# Ameren Illinois Energy Efficiency Market Potential Assessment

Report Number 1404

Volume 4: Program Analysis – DRAFT FOR FILING

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*Prepared for:*
Ameren Illinois

*Presented on:*
July 8, 2013

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# INTRODUCTION

## Background

Ameren Illinois contracted with EnerNOC to conduct an electricity and natural gas Energy Efficiency (EE) Market Potential study covering the period of performance from June 1, 2014 through May 31, 2017 to aid the development of a three year plan for programs implemented by Ameren Illinois in Cycle 3. In addition, the analysis also included the period of performance from June 1, 2017 through May 31, 2024 to aid in benchmarking and other tasks related to future analyses. This study identifies the potential to achieve the kWh and therm annual load reduction targets within the rate caps identified in Sections 8-103 and 8-104 of the Illinois Public Utilities Act. In addition, the electric component of the study identifies the potential to achieve additional kWh savings per Section *5/16-111.5Bnew* of the Act absent rate cap limitations. This comprehensive study includes primary market research, a full demand side management (DSM) potential analysis for electricity and natural gas, energy efficiency program design, supply curve development, and analysis of wasted energy.

EnerNOC teamed with YouGov|Definitive Insights and Washington University in St. Louis to perform saturation surveys and program-interest research with Ameren Illinois customers. The EnerNOC team worked in collaboration with Applied Energy Group who, under separate contract with Ameren Illinois performed the program analysis presented in this volume. This report represents the combined effort of these four organizations.

## Objectives

The study addresses energy efficiency potential and informs the program design process in the following ways:

- Develop three-year plan for electric and natural gas EE programs implemented in Cycle 3 (2014-2017)
- Develop EE potential estimates for 2017-2024 for benchmarking and future analyses
- Conduct market research to better represent customers in the Ameren Illinois service territory
- Quantify wasted energy due to customer behavior

## Report Organization

This report is presented in six volumes as outlined below. This document is **Volume 4: Program Analysis**.

- Volume 1, Executive Summary
- Volume 2, Market Research Report
- Volume 3, Energy Efficiency Potential Analysis
- Volume 4, Program Analysis
- Volume 5, Supply Curves
- Volume 6, EE Potential Analysis Appendices

# ANALYSIS APPROACH

The attached spreadsheet contains the program analysis and results. Text describing the analysis approach and detailed results is forthcoming.

Ameren Illinois
Potential Study Progr

CHAPTER | 3

# PLACEHOLDER FOR ELECTRICITY RESULTS

CHAPTER | 4

# PLACEHOLDER FOR NATURAL GAS RESULTS

## About EnerNOC Utility Solutions Consulting

EnerNOC Utility Solutions Consulting is part of EnerNOC Utility Solutions group, which provides a comprehensive suite of demand-side management (DSM) services to utilities and grid operators worldwide. Hundreds of utilities have leveraged our technology, our people, and our proven processes to make their energy efficiency (EE) and demand response (DR) initiatives a success. Utilities trust EnerNOC to work with them at every stage of the DSM program lifecycle – assessing market potential, designing effective programs, implementing those programs, and measuring program results.

EnerNOC Utility Solutions delivers value to our utility clients through two separate practice areas – Program Implementation and EnerNOC Utility Solutions Consulting.

- Our Program Implementation team leverages EnerNOC's deep "behind-the-meter expertise" and world-class technology platform to help utilities create and manage DR and EE programs that deliver reliable and cost-effective energy savings. We focus exclusively on the commercial and industrial (C&I) customer segments, with a track record of successful partnerships that spans more than a decade. Through a focus on high quality, measurable savings, EnerNOC has successfully delivered hundreds of thousands of MWh of energy efficiency for our utility clients, and we have thousands of MW of demand response capacity under management.
- The EnerNOC Utility Solutions Consulting team provides expertise and analysis to support a broad range of utility DSM activities, including: potential assessments; end-use forecasts; integrated resource planning; EE, DR, and smart grid pilot and program design and administration; load research; technology assessments and demonstrations; evaluation, measurement and verification; and regulatory support.

The EnerNOC Utility Solutions Consulting team has decades of combined experience in the utility DSM industry. The staff is comprised of professional electrical, mechanical, chemical, civil, industrial, and environmental engineers as well as economists, business planners, project managers, market researchers, load research professionals, and statisticians. Utilities view our experts as trusted advisors, and we work together collaboratively to make any DSM initiative a success.

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Volume 5: Supply Curves

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# INTRODUCTION

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# ANALYSIS APPROACH

The purpose of supply curves is to better understand the relationship between energy efficiency savings and the costs required to reach those savings levels. Supply curves can yield insights about a portfolio of conservation programs that are not easily attained by looking at the impacts and costs associated with any one individual program.

Energy efficiency measures and/or programs and their associated impacts are rank-ordered according to their cost per unit of savings. The two data points (unit cost and savings impacts) are plotted successively on a set of axes to create a curve. As programs become more expensive, there is a point on the supply curve where it appears that significantly greater cost will be required to reach a diminishing amount of EE savings.

Supply curves consist of two axes – a y-axis that depicts the cost of the saved energy, and an x-axis that shows the energy savings impacts. The following data were considered and assembled as part of the supply curve.

## Y-axis: Unit Cost

To construct the data for the y component of the supply curve data pairs, one must represent each measure or program's cost per unit of energy saved. This can be done on a first-year basis or a levelized/lifetime basis, wherein the cost is amortized or spread across the lifetime of the savings. Once this data is assembled, it is rank-ordered from least cost to highest cost. An example data set is shown in Table 2-1 below.

## X-axis: Energy Savings Impacts

To construct the data for the x-axis, one must represent the energy savings obtained by each measure or program. This can be done in terms of absolute energy savings or as a percentage of the baseline forecast. The supply curve and associated data can also be prepared for a single year at a time, or for a summation of cumulative savings over multiple years. Different formulations are useful for different purposes, and it is important to specify the assumptions when presenting the data. An example data set is show in Table 2-1 below.

***Table 2-1 Example of Measure Data Preparation for Supply Curve***

| Measures Entering Supply Curve | Incremental Measure Cost | Number of Units | Annual kWh Savings/Unit | Effective Useful Life (years) | X-Axis | Y-Axis (option 1) | Y-Axis (option 2) |
|---|---|---|---|---|---|---|---|
| | | | | | Total First-Year kWh Savings | First-Year $/kWh | Lifetime or Levelized $/kWh* |
| | A | B | C | D | B * C | A / C | (A amortized over D)* / C |
| CFL lamp | $2 | 100,000 | 30 | 5 | 3,000,000 | $0.07 | $0.01 |
| Ceiling Insulation | $500 | 1,200 | 1500 | 25 | 1,800,000 | $0.33 | $0.02 |
| SEER 16 AC | $150 | 800 | 350 | 14 | 280,000 | $0.43 | $0.04 |
| Heat Pump Maintenance | $50 | 150 | 90 | 3 | 13,500 | $0.56 | $0.19 |

## Overall Savings and Costs

The first step toward creating the program-level supply curves was to create two separate scenarios that correspond to the measure-level energy efficiency potentials assessed in Volume 3: Energy Efficiency Potential: Realistic Achievable Potential (RAP) and Maximum Achievable Potential (MAP).

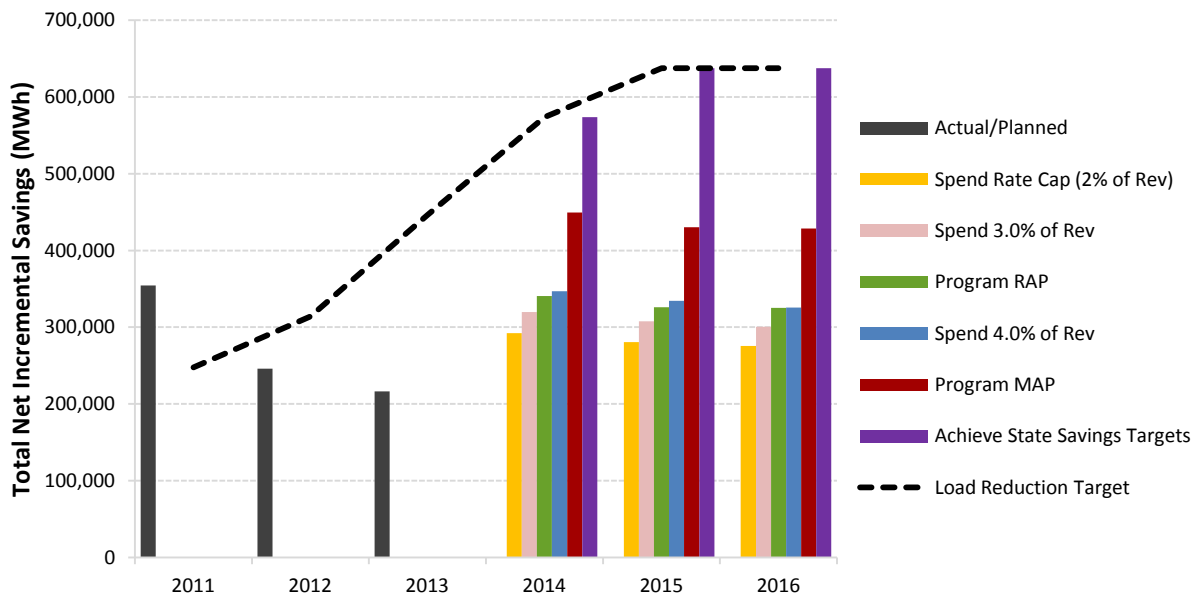
EnerNOC provided the measure-level costs and savings to AEG, who in-turn developed the energy efficiency programs. The cost-effective measures were combined to develop two portfolios of energy efficiency programs – Program RAP and Program MAP. As described in Volume 4, the savings are levied with appropriate costs for incentives, implementation, marketing and education, evaluation, and program administration. After applying all the delivery and cost structures, the Program RAP and Program MAP portfolios resulted in a set of program potential savings and estimated budgets.[1]

### Using RAP and MAP to Interpolate or Extrapolate to New Portfolio Scenarios

These two portfolios provided guidelines, allowing us to create various portfolio scenarios by interpolating between Program RAP and Program MAP, optimizing to consider a number of other scenarios relevant to planning considerations; namely: attainment of the Illinois state goals, spending exactly at the rate caps, and increments of spending between (for example: spending 3% of revenue or 4% of revenue).

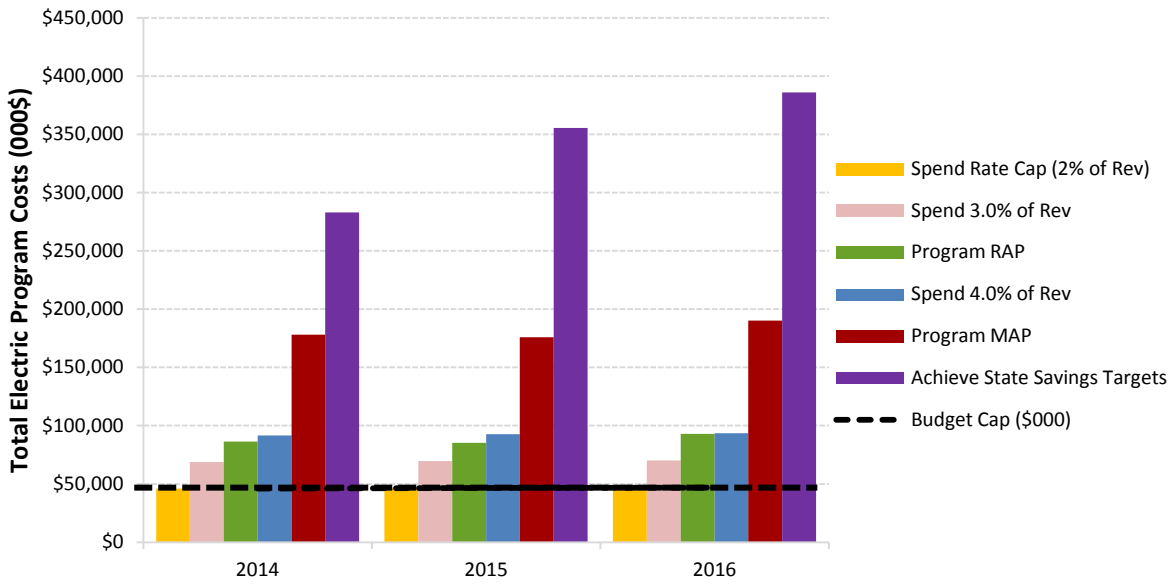
Figure 2-1 below shows the resulting Net Incremental MWh savings per year for the various portfolios, along with a line indicating the level of load reduction necessary to meet the IL state targets in any year. Figure 2-2 shows the total program costs to achieve these electricity savings.

***Figure 2-1 Net Incremental Electricity Savings (MWh)***




[1] For details on the development of programs, please refer to Volume 4: Program Design.

***Figure 2-2 Total Electric Program Costs***




For the natural gas portfolios, the resulting Net Incremental therm savings per year are shown in Figure 2-3. The respective costs to achieve the savings are shown in Figure 2-4 below.

***Figure 2-3 Net Incremental Natural Gas Savings (1,000 therms)***

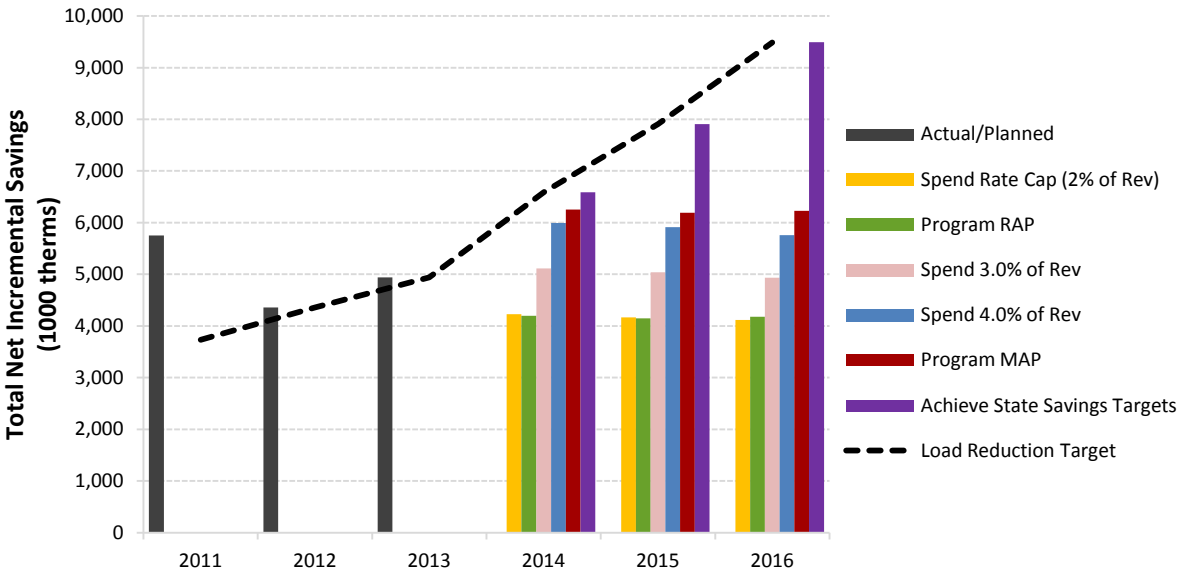
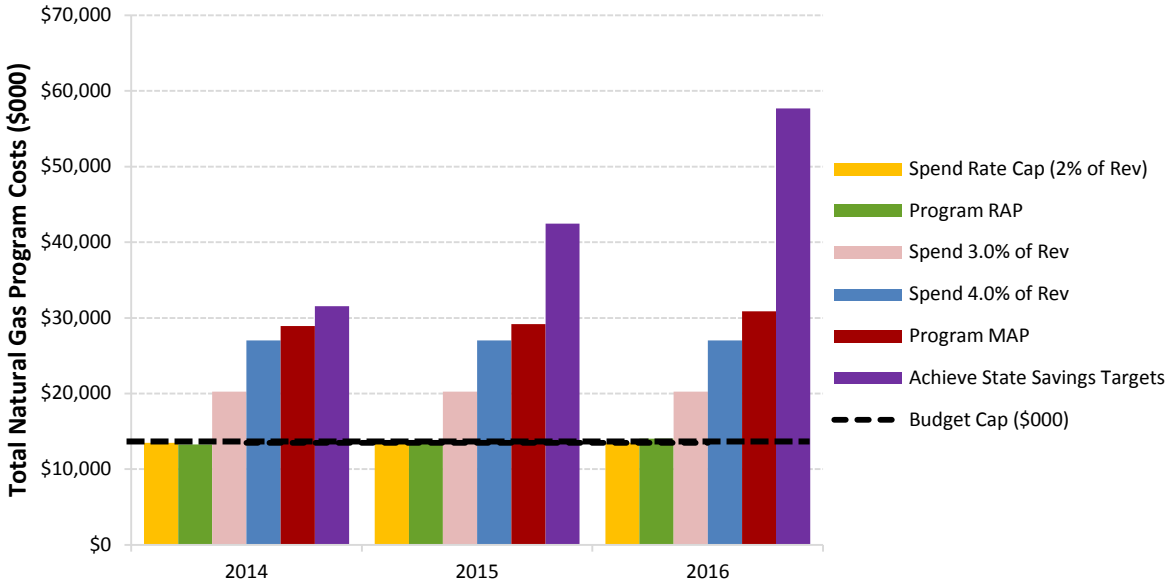


***Figure 2-4 Total Natural Gas Program Costs***




## Supply Curve Formats

To develop the supply curves in this report, the following formats and assumptions were applied:

- First, values representing the y-axis of the curves were constructed. The y-axis values represent the total program cost divided by the program's savings in the first year to yield an incremental or first-year cost per kilowatt-hour ($/kWh). This cost is considered to be the same for every unit of savings acquired in a given program, and therefore creates a unique horizontal line for each program.
- Values representing the x-axis of the curves were then constructed. The x-axis values represent the first-year potential energy savings (in terms of annual MWh savings) by individual EE program for a given program year.

# ELECTRICITY SUPPLY CURVE RESULTS

Figure 3-1 through Figure 3-3 show the supply curves for the various electric EE programs, at the various implementation levels, for the program years 2014-2016. Each horizontal line is a discrete program with a bundle of measures and an explicit delivery mechanism and cost structure. Several program levels are shown, as well as the supply curve for achieving the state target.

***Figure 3-1 Electric Energy Efficiency Program Supply Curves—Potential in 2014***

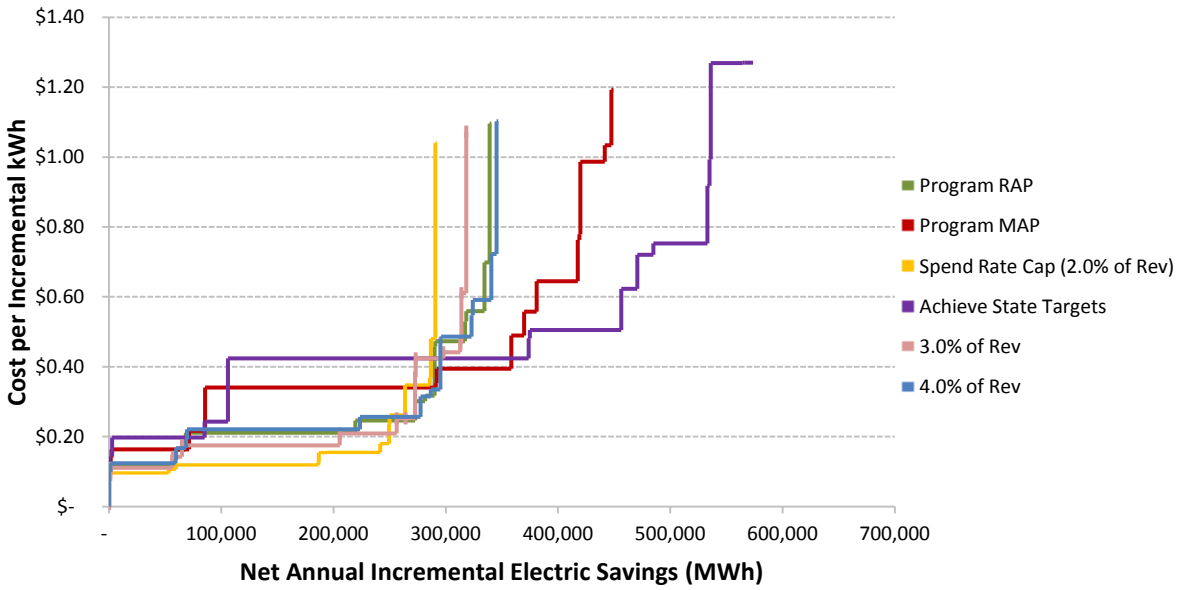



***Figure 3-2 Electric Energy Efficiency Program Supply Curves—Potential in 2015***

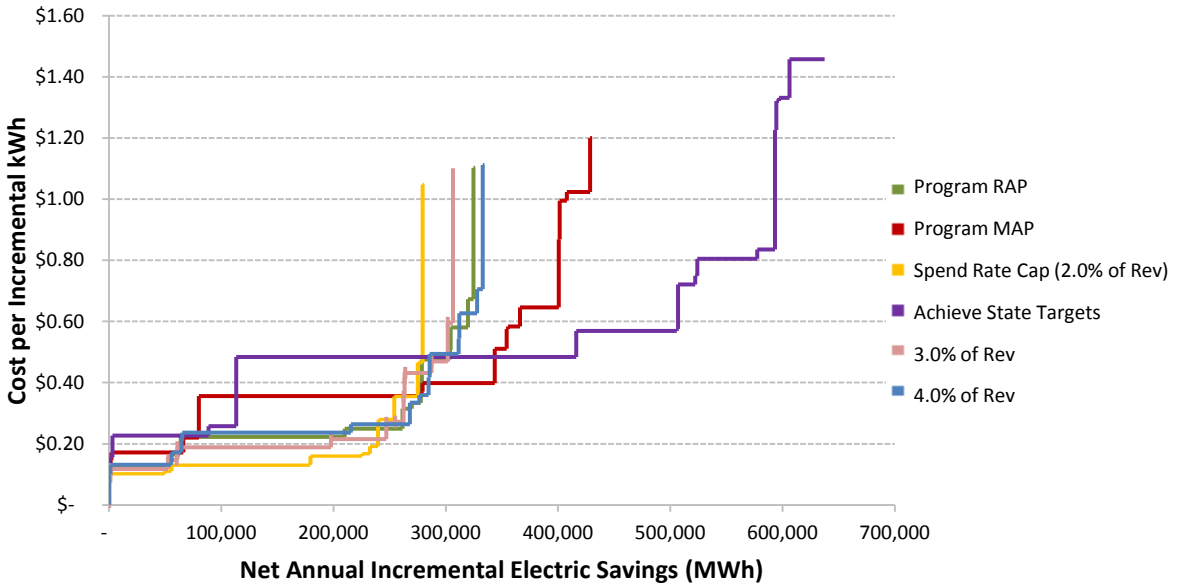
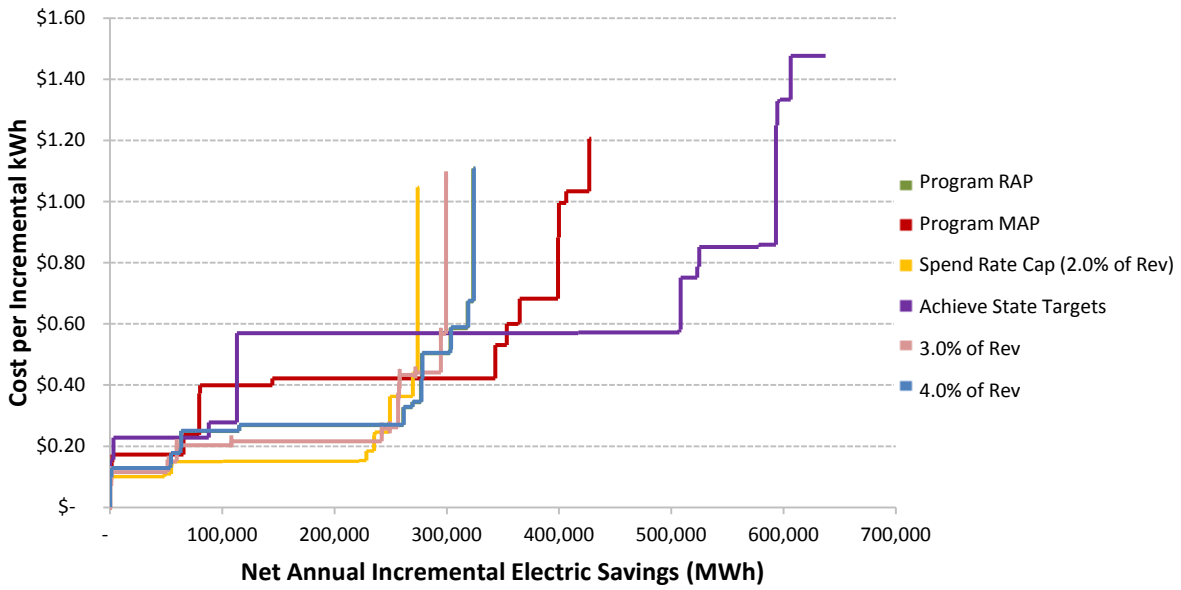


***Figure 3-3 Electric Energy Efficiency Program Supply Curves—Potential in 2016***




In general, several observations can be made from the results of the supply curve analysis:

- Overall, the analysis shows a significant majority of the EE program savings fall under $0.40/kWh, where kWh are given in incremental or first-year terms.
- The portfolio representing spending at the rate cap level of 2% of revenue is significantly lower than the Program RAP level from the EE potential analysis[2].
- While most of the programs are very cost-effective at an aggregate, program level, there are some higher cost programs which include: Residential HVAC, Retro Commissioning and the Building Codes and Standards program. Building Codes and Standards unit costs are significantly higher than the second most expensive program.

## Analysis and Recommendations

Based on the results presented above, it is clear that each implementation level presents certain risks and rewards. For the Spend Rate Cap portfolio, there is less risk posed and savings would remain close to historic and current levels. The Program High portfolio provides the largest amount of savings of any achievable level, but those savings are realized at a very high cost in absolute terms. Budgets would need to be increased dramatically beyond current and historic levels to accommodate the intense level of program activities.

Regarding the electric EE programs, the Program RAP portfolio offers the best opportunity for Ameren Illinois to achieve a cost-effective portfolio with levels of savings greater than the current Cycle 2 portfolio and the Cycle 3 "Spend Rate Cap" portfolio, while also having less risk and uncertainty than the Program MAP portfolio. As can be seen from the supply curves, the Program RAP would be very similar to the portfolio that spends 4.0% of Revenue in the three program years. This gives a barometer of the level of spending that would be required to achieve the savings in the Program RAP scenario.

[2] Note that the Program RAP scenario in the chart is obscured by the 4.0% of revenue line since the values are so close to each other.

# NATURAL GAS SUPPLY CURVE RESULTS

The supply curves for the various natural gas EE programs portfolios are presented below in Figure 4-1 through Figure 4-3 for the program years 2014-2016:

***Figure 4-1 Natural Gas Energy Efficiency Program Supply Curves—Potential in 2014***

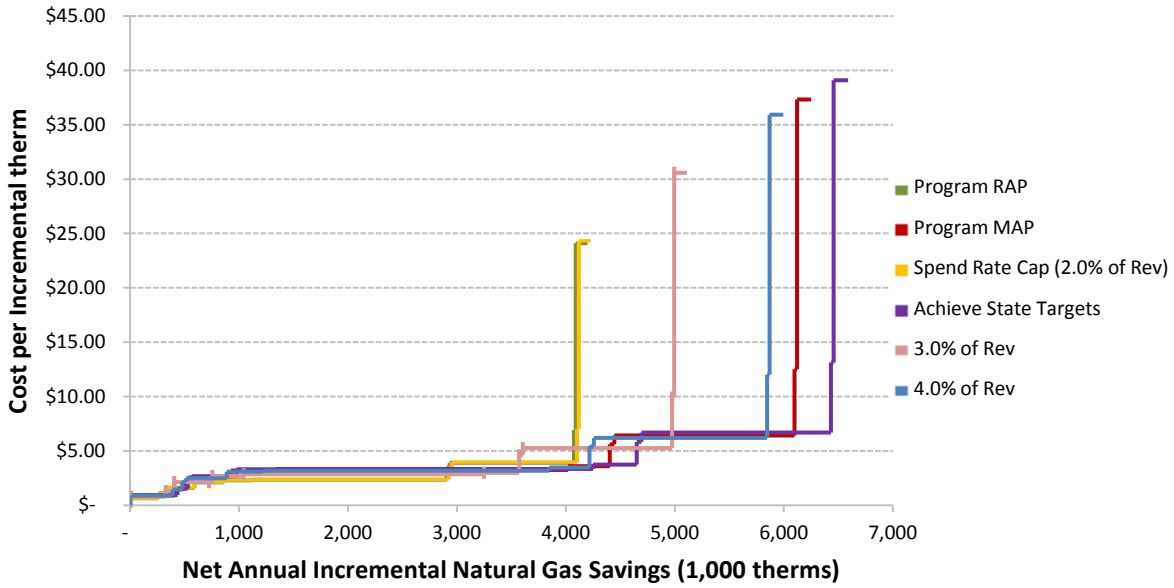



***Figure 4-2 Natural Gas Energy Efficiency Program Supply Curves—Potential in 2015***

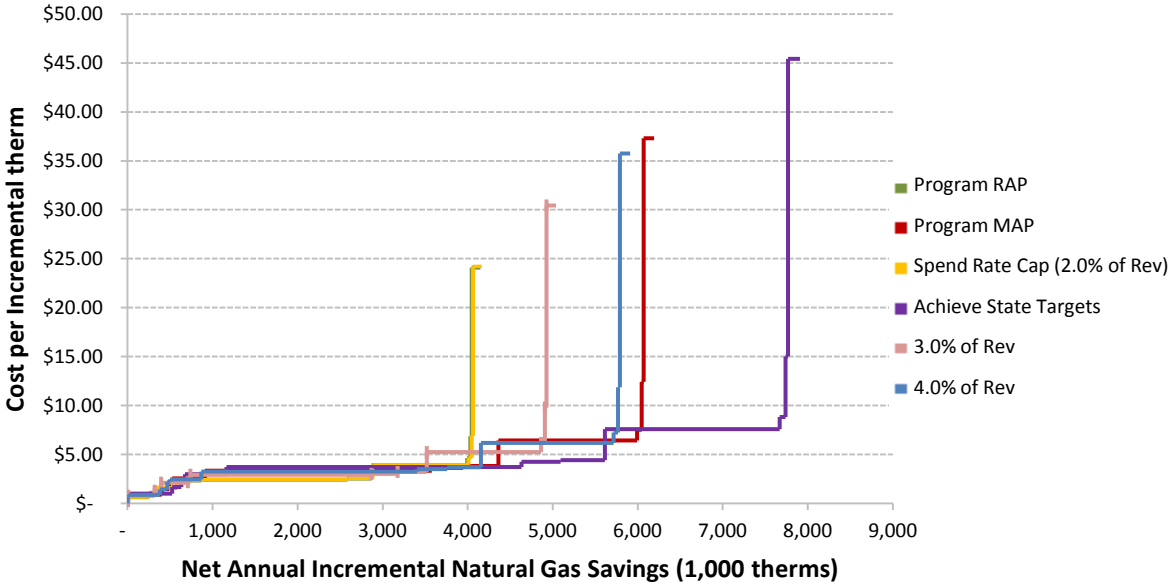
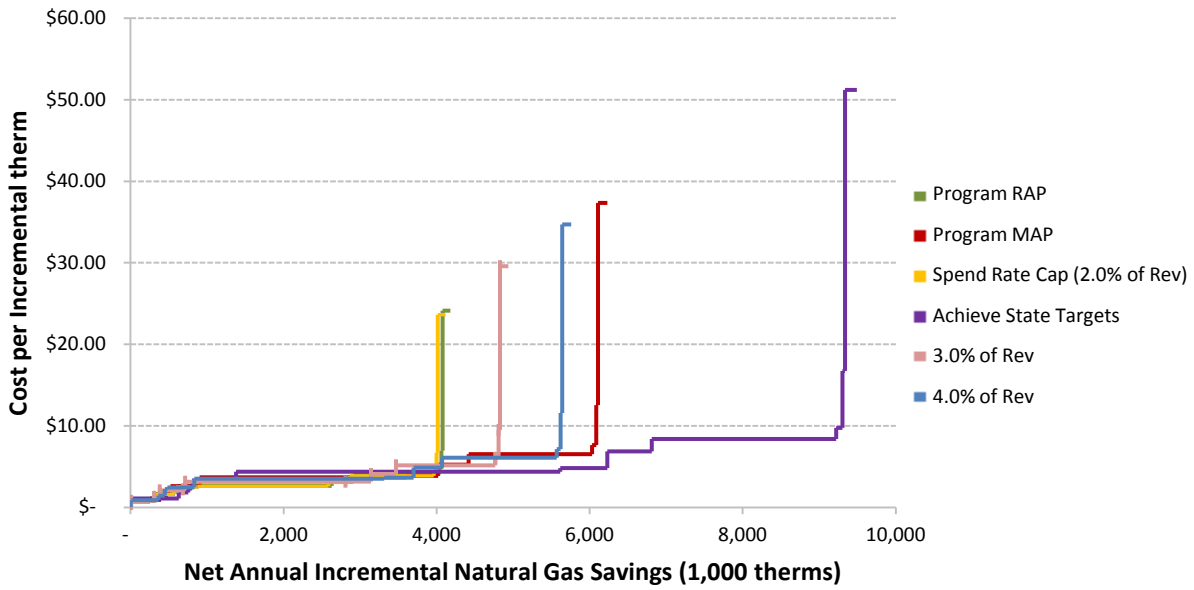


***Figure 4-3 Natural Gas Energy Efficiency Program Supply Curves—Potential in 2016***




Observations that can be made from the natural gas supply curves analysis include:

- A majority of the EE program savings for natural gas are under and around the $5.00/therm level, where therms are given in incremental or first-year terms.
- The portfolio representing spending at the rate cap level of 2% of revenue is closer to the Program RAP scenario for natural gas than it is in the electricity analysis.
- There are several programs with a high per-unit savings cost, including: Residential ENERGY STAR Homes, Residential Moderate Income, and Retro Commissioning.

## Analysis and Recommendations

Based on the results presented above, it is clear that each implementation level presents certain risks and rewards. For the Spend Rate Cap portfolio, there is less risk posed and savings would remain close to historic and current levels. The Program High portfolio provides the largest amount of savings of any achievable level, but those savings are realized at a very high cost in absolute terms. Budgets would need to be increased dramatically beyond current and historic levels to accommodate the intense level of program activities.

For the natural gas EE programs, the Program RAP portfolio offers the most cost-effective portfolio for Ameren Illinois, maintaining spending levels close to the "Spend Rate Cap" portfolio and providing slightly lower $/therm cost.

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