
Minnesota Energy Efficiency Potential Study: 2020–2029

Appendix O: Review of Past Minnesota Energy Efficiency Potential Studies

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Overview

Minnesota has a thirty-plus year history of leadership in energy efficiency policy and achievements. In order to continue to maximize the benefits of cost-effective energy efficiency resource acquisition by utilities, the project team, consisting of Center for Energy and Environment (CEE), Optimal Energy (Optimal) and Seventhwave, was commissioned to:

- Estimate statewide electric and natural gas energy efficiency and carbon-saving potential for 2020-2029;
- Produce data-driven and stakeholder-informed resources defining market segments, end uses, measures, and programs that could be targeted in the decade ahead to realize the state's cost-effective energy efficiency potential; and
- Engage stakeholders in order to help advance robust energy policies and energy efficiency programs in the state, and to inform future efficiency portfolio goals.

The full report, supporting documentation, and associated presentations can be found at the following website: <https://www.mncee.org/mnpotentialstudy/final-report/>

This appendix compares the results of previous potential studies conducted in Minnesota to the actual savings levels achieved by utilities during the period covered by those studies. The project team conducted this analysis in order to determine if potential studies were routinely under or overestimating utility-driven efficiency potential. As noted in the main report, potential studies all have limitations in their ability to predict the available future savings, and these limitations become more pronounced the further out the time horizon of the study.

After analyzing ten Minnesota potential studies, the team found that almost every study underestimated the actual performance of Minnesota utilities in the ensuing years. This suggests that technological and programmatic improvements consistently leads higher utility efficiency achievements than potential studies predict.

Annual incremental potential energy savings

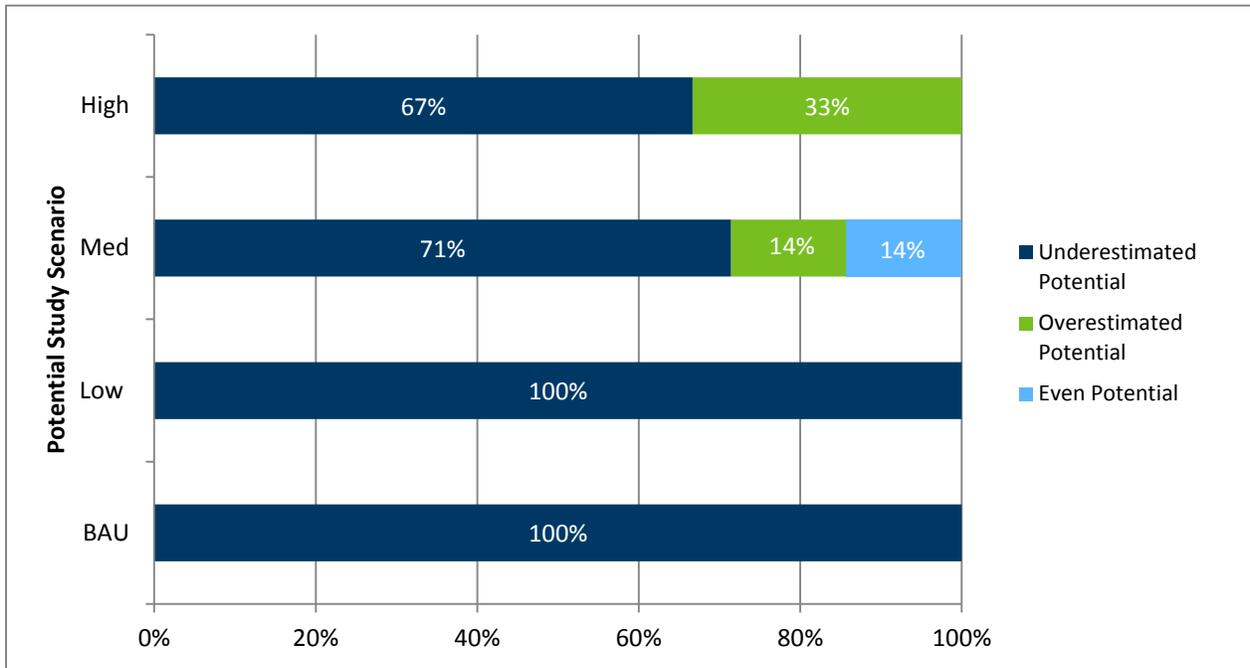
The project team compared the annual incremental energy savings potential estimated in ten different potential studies (Figure 1) to the actual CIP achievements in 2016 and 2017 of the Minnesota utilities covered by those studies. The results of the comparison showed that the majority of potential studies underestimated energy savings potential, no matter what scenario is examined (e.g. high, medium, low)¹. From Figure 2, we can see that all business as usual (BAU) and low potential scenarios underestimated actual achievements, and the majority of medium and high potential scenarios also underestimated actual achievements.

Figure 1. List of previous potential studies analyzed in this appendix

Report Name	Utility Territory	Study Period
Minnesota Gas Energy Efficiency Potential	CenterPoint, Xcel, MERC	2009 - 2019
CenterPoint Energy Minnesota Natural Gas Efficiency Potential Study	CenterPoint	2015 - 2025
Assessment of Achievable Potential from Energy Efficiency Programs for Great River Energy	GRE	2009 - 2030
Electric Demand Side Management (DSM) Market Potential Study	Otter Tail	2017 - 2031
Xcel Energy Minnesota DSM Market Potential Assessment	Xcel	2011 - 2021
2014 Update to the Minnesota DSM Market Potential Assessment	Xcel	2014 - 2023
Appendix B—Demand-Side Management (DSM) Part 2—Energy Conservation Resource Alternatives and Rate Impact Study	Minnesota Power	2017 - 2044
Assessment of Energy Efficiency and Demand Response Potential	MRES	2015 - 2039
Energy-Efficiency and Carbon Savings Potential Study	Minnesota Power	2015 - 2039
Summit Blue – Minnesota Statewide Electricity Efficiency Potential Study DSM Potentials Report	Statewide	2008 - 2028

¹ Scenario definitions are not always consistent between potential studies, and may refer to relative levels of assumed customer incentives, natural gas prices, etc. The project team grouped the scenarios into four buckets (high, medium, low, and business as usual) for the purpose of this analysis.

Figure 2. Potential study estimates versus actual utility savings performance



The trend of underestimating energy savings potential is clear, but it is important to note that there are some limitations to the above analysis. Some studies only presented a single cumulative savings value, so in those cases the project team divided the total savings by the number of years in the study. Also, this analysis is a snapshot-in-time, which may miss variation in estimated potential over the course of longer term study periods. These issues are addressed in the following section.

Cumulative potential energy savings

To address some of the limitations discussed above, the project team decided to analyze cumulative energy savings.² This poses a challenge when analyzing study periods that are not yet complete. For example, Xcel's most recent potential study runs from 2011-2020. Each study was handled on a case-by-case basis as to how the project team would address these time gaps.

The project team completed cumulative analysis on three potential studies: [Xcel's 2012 Study conducted by Kema \(now DNV GL\)](#), CenterPoint's 2015 Study conducted by Navigant, and the [Statewide Electricity Efficiency Study 2010 conducted by Summit Blue Consulting](#).

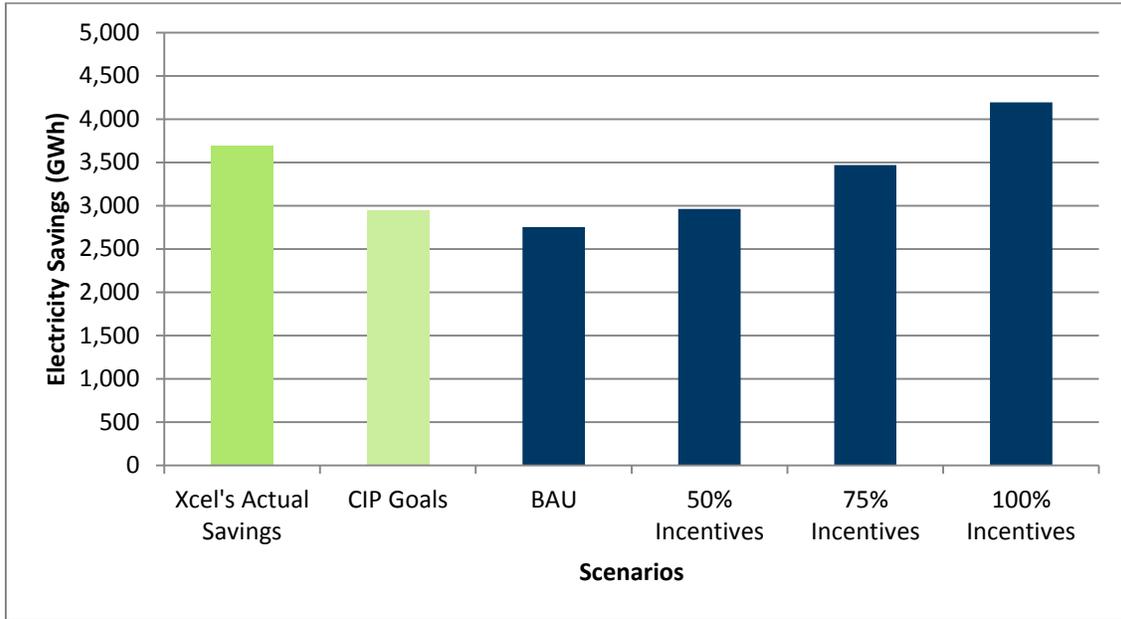
2012 Xcel Energy Minnesota DSM market potential assessment

The Xcel potential study covers a whole decade (2011-2020). The project team compiled actual savings from CIP status reports and CIP goals from triennial plans and compared them to the results of Xcel's potential study. Figure 3 shows the actual savings from Xcel's CIP status reports in the darker green bar and Xcel's potential study's results in the blue bars. The actual savings is greater than the BAU, 50% and 75% scenario.³ The 100% incentive scenario was greater than the actual savings by a slight margin.

² Cumulative potential energy savings are additive from year to year. They are defined as the energy savings occurring in a given year from the efficiency measures installed during that year, plus the savings in that year from measures installed in previous years that are still within their measure lifetimes.

³ The business as usual (BAU) scenario, projects Xcel's current program design and implementation features across the forecast horizon. The 50%, 75%, and 100% scenarios refer to the percentage of incremental measure costs paid out in customer incentives under a given scenario.

Figure 3. Xcel Energy potential study: Cumulative savings (2011-2017) estimates compared to actual savings performance



The project team also analyzed whether it was likely that the 100% incentive level scenario would continue to outperform Xcel’s actual savings going forward. Figure 4 shows an extended period of time. To estimate what Xcel’s actual achievement levels could be over this time period, the project team added Xcel’s 2018 and 2019 goals from the company’s CIP Triennial Plans to Xcel’s 2011-2017 actual savings to create the dark green bar. As you can see over this time period, Xcel’s CIP actual and goal savings are greater than all four scenarios from Xcel’s potential study. If the entire study period (2011-2020) was simulated, the difference between actual savings and each potential scenario would be even greater, as 2020 represents the lowest potential for all study scenarios and it is unlikely that actual savings would be that low.

Figure 4. Xcel Energy potential study: Cumulative savings (2011-2019) estimates compared to actual savings performance

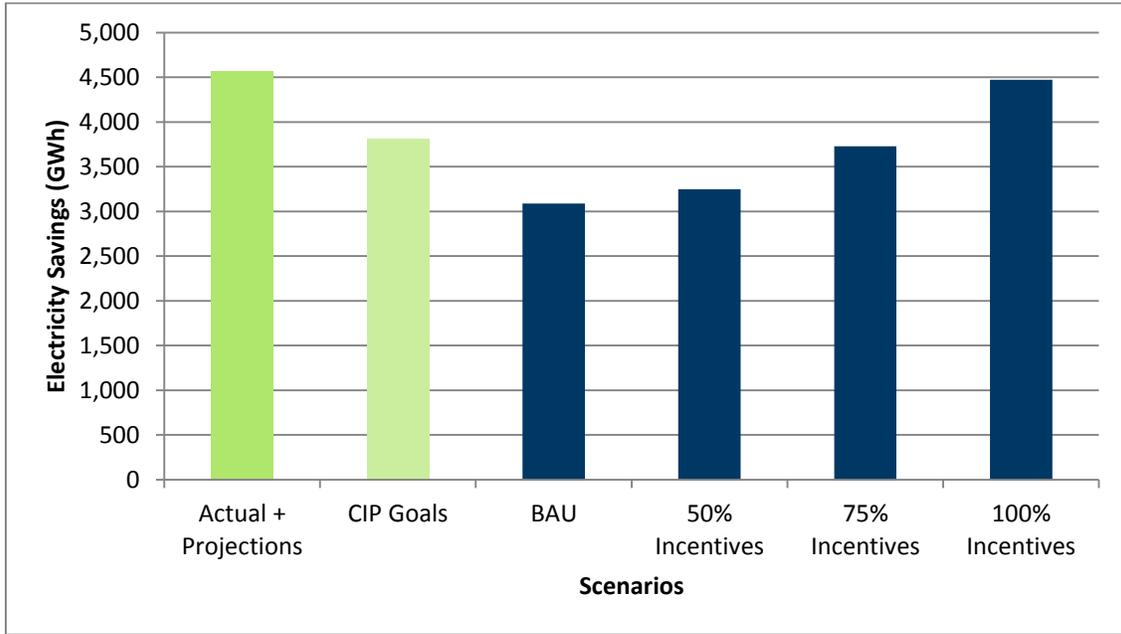
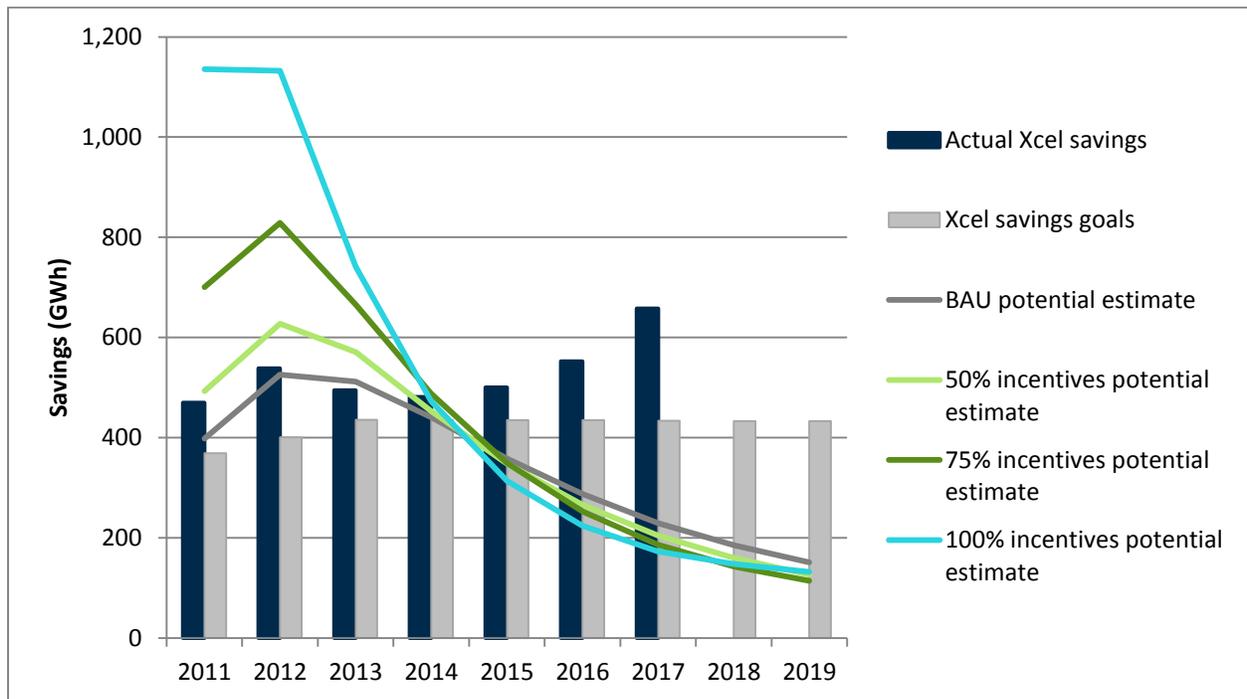


Figure 5 graphs the savings predicted each year in each of Xcel’s potential study scenarios. The vast majority of total savings were predicted to occur from 2011-2014, with very little potential expected in 2017-2020. When this trend is compared to the bar graphs showing actual savings and CIP goals, a significant difference can be seen.

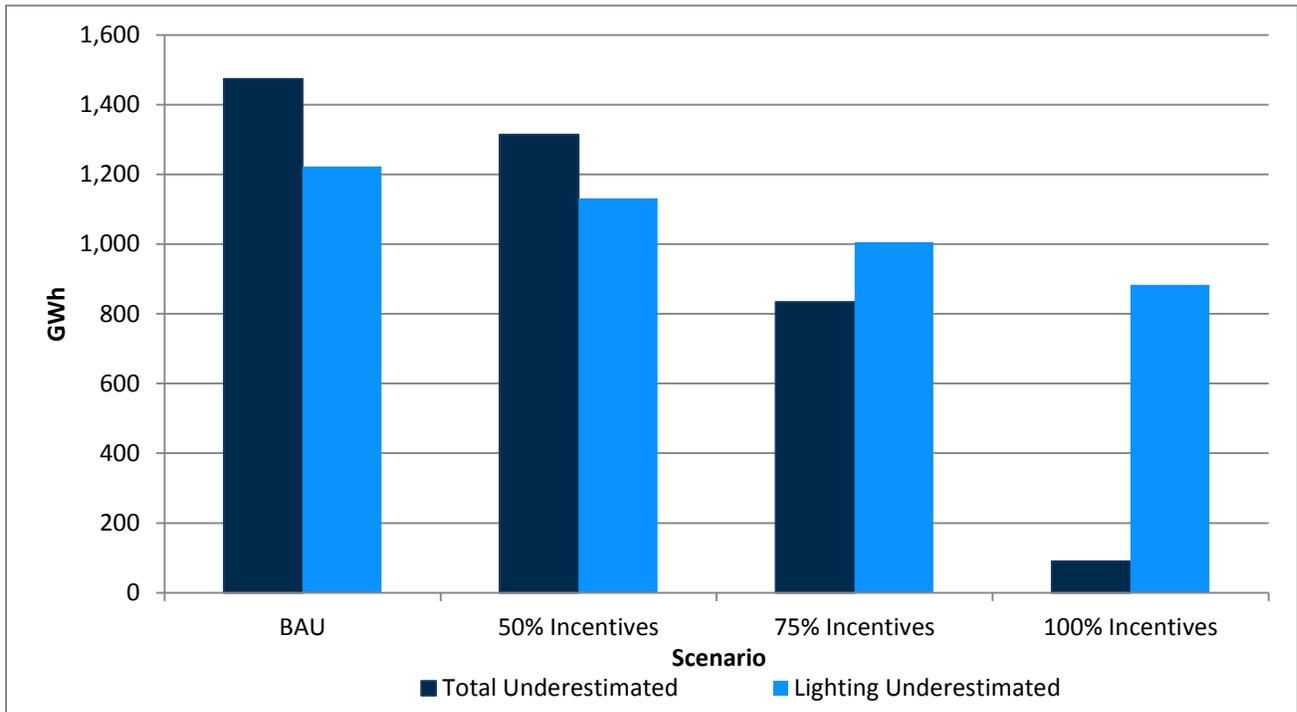
Figure 5. Xcel Energy annual savings versus potential study estimates



Given the rapid penetrations of LEDs into the market, it is well known that the lighting sector was underestimated in nearly all predictions of efficiency potential. This is also true for the Xcel potential Study. Figure 6 shows the total energy in GWh that was underestimated by the study in dark blue and the total energy from lighting that was underestimated in lighter blue.

In the BAU and 50% incentive scenarios the underestimation of lighting makes up the majority of the total underestimated amount. However, there were additional programs that were underestimated. In the 75% and 100% incentive scenarios, lighting underestimates were larger than the total underestimates, meaning that other programs were overestimated during the time period. This makes sense as few programs offer 75 or 100% incentives.

Figure 6. Xcel potential study lighting specific underestimation of potential



Some may attempt to use the example of lighting to dismiss the overall trend of underestimating potential, but this just highlights the idea that potential studies are likely to underestimate achievement. Over any given time period, there is likely to be one or more technologies and/or programs that see significant technological advancement, drastically lower prices, and increased customer awareness that cause savings to increase in a way studies cannot predict. It may not be possible to identify all future successful technologies, but over the course of this study period (2020-2029), the next 'LED Light Bulb' energy efficiency opportunity may emerge.

Summit Blue potential study

The statewide electricity potential study released in 2010, which was conducted by Summit Blue Consulting, LLC (now Navigant Consulting) shows similar trends in underestimating cumulative energy savings potential. However, there is less granular information in this study so judgements cannot be made on what technologies were specifically underestimated. Figure 7 shows the actual statewide CIP energy savings results compared to Summit Blue's potential study results. Examining this graph, not only do the actual cumulative results outperform all three potential scenarios, but that the actual savings are higher than the annual savings predicted in for each scenario, in each year except one.

Figure 7. 2010 Summit Blue potential study (2009-2017) estimates compared to actual CIP statewide savings

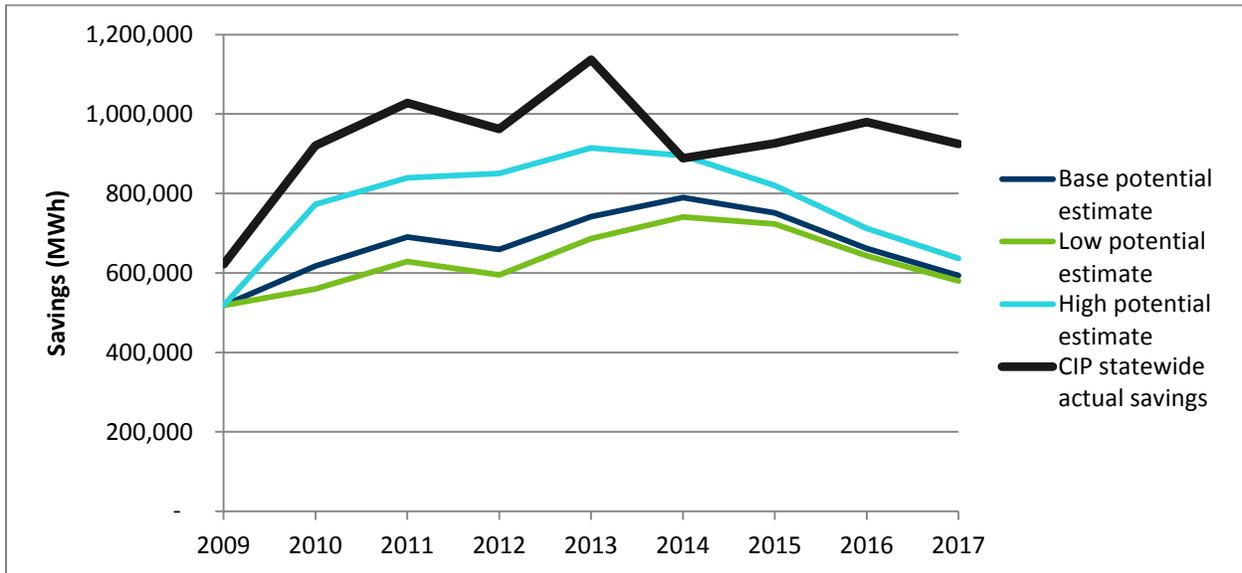
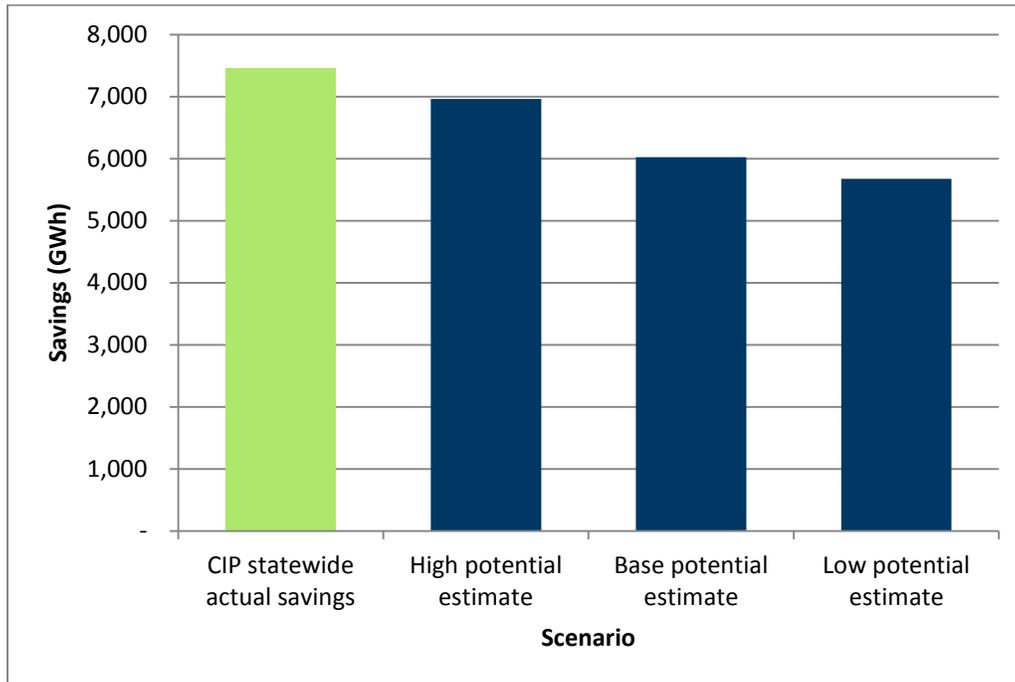


Figure 8 allows the cumulative savings and potential study results to be seen more clearly. As stated earlier, actual savings outperformed all study scenarios including the “High” scenario.⁴

⁴ High case estimate in this study is based on the experience of the best of the best-practice utilities’ DSM program results.

Figure 8. Statewide electricity savings (2009 – 2017) estimates compared to actual CIP statewide savings



2015 CenterPoint Energy Minnesota natural gas efficiency potential study

Underestimating potential occurs in natural gas studies as well. This section looks at CenterPoint Energy’s 2015 Minnesota natural gas efficiency potential study conducted by Navigant Consulting. Figure 9 and Figure 10 compare the study’s potential estimates to CenterPoint’s actual savings performance. Reviewing the figures shows that all of CenterPoint’s potential study scenarios⁵ underestimated potential up to 2017, both as an absolute value and as a percentage of sales. It is worth noting that all the scenarios have potential peaking and declining or leveling off around 2019.

⁵ Scenarios in this study varied by quantity and design of program offerings, customer incentive levels, and potential policy changes such as allowing fuel switching within CIP.

Figure 9. 2015 CenterPoint Energy Minnesota natural gas efficiency potential study annual savings estimates compared to actual savings performance (Dekatherms)

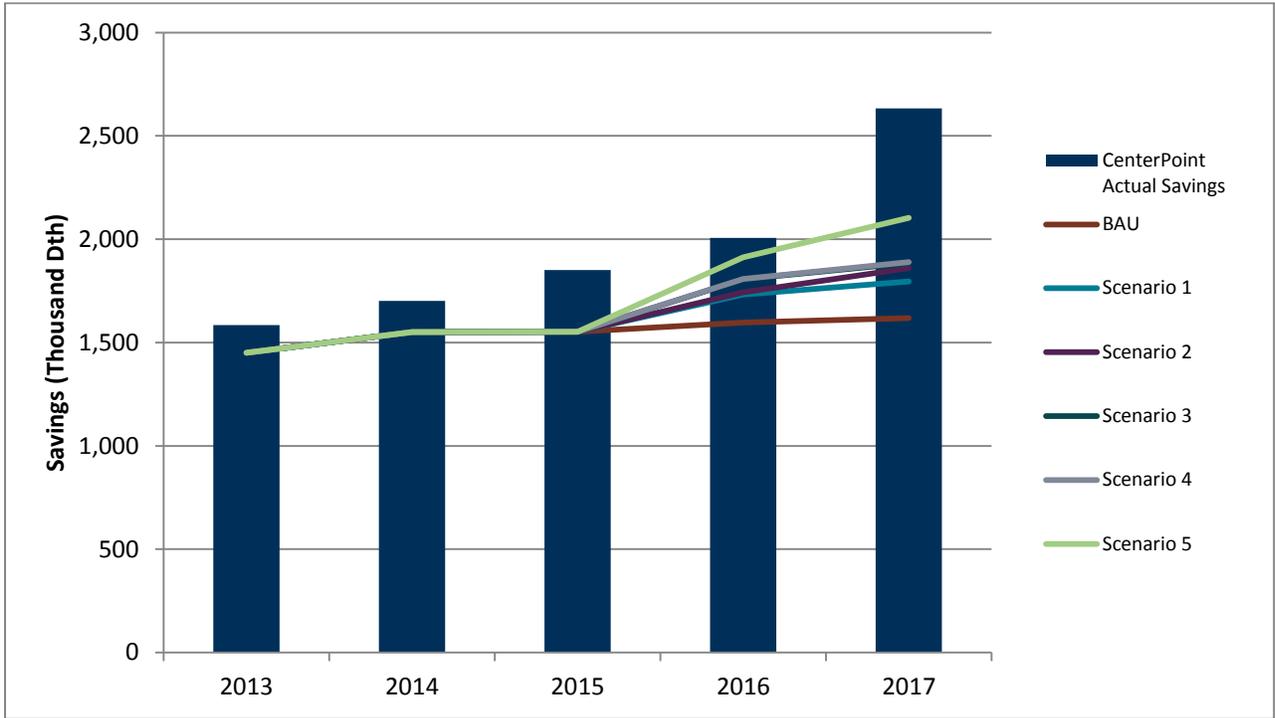


Figure 10. 2015 CenterPoint Energy Minnesota natural gas efficiency potential study annual savings estimates compared to actual savings performance (% savings basis)

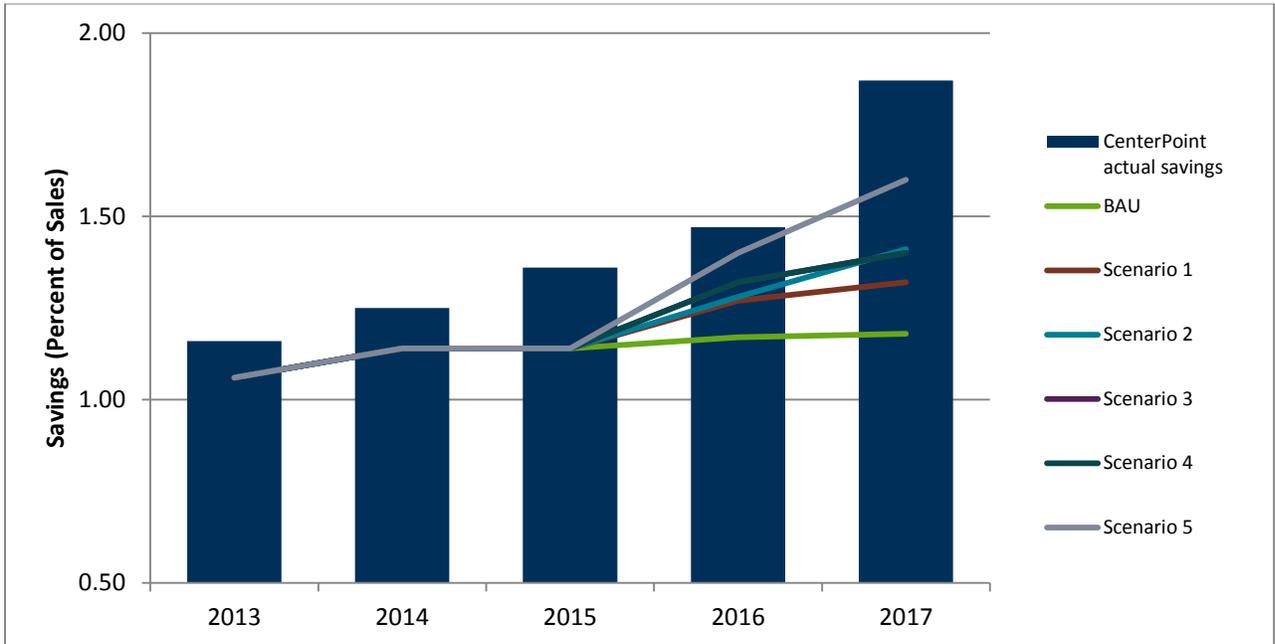


Figure 11 shows the CenterPoint potential study's estimated cumulative savings from 2013-2017 compared to the company's actual energy savings achievements during the same period. Similar to other examples, actual savings are greater than all potential study scenarios. It can also be seen that there is not a lot of differentiation between the scenarios. This is because CenterPoint's study goes through 2025, meaning there are relatively few data points to compare to actual savings. Actual savings in this time period are approximately 15% higher than the potential study's predictions.

Figure 11. CenterPoint potential study's 2013-2017 cumulative savings estimates versus actual performance for the same time period

