
Residential Equipment	$477,510	$1,736,588
Nonresidential Equipment	$1,039,560	$3,774,746
Commercial New Construction	$596,840	$1,887,601
Upstream Retail Lighting	$70,470	$558,255
Industrial Partners	$210,290	$608,815
Commercial Assessment	($18,640)	$106,763
Residential Assessment	($29,840)	$101,952

Where primary NTG research is warranted for many programs, Iowa stakeholders should consider implementing the market-based methods detailed in this report to gain a more comprehensive understanding of the larger energy efficiency programs, and the markets in which they operate. Market-

based NTG research approaches to programs should also be used to generate common practice market baseline values and/or NTG values. This is especially appropriate given that it will help utilities comply with the CPP, which suggests a common practice market baseline approach. Programs should be considered on an individual basis in determining the best NTG research approach and associated timing, and approaches and timing should be adaptable to changing markets and programs.

Navigant's research process for this report and attendant conversations with and between stakeholders have resulted in a better understanding of the NTG research issue overall and a high degree of agreement on a large number of NTG research issues. Identification of the three key perspectives on NTG research has provided a framework within which stakeholders can more easily define and articulate their values and priorities, and translate those into appropriate NTG research methods on a program-by-program basis. While some issues remain unresolved, conversations and dialogue between stakeholders have at least delineated their preferences, viewpoints and rationales, facilitating future compromise.

During the development of this research report, draft federal guidelines were released in a final version of the Clean Power Plan (CPP), and this, as well, has implications for potential Iowa NTG research approaches. While the CPP indicates that either Net or Gross approaches may be adopted where justified, it supports adoption of a common practice market baseline approach to NTG. This is an approach that has been pioneered and used for decades in the Pacific Northwest. A common practice market baseline approach effectively assumes a NTG value of 1.0, but reduces gross savings relative to existing code and minimum standard baselines. The common practice baseline approach is discussed in detail in Section 4 , along with other NTG methods.

Table 2 summarizes Navigant's recommendations to guide Iowa in moving forward with a uniform approach to NTG research.

Table 2. NTG Research Recommendations for Consideration by the Oversight Committee

Continue with a deemed NTG value of 1.0 for programs with low net benefits and savings, and where research has found programs are likely to have a NTG value close to 1.0.
Continue to apply state-of-the-industry net savings research methods to demand management programs such as demand response and direct load management programs, and for residential behavior programs such as Opower HERs.
Conduct secondary research to determine and establish deemed values other than 1.0 for programs where the costs of NTG research are not justified, but research shows a NTG value of 1.0 to be unlikely. These are generally the programs in yellow and orange in Table 1.
Conduct primary NTG research to estimate NTG values and/or common practice market baselines for key programs contributing large savings to the utility's DSM portfolio, using any or multiple methods outlined in this report. Most of these programs are represented in green in Table 1, though there may be additional programs for which the utility conducts primary research.
For programs warranting primary NTG research, market-based methods may be used as the primary research methodology, providing a comprehensive understanding of energy efficiency markets, facilitating development of common practice market baselines, and/or generating estimates of the FR and SO components of NTG values.
NTG research should begin immediately rather than during the next five-year planning cycle, and resulting NTG values should be applied prospectively. Particularly for the green programs in Table 1, research should begin during the current planning cycle to facilitate updates to the Iowa TRM and utility program designs prior to finalizing the next set of five-year plans.
NTG research should be conducted at a minimum once per each five-year planning cycle, but for programs contributing large savings to the portfolio, programs in rapidly changing markets, primary research may need to be conducted every 2 to 3 years and possibly more frequently. Ultimately, the research findings will provide guidance as to when additional / new NTG research should be conducted.
Periodic review of all established deemed NTG value should be conducted to ensure they remain relevant and appropriate.

1. Introduction

1.1 History and Context

Section 1 Contents:
• History and Context
• Research Goals and Objectives
• Organization of this Report

The Iowa Administrative Code requires utilities to "estimate gross and net capacity and energy savings, accounting for free riders, take-back effects, and measure degradation."[3] Historically, utilities have met this requirement in energy efficiency plans by relying on a deemed net-to-gross (NTG) ratio of 1.0.

This deemed value has existed for more than a decade, beginning with an initial IUA report prepared in 2002 that laid out recommendations for dealing with NTG issues in the Energy Efficiency Plans filed by the state's utilities for 2004-2008.[4] That report provided a comprehensive look at the current state and history of NTG policy, exploring existing methods and identifying common practices in use across the United States, while focusing on the competing forces of free-ridership and spillover. At that time, the report concluded that due to lack of consensus on best practices, problems with accuracy of measurement and practical time and expense constraints, Iowa was best served by adopting a deemed NTG value of 1.0, implying that the effects of free-ridership and spillover effectively cancel one another out.

Iowa's utilities revisited the issue of NTG policy in 2008 in advance of the 2009-2014 Energy Efficiency Plans.[5] While again addressing trends and recent approaches to NTG accounting, free-ridership and spillover, the second report broadened the scope of inquiry to include potential market effects. The 2008 IUA-sponsored report found that the majority of evaluation studies issued after 2002 still calculated NTG values close to 1.0. In line with the 2002 study, the report suggested Iowa's investor-owned utilities maintain the assumption of a NTG ratio of 1.0. However, the report concluded with the caveat that due to the existence of free-ridership, Iowa's utilities should continue to design incentive programs with the intention of discouraging free riders. The most recent iteration of the report, conducted in 2012 in advance of the 2014-2018 Energy Efficiency Plans, was similar in scope and findings to its predecessors.[6] Updated research and evaluation report findings were presented, but the conclusions drawn and recommendations made to Iowa's utilities and stakeholders were largely unchanged.

The Iowa Utilities Board (Board) in its most recent orders approving the 2014-2018 Energy Efficiency Plans developed by Alliant Energy, Black Hills Energy and MidAmerican Energy, described a collaborative NTG process. The Board stated that the Settlement Agreement establish a new collaborative process "will ultimately provide more complete and accurate information regarding net-to-gross in Iowa" and that the "settlements reached in the various energy efficiency plan dockets, all investor-owned utilities will participate in the net-to-gross collaborative, which should result in a better product than if each utility proceeded independently."[7]

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[3] 199 IAC 35.8(2) "c".

[4] Global Energy Partners and Quantec (2002). *Assessment of Energy and Capacity Savings Potential in Iowa, Volume II: Free Riders and Spillover—A Look Back, A Path Forward*.

[5] Quantec, Summit Blue Consulting, Nexant Inc., A-TEC Energy Corporation and Britt/Makela Group (2008). *Assessment of Energy and Capacity Savings Potential in Iowa, Volume II*.

[6] Cadmus (2012) *Assessment of Energy and Capacity Savings Potential in Iowa, Volume I*.

[7] This quote was taken directly from the MidAmerican docket, but Alliant Energy and Black Hills Energy's Order dockets are also cited here for reference. State of Iowa Department of Commerce Utilities Board, MidAmerican

The collaborative process includes an Oversight Committee that – on behalf of the state of Iowa, its utilities, and other interested parties – is charged in the Settlement Agreement with preparing "a report to the Board with recommendations regarding NTG policy and possible implementation framework."[8] In addition to the three investor-owned utilities, the Oversight Committee includes representative from the Iowa Office of Consumer Advocate, the Iowa Energy Center, the Environmental Law and Policy Center, and the Iowa Environmental Council.

1.1.1 National NTG Context

Iowa has many of the same NTG challenges and opportunities faced by states across the U.S. in determining how to approach (NTG) in a rapidly evolving political and regulatory landscape. Nationwide, over the past decade utility-run energy efficiency, demand response and behavioral programs have increased in number and prominence, ushering in renewed interest in estimating net savings through NTG research. The increasing prominence of demand-side programs contributed to publication of the Net Savings Uniform Methods Project (UMP) chapter, a national effort to detail current net savings estimation methods, to examine best practices for estimating savings from energy efficiency programs, and encourage application of methods consistent with these practices.

The EPA's Clean Power Plan (CPP), finalized in August of 2015, is another key political change increasing the importance of energy efficiency portfolios. The proposed CPP requires states to significantly reduce CO2 emissions from fossil fuel plants, while granting states some flexibility in meeting this mandate. Choices in energy efficiency portfolios and defensible savings may hold the key to many states, including Iowa, complying with these new regulations. [9]

1.2 Study Goals and Objectives

The Oversight Committee contracted with Navigant Consulting, Inc. and Apex Analytics (the Navigant team) to conduct a new NTG study in 2015. The Navigant team's role was to provide the Oversight Committee with the context and information necessary to make informed choices on appropriate NTG research agendas for Iowa and its utilities.[10] The goal was to provide the Oversight Committee with information needed for them to set policies consistent with goals and objectives regarding EE in Iowa.

At the onset of this assignment the Oversight Committee established the following study objectives:

Energy Company Docket Number EEP-2012-0002, Final Order, issued December 16, 2013; State of Iowa Department of Commerce Utilities Board, Interstate Power and Light Company Docket Number EEP-2012-0001, Final Order, issued December 2, 2013. State of Iowa Department of Commerce Utilities board, Black Hills/Iowa Gas Utility, LLC, dba Black Hills Energy, Order Approving Settlement, December 17, 2013.

[8] State of Iowa Department of Commerce Utilities Board, MidAmerican Energy Company Docket Number EEP-2012-0002, Final Order, issued December 16, 2013; State of Iowa Department of Commerce Utilities Board, Interstate Power and Light Company Docket Number EEP-2012-0001, Final Order, issued December 2, 2013. State of Iowa Department of Commerce Utilities board, Black Hills/Iowa Gas Utility, LLC, dba Black Hills Energy, Order Approving Settlement, December 17, 2013.

[9] Clean Power Plan, U.S. Environmental Protection Agency website: http://www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants.

[10] As cited in footnote 7, the MidAmerican Final Order docket states that Navigant's research fills the role of helping the Oversight Committee to prepare "a report to the Board with recommendations regarding NTG policy and possible implementation framework."

- Provide a review of current net-to-gross practices around the country, the relationship between different approaches to net-to-gross and policy objectives.
- Provide a description of trends in the use of net-to-gross ratios, particularly with respect to best practices for net-to-gross ratios in states with strong and effective energy efficiency programs and standards.
- Provide a review of the practical application of various methods used to estimate net- to-gross results.
- Provide an estimate of the cost of conducting net-to-gross analyses per customer and per percent of budgets.
- Describe the frequency required to maintain accurate net-to-gross ratios with respect to different energy efficiency measures.
- Describe the level of accuracy achieved through net-to-gross studies.
- Provide analysis as to whether and how use of net-to-gross might improve the design, cost-effectiveness, and confidence in reported savings of energy efficiency programs in general.
- Provide an Iowa-specific analysis as to whether net-to-gross ratios should apply to all measures or programs or whether certain measures or programs should be prioritized.

1.3 Organization of this Report

The remainder of this report is organized as follows:

- Section 2 - Iowa NTG Background
- Section 3 - New Perspectives on NTG, Attribution, and Research
- Section 4 - Review of Practical NTG Approaches, Best Practices, Trends and Methods
- Section 5 - State-Specific NTG Approaches, and Relationship to Policy Objectives and Perspectives
- Section 6 - Benefit / Cost Analysis of NTG Research
- Section 7 - An Iowa Research Agenda for Net Savings

2. Iowa NTG Background

Section 2 Contents:
• Statement of Issues and Settlement Agreement
• Outcomes of Settlement Relating to NTG
• Ongoing use of NTG by Iowa Utilities
• Iowa Utilities' Current EE Portfolios

The determination of net savings and/or NTG ratios is not a new issue to Iowa utilities and stakeholders. NTG has been considered by Iowa utilities both implicitly (in program and rebate design) and explicitly for many years. Iowa utilities use a portfolio-wide NTG value of 1.0, a practice currently in place in several other states. While Navigant holds that this portfolio-wide deemed approach is no longer appropriate by current industry standards, Iowa's historical use of a portfolio deemed value was based on secondary research, conducted during each planning cycle going back more than a decade, which found the portfolio-wide deemed value appropriate.[11] By contrast, utilities in many states employ primary research-based NTG estimation methods such as participant and trade ally surveys, structured expert judgement and historical tracing approaches, randomized controlled trials (RCTs) and billing analyses.[12] Each method has its place, and there is no one-size-fits-all approach to address NTG research questions.

This section provides context for recent and historical NTG dialogue in Iowa, describes how Iowa utilities arrived at the current state of NTG estimation, and identifies utility and stakeholder concerns and interests in moving forward with NTG research. The Navigant team contacted various members of the Oversight Committee, Alliant Energy, Black Hills Energy and MidAmerican Energy to collect relevant documents, briefings, testimony, reports and filings related to the utilities programs and NTG research in Iowa. [13] These and other documents are synthesized to provide needed background for the report and create a balanced view of the current state of NTG research in Iowa, while shedding light on the events leading to Iowa stakeholders' current investigation of NTG research options.

2.1 Statement of Issues and Settlement Agreement

In July of 2013, Iowa utilities, environmental and consumer advocacy groups, along with several other stakeholders, filed a Joint Statement of Issues before the Iowa Utilities Board, asking that the Board make a determination on a range of issues surrounding Iowa utilities' energy efficiency portfolios, practices

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[11] Global Energy Partners and Quantec (2002). *Assessment of Energy and Capacity Savings Potential in Iowa, Volume II: Free Riders and Spillover—A Look Back, A Path Forward*; Quantec, Summit Blue Consulting, Nexant Inc., A-TEC Energy Corporation and Britt/Makela Group (2008). *Assessment of Energy and Capacity Savings Potential in Iowa, Volume II*; Cadmus (2012) *Assessment of Energy and Capacity Savings Potential in Iowa, Volume I.*

[12] All these methods, and others, are described in Section 3.

[13] *MidAmerican Iowa Exploratory NTG Research: Background, Methodology, Results and Key Findings*, prepared by Tetra Tech, November 30, 2014; *The Assessment of Energy and Capacity Savings Potential in Iowa,* prepared by The Cadmus Group, February 28, 2012; *Energy Efficiency and Demand Response Potential for Iowa municipal Utilities, For the Years 2012 and 2018,* prepared by Energy Center of Wisconsin, June, 2009; State of Iowa Department of Commerce Utilities Board, MidAmerican Energy Company Docket Number EEP-2012-0002, Joint Statement of Issues, Filed July 29, 2013; State of Iowa Department of Commerce Utilities Board, MidAmerican Energy Company Docket Number EEP-2012-0002, Non-Unanimous Partial Settlement Agreement, filed August 26, 2013; State of Iowa Department of Commerce Utilities Board, MidAmerican Energy Company Docket Number EEP-2012-0002, Final Order, issued December 16, 2013; State of Iowa Department of Commerce Utilities Board, MidAmerican Energy Company

and planning. Some of the issues raised in the Statement which were pertinent to NTG research included:

- Whether a NTG value other than 1.0 should be considered for certain programs, and what the implications would be.
- Whether the utilities' Energy Efficiency Portfolios were cost-effective.
- Whether the utilities are achieving sufficient economic potential.
- Whether utility savings targets are appropriate.
- Whether utilities' energy efficiency programs provide optimal benefits to customers, and if additional performance-based criteria should be used to gauge optimal benefits and help to optimize cost-effective energy efficiency opportunities.

Consideration of these issues with respect to all three utilities ultimately resulted in a Joint Motion for Approval of Non-Unanimous Partial Settlement for Alliant Energy and MidAmerican Energy, and a Non-Unanimous Settlement for Black Hills Energy. The settlements were filed by the utilities, the OCA, the ELPC, the IEC and other stakeholders. As a result of the settlement process, a collaborative group was established to investigate NTG in Iowa, and Navigant was hired to provide research on NTG to help inform this collaborative effort.

2.2 Existing NTG Consideration and Research in Iowa

Iowa utilities have been implicitly considering NTG values in designing their programs since they began offering demand-side programs in the early 1990s. In adjusting these programs to move customers up the efficiency ladder and adjust rebate levels (examples include both residential or commercial prescriptive programs), Iowa utilities may *already be taking into consideration* issues such as free ridership (FR) and market effects (ME).

A more explicit example of how Iowa utilities are already considering net savings is in the case of demand response (DR), direct load control (DLC) and Home Energy Report (HER) programs. Typical savings estimation methodologies for DLC and DR programs use participants provide net rather than gross savings due to the use of control groups or control periods. Similarly, HER programs typically utilize a randomized controlled trial (RCT) design, again resulting in net savings estimates. Additionally, MidAmerican Energy has already undertaken NTG research for some of its programs in the previous planning cycle, between 2009 and 2013[14]. MidAmerican describes the purpose of this research as being to better inform Iowa stakeholders as to what NTG research entails and looks like in practice. From this perspective, MidAmerican's initial NTG research provides insights into the types of issues and concerns that will have to be dealt with in future Iowa NTG research efforts.

2.3 Iowa Utilities' Current EE Portfolios

Interviews with Alliant Energy, MidAmerican Energy and Black Hills Energy provided Navigant with an up-to-date perspective on their current energy efficiency portfolios, which programs are top priorities in terms of EE savings, recent changes to programs, and market and industry changes affecting program performance.

[14] Schuauer, Laura, "*MidAmerican Iowa Exploratory NTG Research: Background, Methodology, Results and Key Findings,*" Tetra Tech, November, 2014.

While each utility offers a wide variety of programs, residential and commercial prescriptive rebate programs remain the backbone of the utilities' EE portfolios.[15] Alliant Energy generates 24% of its annual electric savings and 49% of its annual gas savings through its residential and commercial prescriptive rebate programs. These programs provide 49% of MidAmerican Energy's electric savings 32% of its gas savings. Similarly, 67% of Black Hills total gas savings is generated through these programs. Other large programs include Alliant Energy's custom rebate program, MidAmerican Energy's new construction program, and Black Hills Energy's residential new construction program.

Despite a few large programs providing much of the savings, all three utilities offer a wide variety of energy efficiency programs to meet the various needs of their customers including new construction, lighting, energy assessment, low-income weatherization, agriculture, education, appliance recycling and other targeted energy efficiency programs. Though these programs do not contribute large savings to each utility's portfolio, the utilities and other Iowa stakeholders value these programs because they meet the varied needs of different customer segments.

While Iowa utilities' energy efficiency portfolios share many common characteristics, each utility's portfolio exhibits differences based on the needs of its customers. For example,

- Alliant Energy offers a commercial/industrial custom rebate program that accounts for 45% of its annual electric savings, whereas custom programs for the other two utilities are much smaller.
- Black Hills Energy provides gas only, and serves a smaller market than the other two utilities, and has a larger number of low-income targeted energy efficiency programs, including low-income weatherization, low-income energy education, low-income affordable housing and low-income multifamily efficiency improvement programs.
- MidAmerican has dedicated a large percentage of its total EE portfolio expenditures to meet the EE needs of commercial customers. Its Commercial Energy Solutions, Commercial New Construction and Industrial Partners programs account for roughly a quarter of total annual EE portfolio expenditures.

According to all of the utility interviews, their residential new construction programs have been heavily impacted by recent market and industry changes. Participation in these programs has been steadily and rapidly declining due to building code changes which have made program participation less profitable. These utilities have also work in cooperation to administer commercial new construction programs through the Weidt Group, which are largely standardized across utilities. This enables contractors and commercial customers to qualify for similar incentives through a uniform process across utility territories. Finally, due to the increasing prominence of lighting applications, particularly LEDs and CFLs, in prescriptive rebate programs, both Alliant Energy and MidAmerican have recently created

[15] Alliant Energy, Black Hills Energy and MidAmerican Energy all provided regulatory filing documents with the most up-to-date utility cost test values for Navigant to use as benefit inputs for each program. The source documents referenced for each utility are as follows: For Alliant Energy, we referenced the *Interstate Power and Light Company—2014-2018 Energy Efficiency Plan*, prepared for the IUB, Docket No. EEP-2012-0001, November 30, 2012. For Alliant Energy we also referenced the *IPL Energy Efficiency Plan—Compliance*, prepared for IUB, January 31, 2014, Corrected Revised January 25, 2013. For Black Hills Energy Navigant referenced the *Black Hills Energy—Energy-Efficiency Plan 2014-2018*, prepared for the Iowa Utilities Board (IUB), Docket No. EEP-2013-0001, April 1, 2013. For MidAmerican Energy Navigant referenced *MidAmerican Energy Company—2014-2018 Energy Efficiency Plan, Revised Volume II*, prepared for the IUB, Docket No. EEP-2012-0002, February 24, 2014.

upstream lighting programs as stand-alone programs outside the prescriptive programs they were formerly within.

Tables 3 through 5 present detailed information on the majority of EE/DSM programs offered by the three Iowa utilities, including information on the relative size of budget and savings for each program. These tables provide clarity on the relative size and importance of various programs to each utility's portfolio.

Programs have been color-coded in these tables to indicate whether or not NTG research is likely to be beneficial based on the Navigant team's industry experience.[16] Programs in green may potentially yield positive net benefits to conducting NTG research. Blue indicates programs for which net savings are already being calculated through impact evaluations. Programs in red are programs that seem unlikely to yield positive net benefits to conducting NTG research under almost any scenario. By their design and target customer group, these are more likely to have NTG ratios close to 1.0 (e.g., low income programs), or the programs don't claim energy or capacity savings. While the cost-effectiveness of conducting primary NTG research is analyzed in detail for each program in Section 6, the findings in Tables 3 through 5 present general findings on the types of program, by utility, which are generally expected to warrant NTG primary research, versus those that are not.

[16] A more detailed analysis of the cost-effectiveness of NTG research for each program is detailed in Section 6.

Table 3. Alliant Energy—Demand-Side Management Program Information

Portfolio Summary					
Programs	Total 5 Year Plan Program Budget	Program Budget as Percent of Total Portfolio Expenditure	Program Savings as Percent of Total EE Portfolio Electric Savings	Program Savings as Percent of Total EE Portfolio Gas Savings	Recent Changes to the Program
Appliance Recycling	$8,683,739	2%	7%	0%	No major changes for 8 or 9 years.
Change-a-Light	$12,562,177	3%	7%	0%	Now stand-alone program, previously part of prescriptive programs.
Commercial New Construction	$6,224,671	2%	8%	5%	Adoption of 2012 IECP.
Custom Rebates Program	$46,436,752	13%	45%	12%	No recent changes.
Home Energy Assessment Program	$16,595,359	4%	2%	15%	Offers two levels: basic and additional, at higher price.
Non-Residential Prescriptive Rebate	$44,093,861	12%	16%	32%	Added additional measures such as commercial food service
Residential Prescriptive Rebate	$65,209,023	18%	8%	17%	Discontinued all residential appliance rebates.
New Home Construction	$5,122,346	1%	0%	3%	Added HERS rating
Nonresidential Interruptible Program	$122,369,826	33%	NA	NA	
Residential Direct Load Control Program	$12,764,384	3%	NA	NA	
Agriculture	$4,537,592	1%	2%	2%	
Business Assessments Program	$5,365,189	1%	2%	2%	
Low Income Energy Wise Education/Energy Savers Program	$467,677	0%	0%	0%	
Low Income Multifamily and Institutional	$2,459,008	1%	0%	0%	
Low Income Weatherization	$16,154,632	0%	2%	10%	
Multifamily	$786,978	0%	0%	0%	

	Likely to experience net benefits from NTG research
	Already calculating net savings
	Unlikely to experience net benefits from NTG research

Table 4. Black Hills Energy—Demand-Side Management Program Information

Portfolio Summary				
Programs	Gas Only 5 Year Plan Program Budget	Program Budget as Percent of Total Portfolio Expenditure	Program Savings as Percent of Total EE Portfolio Gas Savings	Recent Changes to the Program
Nonresidential Custom Program	$289,500	1%	6%	Incentive target is 2-year payback, with a maximum of 50% of value.
Nonresidential New Construction Program	$1,086,800	4%	2%	Delivered with other utilities.
Nonresidential Prescriptive Program	$4,371,700	15%	21%	More cooking measures added; Some boilers under 300K Btu added.
Residential Evaluation Program	$3,496,500	12%	5%	Multifamily component is new. Has multiple tiers available now.
Residential New Construction Program	$2,660,900	9%	9%	Codes have changed, and no longer using HERS rating.
Residential Prescriptive Program	$12,956,800	45%	50%	Is a feeder program, required to get insulation incentives.
GIAC	$110,000	0%	-	
Low Income Affordable Housing	$534,300	2%	0%	
Low Income Energy Education	$117,800	0%	1%	
Low Income Multifamily Efficiency Improvements	$110,500	0%	0%	
Low Income Weatherization Program/Weatherization Team	$3,221,800	11.1%	2%	
Nonresidential Evaluation Program	$18,200	0%	0%	

	Likely to experience net benefits from NTG research
	Already calculating net savings
	Unlikely to experience net benefits from NTG research

Table 5. MidAmerican Energy—Demand-Side Management Program Information

Portfolio Summary					
Programs	Total 5 Year Plan Program Budget	Program Budget as Percent of Total Portfolio Expenditure	Program Savings as Percent of Total EE Portfolio Electric Savings	Program Savings as Percent of Total EE Portfolio Gas Savings	Recent Changes to the Program
Commercial Energy Solutions	$54,239,586	10%	5%	7%	New program offering. Changed from "Business Check" to increase attractiveness of program to mid-large buildings.
Commercial New Construction Program	$43,393,302	8%	12%	5%	Delivered with other utilities.
Industrial Partners Program	$39,803,537	8%	8%	2%	Recently rebranded, Energy Manager now assigned to individual commercial customers.
Nonresidential Equipment Program	$48,480,366	9%	23%	12%	Bringing in custom as its own track. Expanded to offer more kitchen measures, 15 new measures total.
Residential Assessment Program	$26,682,083	5%	1%	0%	Now all measures initiated through Assessment program are recorded in the Assessment program.
Residential Equipment Program	$114,749,062	22%	9%	35%	Requiring quality installations for HVAC equipment. Many appliances removed. Incentive levels increased.
Upstream Lighting	$13,978,913	3%	12%	NA	Recently offered as stand-alone program
Residential New Construction	$30,260,120	6%	2%	6%	Participation declining due to code impacts and market change
Nonresidential Load Management	$42,855,363	8%	NA	NA	
Residential Behavior Program	$9,465,000	2%	17%	16%	
Residential Load Management	$15,082,639	3%	NA	NA	
Agriculture Program	$1,051,137	0%	0%	0%	
Appliance Recycling Program	$10,545,792	2%	4%	4%	
Multifamily Program	$42,220,230	8%	4%	2%	
Nonresidential Low Income	$385,092	0%	0%	0%	
Residential HVAC Tune-up	$8,567,500	2%	0%	2%	
Residential Low Income Program	$19,673,381	3%	1%	3%	

	Likely to experience net benefits from NTG research
	Already calculating net savings
	Unlikely to experience net benefits from NTG research

3. New Perspectives on NTG, Attribution, and Research

The work on NTG methods and policies, given the historical and current context expressed by Iowa stakeholders, led to Navigant identifying three perspectives on net savings, attribution and research:

- Energy resource view
- Market view
- Deemed view

Section 3 Contents:
• Energy Resource View
• Market View
• Deemed View
• Blended Perspectives
• NTG Viewpoints in Iowa

These perspectives provide a convenient framework for characterizing the priorities and viewpoints of various Iowa stakeholders with respect to NTG research, both currently and looking forward. In addition, looking at these three views can result in a "blended" perspective that might be most appropriate for a state's policy or stakeholder group.

3.1 Energy Resource View

The first of these perspectives is what termed an energy resource view. It is perhaps the most dominant viewpoint, and describes the perspective that NTG research should focus on energy efficiency and other demand-side programs as resource investments that are similar to traditional supply-side resources. In this paradigm, program impacts are measurable in terms of both gross and net savings, akin to power plant operations, outages, etc.

The energy resource view tends to emphasize estimating net savings. The goals of this viewpoint are to achieve more certainty on the return the ratepayers are getting on their investments in energy efficiency and to increase savings caused by the programs. Though market effects may be considered from this perspective, the focus is on the magnitude of market effects and their influence on net savings.

This energy resource perspective can lead to NTG research being performed for selected programs that account for a large part of the overall portfolio savings, or for programs that may have undergone changes and updated information is needed. The rationale behind conducting frequent, regular NTG research on major programs is that if these programs or the markets in which they operate are changing over time, researched NTG values estimated in year 1 may no longer be accurate in the out years of a program plan. The objective is to treat demand-side program savings as a reliable resource. The more resource savings[17] (i.e., resources attributable to the program) at risk that might wrongly attributed to a program (down-side risk) or mistakenly not attributed to a program (upside risk), the greater the incentive to conduct research to pin down more accurate NTG values and reduce that risk.

[17] Resource savings are those saving attributable to the program, i.e., they would not have occurred if the program had not been offered. These savings include direct savings from customer participants, as well spillover savings that are attributable to the program, but are not directly captured in the program tracking system. This includes additional savings that program participants might take as a result of participating in the program, potential non-participant savings, and spillover in the market in terms of trade ally recommendations, stocking practices, and general knowledge regarding energy efficiency practices. These savings are often inconsistently defined in the literature, but generally have been termed spillover and/or market effects.

Consider, for example, a large utility's residential prescriptive rebate program, and suppose that program accounts for a third of all energy efficiency portfolio savings for the utility. In that case, if the utility assumes a NTG value of 1.0 when the true value is 0.7, there could be millions of dollars in program resource savings being wrongly attributed to the program. Those dollars also could be invested in programs or measures to generate more savings. Another way of looking at this from a resource perspective is that the utility's return on investment for that energy efficiency program is 30% lower than it believes. If the utility believes such a scenario is possible for some of its programs, and has a resource perspective, it will aim to conduct research often enough and in a rigorous enough manner to reduce that risk to an acceptable level.

3.2 Market View

The second NTG perspective Navigant has identified is a market view. This view places greater importance on examining the overall market while still recognizing the importance of achieving savings from EE programs and activities. From this perspective, NTG research should focus on understanding the markets in which energy efficiency and other demand-side programs operate, particularly the program's influence on the market, Rather than focusing exclusively on estimates of net savings, free ridership and spillover, a market view focuses on how the program affects the market, whether the program is working as intended, and alternate performance metrics in the form of sales and market share time series showing how energy efficiency programs contribute to changes in the market for energy efficiency. A common research approach from this perspective is to conduct market characterization studies focusing on trade ally practices, retail and distributor equipment stocks, the stock of knowledge related to energy efficiency technologies and practices among building managers, ESCOs and architecture and engineering (A&E) firms. Both common practice market baseline values and NTG values may be generated through market-based research. In light of recent CPP guidance supporting use of a common market baseline approach, a market-based research approach may be particularly valuable to Iowa utilities.

The goal from a market perspective is to understand energy efficiency markets as comprehensively as possible in relation to programs, and use this information to provide program design guidance. While common practice market baseline and NTG values may be produced with market-focused research, these should be complemented by other indicators to provide the larger view of the role of the program in the overall market. In the residential lighting market, for example, this entails understanding how sales of CFLs versus LEDs are shifting and how rapidly, which types of outlets different consumers purchase efficient bulbs from, how saturated is the market for these bulbs in different geographic regions, what trends do retailers see in the sales, prices and diversity of different types of efficient bulbs over time, how do retailers market bulbs and how are their marketing practices changing over time, and how do all of these factors relate to energy efficiency program design and delivery.

As another example, consider new home construction markets, where a market view will be concerned with understanding the interaction between program participation and building codes, changes in building codes over time, anticipated changes in the market for energy efficient construction materials and services, how the knowledge base regarding energy efficient technologies and practices among building managers, ESCOs and A&E firms is changing over time, how trade ally practices are changing over time, how the building stock and equipment stocks are changing over time, in relation to energy efficiency programs.

From the market vantage point, NTG research typically does not need to be undertaken on a yearly basis. A typical timeline for market characterization studies is bi-annually, though this varies by jurisdiction. More important efforts might be trade-ally and market-actor panels that are maintained over time to provide information on the role of the program in providing energy savings, but also on the role of the programs in the overall market.[18] The key is to conduct market characterization research often enough to develop a time series of indicators showing how energy efficiency programs contribute to changes in the market. In the case of many Iowa utilities, the market served by residential new construction programs has changed radically over the past decade, largely due to changes in building codes. A series of regular bi-annual market characterization studies spanning 15 years would paint a clear picture of the interaction between the market for energy efficiency in new home construction and utility new home construction energy efficiency programs. This would clarify how large a role utilities' energy efficiency programs have played in the evolution of this market over time, and help to correctly attribute changes in this energy efficiency market to utilities' programs.

3.3 Deemed View

A deemed perspective suggests that there is enough information in the market to estimate net savings ex ante by looking at current sales data, and from studies in other regions such that net savings is estimated at a level of accuracy acceptable to the stakeholders. This viewpoint may be driven by perceptions that NTG studies are expensive to conduct, are subject to biases, and do not add enough additional accuracy to the ex ante deemed estimates of net savings. From a deemed perspective it often makes more sense to lock in place a prospective NTG value for a program or a group of programs than to conduct research into net savings. A jurisdiction or utility with a deemed perspective may rely on the best NTG research available conducted elsewhere relating to programs or groups of programs in the portfolio, in lieu of conducting primary research to estimate NTG values. A deemed value may be established portfolio-wide, or on a program by program basis, though in Navigant's judgement a portfolio-wide deemed approach is no longer justifiable by current industry standards.

The deemed view holds that funding new NTG research is not warranted because these NTG values may be "close enough," despite the fact that the same inherent biases and precision issues may exist for other jurisdictions' NTG values. In other words, the perceived value of the increase in precision gained through conducting primary NTG research may be outweighed by the cost. Another framing of the idea of borrowing existing NTG values from other jurisdictions' research is that if you collect a large sample of researched NTG values for a given program, using the average of these values may help to converge on the true NTG value and eliminate some of the bias and imprecision of individual estimates through a triangulation-type approach.

An important caveat to the deemed approach is that a careful review of NTG values and their appropriateness to a program or group of programs is always in order. It is never justifiable to lock down a prospective NTG value for a program or group of programs without ever revisiting that value to assess appropriateness in the future. Market changes, technology changes and program changes may all cause formerly adequate NTG values to no longer be appropriate. In this case, even from a deemed perspective, periodic review and evaluation of prospectively deemed NTG values is always necessary. The amount of change in a market or program will generally dictate when and how often these periodic reviews should be conducted.

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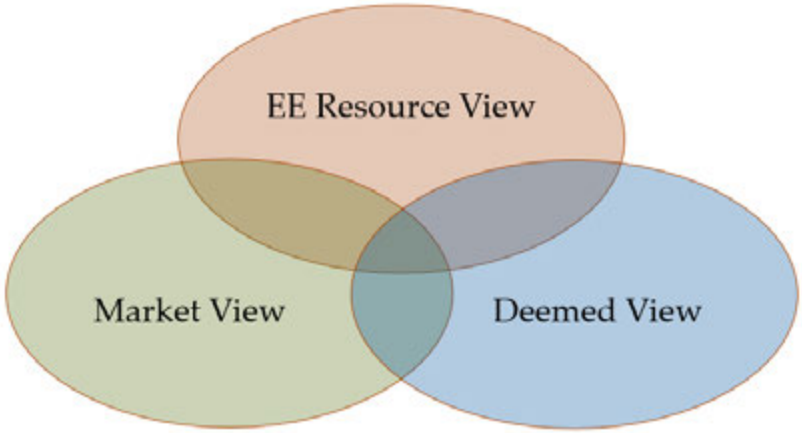
[18] One reason this might be selected as a policy view is to examine the impact of multiple programs targeting a similar market. These might be DOE programs, efforts by cities and regional organizations, and utility programs and activities.

3.4 Blended Perspectives

As shown in Figure 3-1, the energy resource, market and deemed viewpoints are not mutually exclusive. An individual jurisdiction or stakeholder may hold multiple or differing views depending on whether they are considering the entire energy efficiency portfolio versus a particular program, or the type of program and how important it is to the overall portfolio.

For instance, a stakeholder whose overall perspective is a market view may approach a new or large program in a utility's portfolio with a resource view to get a clear idea of what savings that program generates for the utility, and what return the utility is getting on its investment in that program. At the same time that stakeholder may view low-income and multifamily energy audit and insulation programs as unlikely to have a NTG that differs from 1.0, and subscribe to a deemed view for these programs. Other instances where viewpoints may overlap or merge is when looking at NTG research over different time periods. An individual may hold an energy resource view overall, for instance, but for the current year may feel that a deemed approach is more appropriate in order to sync up with planning cycles, process evaluations or other events. In many cases these perspectives are complimentary, and the best outcome for Iowa stakeholders with respect to developing a NTG research agenda will most likely involve a blending of views.

Figure 1. Three Perspectives on NTG Research



3.5 NTG Viewpoints in Iowa

The viewpoints described in this section provide a useful framework for stakeholders to reference when developing a NTG research agenda for Iowa. The utilities have historically demonstrated a deemed perspective on NTG with a portfolio-wide NTG value of 1.0. This NTG value was based on secondary research based on studies outside of Iowa showing that a portfolio-level value of 1.0 was sufficient.[19] By contrast, other Iowa stakeholders including environmental and consumer advocacy groups appear historically to have held a viewpoint better characterized by the energy resource perspective. This

[19] Global Energy Partners and Quantec (2002). *Assessment of Energy and Capacity Savings Potential in Iowa, Volume II: Free Riders and Spillover—A Look Back, A Path Forward*; Quantec, Summit Blue Consulting, Nexant Inc., A-TEC Energy Corporation and Britt/Makela Group (2008). *Assessment of Energy and Capacity Savings Potential in Iowa, Volume II*; Cadmus (2012) *Assessment of Energy and Capacity Savings Potential in Iowa, Volume I*.

perspective is focused on the ability to ensure that the ratepayers are realizing intended returns on investments in energy efficiency programs, that the savings provided by energy efficiency programs are able to be relied upon as a quantifiable and trusted resource, and that savings are maximized by the programs.

Importantly, through ongoing dialogue with utilities and stakeholders in this study, all parties voiced a strong interest in conducting market characterization research, and focusing on trade ally and other market actor experiences, in order to gauge the impact energy efficiency programs have on the market for energy efficiency in Iowa. This suggests that an emphasis on the market view, blended with both deemed and resource perspectives, as a potential avenue for the state of Iowa. We return to this theme in Section 7 of this report.

4. Review of Practical NTG Approaches, Best Practices, and Trends

4.1 Methods for Estimating NTG Values

Section 4 Contents:
• Methods for Estimating NTG Values
• NTG Best Practices and Research Trends
• Confidence, Precision, and NTG Algorithms
• Mapping Methods to Iowa Programs

There are a variety of methods for estimating NTG values, each of which is appropriate under different scenarios. The Uniform Methods Project (2014)[20] and the SEE Action Report and Guides (2012),[21] provide detailed listings of applicable methodologies currently employed and characterizes each in terms of difficulty, applicability and special considerations. The Navigant team augmented this core methods research by examining academic research papers, white papers and current industry standards and practice for estimating NTG ratios and net savings.[22]

Table 4 provides a brief overview of each of the nine major categories of NTG research methods, along with how they align to the NTG perspectives discussed in Section 3.[23] Each method has strengths and weaknesses, and situations where it is appropriate to use as an industry practice, though some of these methods are more commonly used than others. Surveys and structured expert judgment methods, for instance, are more commonly used than historical tracing or top-down macroeconomic approaches. It is common industry practice to use more than one method and triangulate the results, particularly for high priority program where the NTG research results may have larger implications. In this case, multiple methods listed in Table 4 may be used in tandem to research the NTG value for a single program.

High and low costs are approximated in Table 4 for each method, along with a brief summary explanation. All costs are for stand-alone studies, i.e., studies focused primarily on NTG, and not combined with process or impact evaluations. The low-cost end of the range represents industry practice, whereas the high-cost method generally adds in extra sample and data sources. High-cost approaches are usually applied to programs with high expected savings, and where there is uncertainty around NTG such that a more rigorous study is warranted. The higher-cost studies may also provide better information on specific components of NTG. All studies address free ridership, for example, and nearly all address participant spillover. Addressing non-participant spillover, however, may require

[20] Violette, Daniel M. & Rathbun, Pamela. (2014) "Methods for Determining Energy Efficiency Savings for Specific Measures." Chapter 17 in The Uniform Methods Project: Methods for Determining Energy efficiency Savings for Specific Measures. www.nrel.gov/docs/fy13osti/53827.pdf.

[21] *Evaluation, Measurement, and Verification of Residential Behavior-Based Energy efficiency Programs: Issues and Recommendations* (2012a), Todd, A., Stuart, E., Schiller, S. and Goldman, C., of Lawrence Berkeley National Laboratory (LBNL) for State and Local Energy Efficiency Action Network (SEE Action Network), 2012. SEE Action (2012b). *Energy Efficiency Program Impact Evaluation Guide*. Prepared by Steven R. Schiller, Schiller Consulting, Inc, 2012.

[22] *Does Net-to-Gross Really Matter? When Results Affect Cost-Effectiveness Analysis, It Just Might,* Lutz, T., Violette, D. and Rathbun, P., AESP 2015 Annual Conference, 2015; *Custom Free Ridership and Participant Spillover Jurisdictional Review,* prepared for Sub-committee of the Ontario Technical Evaluation Committee, by Navigant, May 29, 2013; *Saving Energy Cost-Effectively: A National Review of the Cost of Energy Saved through Utility-Sector Energy Efficiency Programs,* Friedrich, K., Eldridge, M., Kushler, M. Witte, P, and York, D., American council for an Energy Efficient Economy. Report Number U092, September, 2009; *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects,* California Public Utilities Commission, October, 2001.

[23] Appendix B contains additional methodological details from our presentations to the Oversight Committee in January, 2015.

additional effort in order to get an appropriate sample frame of non-participants, which are often not included in program records. Studying non-participant spillover and market effects may also require addition of another study method in tandem, such as Expert Judgment or Delphi studies. These additions result in higher study costs, but, on balance, these studies provide more information.

A research agenda meeting the needs of stakeholders will determine which of the methods within this range of costs will be selected. Through synergies with an evaluation effort that includes both process (with their attendant surveys[24]) and impact evaluation (where fast-feedback[25] surveys can be conducted of participants) components, the cost of NTG research can be reduced substantially. High-rigor/high-cost methods are often only applied to one or two programs in a utility's portfolio, in cases where the programs' importance justifies the cost. If savings for a particular program are expected to be subject to intense scrutiny, it may benefit the utility to utilize the most rigorous estimation option available, and may justify the added expense. By contrast, programs for which almost all prior research finds NTG values close to 1.0 are less likely to warrant high-rigor/high-cost research.

Table 6 presents the costs of the two types of studies: high-cost and low-cost. Actual costs will vary according to the particular characteristics of a program and the intended use of the information gathered. The cost figures presented in are suggestive, not absolute—they are intended to provide some context for the relative costs of different approaches.

[24] Implementing an NTG survey at the same time as a process evaluation is conducted can allow for some of the NTG questions to be integrated into some of the surveys used in the process evaluation. Usually, not all aspects of the NTG effort can be integrated, but this can reduce costs of survey methods by about 10% when the two efforts can be conducted at the same time.

[25] A fast-feedback study is where participants are given a short survey right after participation, usually focused on Free Rider questions, with possibly some participant spillover questions. Presenting this survey to participants right after participation is completed can reduce recall bias and can attain higher response rates. This method represents current industry practice and can be combined with an impact evaluation or integrated into implementation. It can reduce the costs of the study by 10% to 15% for the free rider factor.

Table 6. NTG Estimation Methods and Potential Costs

Method	Definition	Applicable NTG Research Viewpoints	Lower-Cost/Lower-Rigor	Higher-Cost/Higher-Rigor
Billing Analysis with Randomized Control Trial	Customers assigned at random to participant and control groups. Regression analysis of energy use over time estimates the net savings as the difference between the participants and controls.	Resource	$25,000 for basic analyses up and no primary data collection to assess combined offers.	$80,000, including follow-up surveys on actions taken, combined offers (e.g., lighting kits), and participation in other utility programs.
Billing Analysis with Quasi-Experimental Design	Customers generally self-select into the participant group, and the control group is developed as part of the evaluation research process. Net savings are estimates using regression analyses that are similar to those used in randomized control trials.	Resource	$20,000 if only billing data is used. If participant and non-participant control surveys are needed to gather additional control/independent variables, then $50,000.	If participation model were to be developed to address self-selection bias and future estimates of participation and participation drivers, the cost would be $75,000.
Survey-Based Approaches	Surveys are perhaps the most common method for estimating NTG ratios. Respondents may include participants, nonparticipants, trade allies, and other market actors, and the NTG ratio is determined through scoring algorithms deriving free ridership, spillover, and other market effects.	Resource and Market	Per program: Residential—approximately $40,000 for customer surveys, with related programs adding another $20,000. Commercial & Industrial (C&I)—approximately $60,000 due to complexity and need for telephone surveys. An additional related C&I program would add $30,000.	Good studies would not cost much more than the low-cost analysis for participants. Sample sizes could be increased to give greater precision and address drivers of NTG. However, to get at non-participant spillover, there may be a need to survey non-participating vendors and trade allies. The high-cost analysis for this type of effort would be $100,000 for a custom C&I program, with additional programs (e.g., new construction) adding $50,000. The higher cost is due to the difficulty in identifying nonparticipants and issues with response rates that influence survey design.
Common Practice Baseline	Common practice baseline approaches determine gross savings relative to what customers would have commonly done in the absence of the program, implying that it is also an ex ante estimate of net savings and that little (if any) further adjustments are necessary to obtain ex post net savings. It is important to recognize that common-practice baselines require that all measures in the program have to have a	Deemed or Market	This is done on a measure-by-measure basis and involves an analysis of the market through vendors, customers and trade allies such as specifying A&E firms. In some cases, work performed in a neighboring jurisdiction can be used. For 5 to 10 measures, the cost may be on the order of $100,000.	To apply this to both residential and C&I would require information on many energy-efficiency measures to establish current baselines of energy use. Usually this data is built up over time, but the entire database could cost $500,000 with ongoing costs of $100,000 per year in updates. This is in line with the ongoing work in the Pacific Northwest.

Method	Definition	Applicable NTG Research Viewpoints	Lower-Cost/Lower-Rigor	Higher-Cost/Higher-Rigor
	common baseline established for them, and costs quickly increase as the number of measures increase.			
Market Sales Data	Market sales data determines overall net effects of programs by comparing the pre- and post-program market shares in the program area to those in a non-program comparison area.	Market	This is uncertain, as it can be inexpensive if some sales data are available for the program ($25,000).	Some sales data from third party data consolidators can be expensive to purchase. In addition, if data are not available from states deemed as reasonable control states, it simply may not be possible. Cost can be $100,000 or more.
Top-Down Econometric Modeling	Top-down NTG econometric methods rely on aggregate (e.g., class and system) energy consumption data and an overall level of program efforts, which is generally measured in terms in program expenditure, to estimate total program savings across geographic areas such as utility service territories or states. It is important to recognize that this method does not provide program NTG information. Only NTG estimates for the entire portfolio of EE activities is provided. As a result, this is usually used as a companion study to assess EE in terms of the overall contribution to changes in energy use, and other studies provide program-specific information.	Resource	The challenge here is developing the data by census tract, zip code, or other geographic unit to allow for an adequate number of cross sections to be available for the analysis. This would cost at a minimum $125,000. Although if looking to pool muni data with investor-owned utility (IOU) data and believe that to be reasonable, the cost might be slightly lower. Recent work indicates that $125, 00 and up for these studies. Updates to these studies are cost less as only the incremental years' data need to be added to the data base.	To do this right could be very expensive and require a year or two of lead time to allocate energy-efficiency intensity measures to geographic areas. The cost for a data intensive top-down study within a single state might be as high as $500,000 to $1 million.
Structured Expert Judgment	Expert judgment approaches include Delphi Panels, but may also consist of expert judgment survey methods. They estimate NTG ratios by assembling an expert panel to estimate market effects for measures or programs through a structured process facilitating consensus.	Resource, Market, and Deemed	For both residential and C&I programs, this could be as low as $40,000.	A thorough analysis with participants combined from multiple utilities could be up to $80,000 to $100,000 using online Delphi panels.
Deemed Estimates	Deemed or stipulated NTG ratios have historically been used in Iowa (i.e., NTG = 1.0). They are determined in advance of the program, often by one or more of the above NTG approaches.	Deemed	Deemed values should never just be determined arbitrarily. A low-cost approach would be based on secondary data for the measures or programs where that research	Developing deemed values from a process similar to the common practice baseline approach (which are deemed in their own right, as they are ex ante but

Method	Definition	Applicable NTG Research Viewpoints	Lower-Cost/Lower-Rigor	Higher-Cost/Higher-Rigor
			exists. $50,000 would be a lower bound on investment in secondary research in order to provide sufficiently rigorous findings based on other jurisdictions.	based on more information) might cost as much as $500,000.
Historical Tracing	Historical tracing (case study) methods develop a chronological narrative of the various market influences, which can include programs, codes and standards, tax policy, and other market interventions, and establishing the relative influence of each as in determining the NTG ratio for the program(s) of interest.	Resource and Market	This is a combination of expert judgment and modeling—the low-cost option for residential homes might be $50,000, and $60,000 for commercial due to engineering modeling.	Complex programs that have been in place for a longer period of time would cost more, but not too much. $60,000 for residential program and $70,000 for C&I.

Source: Navigant Team research and the Uniform Methods Project, National Renewable Energy Laboratories (NREL), 2014, http://www.nrel.gov/extranet/ump/

4.2 NTG Best Practices and Research Trends

The remainder of this section reviews NTG approaches currently in use around the country, including information on best practices and trends in NTG estimation, and considers tradeoffs between accuracy, confidence and precision in NTG estimation. In response to feedback from the Oversight Committee, it also maps the NTG methods discussed above to specific programs for Alliant Energy, Black Hills Energy and MidAmerican Energy.

Each method commonly used in NTG research has circumstances and program types for which it is best suited:

- **RCTs** are generally considered, from the energy resource viewpoint, to be the gold standard of NTG estimation techniques and provide highly rigorous and defensible results. However, they require advance planning and are not always feasible given program and logistical constraints. Other methods—such as **market sales data** approaches—hold significant potential, particularly for those with a market perspective, but they are often difficult to perform due to limitations on the availability of relevant and complete sales data. Likewise, **top-down modeling** approaches are often too complex and involve too many difficult-to-derive inputs and assumptions to perform well. Furthermore, top-down methods cannot provide the necessary program-specific information to improve program performance from a market perspective or relevant information to use for program-specific deemed NTG estimates.
- On the other side of the spectrum, **survey-based** approaches are widely applicable, and if well-designed and well-implemented, provide reliable results from both resource and market perspectives.[26] Hence, they are widely used in NTG research. **Quasi-experimental design** approaches—particularly matching methods—are commonly used in place of an RCT for certain program types because they can produce similar results without the necessity of pre-planning and implementing a full RCT design. This is especially helpful in opt-in program situations where it is difficult or impossible to randomly assign customers to treatment and control groups.
- As discussed further below, **structured expert judgment** and **historical tracing** approaches can be used to assess select NTG components (e.g., spillover and market effects), but are usually paired with another approach to discuss free riders, spillover or market effects. Formal Delphi versions with expert panels have been used to address overall NTG in some states.
- **Common baseline approaches** are used in the Northwest, but are not common elsewhere. Still, a key insight from these approaches is that the definitions of baselines as defined in technical reference manuals (TRMs) can affect the way gross and net savings are estimated. The premise behind this method is that a "current" baseline can be estimated ex ante, i.e., before the program is implemented. These baselines are most often determined by the equipment that is typically purchased in the market at the current time, and defined as the

[26] Customer surveys are generally focused on free ridership and spillover, and tend to reflect an energy resource view of NTG. Conversely, distributor, retailer, contractor and other trade ally surveys have a market and market effects focus, and often ask respondents to provide sales, market share and price data, reflecting more of a market NTG view.

average energy efficiency of currently purchased equipment. A variant is to use the value of the highest efficient unit available, or at least a unit with higher-than-average efficiency.

One of the purposes of this research is to help Iowa utilities identify best practices and recent trends in NTG estimation. **Triangulation of methods** is regarded as current industry practice and is increasing in popularity due to its ability to enhance the rigor of results, and to better represent instances of overlapping energy resource and market NTG viewpoints.[27] This practice refers to using data from multiple sources and methods in order to limit bias and measurement error.[28] This methodology also affords evaluators the ability to weight the estimates produced by various methods used in tandem differently based on the perceived likelihood of bias and reliability of the estimates produced.[29]

As an example of triangulation, evaluators of a large residential equipment program that contributes a large portion of overall portfolio savings may want to approach NTG estimation using surveys of participants, trade allies, and contractors, in tandem with billing data analysis using a matching approach to create treatment and comparison groups. The matched billing data approach will provide a picture of differences between the purchases of program participants and nonparticipants, providing an alternate view of net savings in addition to survey-based free ridership, participant, and non-participant spillover findings. This approach also exemplifies the blending of market and resource views.

In order to explore non-participant spillover and longer-run market transformation effects, evaluators may additionally employ a structured expert judgment approach such as a Delphi Panel, in which experts provide input as to the likely state of the market and non-participant purchase decisions in a hypothetical world where the program is absent. These experts will also provide another source of information reinforcing free ridership and spillover findings. To complete the circle, the evaluators may choose to supplement the analysis with collection of market data, which also helps to solidify results on market effects and non-participant spillover. By analyzing changes in market sales before, during, and/or after the program, evaluators can infer how the program has influenced the trajectory of the market and created market effects. As with the first two methods, adding in this second pair of methods creates a triangulated approach using four different methods in tandem, and further blending resource and market views to create a more nuanced and holistic perspective appropriate to consideration of a key program within the utility's portfolio.

4.3 Confidence, Precision, and NTG Algorithms

The Navigant team and most industry NTG practitioners recognize that the accuracy and precision of results generated by a given method may differ based on how that method is implemented. For

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[27] Violette, Daniel M. & Rathbun, Pamela. Op Cit.

[28] Baumgartner, R. (2013). "Survey Design and Implementation Cross-Cutting Protocols for Estimating Gross Savings." Chapter 12 in *The Uniform Methods Project: Methods for Determining Energy efficiency Savings for Specific Measures*. *www.nrel.gov/docs/fy13osti/53827.pdf*.

[29] Megdal, L.; Patil, Y.; Gregoire, C.; Meissner, J.; Parlin, K. (2009). "Feasting at the Ultimate Enhanced Freeridership Salad Bar." Paper presented at the International Energy Program Evaluation Conference, Portland, OR. www.anevaluation.com/pubs/Salad%20Bar%202009%20IEPEC%20paper%205-12-09.pdf.

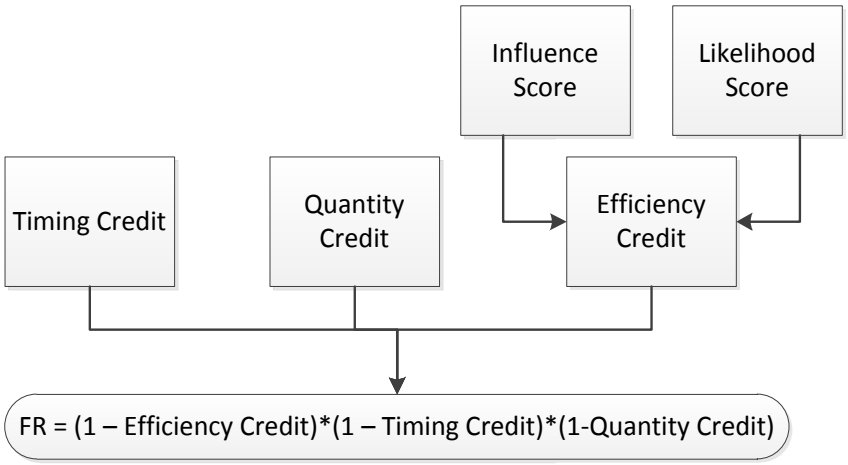
instance, if survey questions are poorly structured or a non-representative group of consumers is surveyed, surveys may provide biased (incorrect) results. Given a large enough sample size, these same surveys can have a high calculated confidence and precision for particular questions being asked. However, this is not the same as having the same degree of confidence and precision around the NTG algorithms (and resulting NTG estimates) that are derived from the questions. In everyday terms, this means a poorly designed and implemented survey with a large enough sample size may yield a very precisely estimated wrong answer.

A thorough approach includes understanding this difference between accuracy and precision—particularly in free ridership and spillover algorithm development—and using alternative approaches to limit bias and maximize the accuracy of results. One way to increase accuracy and limit bias is to ensure that the chosen NTG estimation method is well-designed and well-implemented. The triangulation approach described above also helps to deal with this issue by providing multiple estimates, which can then be compared against each other.

Another means of increasing confidence in the results—or at least build consensus on the efficacy of the approach—derives from explicitly identifying assumptions relating to NTG calculations. To illustrate the point, and the sensitivity of survey-based NTG component algorithms, an algorithm developed for a residential HVAC rebate program in Massachusetts is used as an example .[30] In this example, free ridership (FR in the following figures) was derived from a participant survey in three steps, as depicted in Figure 2, with credit given to the program (a.k.a., partial free ridership) from:

- Accelerated timing of the installation
- An increase in the quantity of measures installed
- An increase in the efficiency of the measure

Figure 2. Example Free Ridership Calculation

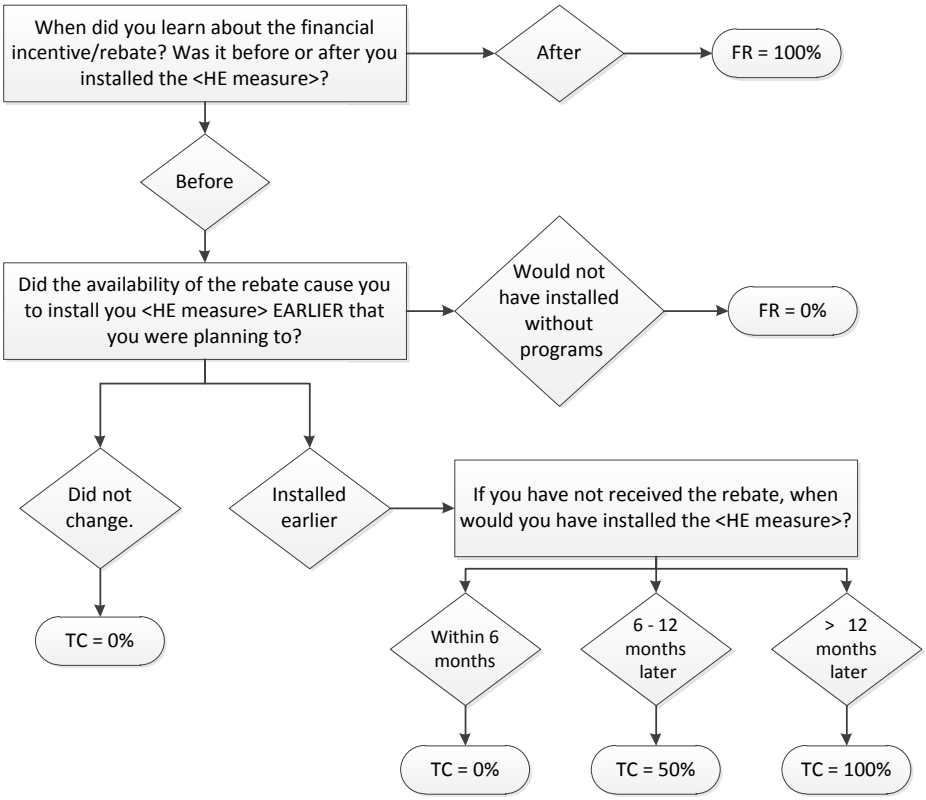


[30] Seiden, K., et al., (June, 2013) "2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation Net-to-Gross, Market Effects, and Equipment Replacement Timing, " prepared for The Electric and Gas Program Administrators of Massachusetts, http://ma-eeac.org.

Source: Seiden, K., et al., Op Cit.

Figure 3 shows the example algorithm for assigning the timing credit (TC). Notice that the magnitude of the TC ultimately depends on whether the participant would have installed the energy efficiency measure more than six months or more than one year in the future. These are subjective values based on experience and often reflect a negotiated algorithm solution based on the experience and judgment of evaluators, program administrators, and other stakeholders developing and reviewing the algorithm.[31]

Figure 3. Example Free Ridership Timing Credit



Source: Seiden, K., et al, Op Cit.

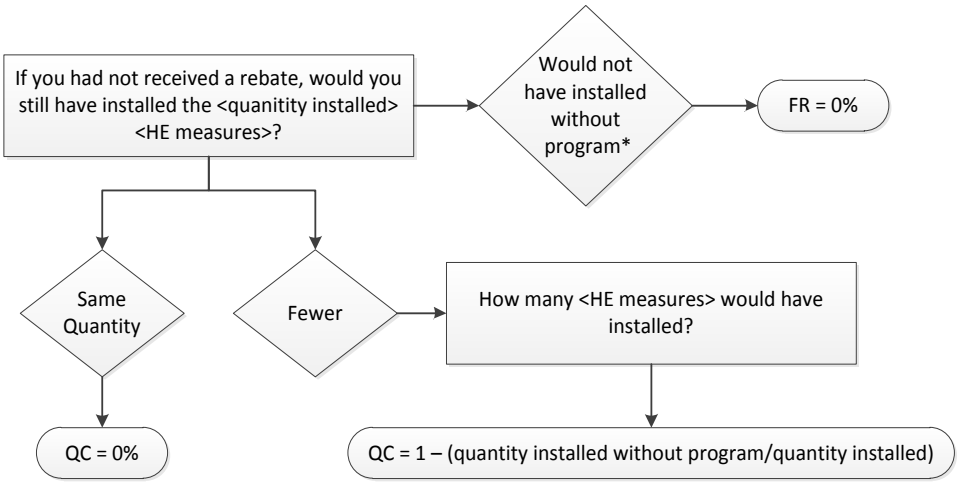
Similarly, the free ridership quantity (Figure 4) and efficiency credits (Figure 5) in this example also include relatively arbitrary adjustments that are based on negotiated assumptions around how survey answers should be treated rather than empirical data. Sensitivity analyses are often performed to assess the influence certain assumptions have on the final values of a free ridership

[31] As an example of the variability around these algorithms, Pennsylvania recently completed statewide NTG methods protocols that, rather than having a timing credit, simply used a one year cutoff as part of an intention score (i.e., if the respondent would have delayed/canceled the installation by more than one year they receive credit towards the attribution algorithm). See "GM-024: Common Approach for Measuring Free-riders for Downstream Programs," Pennsylvania Statewide Evaluation Team, December 23, 2013.

algorithm. In Figure 5 below, for example, the scale values linked to the answers of 1 through 5 on the likelihood of installation question. Instead of 75% for answer 4 – a value of 80% could be tested to see what impacts it has on the free rider score. Similar sensitivities can be used to assess the robustness of the analyses.

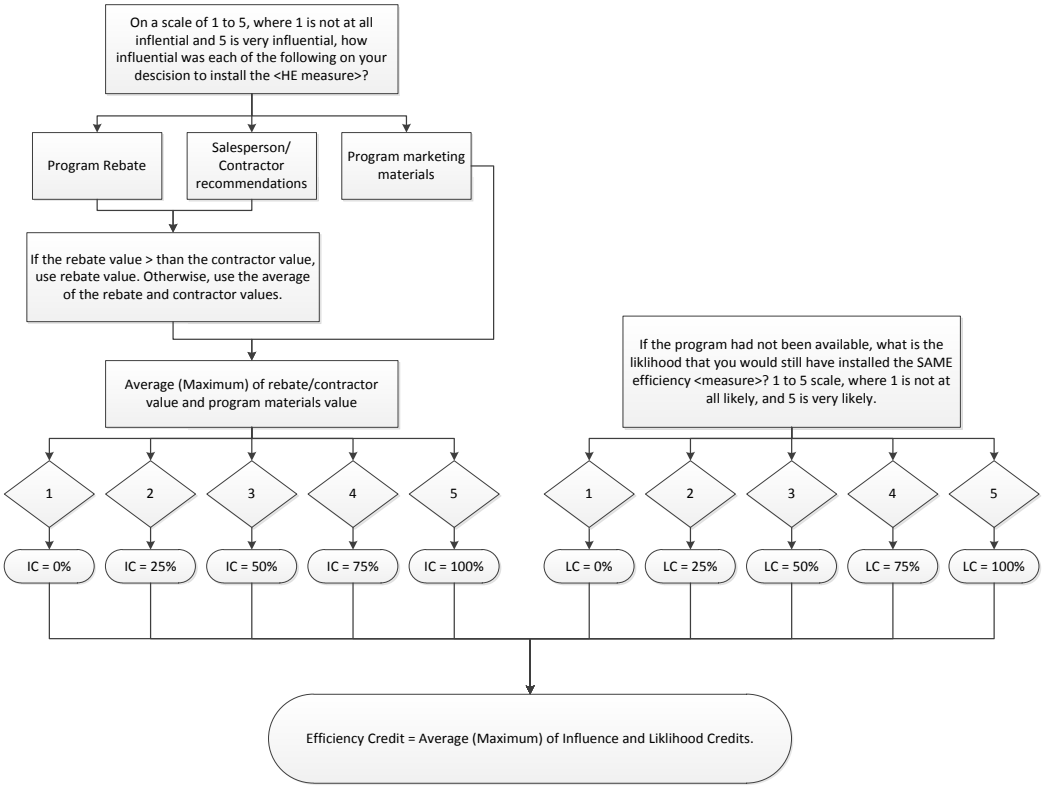
Returning to the overall free ridership algorithm presented in Figure 2, the Massachusetts Program Administrators and other stakeholders recognized and incorporated algorithm uncertainty by conducting sensitivity analysis around the assumptions driving partial free ridership, leading to a greater understanding and appreciation of the difference between survey confidence and precision and the accuracy of resulting free ridership estimates. Sensitivity analysis can be a very useful tool in providing evidence that resulting NTG values are not unduly influenced by subjective scoring algorithm choices such as those described above.

Figure 4. Example Free Ridership Quantity Credit



Source: Seiden, K., et al, Op Cit.

Figure 5. Participant Free Ridership Efficiency Credit



Source: Seiden, K., et al, Op Cit.

4.4 Mapping Methods to Iowa Programs

Iowa's IOUs administer a wide variety of programs to encourage energy efficiency in their customers. Because of the considerable variety in programmatic offerings, there is no one-size-fits-all approach to estimating NTG values for these programs. As stated earlier in the report, Navigant holds that while a portfolio-level deemed approach may have been justified by research in the past, current industry practice suggests a portfolio-wide single NTG value deemed approach is no longer appropriate. Some considerations when mapping an individual program to an appropriate NTG method include: resource vs. market viewpoints, overall size of the program and its importance within the savings portfolio, whether the program is aimed at a small number of diverse participants or many similar customers, the ability to design and implement a randomized control trial prior to program launch, variability of net savings relative to gross savings, cost considerations, relationships with trade allies, trade allies' degree of involvement in the program and data availability issues.

Building upon the program data from each Iowa utility contained in Section 2 (Table 3 through Table 5) the Navigant team mapped each program in the green shaded rows to the methods and associated costs listed in Table 6. The resulting utility-specific Tables 7 to 9 to delineate candidate NTG method(s) by program based on the Navigant Team's experience in designing and implementing NTG research for utilities with programs similar to those offered by Iowa's utilities. These tables present a range of methods and cost estimates for the various NTG estimation options by program to provide the Oversight Committee with information to begin considering the costs and benefits of various approaches. Additionally, these tables provide the foundation for developing NTG research agendas based on program characteristics and the value of information to be gained from research specific to individual Iowa programs.

Table 7. Mapping Candidate NTG Estimation Methods to Alliant Energy Programs

Program Name	Total 5 Year Plan Program Budget	Program Budget as Percent of Total Portfolio Expenditure	Custom Measures	Many, Similar Participants	Degree of Upstream Influence Invisible to Consumers	Variability of Net Savings Relative to Gross Savings	NTG Viewpoints	Potential Method I	Potentenial Method 2	Cost Range	
Residential Prescriptive	$65,209,023	18%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies, in tandem with billing analysis using matching methods or a quasi-experimental design, and/or structured expert judgment	Method I plus sales data approach	$100K	$400K
Custom Rebates (all)	$46,436,752	13%	X		Med/Low	High	Resource, Market and Deemed	Surveys of participants, contractors, distributors and manufacturers	Method I plus structured expert judgement	$80K	$200K
New Home Construction	$5,122,346	1%	X	X	High	Med	Resource, Market and Deemed	Surveys of participants, contractors and trade allies	Method I plus structured expert judgement	$80K	$200K
Home Energy Assessment	$16,595,359	4%		X	Med/Low	Med	Resource and Market	Surveys of participants, contractors and trade allies	Billing analysis using matching methods	$50K	$175K
Commercial New Construction Program	$6,224,671	2%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies	Method I plus structured expert judgement	$80K	$200K
Change-a-Light	$12,562,177	3%		X	High	Med	Resource and Market	Surveys of participants, contractors and trade allies	Method I plus sales data approach	$100K	$400K
Appliance Recycling (all)	$8,683,739	2%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies	Method I plus structured expert judgement	$80K	$200K
Nonresidential Prescriptive	$44,093,861	12%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies, in tandem with billing analysis using matching methods or a quasi-experimental design, and/or structured expert judgment	Method I plus sales data approach	$100K	$400K

Source: Navigant Team research and the Uniform Methods Project, National Renewable Energy Laboratories (NREL), 2014, http://www.nrel.gov/extranet/ump/

Table 8. Mapping Candidate NTG Estimation Methods to Black Hills Energy Programs

Program Name	Total 5 Year Plan Program Budget	Program Budget as Percent of Total Portfolio Expenditure	Custom Measures	Many, Similar Participants	Degree of Upstream Influence Invisible to Consumers	Variability of Net Savings Relative to Gross Savings	NTG Viewpoints	Potential Method 1	Potentenial Method 2	Cost Range	
Residential Prescriptive	$12,956,800	45%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies, in tandem with billing analysis using matching methods or a quasi-experimental design, and/or structured expert judgment	Method I plus sales data approach	$75K	$300K
Residential New Construction Program	$2,660,900	9%	X	X	High	Med	Resource, Market and Deemed	Surveys of participants, contractors and trade allies	Method I plus structured expert judgement	$60K	$150K
Residential Evaluation Program	$3,496,500	12%		X	Med/Low	Med	Resource and Market	Surveys of participants, contractors and trade allies	Billing analysis using matching methods	$30K	$130K
Nonresidential Prescriptive Program	$4,371,700	15%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies, in tandem with billing analysis using matching methods or a quasi-experimental design, and/or structured expert judgment	Method I plus sales data approach	$75K	$300K
Nonresidential New Construction Program	$1,086,800	4%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies	Method I plus structured expert judgement	$60K	$150K
Nonresidential Custom Program	$289,500	1%	X		Med/Low	High	Resource, Market and Deemed	Surveys of participants, contractors, distributors and manufacturers	Method I plus structured expert judgement	$50K	$150K

Source: Navigant Team research and the Uniform Methods Project, National Renewable Energy Laboratories (NREL), 2014, http://www.nrel.gov/extranet/ump/

Table 9. Mapping Candidate NTG Estimates Methods to MidAmerican Energy Programs

Program Name	Total 5 Year Plan Program Budget	Program Budget as Percent of Total Portfolio Expenditure	Custom Measures	Many, Similar Participants	Degree of Upstream Influence Invisible to Consumers	Variability of Net Savings Relative to Gross Savings	NTG Viewpoints	Potential Method 1	Potentenial Method 2	Cost Range	
Residential Equipment Program	$114,749,062	22%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies, in tandem with billing analysis using matching methods or a quasi-experimental design, and/or structured expert judgment	Method I plus sales data approach	$100K	$400K
Residential New Construction Program	$30,260,120	6%	X	X	High	Med	Resource, Market and Deemed	Surveys of participants, contractors and trade allies	Method I plus structured expert judgement	$80K	$200K
Residential Assessment Program	$26,682,083	5%		X	Med/Low	Med	Resource and Market	Surveys of participants, contractors and trade allies	Billing analysis using matching methods	$50K	$175K
Industrial Partners Program	$39,803,537	8%	X		Med	High	Resource, Market and Deemed	Surveys of participants, contractors, distributors and manufacturers	Method I plus structured expert judgement or Sales Data	$80K	$200K
Commercial Energy Solutions	$54,239,586	10%	X		Med	High	Resource, Market and Deemed	Surveys of participants, contractors, distributors and manufacturers	Method I plus structured expert judgement or Sales Data	$80K	$200K
Nonresidential Equipment Program	$48,480,366	9%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies, in tandem with billing analysis using matching methods or a quasi-experimental design, and/or structured expert judgment	Method I plus sales data approach	$100K	$400K
Commercial New Construction Program	$43,393,302	8%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies	Method I plus structured expert judgement	$80K	$200K
Upstream Lighting	$13,978,913	3%		X	High	Med/High	Resource, Market and Deemed	Surveys of participants, contractors and trade allies, in tandem with billing analysis using matching methods or a quasi-experimental design, and/or structured expert judgment	Method I plus sales data approach	$100K	$400K

Source: Navigant Team research and the Uniform Methods Project, National Renewable Energy Laboratories (NREL), 2014, http://www.nrel.gov/extranet/ump/

5. State-Specific NTG Approaches, and Relationship to Policy Objectives and Perspectives

Section 5 Contents:
• Methods for Estimating NTG Values
• NTG Best Practices and Research Trends
• Confidence, Precision, and NTG Algorithms
• Mapping Methods to Iowa Programs

Another consideration in choosing NTG evaluation methods is the regulatory landscape and policies regarding NTG research. Each state is relatively unique in this regard, including Iowa, so understanding state-level policy differences is useful in conducting cross-state NTG comparisons. The Oversight Committee explicitly recognized this issue in defining the goals and objectives of this study, and asked the Navigant team to clarify how key policies and regulatory considerations are related to the choice of NTG policies and approaches, and to put these considerations into the context of Iowa's regulatory framework. Navigant used the American Council for an Energy-Efficient Economy (ACEEE's) 2014 report as a key resource for investigating the state of policies in various jurisdictions around the country.[32]

This section provides a high-level review of NTG policies around the country, as well as case studies of several states with policies and regulatory frameworks of interest to Iowa, and maps specific policy mechanisms such as lost revenue recovery, risk-reward mechanisms, and integrated resource planning regimens to NTG policies. As states, regulators and policymakers bring diverse NTG perspectives to the table, we consider NTG policy, regulatory environments and statues in the context of the three perspectives on NTG research: energy efficiency resource views, market views and deemed views.

5.1 Summary of NTG Policies

To better understand the NTG landscape, the Navigant Team conducted a literature review that examined state energy policy documents and websites, evaluation reports, and prior studies[33] that sought to summarize the NTG policies across the United States. Furthermore, we reached out to both members of our own team as well as other industry experts that do NTG work in each state to confirm our understanding of the policy. This validation step was particularly important for providing insight

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[32] *Examining the Net Savings Issue: A National Survey of State Policies and Practices in the Evaluation of Ratepayer-Funded Energy Efficiency Programs*. American Council for an Energy-Efficient Economy (ACEEE), 2014

[33] A number of different sources were used in developing the state by state NTG and DSM policies (see bibliography for full citations), including Downs (2014), Fagan (2009), Haeri (2012), Edison Foundation (2013), Missouri Energy Initiative (2014), Morgan (2012), and Wilson (2013).
Fagan, J.; Messenger, M.; Rufo, M.; Lai, P. (2009). "A Meta-Analysis of Net to Gross Estimates in California." Paper presented at the 2009 AESP conference. Navigant (2013a). *Custom Free Ridership and Participant Spillover Jurisdictional Review*. Prepared for the Sub-Committee of the Ontario Technical Evaluation Committee, May. www.ontarioenergyboard.ca/documents/TEC/Evaluation%20Studies%20and%20Other%20Reports/Ontario%20NTG%20Jurisdictional%20Review%20-%20Final%20Report.pdf. U.S. Environmental Protection Agency (EPA). Model Energy Efficiency Program Impact Evaluation Guide: A resource of the National Action Plan for Energy Efficiency (NAPEE), available at: http://www.epa.gov/cleanenergy/documents/suca/evaluation_guide.pdf

and understanding into many of the NTG nuances and complexities that often are not fully provided in public documents, in particular the different use of semantics that may appear the same but have different meanings in different states.

While Iowa currently defines itself as a net state with a NTG value of 1.0, a number of states appear as gross savings states (e.g., Pennsylvania), but encourage (and sometimes require) NTG estimates to help improve program design. In fact, there is no state that we aware of that would prohibit NTG research for this purpose. To ensure a common denominator platform for comparison, however, our research focused on NTG policy with regards to the reporting of energy savings and assessment against savings goals.

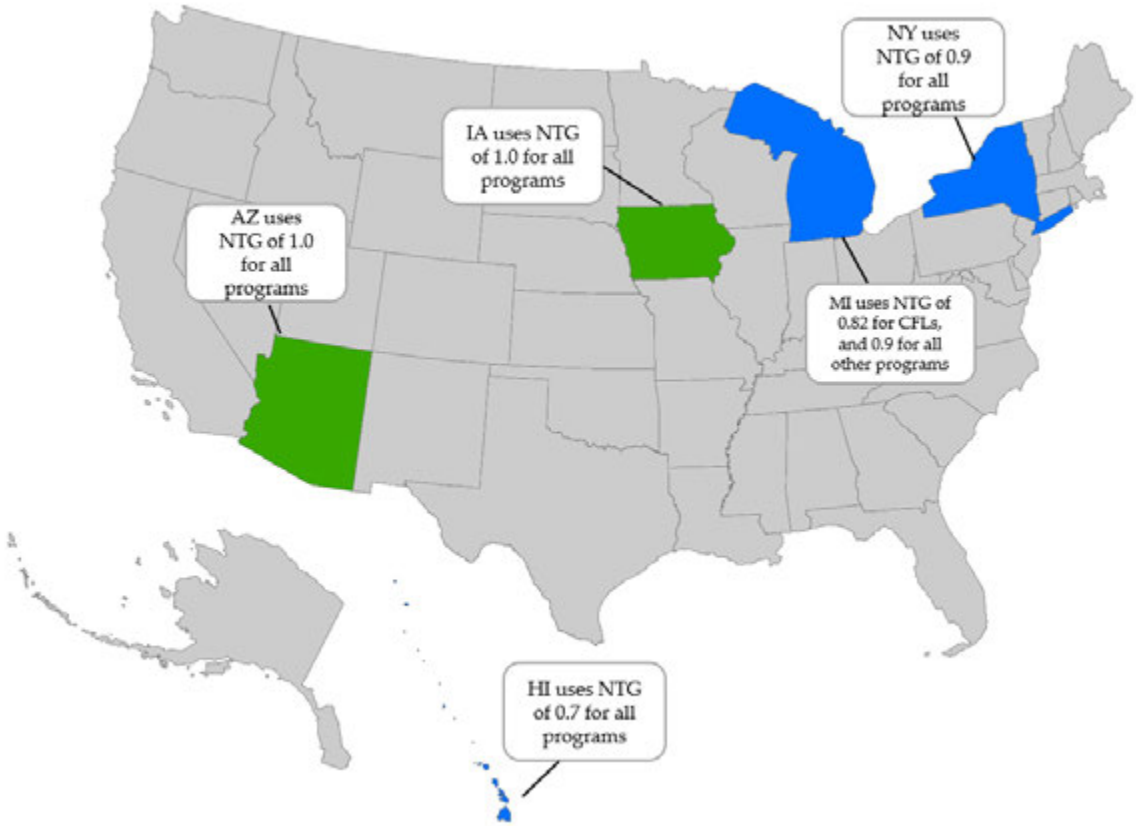
Appendix A contains the detailed state-by-state findings of our research. The sections below summarize our findings across a number of NTG policies, including:

- ***Overall NTG Policy***. This shows whether or not program administrators must report savings and assessment against goals at the gross or the net level. Note that states that assume a NTG of 1.0 are assumed to effectively be gross states since there are no upward or downward adjustments due to program attribution.
- ***Definition of Net Savings (Allowance for Spillover)***. Within the net savings jurisdictions, there is a wide variation of which aspects of NTG are allowed in terms of savings claims. Some states consider net of free ridership—not counting any aspects of spillover—to be net savings. Other states allow different aspects of spillover (i.e., participant and non-participant) to be counted as achieved savings.
- ***NTG Methods Protocols***. Certain states (such as California and Massachusetts) have developed NTG method protocols that recommend specific approaches and in some cases specifics regarding the calculations (e.g., survey batteries and analysis algorithms for self-report approaches). The use of these may be recommended, or in certain states (e.g., Pennsylvania), an emerging practice is to require the use of the Methods protocols.
- ***Fixed or Researched Net Savings***. A number of net savings states lock in a fixed NTG value that applies to all, or at least most, programs. Note that while this has a prospective aspect to it (in that NTG is fixed prior to the program year), this is considered different than our definition of prospective NTG (below), which is typically based on researched values that can vary by program and measure.
- ***Prospective versus Retrospective Application of Net Savings Values***. Another emerging practice is the move toward the prospective use of NTG values, whereby NTG values researched in a current program year are applied prospectively to future year(s), rather than retrospectively to the current or past program year(s). Once NTG values are established, therefore, they are essentially locked until an updated value is derived and applied prospectively.

5.2 Overall NTG Policy: Gross versus Net

While some states adopt a net policy and others adopt a gross policy, a number of net states deem all program NTG values at 1.0 or a different value. As shown in Figure 6, there are several states that have similar policies to the NTG policy currently adopted by Iowa of 1.0 for all programs, while other states deem a value other than 1.0 for all programs, and Michigan deems all values at 0.9, with the exception of CFLs which have their own deemed NTG value.

Figure 6. Net States with Deemed NTG Values



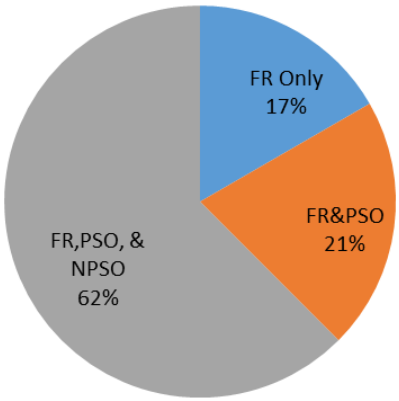
Source: Navigant Team research

5.3 Definition of Net Savings (Allowance for Spillover)

As shown in Figure 7, nearly two-thirds (62%) of those jurisdictions that use net savings allow for free ridership, participant spillover, and non-participant spillover, while 21% allow for free ridership and participant spillover but do not allow for non-participant spillover.[34] Only 17% of the jurisdictions with net savings (a total of four states) limit net savings to net of free ridership (i.e., do not allow for contributions from spillover to count toward the net savings estimates).

The broader inclusion of participant and non-participant spillover would be most reflective of the resource view perspective, whereby the emphasis would be on estimating and quantifying all aspects of program attribution; but, to a lesser extent, the market perspective would examine these same components as part of the research in understanding how markets have shifted over time due to program interventions.

Figure 7. Inclusion of Free Ridership (FR), Participant Spillover (PSO), and Non-Participant Spillover (NPSO) in NTG Ratios (n=24)



Source: Navigant Team research

5.4 NTG Methods Protocols

As discussed in Section 4, there are numerous methods that can be used to estimate NTG ratios. As part of its 2006-2008 evaluations, California developed recommended methods for use in estimating NTG ratios. Two sets of methods were developed, one for residential programs and one for non-residential

[34] Note that we including market effects as a subset of non-participant spillover, rather than breaking it out separately, because we are not considering it in the context of market transformation studies, but rather as a subcategory of non-participant spillover. Precedent for this distinction is set in the U.S. Environmental Protection Agency (EPA) in the Model Energy Efficiency Program Impact Evaluation Guide: A resource of the National Action Plan for Energy Efficiency (NAPEE), available at: http://www.epa.gov/cleanenergy/documents/suca/evaluation_guide.pdf

programs, and both have received periodic updates.[35] Massachusetts also developed detailed guidance for NTG approaches and methodologies, issuing both residential and C&I methods documents in 2011.[36]

The NTG guidance documents in both California and Massachusetts focused on the selection of methods (i.e., which methods are most appropriate for specific program types) as well details regarding the approaches that should be taken for specific programs, in particular programs using the self-report approach. The documents even list example questions and scoring algorithms to determine NTG ratios.

More recently, Pennsylvania has instituted common NTG approaches,[37] and Illinois, as part of the most recent 3-year program cycle beginning in 2014, has also required that utilities and their evaluators coordinate on NTG methods that will be filed as part of the Technical Reference Manual.

Because most portfolios offer such a diversity of programs, the recommended NTG methods have generally selected certain program types (e.g., downstream rebates) in prescribing the more detailed NTG approaches, although there has been a more recent effort to expand the types of programs. Pennsylvania and Illinois, for example, both included appliance recycling programs and are working on common approaches for estimating NTG for upstream lighting.

The primary reason for developing common approaches to NTG estimation is to help ensure that differences over time or between program administrator service territories are due to actual differences in program attribution as opposed to differences in research methodologies. In addition, bringing together program administrators and their evaluators is perceived as an opportunity to refine and improve existing methods.

The primary drawback of common approaches, however, is that they can be perceived as inflexible, and thus inappropriate for programs that do not exactly fit a typical model. They can also be seen as stifling innovation for new and potentially superior approaches. In response to these concerns, some of the more recent protocols have tried to remain as flexible as possible (e.g., giving example questions that can be adopted to specific program designs and features), plus, in some cases, allowing evaluators to propose alternative methods that can attempted with regulatory approval.

The language in the Illinois final DSM orders for the 2014-2016 plans captures both the strengths and limitations of common approaches:[38]

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[35] "Methodological Framework for Using the Self-Report Approach to Estimating Net-to-Gross Ratios for Nonresidential Customers, Prepared for the Energy Division," Prepared for the California Public Utilities Commission by The Nonresidential Net-To-Gross Ratio Working Group, October 16, 2012.

[36] "Cross-Cutting Net to Gross Methodology Study for Residential Programs – Suggested Approaches (Final)," Prepared for the MA Program Administrators by NMR Group, Inc. with contributions by Tetra Tech and KEMA, July 20, 2011; and "Cross-Cutting C&I Free-Ridership and Spillover Methodology Study Final Report," Prepared for the MA Program Administrators by Tetra Tech, NMR Group and Kema, May 20, 2011. http://ma-eeac.org/studies.

[37] "Common Approach for Measuring Free-riders for Downstream Programs", Prepared by Jane Peters and Ryan Bliss, Research Into Action as part of the Statewide Evaluation (SWE) for the Pennsylvania Electric Distribution Companies (EDCs) and the Pennsylvania Technical Utility Staff (TUS), December 23, 2014.

[38] For example, the Nicor Gas Final Order can be located at http://www.icc.illinois.gov/downloads/public/edocket/378494.pdf

> "The Commission notes that this directive is not to create entirely 'new' NTG methodologies for every energy-efficiency program, but rather to assess NTG methodologies and survey instruments that have been used to evaluate energy-efficiency programs offered in Illinois, and to compile the most justifiable and well-vetted methodologies (or potentially combine certain components from the existing approaches to better represent the most justifiable and well-vetted method consistent with best practices) in an attachment to the Updated IL-TRM that would get submitted to the Commission for approval. The Commission notes that the IL-NTG Methods will be flexible and adaptable to multiple program designs and budgets and tailored to appropriately assess the specifics of each of the program administrators' energy-efficiency programs, consistent with standard NTG methodologies adopted in other states that were filed in this proceeding. The Commission agrees with Staff that in the interest of efficiency, the current program evaluators should take the lead in compiling and formalizing standard methodologies for NTG in Illinois taking into consideration SAG input."

5.5 Fixed or Researched Net Savings

Three states—Hawaii, Michigan, and New York—rely on fixed NTG values that differ from 1.0 for all programs within the energy-efficiency portfolios. As shown in Table 10, the ratios range from 0.7 to 0.9, and Michigan lowered the NTG for CFLs based on research showing a lower NTG than the other measures in the portfolio. Arkansas used a similar approach during the first year of program implementation in 2011 by having all programs use a stipulated NTG of 0.8. CFLs were the exception, and were required to use an NTG of 0.62. After the first year, the programs were required to rely on researched values.

Using fixed, portfolio level NTG values is an approach under the deemed view perspective, implicitly implying that having distinct NTG values for each program and/or measure are likely too imprecise, and that overarching adjustments – in some cases based on findings from other jurisdictions – are adequate.

Table 10. Values for Fixed NTG Ratios

State	Fixed NTG Ratio
Hawaii	0.7
Michigan	0.9 (0.82 for CFLs)
New York	0.9

Source: Navigant Team research

5.5.1 Prospective versus Retrospective Applications

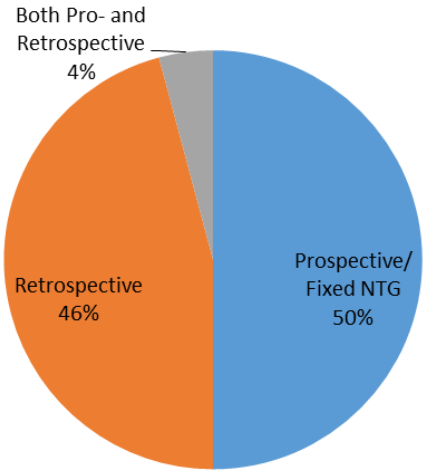
Because NTG ratios can be so volatile and the elasticity of the findings is 1.0 (i.e., a 1% drop in NTG is a 1% drop in attributable savings), program administrators have perceived significant risk and uncertainty with retrospective NTG application. Thus, many states have now moved to the use of NTG results prospectively, rather than retrospectively. As described above, prospective NTG means that any updates

to NTG values are applied in future program years, not in the year in which they are developed or to prior program years. As shown in Figure 8, half of the jurisdictions with net savings (50%) use either a fully prospective/fixed NTG or a combination of prospective and retrospective.[39]

While this method can significantly reduce risk for program administrators, to be effectively implemented it requires careful planning in terms of the timing and nature of the NTG research so that the results are applicable going forward. Research needs to be updated as markets and incentive structures change, and secondary research from other similar programs may be helpful in determining NTG ratios.

The use of retrospective NTG application would be most consistent with the resource view perspective: savings should be real, quantifiable, and only claim what is actual occurring. The use of prospective NTG application, however, would be more reflective of the market view perspective (i.e., NTG has some uncertainty and what's most important is impacting the market), as well as the deemed view (i.e., NTG has significant uncertainty so it's essential to lock down values prior to program implementation).

Figure 8. Use of Prospective vs. Retrospective NTG (n=24)



Source: Navigant Team research

5.6 Relationship between NTG Policy and Other DSM Policy Objectives

While a review and summary of NTG approaches, trends, and policies is helpful for supporting decision-making, it is also important to understand NTG policy in the context of other DSM policies. Certain jurisdictions may have DSM policies—particularly financial policies—where the importance of more precise, fully attributable savings estimations may be perceived as more important. In addition,

[39] California, as part of the Efficiency Savings and Performance Initiative (ESPI), allows prospective NTG for some measures but retrospective NTG for measures that are determined to be less stable in terms of program attribution.

other DSM policies may be related to the treatment of NTG. The Navigant Team examined a number of DSM policies and their relationships to NTG policy, including:

- **Energy Efficiency Resource Standards (EERS):** State-level policy that sets long-term mandatory energy savings targets for utilities and energy-efficiency program administrators.
- **Decoupling:** A regulatory tool that serves as a means of helping utilities overcome the throughput incentive; i.e., the contribution to gross income that occurs with every energy unit sold because the unit (variable) price recovers some of a utility's fixed costs. A decoupling mechanism separates a utility's revenue from its unit sales volume without affecting the design of customer rates.
- **Lost Revenue Recovery:** Allows a utility to recover the lost revenue attributable to DSM programs by increasing revenue by that same amount. Can be based on decoupling (see above) or by adjustments (rate adjustment).
- **Risk-Reward Mechanisms**: Allows utilities to earn bonuses for meeting or exceeding goals, or imposes financial penalties for savings shortfalls.

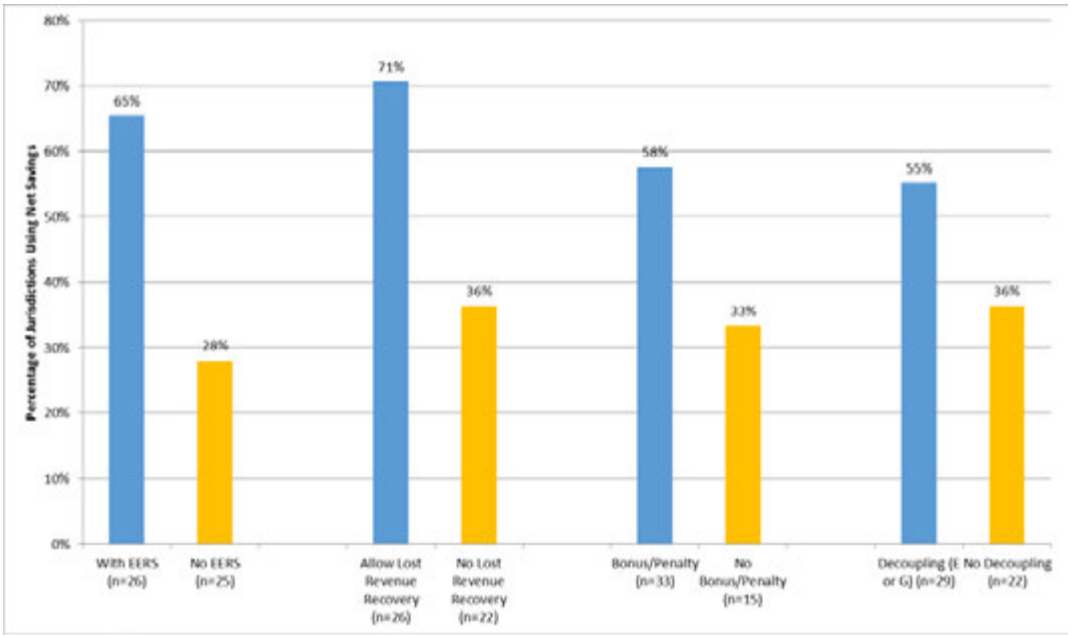
The charts below focus on trends and correlations between the NTG policies and the broader DSM policy objectives. Note the sample sizes are small, and each subset of analysis (e.g., examining only states that have net savings policies) leads to even smaller sample sizes. The results, therefore, need to be used with caution; they may not imply causation, but strong correlations do suggest that certain policies may be related.

The analysis focused on two of the most important NTG policies: the overarching policy of requiring savings at a gross versus a net level; and for those jurisdictions that use net savings, whether or not the NTG is applied prospectively or retrospectively. These NTG policies are then compared against the different DSM policies outlined above.

As shown in Figure 9, jurisdictions that have an EERS allow lost revenue recovery and have bonuses or penalties tend to also require net, rather than gross, savings. These differences are substantial; for example, 71% of the jurisdictions that allow for lost revenue recovery also require net savings, while only 36% of the jurisdictions that do not allow for lost revenue recovery require net savings. Each of these DSM policies with greater correlation with net savings also tend to be associated with increased stakes—particularly financial—in terms of the outcome. In other words, states where there are potentially millions of dollars at stake on the outcome of the savings assessment also tend to use net, rather than gross, savings.

Interestingly, decoupling is also associated with net savings. This may reflect program administrators' interest in mitigating risk due to DSM—and possibly net savings—through the use of decoupled rates.

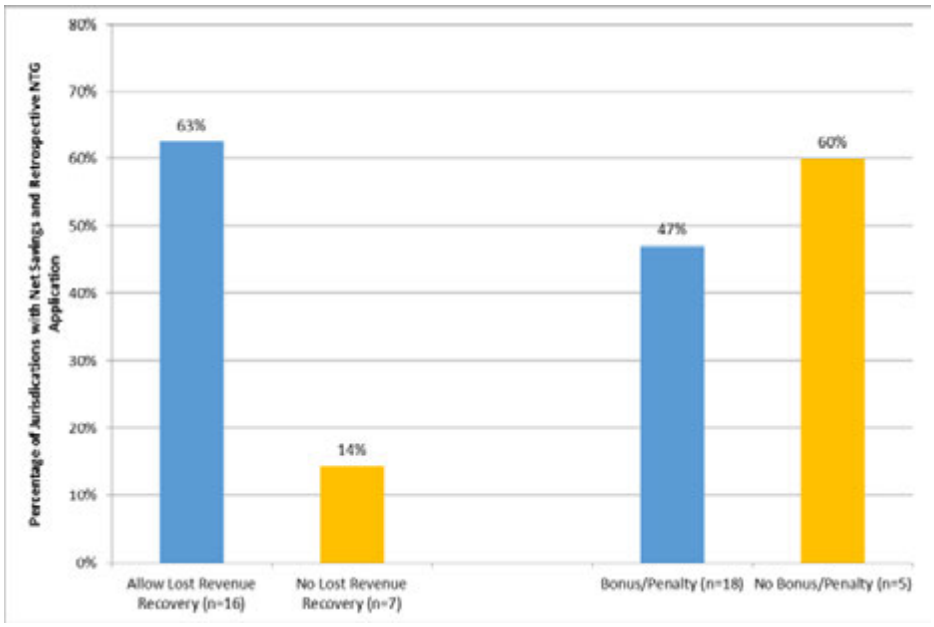
Figure 9. Percentage of Jurisdictions with Net Savings that also have a DSM Policy



Source: Navigant Team research. Note, for example, the first blue bar indicates that 65% of the states that have an EERS require net savings and the second blue bar says that 71% of the states that allow for lost revenue recovery also require net savings.

The Navigant Team also examined the relationship of prospective versus retrospective NTG application and other DSM policy objectives. Due to the small sample size, the analysis was limited to two DSM financial policies: lost revenue recovery and risk-reward mechanisms. As shown in Figure 10, jurisdictions with lost revenue recovery are much more likely to have retrospective application of NTG findings versus areas without lost revenue recovery (63% vs. 14%). The relationship of risk-reward mechanism and the use of prospective versus retrospective NTG application was less clear, particularly since only five states with net savings did not have a bonus or penalty.

Figure 10. Percentage of Jurisdictions with Retrospective NTG Application by Other DSM Policy (States with Net Savings Only)[40]



Source: Navigant Team research

5.6.1 Relating Findings to Iowa NTG Policy

In examining the findings, it is important to note that although Iowa has established goals (i.e., an EERS), it does not have decoupling, lost revenue recovery, or risk-reward mechanisms. In general, these policies tend to lessen the financial stakes in the outcome of the savings findings, and tend to be associated with the use of gross, rather than net, savings. In addition, those states that do not have lost revenue recovery but still require net savings tend not to require retrospective NTG application (i.e., they tend to use prospective NTG).

[40] Note that since California has both prospective and retrospective NTG it is not included in this chart.

5.7 Case Studies

The Navigant Team selected a number of states as case studies to compare NTG and other DSM policies in relation to Iowa. Navigant selected states based on similarity to Iowa in terms of DSM policies (e.g., Maine and New Jersey), geographic proximity to Iowa (e.g., Illinois), comprehensiveness (e.g., Massachusetts), and new entry into DSM (e.g., Pennsylvania).

As shown in Table 11, Navigant selected two NTG policies (gross vs. net and prospective vs. retrospective application) as well as two DSM policies (lost revenue recovery and risk-reward mechanism) to focus on as part of the case studies. In addition, the comparison introduces program activity based on program budgets and energy savings as assessed by the American Council on an Energy Efficient Economy (ACEEE) scorecard report.[41]

Table 11. Selected States for Case Studies

State	ACEEE State Scoring on Utility and Public Benefits Programs		Selected NTG Policies		Selected DSM Policies	
	2013 Electricity Score (10 pts.)	2013 Natural Gas Score (4 pts.)	Gross or Net	(If Net) Prospective or Retrospective	Lost Revenue Recovery (Y/N)	Risk-Reward Mechanism (Y/N)
Iowa	6	3.5	Net	N/A	N	N
Illinois	5	2	Net	Prospective	N	Y (Penalty)
Maine	4.5	1.5	Net	Prospective	N	N
Massachusetts	10	4	Net	Prospective	Y	Y (Bonus)
New Jersey	5.5	2	Gross	N/A	N	N
Pennsylvania	4	0.5	Gross	N/A	N	Y (Penalty)

Source: ACEEE and Navigant team research

[41] Note that the scores presented here are based only on the combination of the electric program budgets and savings (maximum of 10 points) and the gas program budgets and savings (maximum of 4 points) as presented in the ACEEE report; the presence of DSM enabling policies, as well as other scores that feed into the overall state ranking (e.g., transportation), are not included. See "The 2014 State Energy Efficiency Scorecard", ACEEE, Report Number U1408, Table 8, pp. 23-24, October 2014.

5.7.1 Illinois

Like Iowa, Illinois has an EERS, but its DSM policy differs substantially from Iowa in that program administrators face a penalty if goals are not met. In addition, decoupling is allowed for gas utilities. ACEEE ranks both the electric and gas programs slightly behind Iowa as measured by program budgets and savings. Illinois does use net savings, which are applied prospectively. As of the program year beginning in 2015, the prospective NTG values are developed as part of the TRM, which is finalized approximately 3 months prior to the beginning of each program year. Illinois is in the process of developing statewide NTG methods protocols.

5.7.2 Maine

The DSM policies in Maine are quite similar to Iowa in that Maine has an EERS, but does not have lost revenue cost recovery, bonuses or penalties, or decoupling. As assessed by ACEEE for 2013, electric DSM activity for Maine was considered slightly less aggressive compared to Iowa for electric programs (4.5 out of 10.0 for Maine vs. 6.0 for Iowa), and was further behind on gas DSM (1.5 for Maine vs. 3.5 for Iowa). Maine does require NTG, which is researched as part of the evaluation process but applied through annual updates to the TRM (i.e., NTG is applied prospectively).

5.7.3 Massachusetts

Massachusetts differs substantially from Iowa in that it has had some of the most aggressive DSM programs in the United States for many years (top ranked by ACEEE for both gas and electric in terms of budget and savings), allows lost revenue recovery, and has a bonus reward mechanism. Massachusetts requires net savings, which, beginning with the 2013-2015 program cycle, are applied prospectively over the entire 3-year program cycle. Massachusetts has developed statewide NTG methods protocols.

5.7.4 New Jersey

Like Maine, New Jersey also has very similar DSM policies as Iowa. New Jersey, for example, does not have an EERS, lost revenue recovery, or bonuses or penalties. Decoupling is allowed, but only for gas. The state's electric programs are slightly less aggressive than Iowa (5.5 for New Jersey compared to 6.0 for Iowa), while its gas programs lag behind Iowa (2.0 for New Jersey vs. 3.5 for Iowa). New Jersey is a gross state, and thus does not require NTG research. A review of the New Jersey Clean Energy website found limited impact evaluation reports, and the ones that were conducted focused only on gross savings and did not provide NTG ratios.[42]

5.7.5 Pennsylvania

Pennsylvania differs from Iowa in that program administrators face a penalty if savings goals are not met. The state's electric programs, as scored by ACEEE, are considered behind Iowa (4.0 for Pennsylvania compared to 6.0 for Iowa), and its gas programs are substantially behind Iowa (0.5 for Pennsylvania compared to 3.5 for Iowa). Pennsylvania is a gross state, but does require the electric distribution companies to conduct NTG research to inform program design and cost-effectiveness. In addition, Pennsylvania is in the process of developing statewide NTG methods protocols.

[42] www.njcleanenergy.com

6. Benefit / Cost Analyses of NTG Research

Section 6 Contents:
• Methods for Estimating NTG Values
• NTG Best Practices and Research Trends
• Confidence, Precision, and NTG Algorithms
• Mapping Methods to Iowa Programs

A fundamental consideration by stakeholders in determining whether and what type of net savings[43] or NTG research to perform, is whether the benefits justify the costs. This cost/benefit calculation is not unique to NTG research—it is the most basic consideration in any investment decision. In this sense, the decision of whether and how much NTG research to conduct is similar to other investment decisions. In the utility industry, this might be investing in more generation capacity or demand-side program, investment in better transmission lines, investment in community outreach to improve customer satisfaction—each of these investment costs is weighed against its expected benefits in determining whether or not the expense is justified. Similarly, in the case of NTG research, regulators, stakeholders and utilities might want to assess the usefulness of improvements in information and reductions in "at risk" benefits outweigh the costs of conducting formal net savings research.

An important part of this analysis is an equity view. If a program claims it is achieving 5 million kWh per year under the assumption that the NTG is 1.0; but, it turns out that the true NTG value is .5; then, 50 percent of the assumed kWh savings would have occurred anyway and the program is credited with 2.5 million kWh that it was not responsible for. It is hard to argue that this is efficient from a ratepayer's point of view as they are paying for savings that would have occurred anyway. This is considered to be an efficiency loss, not a full net loss as the program's benefit-cost ratio even at 2.5 million kWh could exceed one. However, this program could be more efficient[44] and ratepayers likely could have saved money and/or invested program dollars to generate more savings.

A caveat is in order to this discussion of cost/benefit analysis. Navigant cautions against over-simplifying the NTG research performance question to a simple "yes" or "no" answer, as with a math problem that can be "solved." There is not one correct "solution" to be reached in deciding whether or not and what level of NTG research to conduct. For each stakeholder and each program there are multiple considerations, and a variety of potentially valid NTG research agendas, each of which has its own merits based on the stakeholder's perspective and goals. In this context, cost/benefit analysis is only one consideration, yet it is an important and deserving of attention.

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[43] The terms "net savings research" and "NTG research" are often used synonymously. This can be confusing in that some net savings estimation approaches only produce a net savings number, and a net-to-gross (NTG) value is not determined. This is true for Random Control Trials and Quasi-Experimental designs where the method directly produces net savings values rather than an interim NTG value used to calculate net savings from gross savings. In this chapter, the term used for general net savings research is the short hand NTG term.

[44] It is generally assumed that most all EE programs will have some free riders as it is impossible to tailor each incentive and each informational activity perfectly for each participant. As a result, some averaging occurs and there are some participants that likely would have participated in the program anyway. A program with zero free riders is probably so tightly designed that it is missing out on participants that would have more than made up for the free riders. This tension regarding an optimal number (or desired number) of free riders and program efficiency is present in any program design. Also, free riders can be offset by spillover and spillover related market effects.

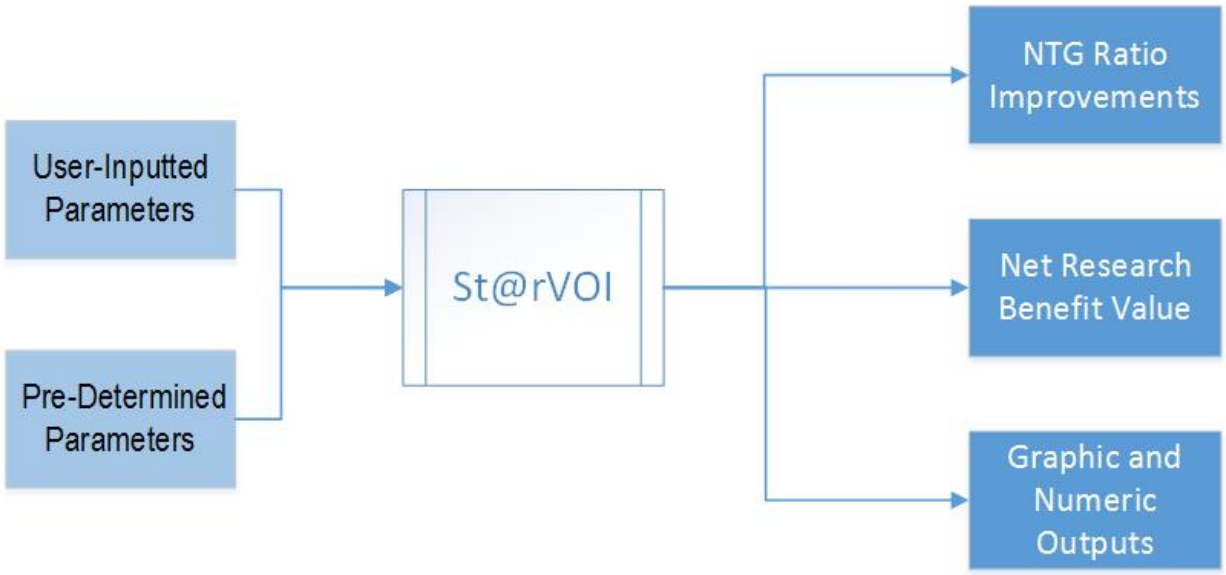
6.1 Analysis Overview—Modeling the Value of Information (VOI) from NTG Research

The modeling approach taken by the Navigant team can be viewed as a "value of information" analysis as it compares the change in benefits resulting from better information on NTG values to the cost of obtaining the information through NTG research. Benefits are expressed as the net energy resource benefits at risk due to assuming a 1.0 deemed value when that is not the case. The NTG research can manage these risks by using the NTG research to prospectively affect program design. The Oversight Committee should therefore view the analysis as reflecting an energy resource NTG or net savings perspective.

The Navigant team developed an interactive Analytica-based tool which is similar to a spreadsheet but more useful in conducting real-time scenario and sensitivity analyses, as well as producing flowcharts illustrating relationships. For reporting purposes we call the tool made for this analysis in Iowa St@rVOI (Stochastic at Risk Value of Information calculator).[45] We presented initial results and conducted additional model runs in-person with Oversight Committee members in May, 2015. In conducting this analysis we noted the uncertainty in monetizing NTG research benefits. Although it is virtually impossible to exhaust all reasonable scenarios and sensitivities, certain trends were apparent and are highlighted in this section. Still, we encourage the Oversight Committee to view this modeling exercise as *directional rather than definitive*.

Based on different combinations of inputs and parameter assumptions, the tool provides results on the predicted net savings, cumulative five-year plan net research benefits from the improved information, and other key metrics regarding the cost-effectiveness of NTG research. The flow of information is shown below.

Figure 11. St@rVOI Net Research Benefits Tool Overview



[45] Analytica is a modeling platform used primarily to create visual representations of decision models, and is capable of producing net benefit results in graphic and tabular forms. This software allowed the Navigant team to incorporate uncertainty into this application in an intuitive manner.

User-inputted parameters include:

- **Distribution of Net Savings Estimates**—Uncertainty is built into the program by creating a distribution based on collected researched NTG values for similar programs in other jurisdictions. Based on that distribution, the risk percentile determines the likelihood of net savings research resulting in a NTG value very different from 1.0. The higher the percentile, the higher the risk of finding a NTG value far from 1.0.
- **NTG Improvement Factor**—The model assumes NTG research provides information leading to constructive program design improvements. The NTG improvement factor is the rate at which the accuracy increases net savings increases due to program design improvements based on the additional research.
- **Research Frequency**—Research frequency is how often during each five-year planning cycle NTG research is conducted. The default assumption is once every five-year planning cycle.
- **Research Benefits**—Research benefits include the different benefits realized through NTG research which may include reductions in benefits at risk, improvements in accuracy of the NTG ratio, improved program design, increased reliability of energy efficiency resources, market effects and other positive outcomes.
- **Research Costs**—Research costs are the direct costs of conducting NTG research. Research costs vary with the method and rigor of the research conducted. The model assumes that spending more on NTG research leads to greater resulting improvements in the NTG ratio and other benefits, due to the study producing better actionable information.

6.2 NTG Research Cost Inputs

Research costs are a key input to the net research benefit calculation tool. Table 4 in Section 4.1 describes a range of costs associated with the various methods that may be applied to NTG research for particular programs. The low-end research cost estimate is most representative of what will typically be seen in NTG research costs for most utilities and programs using industry standard practices. The high-end cost is more representative of special cases in which a program undergoes greater than usual scrutiny, the program or market is undergoing rapid change, or other situations require an especially high level of research rigor. Other cost considerations include the frequency of research and the ability to combine NTG research efforts with process evaluation efforts to reduce costs. These additional cost considerations are accounted for in the model as parameters which can be varied directly on a by-program basis.

6.3 NTG Research Benefit Inputs

The most basic NTG research benefit included in the model is the net program benefit under the utility cost test. Navigant has chosen the utility (or Program Administrators') cost test values as the basis for the main research benefit input to the model based on the fact that it reflects the resource view while also providing changes in a utility's revenue requirements and the reduced (or increased) changes in rate payers costs (both participants and non-participants). Other benefit-cost frameworks could just as easily

been used. The model uses as its base benefit input value the net program benefits under the utility cost test, as reported in each utility's regulatory filings.[46]

The tool allows users to include additional program benefits including energy efficiency resource reliability, program design, portfolio construction, program implementation efficiency, investment confidence improvements. Additionally, NTG research can help utilities and stakeholders better understand how utility-run programs influence and change the market for energy efficiency. The model assumes that NTG research benefits cannot be realized unless the utility takes action based on the results of research. NTG research provides better information to utilities, which allows them to implement changes in program design and implementation. Based on these changes, the utility is able to achieve higher NTG values over time.

The net benefits of NTG research will be significantly affected by the assumed levels of benefits at risk. If the utility assumes a NTG ratio of 1.0 and NTG research reveals the true NTG value is closer to 0.6, this would imply that roughly 40% of the benefits currently being attributed to the program are not in reality being realized by the program. We can describe these misattributed benefits as "benefits at risk," and the "risk percentile" as the likelihood of the actual NTG value being significantly below the assumed NTG value of 1.0. St@rVOI also allows the user to draw researched NTG values from different percentiles of risk in order to gauge the effects on net benefits of NTG research. The higher the risk percentile, the more benefits at risk, the larger the potential net benefits of NTG research.

Figures 12, 13, and 14 demonstrate, for a generic program, the effect of different risk percentile assumptions on the benefits at risk. The main finding conveyed by this series of figures is that the higher the risk percentile, the greater the value of benefits at risk.

[46] Alliant Energy, Black Hills Energy and MidAmerican Energy all provided regulatory filing documents with the most up-to-date utility cost test values for Navigant to use as benefit inputs for each program. The source documents referenced for each utility are as follows: For Alliant Energy, we referenced the *Interstate Power and Light Company—2014-2018 Energy Efficiency Plan*, prepared for the IUB, Docket No. EEP-2012-0001, November 30, 2012. For Alliant Energy we also referenced the *IPL Energy Efficiency Plan—Compliance*, prepared for IUB, January 31, 2014, Corrected Revised January 25, 2013. For Black Hills Energy Navigant referenced the *Black Hills Energy—Energy-Efficiency Plan 2014-2018*, prepared for the Iowa Utilities Board (IUB), Docket No. EEP-2013-0001, April 1, 2013. For MidAmerican Energy Navigant referenced *MidAmerican Energy Company—2014-2018 Energy Efficiency Plan, Revised Volume II*, prepared for the IUB, Docket No. EEP-2012-0002, February 24, 2014.

Figure 12. 50th Percentile Risk Example

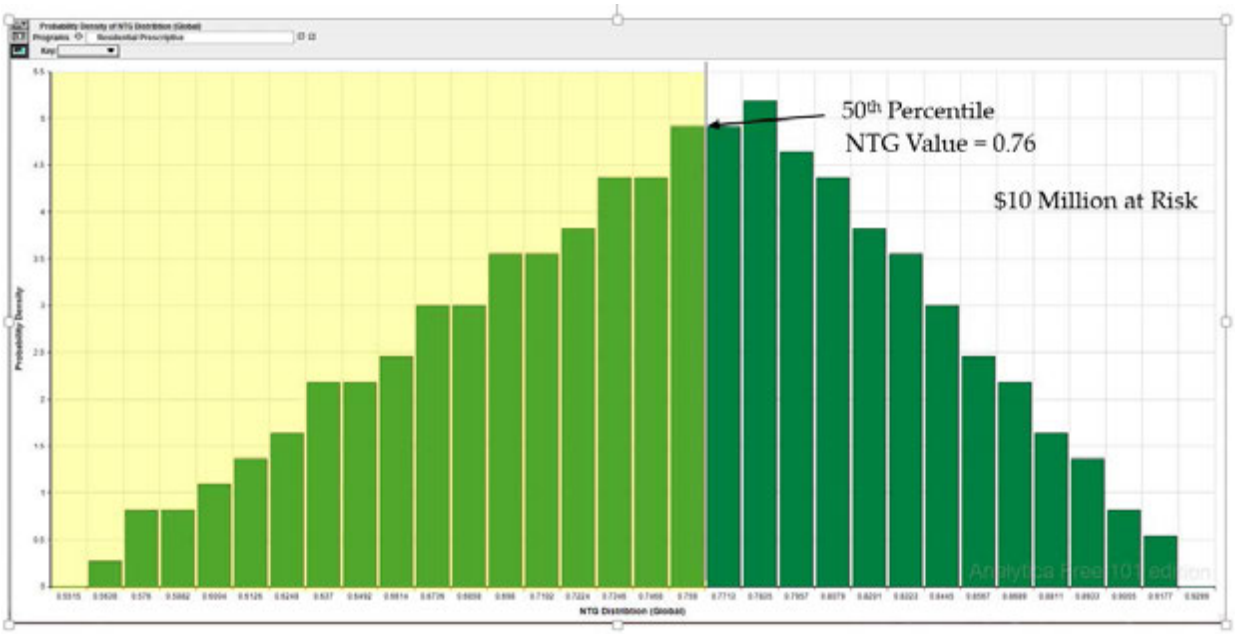


Figure 13. 20th Percentile Risk Example

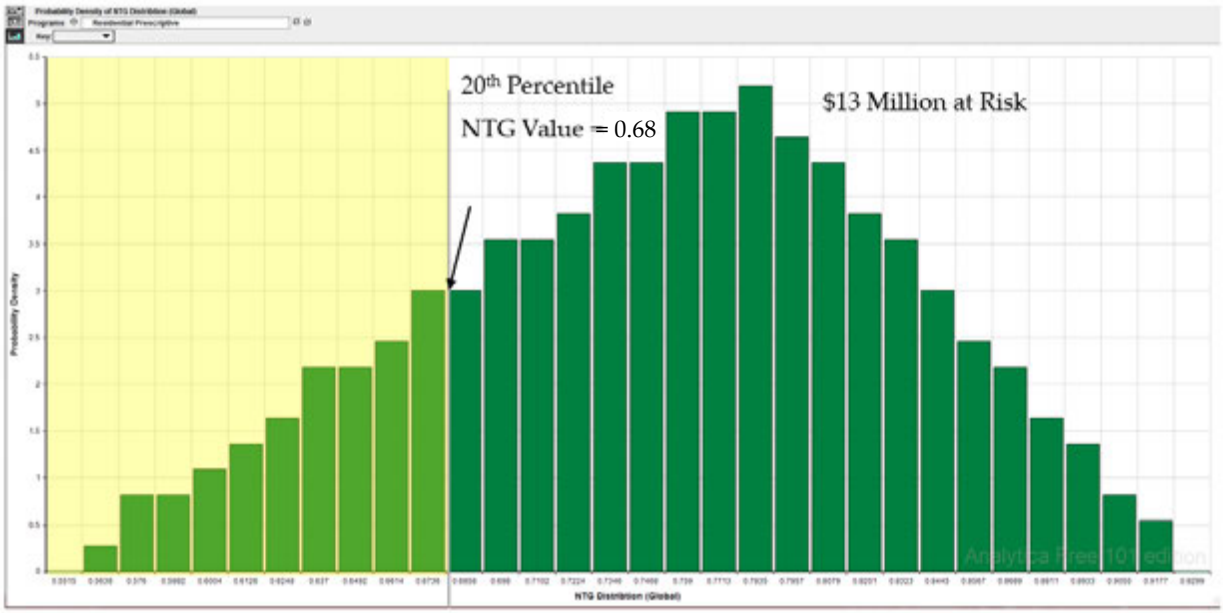
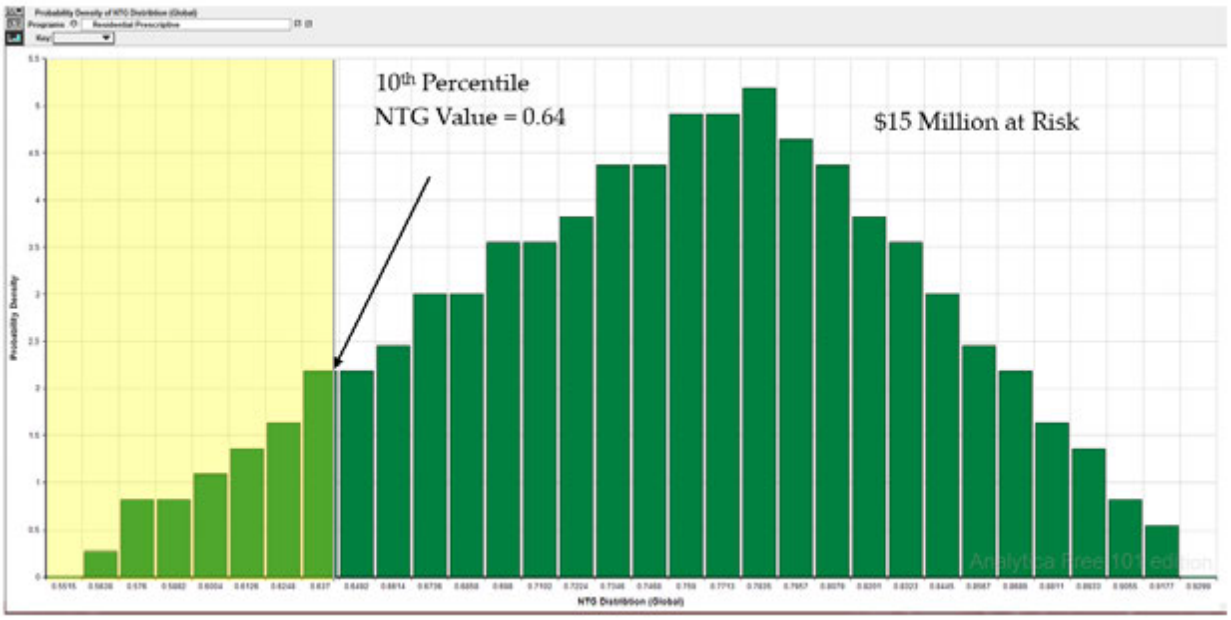


Figure 14. 10th Percentile Risk Example



Additionally, the more frequently NTG research is conducted, the more frequently improvements in research design can be implemented based on better information, and as a result, the greater the improvement in the net savings yield of the program. In order to make the model realistic, it incorporates decreasing returns to research, so that the improvement in the programs' net savings yield is smaller each time a successive round of NTG research is completed. The following series of figures (Figures 15, 16 and 17) illustrate this point by showing that the net savings yield improves more with more frequent NTG research. Note that the vertical axis in each figure, which has the NTG ratio, is not strictly correct; net savings or benefits would be a more accurate mathematical representation of the areas show in each figure. Therefore, the reader should view the NTG ratio dimension on the vertical axes as a simplifying construct to normalize the data and illustrate how research frequency affects net savings in this tool. This is consistent with the notion that these examples are purely for illustrative purposes and are not specific to any program.

Figure 15. Base Case – No Increase in Net Savings due to Zero NTG Research Conducted over a Five Year Plan

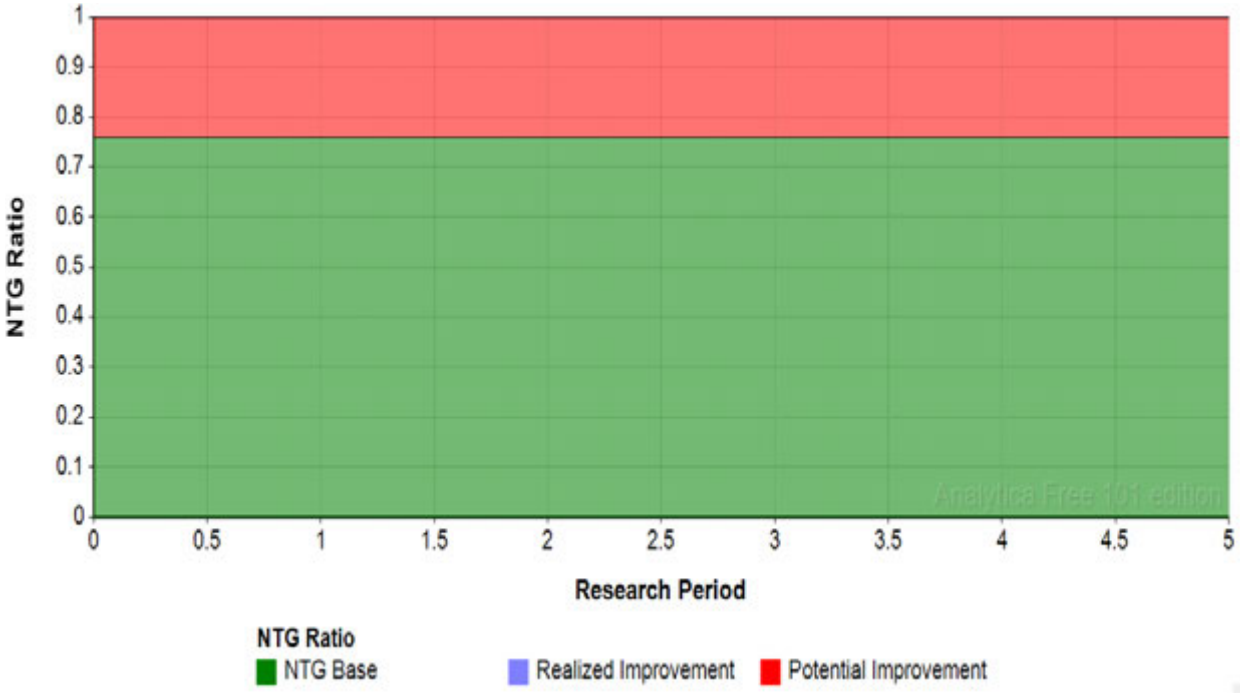


Figure 16. Improvements in Net Savings Based on One Round of NTG Research per Five Year Plan

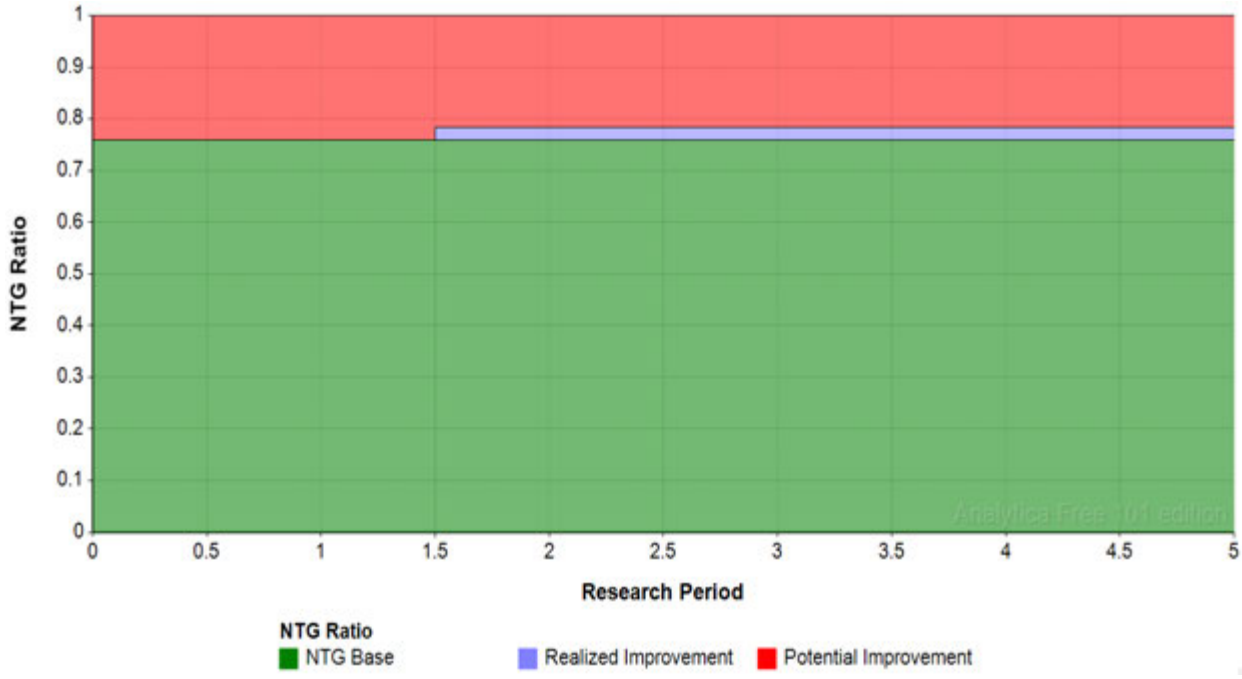
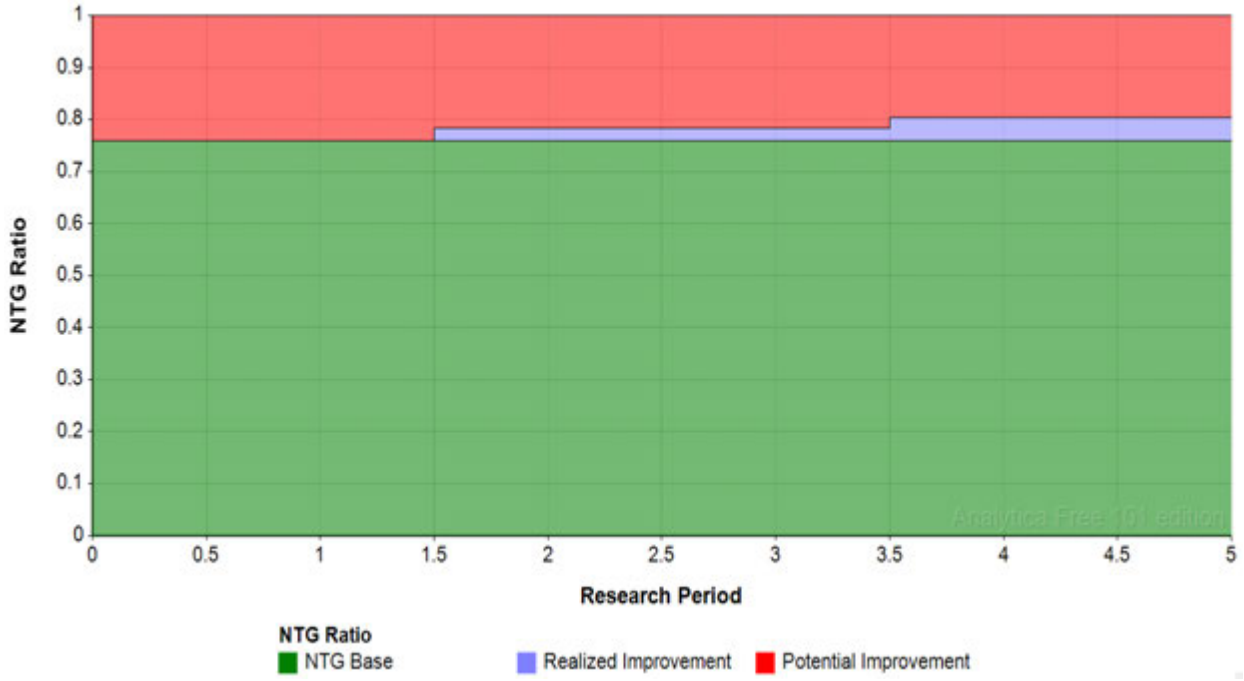


Figure 17. Improvements in Net Savings Based on Two Rounds of NTG Research per Five Year Plan



6.4 Directional VOI Findings

While the St@rVOI tool gives users the ability to analyze changes in NTG research net benefits based on a nearly unlimited number of permutations of different parameters such as risk factors, research frequency, research synergies and program improvement factors, there is limited space in this report to present the results of various scenarios by program. Navigant has chosen several informative scenarios and has included output results for several different scenarios by utility and program as a reference for Iowa stakeholders.

Navigant emphasizes that while we have been explicit about the assumptions underlying these model results, they are nonetheless based on multiple assumptions. Accordingly, less importance should be placed on exact dollar amounts or NTG values, and more on the direction of these results and how changes in key parameters affect NTG research cost-effectiveness. This information allows stakeholders to compare their views on NTG research with information on how the benefits change across scenarios.

As explained in previous sections, distribution of NTG values, research frequency, research costs and assumed program design benefits owing to NTG research can all dramatically affect research benefits. In order to present relevant and informative results for reference by Iowa utilities and stakeholders, we present the results of three different potential scenarios in this section:

- Scenario 1
    - Medium research cost/rigor
    - Research frequency once per five year plan
    - Median (50th percentile) risk percentile
    - Program design improvement factor of 10%
- Scenario 2
    - Identical to Scenario 1 with the exception of a higher program design improvement factor (20%)
- Scenario 3
    - Identical to Scenario 2 with the exception of higher risks (10th percentile risk)

Table 11 summarizes the low and high range outcomes of Scenarios 1 through 3 for each utility by program. Green indicates programs for which NTG research produces positive net research benefits under all scenarios, red indicates the opposite, and yellow indicates programs for which cost-effectiveness varies by scenario. Again, the results of these scenarios are intended to provide context for assessing how various assumptions may affect the cost-effectiveness of conducting NTG research for specific programs. For some programs it is never cost-effective to perform NTG research, particularly programs with expected NTG values close to 1.0 and programs with very low savings. The full results of these scenarios are presented in Appendix C.

From a deemed perspective, even programs that exhibit only marginally positive net research benefits may be candidates for assigning deemed values based on other jurisdictions' findings, along with infrequent NTG research to validate or calibrate these values. By contrast, the programs which feature most prominently in utilities' energy efficiency portfolios are more likely to warrant NTG research, and this is especially true for programs in larger utilities which have large savings values relative to research costs.

Table 12. Summary of High and Low Net Research Benefit Outcomes by Program

Alliant	Low Value of NTG Research in Year 5	High Value of NTG Research in Year 5	Low Projected NTG Ratio in Year 5	High Projected NTG Ratio in Year 5
Commercial New Construction	$1,267,610	$3,813,441	0.54	0.68
Custom Rebates	$2,132,920	$7,316,725	0.64	0.79
Nonresidential Prescriptive Rebates	$290,280	$1,183,585	0.72	0.81
Residential Prescriptive Rebates	$142,990	$748,572	0.72	0.81
Appliance Recycling	$53,950	$259,222	0.61	0.67
Change-a-Light	($84,170)	$124,714	0.64	0.74
Home Energy Assessments	($67,730)	($51,548)	0.63	0.77
Black Hills Energy				
Residential Prescriptive	($56,730)	$76,637	0.72	0.81
Nonresidential Prescriptive	($89,270)	($4,885)	0.69	0.81
Residential New Construction	($55,330)	($12,505)	0.68	0.84
Nonresidential Custom	($54,610)	($25,766)	0.64	0.79
Nonresidential New Construction	($61,480)	($45,533)	0.54	0.68
MidAmerican				
Residential Equipment	$477,510	$1,736,588	0.72	0.81
Nonresidential Equipment	$1,039,560	$3,774,746	0.68	0.81
Commercial New Construction	$596,840	$1,887,601	0.54	0.68
Upstream Retail Lighting	$70,470	$558,255	0.64	0.74
Industrial Partners	$210,290	$608,815	0.61	0.67
Commercial Assessment	($18,640)	$106,763	0.63	0.77
Residential Assessment	($29,840)	$101,952	0.68	0.84

7. Report Summary and Recommendations

The Navigant team has found, through the process of conducting research for this report and interacting with various Iowa stakeholders, that the three perspectives taxonomy is representative of Iowa stakeholder positions. While some stakeholders display a more energy efficiency resource-based perspective, others hold a decidedly deemed view.

Section 7 Contents:
• Summary of Report Findings
• Recommendations for an Iowa Net Savings Research Agenda

However, all stakeholders expressed interest in a market view on NTG research, concurrent with understanding market trends, trade ally relationships, and being able to identify ways in which utility programs have changed energy efficiency markets over time. Most stakeholders expressed some degree of flexibility, as evidenced by their willingness to adopt a view under certain scenarios that differed from their overall perspective. Some stakeholders with a predominantly energy efficiency resource perspective, for example, conceded that for certain programs a deemed perspective and approach were justified. Similarly, some stakeholders with deemed perspectives agreed that under certain circumstances, formal NTG research could be justified for major programs.

7.1 Summary of Report Analyses and Findings

Iowa utilities are already conducting NTG research for certain programs due to the nature of typical impact evaluation methods.

- Particularly in the case of demand reduction, load management and residential behavior (i.e.- Home Energy Report) programs, Iowa utilities are already generating evaluated net savings values.
- Both Alliant Energy and MidAmerican Energy implement Demand Reduction or Load Management programs that are currently evaluated to produce net savings estimates.
- MidAmerican offers a residential behavior program for which it estimates net savings values.

For many programs, continuing with deemed values is appropriate.

- Stakeholders agreed that for minor programs such as education or tree planting programs, and for low income programs and some multifamily programs, a deemed NTG value of 1.0 is the most appropriate choice, and formal NTG research is not currently necessary or justified.
- There was also general agreement that for large, core programs where NTG research is shown to be cost-effective under most scenarios and assumptions, and for some programs demonstrating marginally positive net research benefits, primary research would be justified.
- Some utilities expressed the desire not to rely exclusively on customer surveys to estimate free ridership and spillover, as these may over-estimate free ridership and under estimate spillover (failing to account for market transformation) in mature markets.

- Most stakeholders expressed agreement that in the case of programs which exhibit negative net research benefits under almost all scenarios, and even some which demonstrate only marginally positive benefits, secondary research to obtain deemed NTG values for these programs or suites of programs would be in order, and that these values may differ from 1.0.

A market perspective provided common ground for the majority of stakeholders on the Oversight Committee and participating utilities.

- All parties expressed interest in pursuing market characterization studies or other methods appropriate to a market view in order to better understand Iowa markets, trends and trade ally relationships.
- Stakeholders also expressed interest in understanding changes in energy efficiency markets over time attributable to the influence of utility programs.
- Alliant Energy and MidAmerican Energy both expressed willingness to conduct NTG research using point-of-sale (POS) data, manufacturer and trade ally research or other market perspective approaches.

Stakeholders are generally in agreement about prospective versus retrospective use of NTG values, but differed in views on whether NTG changes should be applied to current or only future plans.

- Stakeholders generally agreed that changes in NTG values should be prospective.
- There was no consensus on whether these prospective NTG values should be applied to utilities' current plans or just to future plans
- Utilities expressed the desire for prospective changes in NTG values to be applied only to future plans rather than the current plan.
- As justification for this view, some utility stakeholders suggested that because process and impact evaluation activities are already determined for the current plan, there would be no opportunity cost-reductions in NTG research through synergies with evaluation activities if utilities were mandated to apply prospective changes in NTG values during their current plan.
- Environmental stakeholders stated that the settlement makes clear that changes in NTG values may affect the current plan, and they expressed a strong preference to apply changes to the current plan on these grounds.

Navigant's VOI analysis highlighted the inherent uncertainty around net benefits to conducting NTG research, and the sensitivity of net benefit results to different key assumptions.

- Analysis demonstrated that there are programs where under a wide variety of scenarios and assumptions, and allowing for a high degree of uncertainty, net research benefits are positive.
- Analysis also demonstrated the opposite case—there are a number of programs for which NTG research is not cost-effective under most realistic scenarios.
- There are a number of programs for which the net benefits of NTG research depend on the assumptions made—these programs may or may not warrant research under different scenarios.

- Utility size and scope has a large influence on the cost-effectiveness of conducting NTG research. Smaller utilities such as Black Hills, which provide only gas, have fewer programs exhibiting positive net benefits to NTG research under most scenarios.

Navigant's research revealed the potential for cost-reductions through joint research efforts where there are similar programs.

- There was general agreement by stakeholders that cost-sharing in the form of jointly conducted NTG studies for particular programs or suites of programs would be in order.
- Particularly for Black Hills Energy, cost-sharing and jointly conducted research could make NTG research feasible for a larger number of programs.
- Both Alliant Energy and MidAmerican Energy indicated that conducting joint research with Black Hills Energy would be feasible for some programs.

The most appropriate process for implementing prospective NTG changes remains unresolved, yet there was some agreement on the current annual review process as the appropriate venue.

- There was no agreement between stakeholders on the most appropriate process for making NTG value changes prospectively.
- Various parties concurred that an annual review process is already in place, through which stakeholders are able to weigh in on proposed changes moving forward, and this existing forum was considered as an appropriate venue for the process of changing NTG values prospectively.
- Utilities and other stakeholders did not come to complete agreement on how much of the NTG research process should be left to utilities' discretion, versus how many decisions on NTG research should be made collaboratively in a public forum. However, utilities affirmed that based on the settlement terms, all program and measure changes are intended to be transparent to stakeholders and to be made available for comment before they are submitted to the Board.

7.2 Recommendations for an Iowa Net Savings Research Agenda

The Navigant team recommends that Iowa stakeholders build on the momentum generated through dialogue and involvement in the creation of this NTG research report to develop an Iowa appropriate NTG research agenda. Iowa stakeholders agree on a number of key issues, and a framework for an Iowa NTG research agenda has already been developed. Articulation of a complete NTG research plan will require stakeholders to compromise on unresolved issues. However, as summarized above, general areas of agreement have been identified, providing the foundation for facilitating a final NTG research agenda.

This foundation blends market, deemed and resource views in an Iowa NTG research agenda that is flexible and responsive, and meets the needs of all stakeholders. Tables 13 and 14 reiterate key information on the cost-effectiveness of NTG research by specific utility program, and specific NTG research actions for the Oversight Committee's consideration, based on the findings in this report. Both of these tables are initially presented in the Executive Summary.

Table 13. Summary of High and Low Net Research Benefit Outcomes by Program

Alliant	Low Value of Primary NTG Research	High Value of Primary NTG Research
Commercial New Construction	$1,267,610	$3,813,441
Custom Rebates	$2,132,920	$7,316,725
Nonresidential Prescriptive Rebates	$290,280	$1,183,585
Residential Prescriptive Rebates	$142,990	$748,572
Appliance Recycling	$53,950	$259,222
Change-a-Light	($84,170)	$124,714
Home Energy Assessments	($67,730)	($51,548)
Black Hills Energy		
Residential Prescriptive	($56,730)	$76,637
Nonresidential Prescriptive	($89,270)	($4,885)
Residential New Construction	($55,330)	($12,505)
Nonresidential Custom	($54,610)	($25,766)
Nonresidential New Construction	($61,480)	($45,533)
MidAmerican		
Residential Equipment	$477,510	$1,736,588
Nonresidential Equipment	$1,039,560	$3,774,746
Commercial New Construction	$596,840	$1,887,601
Upstream Retail Lighting	$70,470	$558,255
Industrial Partners	$210,290	$608,815
Commercial Assessment	($18,640)	$106,763
Residential Assessment	($29,840)	$101,952

Table 14. NTG Research Recommendations for Consideration by the Oversight Committee

Continue with a deemed NTG value of 1.0 for programs with low net benefits and savings, and where research has found programs are likely to have a NTG value close to 1.0.
Continue to apply state-of-the-industry net savings research methods to demand management programs such as demand response and direct load management programs, and for residential behavior programs such as Opower HERs.
Conduct secondary research to determine and establish deemed values other than 1.0 for programs where the costs of NTG research are not justified, but research shows a NTG value of 1.0 to be unlikely. These are generally the programs in yellow and orange in Table 12.
Conduct primary NTG research to estimate NTG values and/or common practice market baselines for key programs contributing large savings to the utility's DSM portfolio, using any or multiple methods outlined in this report. Most of these programs are represented in green in Table 12, though there may be additional programs for which the utility conducts primary research.
For programs warranting primary NTG research, market-based methods may be used as the primary research methodology, providing a comprehensive understanding of energy efficiency markets, facilitating development of common practice market baselines, and/or generating estimates of the FR and SO components of NTG values.
NTG research should begin immediately rather than during the next five-year planning cycle, and resulting NTG values should be applied prospectively. Particularly for the green programs in Table 1, research should begin during the current planning cycle to facilitate updates to the Iowa TRM and utility program designs prior to finalizing the next set of five-year plans.
NTG research should be conducted at a minimum once per each five-year planning cycle, but for programs contributing large savings to the portfolio, programs in rapidly changing markets, primary research may need to be conducted every 2 to 3 years and possibly more frequently. Ultimately, the research findings will provide guidance as to when additional / new NTG research should be conducted.
Periodic review of all established deemed NTG value should be conducted to ensure they remain relevant and appropriate.

Glossary

A&E Firm:	Architecture and engineering firm
Accuracy:	Proximity of a researched value to the actual value
ACEEE:	American Council for an Energy-Efficient Economy
AESP:	Association of Energy Services Professionals
Analytica:	A software package for creating, analyzing and communicating quantitative decision models.
Attribution:	Resource savings credited to an energy efficiency program?
Benefits at Risk:	Benefits attributed to a program but not being realized in reality due to free ridership
C&I:	Commercial and industrial
Common Practice Baseline:	Using estimates of current typically installed equipment as baseline for comparison—estimating savings as difference between efficiency of equipment installed minus the CPB
Confidence:	The level of certainty with which something is estimated
CI:	Confidence interval
CPP:	Clean Power Plan
CPUC:	California Public Utilities Commission
Decoupling:	A regulatory tool that serves as a means of helping utilities overcome the throughput incentive. A decoupling mechanism separates a utility's revenue from its unit sales volume without affecting the design of customer rates.
Deemed:	An assumed Net to Gross value which may be based on secondary research but not primary
Deemed Perspective:	A NTG research viewpoint that views primary NTG research as overly uncertain and views secondary research sources as sufficient for supplying NTG values that are "close enough" to actual program NTG values
Delphi Panel/Study:	A structured communication technique utilizing a panel of experts to converge on a NTG value, input (FR or SO) or other market information estimate
DLC:	Direct Load Control
Downstream Program:	A program in which the consumer directly receives the incentive on efficiency equipment rather than the distributor, contractor, or manufacturer.
DR:	Demand Response
DSM:	Demand Side Management
EE:	Energy Efficiency
EERS:	Energy Efficiency Resource Standard
EE Resource Perspective:	A NTG research view in which energy efficiency and other demand side programs are viewed as resource investments and the focus is on ensuring the return on investments in EE and precisely estimating NTG values, FR and SO.
EPA:	Environmental Protection Agency

ESCO:	Energy Service Company
ESPI:	Efficiency Savings and Performance Initiative
Fast-feedback Survey:	A short survey given to program participants immediately after participation, used to estimate free ridership.
FR:	Free ridership
GIAC:	Green Iowa AmeriCorps—A group working with Black Hills Energy to implement certain weatherization programs.
Gross Savings:	Savings from energy efficiency programs prior to applying a NTG value to subtract off free ridership and add in spillover.
HER:	Home Energy Rating
HERS Rating:	Home Energy Rating System score
Historical Tracing:	A Net to Gross estimation method which involves developing a chronological narrative of market influences.
HVAC:	Heating, Ventilation, and Air Conditioning
IECP:	International Energy Cooperation Program
Impact Evaluation:	An evaluation determining the savings associated with energy efficiency or DSM programs.
IOU:	Investor owned utility
IUA:	Iowa Utility Association
IUB:	Iowa Utilities Board
Lost Revenue Recovery:	Allows a utility to recover the lost revenue attributable to DSM programs by increasing revenue by that same amount.
Market Perspective:	A Net to Gross viewpoint in which a focus in made of the energy efficiency programs influence on the broader market.
MEEA:	Midwest Energy Efficiency Alliance
NAPEE:	National Action Plan for Energy Efficiency
Net Savings:	Savings from energy efficiency programs, after using the NTG value to account the effects of free ridership and spillover by subtracting FR and adding SO to the gross savings value.
NPSO:	Non-Participant Spillover
NREL:	National Renewable Energy Laboratory
NTG:	Net-to-Gross
NTGR:	Net-to-Gross Ratio
OCA:	Office of Consumer Advocate
POS:	Point of Sale
Precision:	A measurement of how tight the confidence bounds around a researched value is.
Process Evaluation:	A program evaluation focusing on process aspects such as participant and trade ally program satisfaction, delivery and implementation issues.
Prospective Application:	NTG values are applied into future years.
QED:	Quasi-experimental design
RCT:	Randomized Control Trial
Retrospective Application:	Net to Gross values are applied into past years.
Risk Reward Mechanism:	Incentives (penalties) associated with exceeding (falling short of) net or gross savings targets.

Risk Percentile:	The likelihood of actual Net to Gross values being significantly lower than the assumed value.
SO:	Spillover
St@rVOI:	Stochastic at Risk Value of Information calculator. The Analytica tool created by Navigant to estimate program-level net NTG research benefits.
Stochastic:	A property of a parameter having a random probability distribution or pattern that may be analyzed statistically but may not be predicted precisely
SEJ:	Structured expert judgement
Top-Down Model:	Macroeconomic model
TRCT:	Total Resource Cost Test
TRM:	Technical Reference manual
UCT:	Utility Cost Test
UMP:	Uniform Methods Project
Upstream Program:	An energy efficiency program in which the incentives are targeted towards equipment distributors, contractors, or manufacturers, rather than the consumer.
VOI:	Value of Information

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Appendix A. State Net-to-Gross Policy Summaries

	Use of Gross or Net Savings			Components of NTG				DSM/Cost Recovery Policies			
State	(A) Gross (savings assume NTG of 1.0) or net?	(B) NTG Fixed at single value other than 1.0 for all measures?	(C) If (b)=Y then ask: What is the alternative value?	Participant SO	Non-Participant SO	Free Ridership	Goal Assessment: Gross, Deemed net (prospective), or Adjusted (retro) net?	Energy Efficiency Resource Standard	Decoupling	Lost revenue recovery	Risk/ Reward
Alabama	Gross	No	n/a	N	N	N	Gross	No	No	Yes	Bonus
Alaska	Gross	No	n/a	N	N	N	Gross	No	No	No	No
Arizona	Gross	No	n/a	N	N	N	Gross	Yes	E&G	Yes	Bonus
Arkansas	Net	No	n/a	Y	Y	Y	Retrospective	Yes	G, Pending E	Yes	Bonus
California	Net	No	n/a	Y	N	Y	Deemed and Retrospective	Yes	E&G	No	Both
Colorado	Net	No	n/a	Y	Y	Y	Retrospective	Yes	No	Yes	Bonus
Connecticut	Net	No	n/a	Y	Y	Y	Deemed	Yes	E, Pending G	Yes	Bonus
Delaware	Gross	No	n/a	N	N	N	Gross	No	Pending G	Pending	No
DC	Gross	No	n/a	N	N	N	Gross	No	E	No	Bonus
Florida	Net	No	n/a	Y	Y	Y	Retrospective	No	No	Yes	Bonus
Georgia	Net	No	n/a	Y	Y	Y	Deemed	No	G	No	Bonus
Hawaii	Net	Yes	0.7	N	N	Y	Deemed	Yes	No	No	Bonus
Idaho	Gross	No	n/a	N	N	N	Gross	No	E	No	No
Illinois	Net	No	n/a	Y	Y	Y	Deemed	Yes	G	No	Penalty
Indiana	Gross	No	n/a	Y	Y	Y	Gross	Yes	G	Yes	Bonus
Iowa	Gross	No	n/a	Y	Y	Y	Gross	Yes	No	No	No
Kansas	Net	No	n/a	N	N	Y	Retrospective	No	No	Yes	Bonus
Kentucky	Gross	No	n/a	N	N	N	Gross	No	No	Yes	Bonus
Louisiana	Gross	No	n/a	N	N	N	Gross	No	No	Yes	Bonus
Maine	Net	No	n/a	Y	N	Y	Deemed	Yes	No	No	No
Maryland	Gross	No	n/a	N	N	N	Gross	Yes	E&G	Yes	No
Massachusetts	Net	No	n/a	Y	Y	Y	Deemed	Yes	E&G	Yes	Bonus
Michigan	Net	Yes	0.9 for all except CFLs, which are 0.82	Y	Y	Y	Deemed	Yes	E&G	Yes	Bonus
Minnesota	Gross	No	n/a	N	N	N	Gross	Yes	G, Pending E	No	Bonus

	Use of Gross or Net Savings			Components of NTG				DSM/Cost Recovery Policies			
State	(A) Gross (savings assume NTG of 1.0) or net?	(B) NTG Fixed at single value other than 1.0 for all measures?	(C) If (b)=Y then ask: What is the alternative value?	Participant SO	Non-Participant SO	Free Ridership	Goal Assessment: Gross, Deemed net (prospective), or Adjusted (retro) net?	Energy Efficiency Resource Standard	Decoupling	Lost revenue recovery	Risk/ Reward
Mississippi	Gross	No	n/a	N	N	N	Gross	No	No	Pending	Pending
Missouri	Net	No	n/a	Y	Y	Y	Deemed	No	No	Yes	Bonus
Montana	Gross	No	n/a	N	N	N	Gross	No	No	Yes	Pending
Nebraska	Gross	No	n/a	N	N	N	Gross	No	Pending G	No	No
Nevada	Net	No	n/a	N	N	Y	Retrospective	Yes	G	Yes	No
New Hampshire	Gross	No	n/a	N	N	N	Gross	No	No	No	Bonus
New Jersey	Gross	No	n/a	N	N	N	Gross	No	G	No	No
New Mexico	Net	No	n/a	N	N	Y	Retrospective	Yes	No	Yes	Bonus
New York	Net	Yes	0.9	Y	Y	Y	Deemed	Yes	E&G	No	Bonus
North Carolina	Net	No	n/a	Y	Y	Y	Retrospective	Yes	G	Yes	Bonus
North Dakota	Gross	No	n/a	N	N	N	Gross	No	No	No	No
Ohio	Gross	No	n/a	N	N	N	Gross	Yes	E	Yes	Bonus
Oklahoma	Gross	No	n/a	N	N	N	Gross	No	No	Yes	Bonus
Oregon	Net	No	n/a	Y	Y	Y	Deemed	Yes	E&G	Yes	No
Pennsylvania	Gross	No	n/a	Y	Y	Y	Gross	Yes	No	No	Penalty
Rhode Island	Net	No	n/a	Y	Y	Y	Deemed	Yes	E&G	Yes	Bonus
South Carolina	Gross	No	n/a	N	N	N	Gross	No	No	Yes	Bonus
South Dakota	Net	No	n/a	Y	N	Y	Retrospective	No	No	Yes	Bonus
Tennessee	Gross	No	n/a	N	N	N	Gross	No	G	No	No
Texas	Gross	No	n/a	N	N	N	Gross	Yes	No	No	Bonus
Utah	Net	No	n/a	Y	Y	Y	Retrospective	No	G	Yes	No
Vermont	Net	No	n/a	Y	Y	Y	Deemed	Yes	E	No	Bonus
Virginia	Gross	No	n/a	N	N	N	Gross	No	G	Pending	No
Washington	Gross	No	n/a	N	N	N	Gross	Yes	G, Pending E	No	Penalty
West Virginia	Gross	No	n/a	N	N	N	Gross	No	No	No	Pending
Wisconsin	Net	No	n/a	Y	N	Y	Retrospective	Yes	E&G	No	Bonus
Wyoming	Net	No	n/a	Y	N	Y	Retrospective	No	G	Yes	No

Appendix B. NTG Methods Presentation to the Oversight Committee, January, 2015

Appendix B is provided as a separate PDF of a PowerPoint file presented to the Oversight Committee on January 8 and January 16, 2015.

Appendix C. Scenario Results—Net Research Benefit Outcomes

Detail results for the Scenarios 1 through 3 as described in Section 6.4 are provided in Tables C-1 through C-3. The green rows indicate programs for which the net benefits of NTG research are positive under a given scenario, red rows indicate that research is not cost-effective for the program under a scenario, and yellow rows indicate marginally positive or negative research benefits. Under Scenario 1, some programs warrant NTG research while others do not.

Moving to Scenario 2 with a higher program design improvement factor (i.e.-greater improvements in program design owing to NTG research), some of the programs for which NTG research was previously not cost effective are now either marginally or fully cost-effective. Scenario 2 demonstrates that higher expected returns to research in terms of resulting program improvements make NTG research more cost-effective.

Finally, moving to Scenario 3, in which a higher risk percentile is assumed (meaning an increased likelihood of finding a researched NTG value farther from 1.0), again, the cost-effectiveness of NTG research for certain programs improves, because the incremental benefit of better information is greater. Once again, several programs which previously had negative net benefits to NTG research now have marginally or fully positive net research benefits under Scenario 3. Scenario 3 demonstrates that the farther we believe the true NTG value to be from 1.0, the larger the potential benefits of NTG research, and accordingly, the more cost-effective NTG research may be.

Table C-1. Scenario 1 Results

Alliant	Total Research Benefits (Thousands)	Total Research Costs (Thousands)	Net Research Benefits (Thousands)	Pct. Change in Net Benefits	Projected NTG Ratio in Yr. 5
Commercial New Construction	$1,360.61	$93.00	$1,267.61	1.3%	0.64
Custom Rebates	$2,225.92	$93.00	$2,132.92	0.9%	0.76
Nonresidential Prescriptive Rebates	$457.28	$167.00	$290.28	0.5%	0.78
Residential Prescriptive Rebates	$309.99	$167.00	$142.99	0.4%	0.78
Home Energy Assessments	$7.27	$75.00	-$67.73	-9.3%	0.74
Change-a-Light	$115.83	$200.00	-$84.17	-0.8%	0.71
Appliance Recycling	$146.95	$93.00	$53.95	0.5%	0.63
Black Hills					
Nonresidential Custom	$12.39	$67.00	-$54.61	-4.1%	0.76
Residential Prescriptive	$68.27	$125.00	-$56.73	-0.7%	0.78
Nonresidential Prescriptive	$35.73	$125.00	-$89.27	-2.0%	0.79
Nonresidential New Construction	$8.52	$70.00	-$61.48	-10.2%	0.64
Residential New Construction	$14.67	$70.00	-$55.33	-2.7%	0.82
MidAmerican					
Residential Equipment	$644.51	$167.00	$477.51	0.6%	0.78
Nonresidential Equipment	$1,206.56	$167.00	$1,039.56	0.7%	0.78
Commercial New Construction	$689.84	$93.00	$596.84	1.2%	0.64
Commercial Assessment	$56.36	$75.00	-$18.64	-0.3%	0.74
Upstream Retail Lighting	$270.47	$200.00	$70.47	0.3%	0.71
Industrial Partners	$285.29	$75.00	$210.29	1.1%	0.63
Residential Assessment	$45.16	$75.00	-$29.84	-0.5%	0.82

Table C-2. Scenario 2 Results

Alliant	Total Research Benefits (Thousands)	Total Research Costs (Thousands)	Net Research Benefits (Thousands)	Pct. Change in Net Benefits	Projected NTG Ratio in Yr. 5
Commercial New Construction	$2,721.22	$93.00	$2,628.22	2.7%	0.68
Custom Rebates	$4,451.83	$93.00	$4,358.83	1.8%	0.79
Nonresidential Prescriptive Rebates	$914.56	$167.00	$747.56	1.4%	0.81
Residential Prescriptive Rebates	$619.99	$167.00	$452.99	1.2%	0.81
Home Energy Assessments	$14.54	$75.00	-$60.46	-8.3%	0.77
Change-a-Light	$231.65	$200.00	$31.65	0.3%	0.74
Appliance Recycling	$293.90	$93.00	$200.90	2.0%	0.67
Black Hills					
Nonresidential Custom	$24.77	$67.00	-$42.23	-3.2%	0.79
Residential Prescriptive	$136.54	$125.00	$11.54	0.1%	0.81
Nonresidential Prescriptive	$71.47	$125.00	-$53.53	-1.2%	0.81
Nonresidential New Construction	$17.04	$70.00	-$52.96	-8.8%	0.68
Residential New Construction	$29.34	$70.00	-$40.66	-2.0%	0.84
MidAmerican					
Residential Equipment	$1,289.03	$167.00	$1,122.03	1.5%	0.81
Nonresidential Equipment	$2,413.11	$167.00	$2,246.11	1.6%	0.81
Commercial New Construction	$1,379.68	$93.00	$1,286.68	2.6%	0.68
Commercial Assessment	$112.73	$75.00	$37.73	0.7%	0.77
Upstream Retail Lighting	$540.94	$200.00	$340.94	1.4%	0.74
Industrial Partners	$570.59	$75.00	$495.59	2.5%	0.67
Residential Assessment	$90.31	$75.00	$15.31	0.2%	0.84

Table C-3. Scenario 3 Results

Alliant	Total Research Benefits (Thousands)	Total Research Costs (Thousands)	Net Research Benefits (Thousands)	Pct. Change in Net Benefits	Projected NTG Ratio in Yr. 5
Commercial New Construction	$3,906,440.96	$93,000.00	$3,813,440.96	2.3%	0.54
Custom Rebates	$7,409,725.12	$93,000.00	$7,316,725.12	3.1%	0.64
Nonresidential Prescriptive Rebates	$1,350,585.10	$167,000.00	$1,183,585.10	2.2%	0.72
Residential Prescriptive Rebates	$915,571.71	$167,000.00	$748,571.71	2.0%	0.72
Home Energy Assessments	$23,451.75	$75,000.00	-$51,548.25	-7.0%	0.63
Change-a-Light	$324,713.70	$200,000.00	$124,713.70	1.2%	0.64
Appliance Recycling	$352,222.03	$93,000.00	$259,222.03	2.5%	0.61
Black Hills					
Nonresidential Custom	$41,233.64	$67,000.00	-$25,766.36	-1.9%	0.64
Residential Prescriptive	$201,636.70	$125,000.00	$76,636.70	0.9%	0.72
Nonresidential Prescriptive	$120,114.75	$125,000.00	-$4,885.25	-0.1%	0.69
Nonresidential New Construction	$24,467.28	$70,000.00	-$45,532.72	-7.5%	0.54
Residential New Construction	$57,495.19	$70,000.00	-$12,504.81	-0.6%	0.68
MidAmerican					
Residential Equipment	$1,903,588.13	$167,000.00	$1,736,588.13	2.3%	0.72
Nonresidential Equipment	$3,941,746.48	$167,000.00	$3,774,746.48	2.6%	0.68
Commercial New Construction	$1,980,601.38	$93,000.00	$1,887,601.38	3.9%	0.54
Commercial Assessment	$181,762.77	$75,000.00	$106,762.77	1.9%	0.63
Upstream Retail Lighting	$758,254.91	$200,000.00	$558,254.91	2.3%	0.64
Industrial Partners	$683,815.10	$75,000.00	$608,815.10	3.1%	0.61
Residential Assessment	$176,952.40	$75,000.00	$101,952.40	1.6%	0.68