State Net-to-Gross Ratios

Research Results and Analysis for Average State Net-to-Gross Ratios Used in Energy Efficiency Savings Estimates

Prepared for the United States Environmental Protection Agency

January 23, 2015

AUTHORS

Erin Malone
Wendy Ong
Max Chang

Synapse
Energy Economics, Inc.

485 Massachusetts Avenue, Suite 2
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

CONTENTS

1. EXECUTIVE SUMMARY

At the request of the United States Environmental Protection Agency (EPA), Synapse Energy Economics (Synapse) researched net-to-gross (NTG) ratios that states use for energy efficiency savings estimates. This research focused on: (1) state-specific NTG ratios for 2011 through 2015 at the customer-sector level (residential, low-income, and commercial and industrial [C&I]), and (2) NTG ratios at the regional or national level. This report summarizes the results of that research.

Synapse encountered a number of issues related to data availability, reliability, and consistency across states. As such, the results presented in this report provide a general indication, rather than an absolute value, of the NTG ratios used by states. The lack of complete and/or reliable data also determined the subset of states analyzed in this report: While Synapse reviewed all 50 states and the District of Columbia at a high level, we found that only 24 states could be researched in more detail.

Overall, for those 24 states across the five-year study period, Synapse reviewed 80 NTG ratios for residential, 47 NTG ratios for low-income, 80 NTG ratios for C&I, and 85 portfolio total NTG ratios, for a total of 292 NTG ratios. Key results and findings from Synapse's research are provided below.

Figures ES.1 and ES.2, below, show state NTG ratios for 2011 through 2015 by customer sector. Figure ES.1 presents the ratios by year and Figure ES.2 presents the ratios averaged for those years. The figures show:

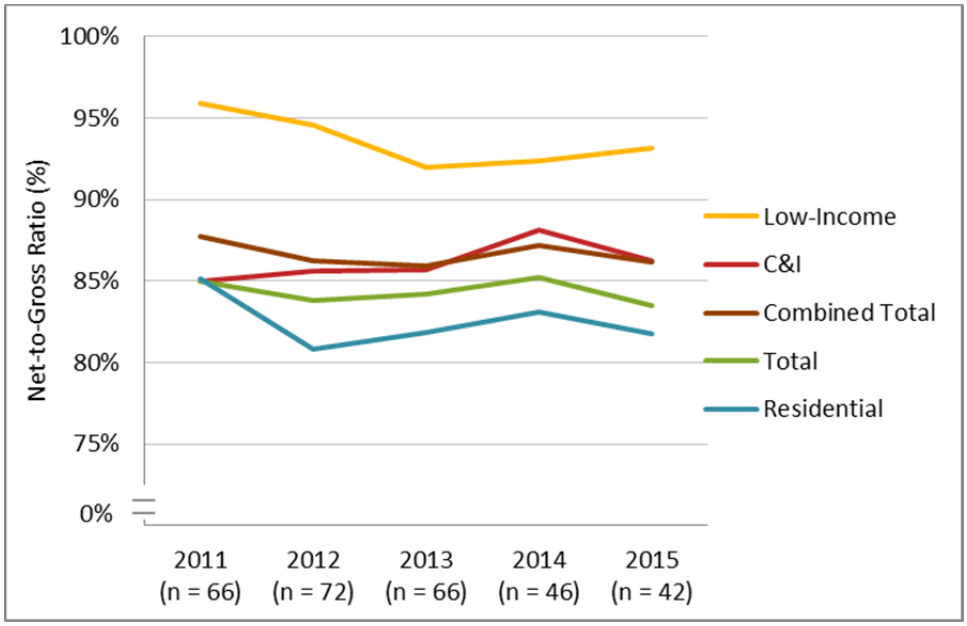
- Average NTG ratios range from 83 percent to 94 percent depending on the customer sector, with 87 percent being the average across all years and customer sectors. Note that the combined total values shown in Figures ES.1 and ES.2 represent the average across the three customer sectors and in total. This was included to average all of the data, as not all states provided NTG ratios by sector or in total.
- Over the five-year research period, NTG ratios decrease slightly for all customer sectors except for C&I, indicating an increase in free ridership or a decrease in spillover. C&I NTG ratios increase slightly over the study period, indicating an increase in spillover or a decrease in free ridership for this customer sector.
- Residential NTG ratios[1] tend to be the lowest of the three customer sectors, indicating a higher degree of free ridership. Therefore, residential customers are more likely than other customer sectors to implement energy-efficient measures or practices in the absence of the programs, but participate in energy efficiency programs anyway to receive the customer incentive.

[1] If a state separately identified savings or NTG ratios for the low-income sector, then it is included in the low-income data presented in Figures ES.1 and ES.2. However, if a state does not separately identify low-income customers, then it is presumably included with the residential data presented in Figures ES.1 and ES.2.

- When reported separately from residential programs,[2] the NTG ratios for low-income programs tend to be closest to 100 percent, indicating that low-income customers are less likely to install energy efficiency measures absent a utility energy efficiency program (see Table B.4 in Appendix B for supporting information).[3]

- The C&I sector has NTG ratios greater than 100 percent more frequently during the study period than the other sectors. This suggests that it is more common for C&I customers to install energy efficiency measures without participating in an energy efficiency program but as a result of the programs' influence, regardless of whether the C&I customer previously participated in an energy efficiency program (see Table B.5 in Appendix B for supporting information).[4]

Figure ES.1. Simple State Average Net-to-Gross Ratios for 2011 through 2015 by Customer Sector (%)

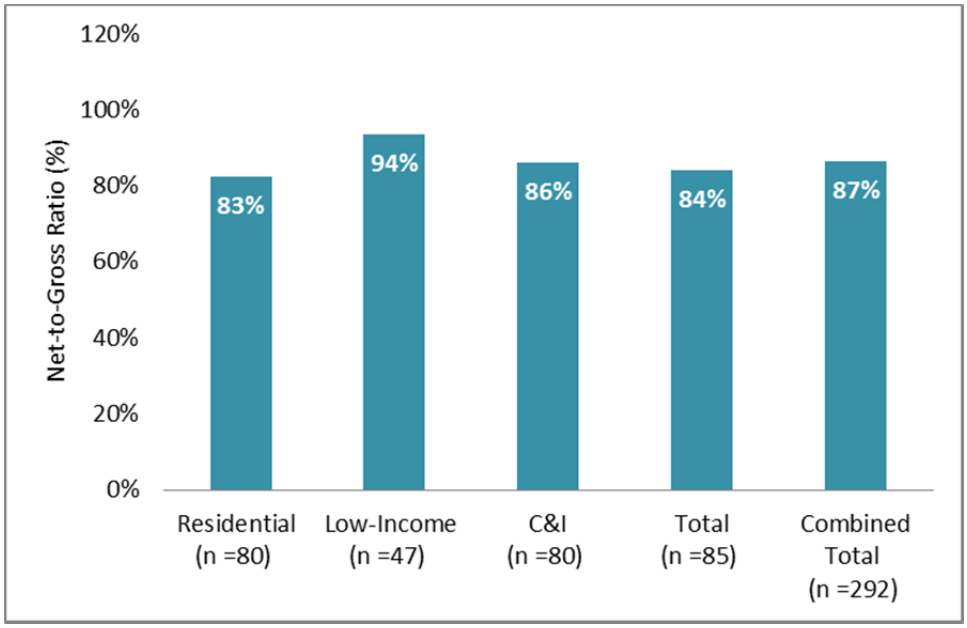


[2] Fourteen states report low-income separately from residential customers. These states are Arizona, California (for 2014-2015 only), Colorado, Connecticut, District of Columbia, Illinois (for 2011 only), Maryland (for 2011-2012 only), Massachusetts, Michigan, Nevada (for all years except 2011), New York, Pennsylvania, Rhode Island, and Utah.

[3] There are 34 instances of a NTG ratio equal to 100 percent over the years, states, and sectors. Eighteen of the 34 instances are for the low-income customer sector.

[4] There are 24 instances of a NTG ratio greater than 100 percent over the years, states, and sectors. Nine of the 24 instances are for the C&I customer sector.

Figure ES.2. Simple State Average of Net-to-Gross Ratios, Averaged for 2011 through 2015, by Customer Sector (%)



More broadly, our research also found:

- Not all states indicate clearly the type of saving that they report and how those savings are calculated. Even when states do provide definitions for the types of savings reported, those definitions are typically inconsistent across states. More specifically, state-reported data in many instances did not indicate whether the state reports gross savings at the meter or generator level, or whether the net savings that the state reports include adjustments for realization, persistence, in-service rates and others, in addition to free ridership and/or spillover impacts.

- States that report net savings determine those net savings either through evaluation studies or through deemed NTG values. Most states that apply NTG ratios (17 out of 23) determine those values through evaluation studies, which often focus on participant surveys to determine the ratio.

- Depending on the state, NTG ratios can be applied at the measure, sector, or program level, or a combination of these levels depending on the type of programs or the evaluation studies that have been conducted. For example, at least six states assume a 100 percent NTG ratio for all low-income programs.

- States may not provide net savings for all programs or measures. Maine and at least three of the 27 states that were not researched further, including Florida, New Jersey, and Tennessee, report gross savings for all measures except for certain end uses or measures for which evaluation results have indicated a clear NTG ratio or identified other impacts.

- States use net and gross savings differently, depending on what the savings are being used to estimate. As examples, net savings can be used to determine a utility's performance incentives (i.e., Georgia), or for cost-effectiveness and program design

(i.e., Maryland), while gross savings are the state's focus for program goals and reporting.

- Steps that states can take to improve the transparency of their savings assumptions include indicating upfront (1) the type of savings they are using; (2) how they define those savings, including the impacts that are and are not accounted for in the savings type; and (3) how those savings are used by the state, regulators, and the utility.

- There is some anecdotal information to indicate that states have been focused on developing and studying NTG ratios in recent years. As examples, Maine started to study NTG ratios beginning in 2012, North Carolina included net savings in their 2014 energy efficiency data for what appears to be the first time, and Massachusetts conducted a significant NTG study in 2012 to update its previous NTG ratios.

- Leading states[5] are more likely than developing states[6] to evaluate and consider net savings, rather than gross savings alone.

- Leading states typically have higher NTG ratios than non-leading states, indicating that their programs are resulting in more direct benefits to customers.

- States that are developing energy efficiency programs may not have the funding or resources available for studying or evaluating NTG ratios, while leading states are more likely to have a larger budget available for such research.

- Our research on other studies indicates that ACEEE applies a NTG ratio of 90 percent to convert gross savings to net savings. Navigant conducted a study of 9 jurisdictions involving 38 NTG ratio values, and concluded that the average NTG ratio for non-residential gas energy efficiency programs is about 87 percent. These values are slightly higher than the 87 percent found in Synapse's research.

2. BACKGROUND: DEFINING NET-TO-GROSS

Within the energy efficiency industry, there are many terms used to classify different types of energy savings. These terms are important to understand before reviewing and discussing NTG ratios. Appendix A provides detailed definitions for commonly used energy efficiency savings terms, which have been

[5] We define leading states as those states that ACEEE has ranked within the top ten states, on average, between the 2011 and 2014 ACEEE Scorecards. More specifically, the leading states are (with the average rank indicated in parentheses): California (2), Connecticut (6), Massachusetts (1), Maryland (9), Minnesota (9), New York (4), Oregon (4), Rhode Island (5), Vermont (5), and Washington (7).

[6] We define developing states as those states that ACEEE has ranked within the bottom ten states, on average, between the 2011 and 2014 ACEEE Scorecards. More specifically, the developing states are (with the average rank indicated in parentheses): Alabama (40), Alaska (45), Kansas (43), Louisiana (43), Mississippi (49), Missouri (44), Nebraska (42), North Dakota (51), South Carolina (42), South Dakota (46), West Virginia (46), and Wyoming (50).

borrowed from Northeast Energy Efficiency Partnerships (NEEP).[7] Condensed definitions are repeated below for certain key terms.

- **Gross Savings**: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated and unadjusted by any factors.
- **Adjusted Gross Savings**: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated. It adjusts for such factors as data errors, installation and persistence rates, and hours of use, but does not adjust for free ridership or spillover.
- **Net Savings**: The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of free drivers, free riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand.
- **Free Rider**: A program participant who would have implemented the program measure or practice in the absence of the program.
- **Spillover**: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program.
- **Net-to-Gross Ratio**: A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts. The factor itself may be made up of a variety of factors that create differences between gross and net savings, commonly including free riders and spillover. The commonly used formula for calculating NTG ratios is: 1 – Free Ridership Rate + Spillover Rate = NTG Ratio.

Gross savings can be estimated either at the generator level or at the meter level, with the difference being that line losses are taken into account at the meter level but not at the generator level. Once gross savings are determined, impact factors that account for measure effects such as persistence and realization can be applied to determine the adjusted gross savings. Finally, net savings are determined by applying free ridership and spillover factors to the adjusted gross savings, often through an NTG ratio that combines both of these factors.

When NTG ratios account for both free ridership and spillover effects, the free ridership effect decreases the NTG ratio, indicating that a percentage of savings are attributable to free riders. A free rider would have saved electricity in the absence of an energy efficiency program, even though a program administrator provided an incentive to the free rider to use energy more efficiently. Therefore, the free

[7] Northeast Energy Efficiency Partnerships, "Glossary of Terms, Version 2.1," a Project of the Regional Evaluation, Measurement, and Verification Forum, July 2011.

rider's savings are not considered a direct result of the programs' efforts, and are typically not attributable to the program. The free rider effect reduces a program administrator's savings.

Conversely, spillover increases the NTG ratio, indicating that a high percentage of savings are attributable to spillover effects. Spillover savings are in addition to the programs' savings and are realized because of the program's efforts, and are typically attributable to the program. The spillover effects increases a program administrator's savings.

With an NTG ratio that accounts for both free ridership and spillover, the two effects will cancel against each other. If an NTG ratio is below 100 percent, then free ridership is greater than spillover effects, while an NTG ratio above 100 percent indicates that spillover effects outweigh free ridership effects.

States can use net and gross savings for different purposes, depending on what the savings are being used to estimate. For example, gross savings can be used for system planning purposes to be able to accurately build a reliable system, while net savings can be used for regulatory purposes to indicate the amount of savings that are directly attributable to the programs efforts.

3. METHODOLOGY

3.1. Overview

For this research, Synapse focused on electric NTG ratios in state energy efficiency plans and reports between 2011 through 2015 at the customer sector level (residential, low-income, and C&I). Synapse also researched any regional or national level NTG ratios that are generally applied by the American Council for an Energy Efficiency Economy (ACEEE) or similar organizations.

Synapse initially planned to research a subset of states in detail, thereby researching selected states in greater depth rather than researching a range of states on a more shallow level. The aim was to research states that are leaders in energy efficiency program savings, while at the same time ensuring a geographically diverse sample of states regardless of their success in achieving savings. However, as research progressed, it became clear that states approach net and gross savings differently, and information was lacking or incomplete in many instances. This theme is repeated throughout this report. Ultimately, we looked at all states in the United States as well as the District of Columbia[8] to determine whether they report both net and gross savings. Synapse determined that 24 states could be researched in more detail, while the remaining 27 states could not be researched in more detail for this analysis. Unless otherwise noted, we primarily focus the results and findings in this report on the 24 states we researched in detail.

[8] Note that the greenhouse gas reduction goals within EPA 111(d) regulations are based on reducing the "pollution-to-power ratio" of fossil-fuel fired power plants in a given state. Because Vermont and the District of Columbia do not have affected fossil-fuel fired power plants within their borders, they are not required to reduce emissions under EPA 111(d).

Table B.1 in Appendix B identifies the 24 states that were researched in detail. This table also indicates the type of savings states report and how states determine or use the savings. Table B.2 in Appendix B identifies and details the rationale behind the 27 states that Synapse determined were unsuitable for further investigation. In general, Synapse did not research states if they do not implement energy efficiency programs, implement only limited energy efficiency programs,[9] only report gross savings,[10] or where information was too uncertain or incomplete to determine if a state reports net or gross savings.

We examined state policies as articulated in state legislation, rules and regulations, or commission orders to determine if states explicitly define their policy regarding net or gross savings.

3.2. Savings and Net-to-Gross Ratio Research

For the four states that apply deemed NTG ratios,[11] we used those values and did not research savings for the state.[12] The deemed NTG ratios are typically articulated in the state's energy efficiency policy documents.

In instances where we obtained savings information, we collected both the net and the gross annual electric energy savings reported in the state (in either kWh or MWh), and then determined an average NTG ratio weighted by the magnitude of the savings within the customer sector.

For seven states,[13] savings data was more difficult to find. In such instances, Synapse collected, where available, the NTG ratios as presented in plans, reports, evaluation studies, or technical reference manuals (TRM), and calculated a simple average of the ratios by customer sector. However, TRMs typically provide measure-specific NTG ratios, which could not always be incorporated into the customer sector-level research.

---

[9] States that implement only limited energy efficiency programs are those states that either (a) have consistently ranked towards the bottom of states in the ACEEE Scorecards (Missouri and Wyoming), or (b) were not researched in other NTG studies for various reasons (Alabama, Alaska, Louisiana, Mississippi, and West Virginia). As an example for the latter reason, ACEEE's "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs," explains: "the states reporting that they have essentially no formally approved utility ratepayer-funded energy efficiency programs, chose not to participate in this survey, or did not have enough of an established evaluation function to respond to the survey are: Alabama, Alaska, Louisiana, Mississippi, North Dakota, and West Virginia."

American Council for an Energy Efficient Economy, "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs," Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012, p 3, fn 2.

[10] Note that Arizona assumes net savings are equal to gross savings (i.e., the NTG ratio is equal to 100 percent for all measures). Therefore, Synapse classifies Arizona as reporting net savings.

Personal Communications with Southwest Energy Efficiency Project staff, December 2014.

[11] These states are Arizona, California, New York, and Michigan.

[12] Note that California is an exception, as they use NTG ratios for certain programs, and apply an 80 percent deemed NTG ratio for all other programs. Therefore, we researched savings for 2011 through 2013 and used the resulting NTG ratios for those years, and then used the deemed savings for 2014 and 2015.

[13] These states include, for at least some years, Georgia, Maine, Maryland, Nevada, North Carolina, Pennsylvania, and Texas.

The final NTG ratios that Synapse used in this analysis are based on deemed NTG ratios where applicable or savings where available. When deemed NTG ratios or savings could not be used, we used the simple average NTG ratios discussed above. When analyzing the results across states, years, or sectors for this analysis, we took a simple average of these final NTG ratios.

Synapse would have preferred for the analysis of average NTG ratio for states, sectors, and years to be based on both net and gross savings. Such an approach would provide weighted average NTG ratios that account for the magnitude of savings for a given state, sector, or year. However, as a result of the data availability, this approach would not capture states for which savings data is unavailable or states that use deemed NTG ratios. See Tables B.3 in Appendix B for a comparison of the two different types of NTG ratio values. Note that the number of data points for savings totals 182, while the number of data points for NTG ratios totals 292. See Table B.8 in Appendix B for the final NTG ratios used in each state.

Throughout the investigation, Synapse collected as much information as was available. In many instances, however, savings were not available for all five years or for all three customer sectors.[14] Therefore, the results provided in the section below do not summarize savings and NTG ratios across all states, sectors, and years. Rather, the results are mixed depending on the information available. For example, in 2011, 19 states presented residential NTG ratios, but only 11 states presented residential NTG ratios in 2015. As another example, North Carolina presents NTG ratios only at the total portfolio level, and not at the customer-sector level. Tables B.6 and B.7 in Appendix B provide examples of the type of data Synapse collected for this research.

A number of other issues emerged that impacted the data reliability and Synapse's ability to compare data across states. This is elaborated on in the Findings section under "Differences across States." For the purposes of this investigation, Synapse assumed that the terms used by the states are consistent with the definitions provided in Appendix A, including the definition that NTG ratios account for both free ridership and spillover effects. While this assumption is inaccurate or possibly inappropriate for some states,[15] when considering the availability and clarity of data provided by states, such an assumption is necessary to be able to compare data across states. Therefore, given the data availability, reliability, and consistency across states, the results presented below provide a general indication, rather than an absolute value, of the NTG ratios used throughout the United States.

---

[14] Savings or NTG ratios were not available for all 5 years in 15 states. These states are Arkansas (2011-2013), Connecticut (2011-2012), District of Columbia (2012-2013), Georgia (2011-2013), Hawaii (2011-2014), Illinois (all but 2013), Maine (all but 2015), Michigan (all but 2011), Montana (2011), Pennsylvania (2011-2013), Rhode Island (all but 2013), Texas (2013), Utah (2012-2013), Vermont (2011-2013), and Wisconsin (2011, 2013). Typically, data was not available for 2011, 2014, or 2015.

Savings or NTG ratios were not available for all 3 customer sectors in 14 states for the years where state data was available. These states are Arkansas, California (except for 2014-2015), Georgia, Hawaii, Illinois (except for 2011), Maine, Maryland (except for 2011-2012), Montana, Nevada (only for 2011), North Carolina, Oregon, Texas, Vermont, and Wisconsin. Typically, data for the low-income sector were not available separately from the data for the residential sector.

[15] For example, Maine's "net" savings as used for this project are actually the adjusted gross savings reported by the Efficiency Maine Trust.

Efficiency Maine Trust, "2013 Annual Report of the Efficiency Maine Trust," Corrected Version February 11, 2014.

Note that Synapse did not research municipal energy efficiency programs, nor did we research every utility's energy efficiency program in every state. Where multiple utilities implement energy efficiency programs in a state, Synapse researched either the primary utility or a representative sample of the utilities in the state.

Our research also focused on energy savings, in terms of kWh or MWh. Some states presented information in terms of MMBTUs or kW, which could not be adopted in such a manner for the analysis. In such a situation, either the NTG ratio was estimated using the available savings information or the stated NTG ratio was collected. However, in some cases, the NTG ratio may be different depending on the fuel or savings type.[16]

3.3. Source Information

We relied upon utility or third-party program administrator energy efficiency plans and reports as our primary source for savings information. We also referenced state TRMs and third-party evaluation studies conducted on energy efficiency programs, as well as state legislation, rules and regulations, or commission orders as necessary.

For states where information was more difficult to obtain, we contacted (1) state representatives at the regulatory commissions, (2) energy resource departments, (3) utility energy efficiency departments, or (4) the third-party program administrator directly. These contacts either provided the savings information in Excel workbooks, or directed us to the relevant documents, docket numbers, or websites.

We also relied upon literature that previously surveyed states' net and gross savings assumptions, which primarily included studies conducted by the ACEEE and NMR Group.[17] We also looked into policy information provided by regional and national organizations, including the ACEEE State and Local Policy Database,[18] the Midwest Energy Efficiency Alliance (MEEA) website,[19] and the NEEP Regional Energy Efficiency Database (REED).[20]

---

[16] See, e.g., Efficiency Maine, "2012 Annual Report of the Efficiency Maine Trust," Revised Version February 12, 2013.

[17] See American Council for an Energy Efficient Economy, "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs," Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012.

American Council for an Energy Efficient Economy, "Examining the Net Savings Issue: A National Survey of State Policies and Practices in the Evaluation of Ratepayer-Funded Energy Efficiency Programs," Martin Kushler, Seth Nowak, and Patti Witte, Report Number U1401, January 2014.

NMR Group, "Net Savings Scoping Paper, Final," Submitted to: Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, November 13, 2010.

NMR Group, "Regional Net Savings Research, Phase 2: Definitions and Treatment of Net and Gross Savings in Energy and Environmental Policy," Submitted to: Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, December 4, 2012.

[18] American Council for an Energy Efficient Economy, "State and Local Policy Database," accessed December 2014, available at http://database.aceee.org/.

4. RESULTS

This section summarizes the results of our research and analysis. Overall, for 24 states over the period of 2011 through 2015, we reviewed 80 NTG ratios for residential, 47 NTG ratios for low-income, 80 NTG ratios for C&I, and 85 portfolio total NTG ratios, for a total of 292 NTG ratios.

Appendix B provides more detailed information for the values and analysis presented below. In particular, Figures B.1 through B.4 in Appendix B present the distribution and range of NTG ratios for each sector, which is not discussed in this section.

Note that when the combined total value is shown in this section and in Appendix B, it represents the average across the three customer sectors and in total. This is included to provide an average of all of the data, as not all states provided NTG ratios by sector or in total.

4.1. State NTG Ratios

Figure 1 summarizes for each customer sector the average NTG ratios used across the states for each year in 2011 through 2015. This figure indicates how NTG ratios have changed over time for each customer sector.[21] Figure 1 shows that, over the five-year research period, NTG ratios have decreased slightly for all customer sectors except for C&I, indicating an increase in free ridership or a decrease in spillover. C&I NTG ratios increased slightly over the study period, indicating an increase in spillover or a decrease in free ridership for this customer sector. Specifically from 2011 to 2015, the NTG ratios have decreased from 85 percent to 82 percent for residential customers, decreased from 96 percent to 93 percent for low-income customers, increased from 85 percent to 86 percent for C&I customers, decreased from 85 percent to 84 percent across all customer sectors, and decreased from 88 percent to 86 percent for the combined total.

---

[19] Midwest Energy Efficiency Alliance, available at: http://www.mwalliance.org/.

[20] Northeast Energy Efficiency Partnerships, Regional Energy Efficiency Database, Reports, available at: http://www.neep-reed.org/Focus.aspx.

[21] If a state separately identified savings or NTG ratios for the low-income sector, than it is included in the low-income data presented in Figures 1 and 2. However, if a state does not separately identify low-income customers, then it is presumably included with the residential data presented in Figures 1 and 2.

Figure 1. Simple State Average Net-to-Gross Ratios for 2011 through 2015 by Customer Sector (%)

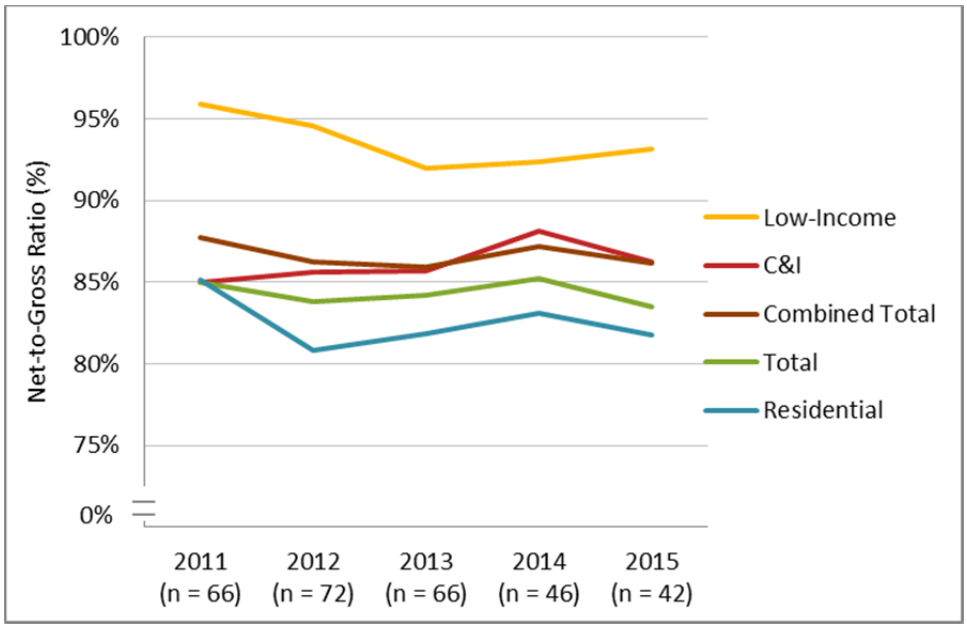
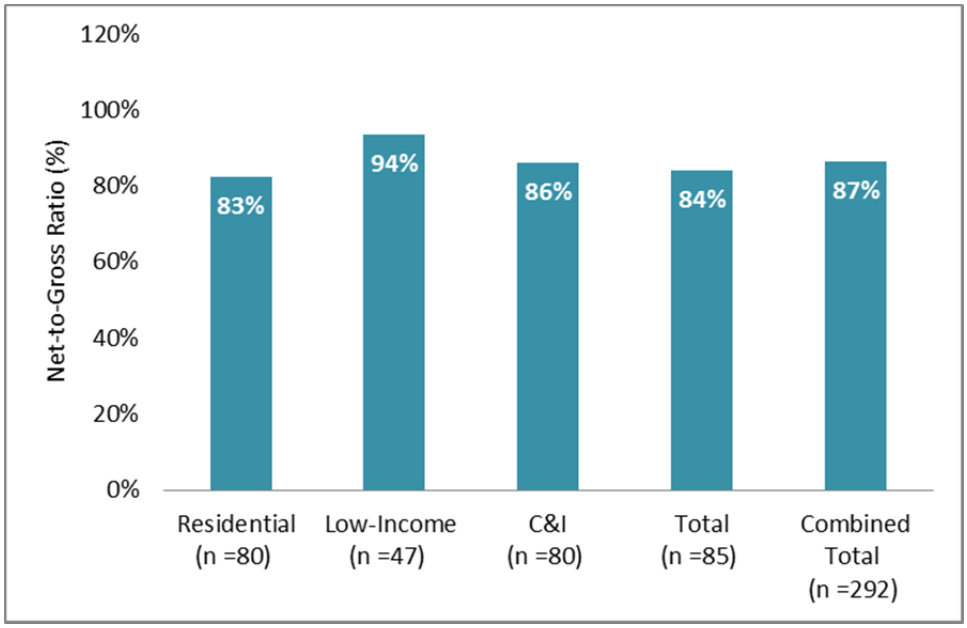


Figure 2 provides for each customer sector the average NTG ratio used across the states, averaged across 2011 through 2015. As Figure 2 shows, average NTG ratios range from 83 percent to 94 percent depending on the customer sector, with 87 percent being the average across all years and customer sectors.

Figure 2. Simple State Average of Net-to-Gross Ratios, Averaged for 2011 through 2015, by Customer Sector (%)



As mentioned in the Background section, if an NTG ratio is below 100 percent, then free ridership is greater than spillover effects, while an NTG ratio above 100 percent indicates that spillover effects outweigh free ridership effects.

Both figures show that the residential NTG ratios tend to be the lowest of the three customer sectors, indicating a higher degree of free ridership. Therefore, residential customers are more likely than other customer sectors to implement energy efficient measures or practices in the absence of the programs, but participate in energy efficiency programs anyway to receive the customer incentive.

For the 14 states that report low-income data separately from residential data,[22] the NTG ratios for low-income programs tend to be closest to 100 percent, indicating that low-income customers are less likely to install energy efficiency measures absent a utility energy efficiency program (see Table B.4 in Appendix B for supporting information).[23] At least six states assume a 100 percent NTG ratio for low-income programs, based on the assumption that low-income customers would not install energy-efficient measures without the assistance of the program.[24]

The C&I sector has NTG ratios above 100 percent more frequently during the study period than the other sectors, indicating that it is more common for C&I customers to install energy efficiency measures without participating in an energy efficiency program but as a result of the programs' influence, regardless of whether the C&I customer previously participated in an energy efficiency program (see Table B.5 in Appendix B for supporting information).[25]

4.2. Regional or National NTG Ratios

Synapse found few studies that summarize NTG values across multiple states or regions. The three primary sources we found are summarized below. These reports may not be directly comparable to Synapse's research, given that one study focuses only on deemed NTG ratios, and another focuses on non-residential gas NTG ratios. Nonetheless, we reviewed and summarized these reports for the purposes of conducting a thorough review and analysis, and to provide a healthy check against our own researched values.

Other studies discuss NTG ratios more generally across regions and states, without specifically recommending or providing NTG ratio values. Such studies are included in the References section under "Multiple States."

[22] Fourteen states report low-income separately from residential customers. These states are Arizona, California (for 2014-2015 only), Colorado, Connecticut, District of Columbia, Illinois (for 2011 only), Maryland (for 2011-2012 only), Massachusetts, Michigan, Nevada, (for all years except 2011), New York, Pennsylvania, Rhode Island, and Utah.

[23] There are 34 instances of an NTG ratio equal to 100 percent over the years, states, and sectors. Eighteen of the 34 instances are for the low-income customer sector.

[24] This is true at least in some years for Arizona, Illinois, Massachusetts, Nevada, Pennsylvania, and Rhode Island.

[25] There are 24 instances of an NTG ratio greater than 100 percent over the years, states, and sectors. Nine of the 24 instances are for the C&I customer sector.

ACEEE Energy Efficiency Scorecard

In its 2014 State Energy Efficiency Scorecard,[26] ACEEE notes that at least eight states[27] do not estimate or report net savings. In these cases, ACEEE applies an NTG ratio of 90 percent to convert gross savings to net savings. ACEEE explains that doing so allows for a more straightforward comparison with other states that do report net electricity savings. ACEEE estimates that an NTG ratio of 90 percent falls within the range of factors used by several states in calculating net efficiency program savings, including Massachusetts, Maryland, New York, Vermont, and Michigan.[28]

NAPEE Impact Evaluation Guide

The National Action Plan for Energy Efficiency (NAPEE)[29] explains that in some states, NTG ratios are stipulated "when the expense of conducting NTG ratio analyses and the uncertainty of the potential results are considered significant barriers. In such a situation, a regulatory body sets the value, which is typically in the 80 to 95 percent range."[30] This NTG ratio range is only for states that stipulate a specific NTG ratio, and does not account for states that estimate NTG ratios through evaluation studies. NAPEE does not provide or estimate a national average NTG ratio, and Synapse is not suggesting that NAPEE is using this range of values as a national average NTG ratio.

Navigant Jurisdictional Review

Navigant studied 38 NTG ratio values for non-residential gas programs in 9 jurisdictions[31] across different years (ranging from 2004 to 2011).[32] Navigant concluded that the average NTG ratio for non-

---

[26] In the ACEEE Scorecards, ACEEE ranks states on their policy and program efforts, and recommends ways that states can improve their energy efficiency performance in various policy areas.
American Council for an Energy Efficient Economy, "The 2014 State Energy Efficiency Scorecard," Annie Gilleo, Anna Chittum, Kate Farley, Max Neubauer, Seth Nowak, David Ribeiro, and Shruti Vaidyanathan, Report Number U1408, October 21, 2014, p v.

[27] ACEEE indicates that at least a portion of 2013 savings were reported as gross for the following states in its 2014 Scorecard: Delaware, Georgia, Hawaii, Minnesota, New Jersey, Pennsylvania, Tennessee, and Washington.
American Council for an Energy Efficient Economy, "The 2014 State Energy Efficiency Scorecard," Annie Gilleo, Anna Chittum, Kate Farley, Max Neubauer, Seth Nowak, David Ribeiro, and Shruti Vaidyanathan, Report Number U1408, October 21, 2014, p 33.

[28] American Council for an Energy Efficient Economy, "The 2014 State Energy Efficiency Scorecard," Annie Gilleo, Anna Chittum, Kate Farley, Max Neubauer, Seth Nowak, David Ribeiro, and Shruti Vaidyanathan, Report Number U1408, October 21, 2014, p 31.

[29] The NAPEE Model Energy Efficiency Program Impact Evaluation Guide is intended to assist gas and electric utilities, utility regulators, and others in the implementation of the recommendation of the National Action Plan for Energy Efficiency and the pursuit of long-term goals. The guide describes a structure and several model approaches for calculating energy, demand, and emissions savings resulting from facility (non-transportation) energy efficiency programs that are implemented by cities, states, utilities, companies, and similar entities.

[30] National Action Plan for Energy Efficiency Leadership Group, "Model Energy Efficiency Program Impact Evaluation Guide, A Resource for the National Action Plan for Energy Efficiency," November 2007, p 5-7.

[31] These jurisdictions include California, Colorado, Massachusetts, Minnesota, New Jersey, New Mexico, Oregon, Washington, and Wisconsin. Navigant, "Custom Free Ridership and Participant Spillover Jurisdictional Review," May 29, 2013, p 14.

residential gas programs is about 87 percent. The more detailed findings are provided below, although note that they primarily focus on NTG ratios that only include free ridership and not spillover.[33] Also note Navigant's focus on non-residential gas programs, which is not directly comparable to Synapse's review of electric programs across all customer sectors. Navigant found that:

- While the dispersion of net-of-free ridership values is quite large, ranging from 21 percent to 100 percent, the majority of values appear to "cluster" between 40 percent and 90 percent.
- There are only a few studies at the extremes of the range of net-of-free ridership values.
- One result reports high levels of free ridership (79 percent) with another reporting zero free ridership.
- The average net-of-free ridership value is 68 percent.
- NTG values are larger when considering spillover. Average net-of-free ridership and participant spillover value is 86 percent and average net-of-free ridership and spillover value is 87 percent, suggesting that non-participant spillover is small for non-residential gas programs.

5. FINDINGS

5.1. Differences across States

Throughout our research it became apparent that states define, calculate, and treat savings differently. As mentioned in the Methodology section above, this leads to a number of issues related to data availability and consistency, which makes drawing conclusions and findings across multiple states difficult. Below, we discuss the key areas where states differ, and provide recommendations on how states could provide greater transparency when planning and reporting savings data.

---

[32] Navigant, "Custom Free Ridership and Participant Spillover Jurisdictional Review," May 29, 2013, pp 17-18.

[33] Navigant focused on free ridership rather than spillover effects in part because it found that spillover is quantified much less often than free ridership. Also, the Ontario Energy Board—the regulatory body in the region for which Navigant was conducting the study—previously did not approve spillover effects for non-residential gas programs.
Navigant, "Custom Free Ridership and Participant Spillover Jurisdictional Review," May 29, 2013, pp 1, 11.

States Define Savings Differently

Not all states indicate clearly the type of saving that they report and how those savings are calculated. Even when states do provide a definition for the type of savings, those definitions are typically inconsistent across states. More specifically, state-reported data in many instances did not indicate whether the state reports gross savings at the meter or generator level, or whether the net savings that the state reports include adjustments for realization, persistence, in-service rates and others, in addition to free ridership and/or spillover impacts.

For example, Hawaii Energy clearly indicates that it provides three types of savings: (1) gross savings at the meter level, (2) gross savings at the generator level, and (3) net savings at the generator level. Hawaii Energy's definition of net savings at the generator level clearly includes the effects of free ridership, but is silent as to whether it accounts for spillover or other impact factors.[34]

Conversely, Massachusetts indicates in the state's TRM that net savings include impacts associated with realization rates, persistence factors, and in-service rates, in addition to free ridership, participant spillover, and non-participant spillover.[35] It is not clear from the state TRM whether Massachusetts savings are at the generator level or meter level. However, further investigation of the benefit-cost analysis workbooks used by the state program administrators indicates that savings are at the generator level.[36] Further, Massachusetts' TRM provides savings information in terms of gross kWh, but the state's program administrators' plans and reports only present net savings. Therefore, gross savings are not readily available in Massachusetts, without further investigating the benefit-cost analysis workbooks used by the state program administrators.

Hawaii's and Massachusetts's net savings cannot be compared on an "apples-to-apples" basis, because it is unlikely that they take into account the same impacts. Further, gross savings could not be compared without a thorough investigation of data.

Below we provide additional examples of different definitions for net and gross savings, as well as examples of where it was difficult to determine whether net or gross savings are reported by a state.

- States that use deemed NTG ratios (Arizona, California, New York, and Michigan) are not specific as to the impacts (free ridership, spillover, etc.) that the deemed NTG ratio is intended to take into account. Perhaps being indeterminate is part of the appeal of using a deemed NTG ratio rather than conducting evaluation studies to be more precise, yet it makes comparisons across states difficult.

---

[34] Hawaii Energy, "Annual Report Program Year 2013, July 1, 2013 - June 30, 2014," November 21, 2014, p 40.

[35] Massachusetts Program Administrators, "Massachusetts Technical Reference Manual, 2013 Program Year – Report Version," June 2014, pp 12-15).

[36] See, e.g., Cape Light Compact, "2013 Energy Efficiency Plan Year Report," D.P.U.14-87, June 20, 2014, Electric Screening Model.

- In Colorado, the NTG ratio definitions do not indicate whether spillover or free ridership effects are taken into account. Upon reading Excel Energy's 2013 energy efficiency annual report, it appears that both free ridership and spillover are accounted for in the NTG ratio. However, given the ambiguous definition, one cannot conclusively assert whether all programs account for free ridership and spillover in net savings.[37]

- Connecticut's most recent TRM provides savings in terms of gross savings, and indicates that net savings include spillover, free ridership, and installation rates, and that realization rates may be applied to specific measures.[38] However, Connecticut's most recent energy efficiency plan simply provides "electricity savings," without indicating whether those savings are net or gross savings.[39] For this reason, Synapse obtained Connecticut's net and gross savings for purposes of this analysis from NEEP, a third party that has aggregated energy efficiency data for the Northeast region.

- For reasons similar to Massachusetts and Connecticut, Synapse was unable to obtain both net and gross savings for the District of Columbia, Maine, Maryland, and Rhode Island, and instead relied on data provided by program administrators in the states or third-party datasets for at least some years.

A more detailed accounting of how all states define net and gross savings in each year is beyond the scope of this investigation given the size of the dataset used for the research. With about one to four or even more sources for every state for each year, the reference list is voluminous and diverse, and it is therefore cumbersome to identify each state's definition of net and gross savings for each of the five years in our study period.

States Calculate Net Savings Differently

States take different approaches to calculating net savings, as explained in more detail below.

States that report net savings determine those net savings either through evaluation studies or through deemed NTG values. As examples, California, Michigan, and New York rely on a default or deemed NTG ratio until an evaluation study provides a more accurate value. In general, most states (17 out of 23) that apply NTG ratios determine those values through evaluation studies, which often focus on participant surveys to determine the ratio.

States apply NTG ratios at the measure, sector, or program level, or a combination of these levels depending on the type of programs or the evaluation studies that have been conducted. For example, at

---

[37] Xcel Energy, "Demand Side Management Annual Status Report, Electric and Natural Gas Public Service Company of Colorado, 2013," Docket No 11A-631EG, corrected on April 15, 2014.

[38] "Connecticut Program Savings Document, 10th Edition for 2015 Program Year," Version Date November 5, 2014.

[39] The Connecticut Light and Power Company, The United Illuminating Company, The Yankee Gas Services Company, Connecticut Natural Gas Corporation, and Southern Connecticut Gas Company, "2014 Annual Update of the 2013-2015 Electric and Natural Gas Conservation and Load Management Plan," February 28, 2014.

least six states[40] assume a 100 percent NTG ratio for all low-income programs. As another example, Massachusetts determines NTG ratios for each measure, and then rolls the savings up to the program level for reporting purposes. North Carolina and the states that use deemed NTG ratios as identified above apply these values at the portfolio level (i.e., it is consistently applied across all programs and measures). Finally, some states, including California, Maine, and Pennsylvania, apply the NTG ratio at the program level.

Additionally, states may not provide net savings for all programs or measures. Maine and at least three of the states that were not researched further, including Florida, New Jersey, and Tennessee, report gross savings for all measures except for certain end uses or measures for which evaluation results have indicated a clear NTG ratio or identified other impacts.

States Use Net and Gross Savings for Different Purposes

States use net and gross savings differently, depending on what the savings are being used to estimate. Gross savings are often used for system planning purposes in order to accurately build a reliable system. Net savings are primarily used for regulatory purposes, to indicate the amount of savings that are directly attributable to the program efforts. Some states use gross savings and some use net savings for regulatory purposes, while in some cases both gross and net savings are applied for different purposes.

As examples, net savings can be used to determine a utility's performance incentives (i.e., Georgia), or for cost-effectiveness and program design (i.e., Maryland), while gross savings are the state's focus for program goals and reporting.

Recommendations for Improved Transparency

States can easily provide greater transparency by being overtly clear on the assumptions used when presenting savings in energy efficiency plans and reports. Steps that states can take to improve transparency of savings assumptions include indicating upfront (1) the type of savings they are using (e.g., annual net at generator, lifetime gross at meter); (2) how they define those savings, including the impacts that are and are not accounted for in the savings type (e.g., free ridership is included while both participant and non-participant spillover are excluded); and (3) how those savings are used by the state, regulators, and the utility (e.g., for goal setting, cost-effectiveness, performance incentives).

Ideally, states should report all types of savings for all programs. This includes gross savings at the generator and at the meter, adjusted gross savings at the meter and generator, and net savings at the meter and generator, as well as clearly indicating all savings assumptions applied to determine each type of saving (e.g., free ridership rates, spillover rates, realization rates). While such an approach will result in significant amounts of data to prepare and digest, it would increase the transparency of states' savings assumptions, and would allow for easier comparison across utilities, states, and regions.

[40] This is true at least in some years for Arizona, Illinois, Massachusetts, Nevada, Pennsylvania, and Rhode Island.

5.2. Changes in Net-to-Gross Ratios over Time

Our study period covers only five years, which limits the extent to which conclusion can be drawn about trends in NTG ratios over time. However, there is some anecdotal information to indicate that states have focused on developing and studying NTG ratios in recent years. As examples, Maine started to study NTG ratios beginning in 2012, North Carolina included net savings in their 2014 energy efficiency data for what appears to be the first time, and Massachusetts conducted a significant NTG ratio study in 2012 to update its previous NTG ratios. Such efforts to improve data accuracy are important for ensuring data reliability and consistency across states. Since it is only in more recent years that NTG ratios have been examined in more detail, Synapse finds that our five-year study period is appropriate for this analysis.

5.3. Comparison of Leading and Developing States

Synapse investigated states that are considered leaders in energy efficiency as well as those states that are starting to develop energy efficiency programs or are developing more robust energy efficiency programs. Synapse devised this break out to see if the two groups of states applied different practices for quantifying net or gross savings compared to states on average. We define leading states as those states that ACEEE has ranked within the top ten states, on average, in the annual ACEEE Scorecards between 2011 and 2014.[41] Developing states are defined as those states that ACEEE has ranked within the bottom ten states, on average, in the annual ACEEE Scorecards between 2011 and 2014.[42]

All ten of the leading states, apart from Minnesota and Washington, report either net savings or both net and gross savings in their energy efficiency plans and reports. Only about 16 of the 41 non-leading states report net or both net and gross savings. All 12 of the developing states were determined unsuitable for further investigation by Synapse for this report for the reasons identified in Table B.2 in Appendix B. The primary reasons these states were not researched further are due to not implementing energy efficiency programs or reporting only gross saving estimates. Therefore, leading states are more likely than developing states to evaluate and consider net savings, rather than gross savings alone.

Across the study period and for the programs in total, the NTG ratio for leading states averages 89 percent, while the NTG ratio for the non-leading states we researched averages 81 percent. This suggests that either free ridership is lower or spillover is higher in leading states compared to other states. Either way, a higher NTG ratio in leading states indicates that their programs are resulting in direct benefits to customers.

---

[41] More specifically, the leading states are (with the average rank indicated in parentheses): California (2), Connecticut (6), Massachusetts (1), Maryland (9), Minnesota (9), New York (4), Oregon (4), Rhode Island (5), Vermont (5), and Washington (7).

[42] More specifically, the developing states are (with the average rank indicated in parentheses): Alabama (40), Alaska (45), Kansas (43), Louisiana (43), Mississippi (49), Missouri (44), Nebraska (42), North Dakota (51), South Carolina (42), South Dakota (46), West Virginia (46), and Wyoming (50).

Net savings can provide important information regarding how well energy efficiency programs are serving customers. By evaluating net savings more regularly, it is possible that the leading states have massaged their program designs over time to best serve customers, thereby limiting free ridership and spillover effects. This could help explain how these states have become leaders in energy efficiency.

We believe that one reason leading states evaluate net savings more regularly than developing states could be due to the program funding available in the states. According to the 2014 ACEEE Scorecard, on average in 2013, the top ten states spent about $45 per capita, while the developing states spent about $4 per capita. NTG ratios are typically determined through evaluation studies, which can be expensive. If states have fixed budgets, they often focus on increasing the customer incentive or marketing portions of their budgets to maximize savings, or a larger portion of costs could be made up of fixed administrative costs. States that are developing energy efficiency savings may not have the funding or resources available for studying or evaluating NTG ratios, while leading states are more likely to have a larger budget available for such research.

5.4. Average Net-to-Gross Ratios

Our analysis determined that average NTG ratios range from 83 percent to 94 percent depending on the customer sector, with 87 percent being the average across all years and customer sectors. NAPEE determined that stipulated NTG ratio range between 80 to 95 percent, and Navigant determined that NTG ratios for non-residential gas programs are about 87 percent, while ACEEE applies a deemed NTG ratio of 90 percent to states that only report gross savings. This leads us to conclude that NTG ratios are typically slightly less than 90 percent on average.

REFERENCES

Multiple States

American Council for an Energy Efficient Economy, "Energy Efficiency Resources Standards: A Progress Report on State Experience," Michael Sciortino, Seth Nowak, Patti Witte, Dan York, and Martin Kushler, Report Number U112, June 2011.

American Council for an Energy Efficient Economy, "The 2011 State Energy Efficiency Scorecard," Report Number E115, October 20, 2011.

American Council for an Energy Efficient Economy, "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs," Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012.

American Council for an Energy Efficient Economy, "The 2012 State Energy Efficiency Scorecard," Report Number E12C, October 3, 2012.

American Council for an Energy Efficient Economy, "The 2013 State Energy Efficiency Scorecard," Report Number E13K, November 4, 2013.

American Council for an Energy Efficient Economy, "Examining the Net Savings Issue: A National Survey of State Policies and Practices in the Evaluation of Ratepayer-Funded Energy Efficiency Programs," Martin Kushler, Seth Nowak, and Patti Witte, Report Number U1401, January 2014.

American Council for an Energy Efficient Economy, "The 2014 State Energy Efficiency Scorecard," Annie Gilleo, Anna Chittum, Kate Farley, Max Neubauer, Seth Nowak, David Ribeiro, and Shruti Vaidyanathan, Report Number U1408, October 21, 2014.

American Council for an Energy Efficient Economy, "State and Local Policy Database," accessed December 2014, available at http://database.aceee.org/.

Messenger, Michael, Itron; Steve Schiller, Schiller Consulting Inc.; Chuck Goldman, Lawrence Berkeley Natl. Laboratory, "Survey of Current EE Program Evaluation Practices and Emerging Issues Across the United States" February 10, 2010.

Midwest Energy Efficiency Alliance, "A Net or Gross Energy Savings Approach: Perspectives at the MEEA 2012 Annual meeting of the Membership," April 2013.

Midwest Energy Efficiency Alliance, available at: http://www.mwalliance.org/.

National Action Plan for Energy Efficiency Leadership Group, "Model Energy Efficiency Program Impact Evaluation Guide, A Resource for the National Action Plan for Energy Efficiency," November 2007.

Navigant, "Custom Free Ridership and Participant Spillover Jurisdictional Review," May 29, 2013.

Northeast Energy Efficiency Partnerships, “Glossary of Terms, Version 2.1,” a Project of the Regional Evaluation, Measurement, and Verification Forum, July 2011.

Northeast Energy Efficiency Partnerships, Regional Energy Efficiency Database, Reports, available at: http://www.neep-reed.org/Focus.aspx.

NMR Group, “Net Savings Scoping Paper, Final,” Submitted to: Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, November 13, 2010.

NMR Group, “Regional Net Savings Research, Phase 2: Definitions and Treatment of Net and Gross Savings in Energy and Environmental Policy,” Submitted to: Northeast Energy Efficiency Partnerships: Evaluation, Measurement, and Verification Forum, December 4, 2012.

Skumatz, Lisa A., Edward Vine, “A National Review of Best Practices and Issues in Attribution and Net-to-Gross: Results of the SERA/CIEE White Paper,” 2010 ACEEE Summer Study on Energy Efficiency in Buildings.

Violette, Daniel M., Pam Rathbun, “Estimating Net Energy Savings: Methods and Practices,” Uniform Methods Project, Version 6, April 30, 2014.

Alabama

See American Council for an Energy Efficient Economy, “A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs,” Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012.

Alaska

See American Council for an Energy Efficient Economy, “A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs,” Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012.

Arizona

Personal Communications with Southwest Energy Efficiency Project staff, December 2014.

See American Council for an Energy Efficient Economy, “Examining the Net Savings Issue: A National Survey of State Policies and Practices in the Evaluation of Ratepayer-Funded Energy Efficiency Programs,” Martin Kushler, Seth Nowak, and Patti Witte, Report Number U1401, January 2014, p 31.

Arkansas

CenterPoint Energy, "Energy Efficiency Program Portfolio Annual Report, 2011 Program Year," April 2, 2012.

Entergy Arkansas, Inc., "Arkansas Energy Efficiency Program Portfolio Annual Report, Docket No. 08-038-RP, 2011 Program Year," April 2, 2012.

Entergy Arkansas, Inc., "Arkansas Energy Efficiency Program Portfolio Annual Report, Docket No. 07-085-TF," 2012 Program Year, April 8, 2013.

Entergy Arkansas, Inc., "Arkansas Energy Efficiency Program Portfolio Annual Report, Docket No. 07-085-TF, 2013 Program Year," April 1, 2014.

California

California Energy Efficiency Policy Manual, Version 5, July 2013, Applicable to post-2012 Energy Efficiency Programs, R.09-11-014.

California Energy Efficiency Statistics, Energy Efficiency Data, available at: http://eestats.cpuc.ca.gov/Views/EEDataLandingPage.aspx

California Public Utilities Commission, "Established Cost-Effectiveness Inputs," available at: http://docs.cpuc.ca.gov/published/Final_decision/11474-13.htm

Colorado

Xcel Energy, "Demand Side Management Annual Status Report, Electric and Natural Gas Public Service Company of Colorado, 2011," Docket No 10A-471EG, April 2, 2012.

Xcel Energy, "Demand Side Management Annual Status Report, Electric and Natural Gas Public Service Company of Colorado, 2012," Docket No 11A-631EG, April 1, 2013.

Xcel Energy, "2014 Demand-Side Management Plan, Electric and Natural Gas, Public Service Company of Colorado," Docket No. 13A-0773EG, July 1, 2013.

Xcel Energy, "Demand Side Management Annual Status Report, Electric and Natural Gas Public Service Company of Colorado, 2013," Docket No 11A-631EG, corrected on April 15, 2014.

Xcel Energy, "2015/2016 Demand-Side Management Plan, Electric and Natural Gas, Public Service Company of Colorado," Proceeding No. 14A-1057EG, October 30, 2014.

Connecticut

Personal Communications with Northeastern Utilities staff, January 2015.

The Connecticut Light and Power Company, The United Illuminating Company, The Yankee Gas Services Company, Connecticut Natural Gas Corporation, and Southern Connecticut Gas Company, "2014 Annual Update of the 2013-2015 Electric and Natural Gas Conservation and Load Management Plan," February 28, 2014.

"Connecticut Program Savings Document, 10th Edition for 2015 Program Year," Version Date November 5, 2014.

See Northeast Energy Efficiency Partnerships, Regional Energy Efficiency Database, Reports, available at: http://www.neep-reed.org/Focus.aspx.

Delaware

Personal Communications with Delaware Division of Energy and Climate staff, December 2014.

Opinion Dynamics Corporation, "Delaware Department of Natural Resources and Environmental Control SEU and State Energy Efficiency Programs EM&V Report," prepared for Department of Natural Resources and Environmental Control," July 2012.

District of Columbia

District of Columbia Sustainable Energy Utility (DCSEU) Net and Gross Savings, provided by Vermont Energy Investment Corporation staff, January 2015.

Florida

Personal Communications with Synapse Energy Economics staff, December 2014.

Georgia

Nexant, "Impact Evaluation of Georgia Power Company's 2011 DSM Programs," December 21, 2012.

Georgia Public Service Commission, "Resolution of Outstanding Issues," Docket No. 31082, June 30, 2010.

Personal Communications with Internal Consultants/Georgia Public Service Commission staff, January 2015.

Hawaii

Hawaii Energy, "Annual Report Program Year 2011, July 1, 2011 - June 30, 2012," December 3, 2012.

Hawaii Energy, "Annual Report Program Year 2012, July 1, 2012 - June 30, 2013," November 7, 2013.

Hawaii Energy, "Annual Report Program Year 2013, July 1, 2013 - June 30, 2014," November 21, 2014.

Hawaii Energy, "Annual Plan Program Year 2014," June 30, 2014.

Illinois

Commonwealth Edison Company, "2014-2016 Energy Efficiency and Demand Response Plan," August 30, 2013.

Commonwealth Edison Company, "Energy Efficiency / Demand Response Plan, Annual Report, Plan Year 4, June 1, 2011-May 21, 2012," April 2014.

Illinois Energy Efficiency Stakeholder Advisory Group, "ComEd Evaluation Reports," PY 5 Evaluation Studies, available at: http://www.ilsag.info/comed_eval_reports.html

Illinois Energy Efficiency Stakeholder Advisory Group, "Net-to-Gross Framework," available at: http://www.ilsag.info/net-to-gross-framework.html

Indiana

Energizing Indiana, "Energizing Indiana Has Come to an End," accessed January 8, 2015, available at: http://www.energizingindiana.com/

Foster, Joanna, "Gov. Pence Lets Indiana Energy Efficiency Program Die" Think Progress, March 31, 2014, available at: http://thinkprogress.org/climate/2014/03/31/3420960/end-indiana-energy-efficiency-program/

Iowa

Interstate Power and Light Company, "Annual Report for 2013 Energy Efficiency Plan," Docket No. EEP-08-1, May 1, 2014.

Interstate Power and Light Company, "2014-2018 Energy Efficiency Plan," Docket No. EEP-2012-0001, November 30, 2012.

MidAmerican Energy Company, "Energy Efficiency Plan, Docket No. EEP-08-2, 2013 Annual Report to the Iowa Utilities Board," May 1, 2014.

Kansas

Midwest Energy Efficiency Alliance, "Energy Efficiency Policies and Practices in Kansas," accessed December 2014, available at: http://www.mwalliance.org/policy/KS/utility

Kentucky

Midwest Energy Efficiency Alliance, "Energy Efficiency Policies and Practices in Kentucky," accessed December 2014, available at: http://www.mwalliance.org/policy/KY

Louisiana

See American Council for an Energy Efficient Economy, "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs," Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012.

Maine

Efficiency Maine, “2012 Annual Report of the Efficiency Maine Trust,” Revised Version February 12, 2013.

Efficiency Maine, “2013 Annual Report of the Efficiency Maine Trust,” Corrected Version February 11, 2014.

Efficiency Maine, “Efficiency Maine Reporting & Tracking System effRT 2.0,” accessed December 2014.

Maryland

Baltimore Gas and Electric Company, “2015-2017 EmPOWER Maryland Program Filing,” Case No 9154, August 28, 2014.

Itron, “Verification of Reported Program Impacts from 2011 EmPOWER Maryland Energy Efficiency Programs & Recommendations to Improve Future Evaluation Research,” Prepared for EmPOWER Maryland Utilities and the Maryland Public Service Commission, May 4, 2012.

Navigant, “2013 Evaluation, EmPOWER Maryland Final Impact Evaluation Report Evaluation Year 4 (June 1, 2012 - May 31, 2013),” June 30, 2014.

Maryland Public Service Commission, Order No 84569, December 22, 2011.

See Northeast Energy Efficiency Partnerships, Regional Energy Efficiency Database, Reports, available at: http://www.neep-reed.org/Focus.aspx.

Massachusetts

Cape Light Compact, “Annual Report on Energy Efficiency Activities in 2011,” D.P.U.12-54, August 1, 2012, Electric Screening Model.

Cape Light Compact, “2013-2015 Three-Year Energy Efficiency Plan,” D.P.U. 12-107, February 21, 2013, Electric BCR Model.

Cape Light Compact, “Annual Report on Energy Efficiency Activities in 2012,” D.P.U.13-118, August 1, 2013, Electric Screening Model.

Cape Light Compact, “2013 Energy Efficiency Plan Year Report,” D.P.U.14-87, June 20, 2014, Electric Screening Model.

Fitchburg Gas and Electric Light Company d/b/a Unitil, "2011 Energy Efficiency Annual Report," D.P.U.12-58, August 1, 2012, Electric Screening Model.

Fitchburg Gas and Electric Light Company d/b/a Unitil, "2012 Energy Efficiency Annual Report," D.P.U. 13-119, August 1, 2013, Electric Screening Model.

Fitchburg Gas and Electric Light Company d/b/a Unitil, “Energy Efficiency Updates,” D.P.U.14-05, February 28, 2014, Electric Screening Model.

Fitchburg Gas and Electric Light Company d/b/a Unitil, “2013 Energy Efficiency Plan Year Report,” D.P.U.14-87, June 20, 2014, Electric Screening Model.

Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid, “2013-2015 Three-Year Energy Efficiency Plan,” February 21, 2013, D.P.U.12-109, Electric BCR Model

Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid, "2012 Energy Efficiency Annual Report," D.P.U. 13-119, August 1, 2013, Electric Screening Model.

Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid, “2013 Energy Efficiency Plan Year Report,” D.P.U.14-87, June 20, 2014, Electric Screening Model.

Massachusetts Program Administrators, “Massachusetts Technical Reference Manual, 2013 Program Year – Report Version,” June 2014.

Western Massachusetts Electric Company, "2011 Energy Efficiency Annual Report," D.P.U.12-55, August 1, 2012, Electric Screening Model.

Western Massachusetts Electric Company, "2012 Energy Efficiency Annual Report," D.P.U. 13-122, August 1, 2013, Electric Screening Model.

Michigan

DTE Energy, Navigant, Consumers Energy, Cadmus, NMR Group, "Results of Net-to-Gross Research in Michigan: Standard CFLs in Upstream Lighting Programs," Presentation to Energy Optimization Collaborative, January 21, 2014.

Michigan Public Service Commission, “Temporary Order,” Case No. U-15800, December 4, 2008, Appendix E.

Michigan Public Service Commission, “Order and Opinion,” Case No. U-17049, December 20, 2012.

Minnesota

Midwest Energy Efficiency Alliance, “Energy Efficiency Policies and Practices in Minnesota,” accessed December 2014, available at: http://www.mwalliance.org/policy/MN

Mississippi

See American Council for an Energy Efficient Economy, “A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs,” Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012.

See American Council for an Energy Efficient Economy, “Examining the Net Savings Issue: A National Survey of State Policies and Practices in the Evaluation of Ratepayer-Funded Energy Efficiency Programs,” Martin Kushler, Seth Nowak, and Patti Witte, Report Number U1401, January 2014.

Missouri

See American Council for an Energy Efficient Economy, “The 2014 State Energy Efficiency Scorecard,” Annie Gilleo, Anna Chittum, Kate Farley, Max Neubauer, Seth Nowak, David Ribeiro, and Shruti Vaidyanathan, Report Number U1408, October 21, 2014.

Montana

Montana Department of Public Service Regulation, Public Service Commission, “Final Order,” Order No. 7219h, October 28, 2013.

NorthWestern Energy, Supplemental Testimony, Docket No. D2012.5.49, January 18, 2013.

Personal Communications with Montana Public Service Commission staff, December 2014.

SBW Consulting, “Impact and Process Evaluation of NorthWestern Energy 2007-2011 Demand Side Management Programs,” January 29, 2013.

Nebraska

Midwest Energy Efficiency Alliance, “Energy Efficiency Policies and Practices in Nebraska,” accessed December 2014, available at: http://www.mwalliance.org/policy/NE

Nevada

Nevada Power Company, "Integrated Resource Plan 2013-2032, Demand Side Plan 2013-2015," Volume 7 of 24, June 2012.

Nevada Power Company, "Integrated Resource Plan 2014-2033, Demand Side Plan 2014-2016," Volume 6 of 16, June 2013.

New Hampshire

Personal Communications with New Hampshire Public Utilities Commission staff, December 2014.

Personal Communications with Unitil Corporation staff, December 2014.

New Jersey

New Jersey Board of Public Utilities, “New Jersey Clean Energy Program, Protocols to Measure Resource Savings,” Draft, January 27, 2014.

Personal Communications with Synapse Energy Economics staff, December 2014.

New York

New York Evaluation Advisory Contractor Team, “New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs,” prepared for New York Department of Public Service, October 15, 2010.

Personal Communications with Office of Energy Efficiency and the Environment staff, December 2014.

North Carolina

Duke Energy Carolinas, "Integrated Resource Plan (Annual Report)," September 1, 2014.

North Dakota

Midwest Energy Efficiency Alliance, “Energy Efficiency Policies and Practices in North Dakota,” accessed December 2014, available at: http://www.mwalliance.org/policy/ND

Ohio

Midwest Energy Efficiency Alliance, “Energy Efficiency Policies and Practices in Ohio,” accessed December 2014, available at: http://www.mwalliance.org/policy/OH

Oklahoma

Personal Communications with Oklahoma Department of Commerce staff, December 2014.

Oregon

Personal Communications with Energy Trust of Oregon staff, December 2014.

Pennsylvania

Duquesne Light, "Final Annual Report for the Period June 2011 through May 2014, Program Year 3," November 15, 2012.

Duquesne Light, "Final Annual Report for the Period June 2012 through May 2013, Program Year 4," January 7, 2014.

Duquesne Light, "Final Annual Report for the Period June 2013 through May 2014, Program Year 5," November 17, 2014.

Metropolitan Edison Company, "Final Annual Report for the Period June 2011 through May 2012, Program Year 3," November 15, 2012.

Metropolitan Edison Company, "Final Annual Report for the Period June 2012 through May 2013, Program Year 4," Revised January 6, 2014.

Metropolitan Edison Company, "Final Annual Report for the Period June 2013 through May 2014, Program Year 5," November 17, 2014.

PECO Energy Company, "Final Annual Report for the Period June 2011 through May 2014, Program Year 3," November 15, 2012.

PECO Energy Company, "Final Annual Report for the Period June 2012 through May 2013, Program Year 4," November 15, 2013.

PECO Energy Company, "Final Annual Report for the Period June 2013 through May 2014, Program Year 5," November 17, 2014.

Pennsylvania Electric Company, "Final Annual Report for the Period June 2012 through May 2013, Program Year 4," Revised January 6, 2014.

Pennsylvania Power Company, "Final Annual Report for the Period June 2012 through May 2013, Program Year 4," Revised January 6, 2014.

PPL Electric Utilities, "Final Annual Report for the Period June 2013 through May 2014, Program Year 5," November 15, 2014.

PPL Electric Utilities, "Final Annual Report for the Period June 2012 through May 2013, Program Year 4," Revised January 15, 2014.

PPL Electric Utilities, "Final Annual Report for the Period June 2011 through May 2014, Program Year 3," November 15, 2012.

West Penn Power Company, "Final Annual Report for the Period June 2012 through May 2013, Program Year 4," Revised January 6, 2014.

Rhode Island

The Narragansett Electric Company, d/b/a National Grid, “Energy Efficiency Program Plan for 2014, Settlement of the Parties,” Docket No. 4451, November 1, 2013, BCR Model supplied by National Grid.

The Narragansett Electric Company, d/b/a National Grid, “Energy Efficiency Program Plan for 2015, Settlement of the Parties,” Docket No. 4527, November 1, 2014, BCR Model supplied by National Grid.

See Northeast Energy Efficiency Partnerships, Regional Energy Efficiency Database, Reports, available at: http://www.neep-reed.org/Focus.aspx.

South Carolina

Personal Communications with South Carolina Office of Regulatory Staff staff, December 2014.

South Dakota

Midwest Energy Efficiency Alliance, “Energy Efficiency Policies and Practices in South Dakota,” accessed December 2014, available at: http://www.mwalliance.org/policy/SD

Tennessee

DNV KKEMA Energy & Sustainability, “Tennessee Valley Authority, Technical Resource Manual, Version 2.0,” December 2013.

Texas

Public Utility Commission of Texas, “Annual Statewide Portfolio Report for Program Year 2013—Volume I,” Project Number 40891, October 6, 2014.

Utah

Personal Communications with Utah Public Service Commission staff, December 2014.

Rocky Mountain Power, "Utah Energy Efficiency and Peak Reduction Annual Report, January 1, 2012 - December 31, 2012," May 1, 2013.

Rocky Mountain Power, "Utah Energy Efficiency and Peak Reduction Annual Report, January 1, 2013 - December 31, 2013," May 16, 2014.

Vermont

Burlington Electric Department, “2011 Energy Efficiency Annual Report,” 2012.

Burlington Electric Department, “2012 Energy Efficiency Annual Report,” 2013.

Burlington Electric Department, “2013 Energy Efficiency Annual Report,” 2014.

Efficiency Vermont, “Savings Claim Summary 2011,” April 1, 2012.

Efficiency Vermont, “Savings Claim Summary 2012,” April 1, 2013.

Efficiency Vermont, “Savings Claim Summary 2013,” April 1, 2014.

Virginia

Personal Communications with Virginia Department of Mines, Minerals and Energy staff, December 2014.

Washington

Personal Communications with Northwest Council Regional Technical Forum staff, December 2014.

West Virginia

See American Council for an Energy Efficient Economy, "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs," Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012.

Wisconsin

Cadmus, "Focus on Energy Territory-Wide Programs Offered in the Wisconsin Public Service Territory Calendar Year 2013 Evaluation Report" September 19, 2014.

Cadmus, ""Focus on Energy Wisconsin Public Service Territory-Wide and Community Pilot Programs Calendar Year 2011 Evaluation Report" January 9, 2013.

Wyoming

See American Council for an Energy Efficient Economy, "The 2014 State Energy Efficiency Scorecard," Annie Gilleo, Anna Chittum, Kate Farley, Max Neubauer, Seth Nowak, David Ribeiro, and Shruti Vaidyanathan, Report Number U1408, October 21, 2014.

APPENDIX A: DEFINITIONS

Within the energy efficiency industry, there are many terms used to classify different types of energy savings. These terms are important to understand for reviewing and discussing NTG ratios. Below Synapse provides detailed definitions for commonly used energy efficiency savings terms, which have been borrowed from NEEP.[43]

- **Generator Level Savings**: Savings from energy efficiency programs that are adjusted upward from the meter or premise level to include transmission and distribution (T&D) line losses and any adjustment for avoided grid reserve margins. Generator level savings are also known as wholesale level savings.

- **Gross Savings at the Meter**: Savings from energy efficiency programs that are at the customer meter or premise level.

- **Gross Savings**: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated and unadjusted by any factors. Gross savings are usually determined through engineering estimates that value savings reductions on a comparison of standard or replaced equipment, and equipment installed through an energy efficiency program.

- **Adjusted Gross Savings**: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated. It adjusts for such factors as data errors, installation and persistence rates, and hours of use, but does not adjust for free ridership or spillover. Can be calculated as an annual or lifetime value.

- **Net Savings**: The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of free drivers, free riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand.

- **Free Rider**: A program participant who would have implemented the program measure or practice in the absence of the program. Free riders can be: (1) total, in which the participant's activity would have completely replicated the program measure; (2) partial, in which the participant's activity would have partially replicated the program measure; or (3) deferred, in which the participant's activity would have completely replicated the program measure, but at a future time than the program's timeframe.

- **Spillover**: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program. There can

[43] Northeast Energy Efficiency Partnerships, "Glossary of Terms, Version 2.1," a Project of the Regional Evaluation, Measurement, and Verification Forum, July 2011.

be participant and/or non-participant spillover. Participant spillover is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy saving practices after having participated in the efficiency program as a result of the program's influence. Non-participant spillover refers to energy savings that occur when a program non-participant installs energy efficiency measures or applies energy savings practices as a result of a program's influence.

- **Net-to-Gross Ratio**: A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts. The factor itself may be made up of a variety of factors that create differences between gross and net savings, commonly including free riders and spillover. Other adjustments may include a correction factor to account for errors within the project tracking data, breakage, and other factors that may be estimated which relate the gross savings to the net effect of the program. Can be applied separately to either energy or demand savings.

APPENDIX B: SUPPORTING ANALYSIS

Table B.1 identifies the 24 states that Synapse researched in detail. This table also indicates the type of savings states report and how states determine or use the savings.

Table B.1. Summary of State Approaches to Net and/or Gross Savings for Key States Researched

#	State	Reports Net or Gross	Notes / How Net is Determined
1	Arizona	Net	A measurement and verification study concluded that net savings are equal to gross savings within the state.
2	Arkansas	Both	Evaluation studies determine NTG ratios. Deemed NTG ratios have also been used in the past by some utilities.
3	California	Net	Default 80% assumption, unless updated by studies. Studies have been conducted to update market-specific values.
4	Colorado	Both	Reports gross savings, adjusted gross savings, and net savings. NTG based on evaluation studies.
5	Connecticut	Net	Reports net only based on evaluation studies.
6	District of Columbia	Both	Evaluation studies determine NTG ratios.
7	Georgia	Both	Gross savings are reported in IRPs and quarterly DSM reports. Net savings are used to calculate the utility performance incentive. Evaluation studies determine NTG ratios.
8	Hawaii	Both	Evaluation studies determine NTG ratios. Historically, the combined program total NTG ratio was applied to all programs.
9	Illinois	Net, but mixed over time	Evaluation studies determine NTG ratios.
10	Maine	Gross	Primarily reports gross savings, but uses adjusted gross savings where information is available/studies have been conducted.
11	Maryland	Both	Evaluation studies determine NTG ratios. Gross savings for reporting, and net savings for cost-effectiveness and program design.
12	Massachusetts	Net	Evaluation studies determine NTG ratios.
13	Michigan	Net	Deemed NTG ratio of 0.90.
14	Montana	Net	Evaluation studies determine NTG ratios.
15	Nevada	Both	Evaluation studies determine NTG ratios.
16	New York	Net	Default NTG of 0.9, unless updated by a study. No studies have updated default value.
17	North Carolina	Both, but primarily Gross	Duke included net savings in its 2014 IRP for what appears to be the first time.
18	Oregon	Both	Evaluation studies determine NTG ratios.
19	Pennsylvania	Both	Evaluation studies determine NTG ratios. Net savings are not used for compliance purposes, but are used for cost effectiveness and future program planning.
20	Rhode Island	Net	Reports only net savings, and relies on evaluations for the NTG ratios. Gross savings were provided by the utility for this analysis.
21	Texas	Both	Evaluation studies determine NTG ratios.
22	Utah	Both	Evaluation studies determine NTG ratios.
23	Vermont	Both	Conducts studies to determine NTG. Net savings in plans; Net and Gross savings in Reports.
24	Wisconsin	Both	Evaluation studies determine NTG ratios.

Table B.2 identifies the 27 states that Synapse determined were not suitable for further investigation, and indicates the reason why the state's practices were not pursued further. In general, Synapse did not research states that do not implement energy efficiency programs, implement only limited energy efficiency programs, only report gross savings,[44] or where information was too uncertain or incomplete to determine if a state reports net or gross savings.

States that implement only limited energy efficiency programs are those states that either (a) have consistently ranked towards the bottom of states in the ACEEE Scorecards (Missouri and Wyoming), or (b) were not researched in other NTG studies for various reasons (Alabama, Alaska, Louisiana, Mississippi, and West Virginia). As an example of the latter reason, ACEEE's "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs," explains: "the states reporting that they have essentially no formally approved utility ratepayer-funded energy efficiency programs, chose not to participate in this survey, or did not have enough of an established evaluation function to respond to the survey are: Alabama, Alaska, Louisiana, Mississippi, North Dakota, and West Virginia."[45]

[44] Note that Arizona assumes net savings are equal to gross savings (i.e., the NTG ratio is equal to 100 percent for all measures). Therefore, Synapse classifies Arizona as reporting net savings.

Personal Communications with Southwest Energy Efficiency Project staff, December 2014.

[45] American Council for an Energy Efficient Economy, "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs," Martin Kushler, Seth Nowak, and Patti White, Report Number U122, February 2012, p 3, fn 2.

Table B.2. States Not Researched Further and the Reasons Why

#	State	Reason Not Researched Further
1	Alabama	Not researched in other NTG studies for various reasons.
2	Alaska	Not researched in other NTG studies for various reasons.
3	Delaware	Mostly gross savings. State expects to report both net and gross savings once funding increases.
4	Florida	Limited information available to determine net or gross savings.
5	Indiana	No future EE programs.
6	Idaho	Limited information available to determine net or gross savings.
7	Iowa	Limited information available to determine net or gross savings. Likely reports gross savings only.
8	Kansas	No EE programs.
9	Kentucky	Gross savings only, although some utilities provde net savings.
10	Louisana	Not researched in other NTG studies for various reasons.
11	Minnesota	Reports gross savings only.
12	Mississippi	Not researched in other NTG studies for various reasons.
13	Missouri	Limited EE programs.
14	Nebraska	Depends on utility. Some report gross savings, some report both net and gross savings.
15	New Hampshire	Reports gross savings only.
16	New Jersey	Limited information available to determine net or gross savings.
17	New Mexico	Limited information available to determine net or gross savings.
18	North Dakota	No EE programs.
19	Ohio	Reports gross savings only.
20	Oklahoma	No EE programs.
21	South Carolina	Reports gross savings only.
22	South Dakota	Depends on utility. Some report gross savings, some report both net and gross savings.
23	Tennessee	Limited information available to determine net or gross savings.
24	Virginia	Limited information available to determine net or gross savings.
25	Washington	Limited information available to determine net or gross savings.
26	West Virginia	Not researched in other NTG studies for various reasons.
27	Wyoming	Limited EE programs.

As stated in the Methodology section above, the final NTG ratios that Synapse used in this analysis are based on deemed NTG ratios where applicable or savings where available. When deemed NTG ratios or savings could not be used, we used the simple average NTG ratios. When analyzing the results across states, years, or sectors for this analysis, we took a simple average of these final NTG ratios.

Synapse would have preferred for the analysis of average NTG ratio for states, sectors, and years to be based on both net and gross savings. Such an approach would provide weighted average NTG ratios that account for the magnitude of savings for a given state, sector, or year. However, as a result of the data availability, this approach would not capture states for which savings data is unavailable or states that use deemed NTG ratios.

Table B.3 provides a summary of net savings, gross savings, and NTG ratios for all states on average where such information was available. The table provides a column titled "Net-to-Gross (Savings Divided)," which divides the net savings by gross savings as summarized in the table. It also shows the "Net-to-Gross (Ratios Averaged)" column, which averages each state's final NTG ratios. These values are used in the Results and Findings sections above, and are calculated in Table B.8 below. Note that the number of data points for savings totals 182, while the number of data points for NTG ratios totals 292. Finally, Table B.3 also provides the difference between the two different ways of calculating NTG ratios.

Table B.3. State Average Net Savings, Gross Savings, and Net-to-Gross Ratios

Year	Customer Sector	n	Net Savings (MWh)	Gross Savings (MWh)	Net-to-Gross (Savings Divided)	n	Net-to-Gross (Ratios Averaged)	Difference in NTG
a	*b*	*c*	*d*	*e*	*f* *(d / e)*	*g*	*h* *see Table B.8*	*i* *(h- f)*
2011	Residential	15	2,208,417	2,842,246	78%	19	85%	7%
2011	Low-Income	6	55,481	58,453	95%	10	96%	1%
2011	Commercial & Industrial	15	2,743,501	3,553,590	77%	18	85%	8%
2011	Total	15	4,793,553	6,210,855	77%	19	85%	8%
2012	Residential	13	2,348,122	3,159,092	74%	19	81%	6%
2012	Low-Income	7	115,275	145,722	79%	12	95%	15%
2012	Commercial & Industrial	13	3,115,540	3,926,528	79%	20	86%	6%
2012	Total	13	5,610,293	7,259,633	77%	21	84%	7%
2013	Residential	12	1,750,016	2,523,240	69%	19	82%	13%
2013	Low-Income	4	139,568	170,049	82%	9	92%	10%
2013	Commercial & Industrial	12	2,452,715	3,545,908	69%	19	86%	17%
2013	Total	12	4,174,868	5,990,017	70%	19	84%	14%
2014	Residential	6	907,066	909,654	100%	12	83%	-17%
2014	Low-Income	3	28,418	30,494	93%	8	92%	-1%
2014	Commercial & Industrial	6	1,768,148	1,703,581	104%	12	88%	-16%
2014	Total	8	3,184,284	3,250,635	98%	14	85%	-13%
2015	Residential	6	1,036,669	1,122,200	92%	11	82%	-11%
2015	Low-Income	3	27,534	28,820	96%	8	93%	-2%
2015	Commercial & Industrial	6	1,763,139	1,744,400	101%	11	86%	-15%
2015	Total	7	3,134,615	3,301,488	95%	12	84%	-11%
2011-2015	Residential	52	8,250,291	10,556,432	78%	80	83%	4%
2011-2015	Low-Income	23	366,276	433,538	84%	47	94%	9%
2011-2015	Commercial & Industrial	52	11,843,044	14,474,007	82%	80	86%	4%
2011-2015	Total	55	20,897,613	26,012,628	80%	85	84%	4%
2011-2016	**Combined Total**	**182**	**41,357,224**	**51,476,605**	**80%**	**292**	**87%**	**6%**

Table B.4 presents the 34 instances of NTG ratios equal to 100 percent over the years, states, and sectors. Eighteen of these instances are for the low-income sector, indicating that low-income customers are less likely to install energy efficiency measures absent a utility energy efficiency program.

Table B.4. Net-to-Gross Ratios Equal to 100 percent

#	Residential	Low-Income	C&I	Total
1	AZ, 2011	AZ, 2011	AZ, 2011	AZ, 2011
2	AZ, 2012	AZ, 2012	AZ, 2012	AZ, 2012
3	AZ, 2013	AZ, 2013	AZ, 2013	AZ, 2013
4	AZ, 2014	AZ, 2014	AZ, 2014	AZ, 2014
5	AZ, 2015	AZ, 2015	AZ, 2015	AZ, 2015
6	ME, 2011	CT, 2011		ME, 2011
7		CT, 2012		
8		IL, 2011		
9		NV, 2011		
10		NV, 2012		
11		NV, 2013		
12		NV, 2014		
13		NV, 2015		
14		PA, 2012		
15		RI, 2011		
16		RI, 2012		
17		RI, 2014		
18		UT, 2013		

Table B.5 presents the 24 instances of NTG ratios greater than 100 percent over the years, states, and sectors. Nine of these instances are for the C&I sector, indicating that it is more frequent for C&I customers to install energy efficiency measures without participating in an energy efficiency program but as a result of the programs' influence, regardless of whether the C&I customer previously participated in an energy efficiency program.

Table B.5. Net-to-Gross Ratios Greater than 100 percent

#	Residential	Low-Income	C&I	Total
1	CT, 2011	DC, 2012	CT, 2011	CT, 2011
2	CT, 2012	DC, 2013	CT, 2012	CT, 2012
3	DC, 2012	MD, 2011	DC, 2012	DC, 2012
4	DC, 2013		DC, 2013	DC, 2013
5	VT, 2011		ME, 2013	ME, 2013
6			ME, 2014	ME, 2014
7			VT, 2011	VT, 2011
8			VT, 2012	
9			VT, 2013	

Figures B.1 through B.4 are box charts that summarize the distribution and range of NTG ratios by year for each sector and in total. The gray boxes summarize the first through the third quartiles, with the dark middle line representing the median NTG ratio. This represents the middle 50 percent of the NTG ratios. The outer whiskers represent the minimum and maximum NTG ratios determined for that year. For example, for the 2011 residential NTG ratios, the minimum was 59 percent, the maximum was 139 percent, the first quartile was 69 percent (i.e., 25 percent of the NTG ratio values were less than 69 percent), the median was 79 percent, and the third quartile was 99 percent (i.e., 75 percent of the NTG values were less than 99 percent).

Figure B.1. Distribution and Range of Residential Net-to-Gross Ratios

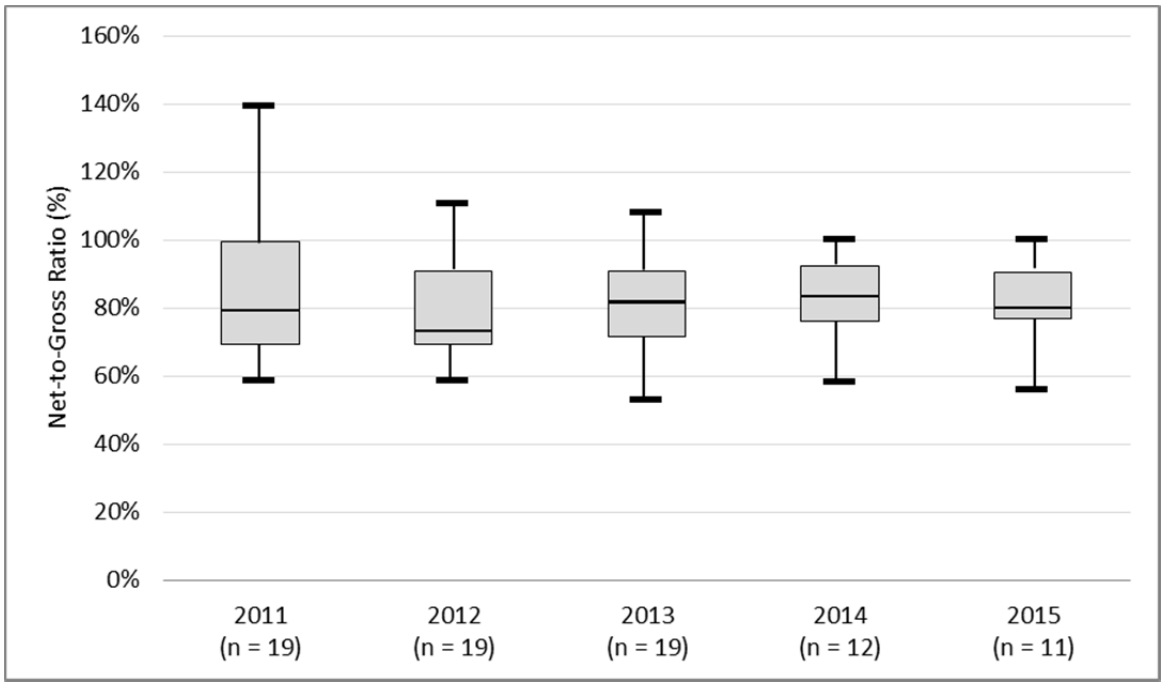


Figure B.2. Distribution and Range of Low-Income Net-to-Gross Ratios

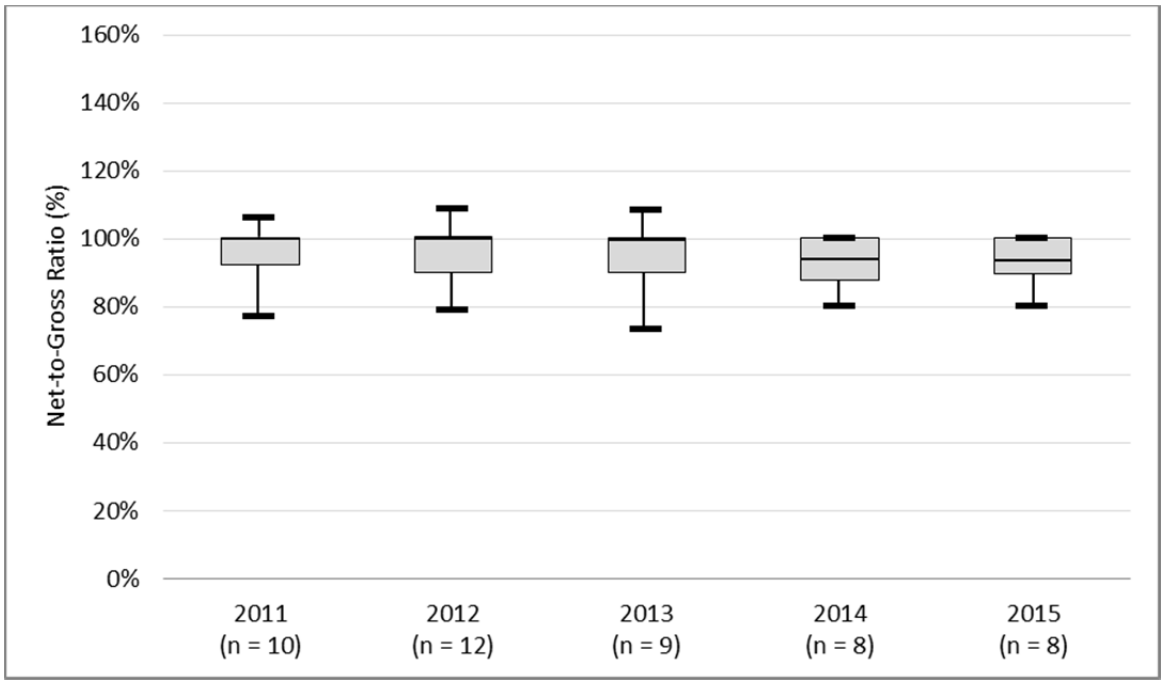


Figure B.3. Distribution and Range of Commercial & Industrial Net-to-Gross Ratios

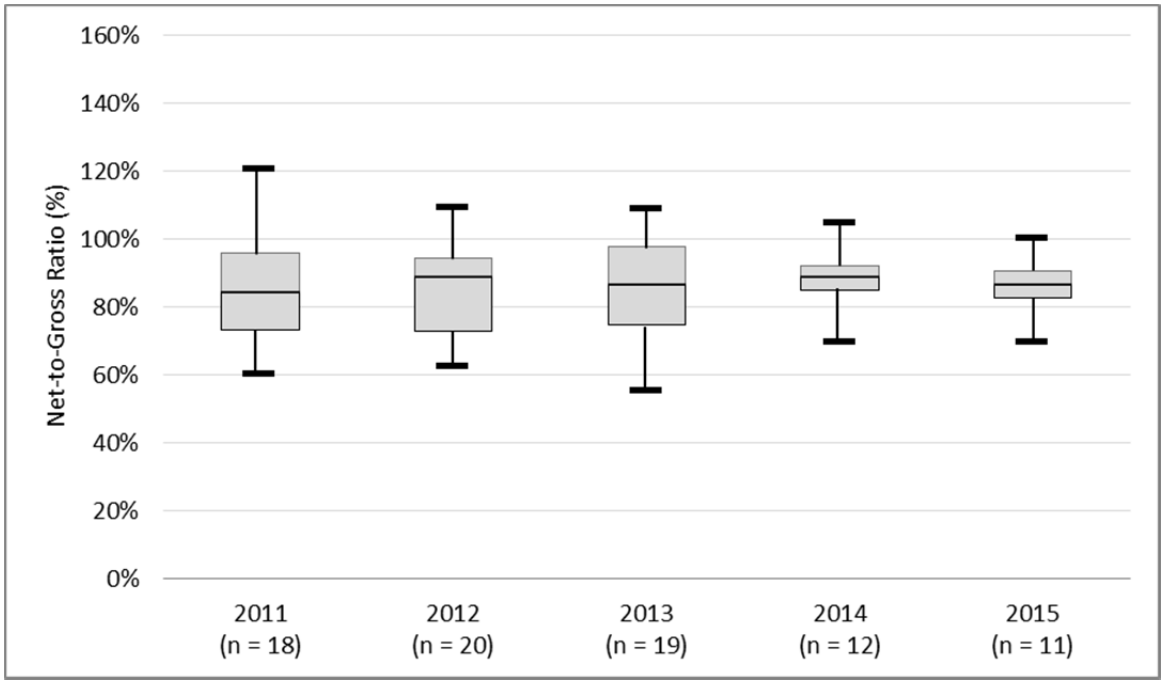
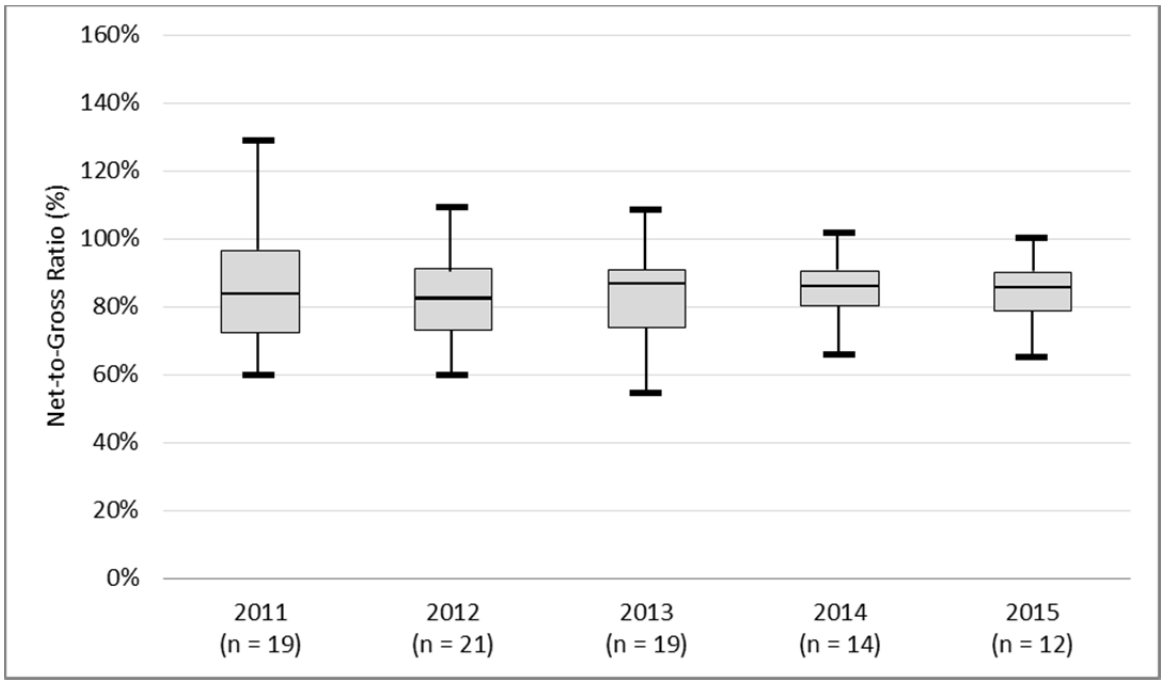


Figure B.4. Distribution and Range of Total Net-to-Gross Ratios



Tables B.6 and B.7 below present Hawaii and Pennsylvania as examples of the type of information collected for each state. Synapse completed tables like these for each of the 24 states it researched in more detail. These tables also illustrate the limited data availability, as neither state has data for all years or all customer sectors. Further, Table B.7 illustrates, to some extent, how we averaged NTG ratios when net and gross savings were not available.

Table B.6 summarizes Synapse's more detailed research of Hawaii's NTG ratio data. The customer sector-level savings values are summed from the program-level savings data included in Hawaii Energy's annual energy efficiency reports (program-level savings are not shown in the table below), and then divided to determine the customer-sector NTG ratios.

Table B.6. Hawaii Net-to-Gross Ratios by Customer Sector and Year

Year	Hawaii	Sector	Net Savings	Gross Savings	Net-to-Gross
2011	HI	Residential	67,635	92,650	73%
2011	HI	Low-Income			
2011	HI	Commercial & Industrial	61,151	83,769	73%
2011	HI	Total	128,786	176,419	73%
2012	HI	Residential	70,795	96,980	73%
2012	HI	Low-Income			
2012	HI	Commercial & Industrial	42,404	58,087	73%
2012	HI	Total	113,199	155,067	73%
2013	HI	Residential	71,242	89,519	80%
2013	HI	Low-Income			
2013	HI	Commercial & Industrial	55,766	72,485	77%
2013	HI	Total	127,008	162,004	78%
2014	HI	Residential			
2014	HI	Low-Income			
2014	HI	Commercial & Industrial			
2014	HI	Total	134,816	167,107	81%
2015	HI	Residential			
2015	HI	Low-Income			
2015	HI	Commercial & Industrial			
2015	HI	Total			

Similar to Table B.6, Table B.7 summarizes Synapse's more detailed research of Pennsylvania's NTG ratio data. The four primary utilities in Pennsylvania[46] provide NTG ratios by program in their annual energy efficiency reports, but only provide gross savings in terms of kWh. Therefore, Synapse averaged each utility's program-level NTG ratios for the customer sectors, and then averaged the customer-sector NTG ratios across all of the utilities to determine the statewide simple average NTG ratio values in the table below.

Table B.7. Pennsylvania Net-to-Gross Ratios by Customer Sector and Year

Year	Pennsylvania	Sector	Net Savings	Gross Savings	Net-to-Gross
2011	PA	Residential			70%
2011	PA	Low-Income			87%
2011	PA	Commercial & Industrial			66%
2011	PA	Total			66%
2012	PA	Residential			64%
2012	PA	Low-Income			100%
2012	PA	Commercial & Industrial			65%
2012	PA	Total			66%
2013	PA	Residential			65%
2013	PA	Low-Income			88%
2013	PA	Commercial & Industrial			72%
2013	PA	Total			69%
2014	PA	Residential			
2014	PA	Low-Income			
2014	PA	Commercial & Industrial			
2014	PA	Total			
2015	PA	Residential			
2015	PA	Low-Income			
2015	PA	Commercial & Industrial			
2015	PA	Total			

[46] The four primary Pennsylvania utilities include Duquesne Light, PECO Energy Company, PPL Electric Utilities, and the FirstEnergy Companies (Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company).