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## **AMEREN ILLINOIS ENERGY EFFICIENCY MARKET POTENTIAL ASSESSMENT**

Report Number 1404

Volume 1: Executive Summary

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## EXECUTIVE SUMMARY

Ameren Illinois (AIC) selected EnerNOC to conduct this Energy Efficiency Market Potential Study to assess the various categories of electric and natural gas energy efficiency potential in the residential, commercial, and industrial sectors of the Ameren Illinois service territory. The key objectives of the study were to:

- Satisfy the legislative requirement to provide an electric potential study with the IPA incremental savings filing that is no less than 3 years old (last one completed in 2010). Ameren Illinois chose to include natural gas as well.
- Provide support for the development of an integrated gas and electric Cycle 3 (2014-2017) Plan.
- Conduct comprehensive market research to better represent customers in the AIC service territory.
- Quantify wasted energy due to customer behavior.
- Develop EE potential estimates for 2017-2024 for benchmarking and future analyses.

The study assesses various tiers of energy efficiency potential including technical, economic, achievable, and naturally occurring potential. The study developed updated baseline estimates with the latest information on federal, state, and local codes and standards for improving energy efficiency. The study consisted of three primary components: market research, a full energy efficiency potential analysis, including program design and estimation of supply curves, and quantification of wasted energy due to customer behavior.

As part of the study, the EnerNOC team conducted primary market research to collect data for the Ameren Illinois service territory, including: electric and natural gas end-use data, end-use saturation data, and customer psychographics, demographics, and firmographics. This information enables Ameren Illinois to understand how their customers make decisions related to their energy use and energy efficiency investment decisions.

Ameren Illinois will use the results of this study in its Demand Side Management (DSM) planning process to optimally implement energy efficiency related savings programs.

### Report Organization

This report is presented in six volumes as outlined below. This document is **Volume 1: Executive Summary**.

- 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

## Definitions

Before launching into the discussion of results, a few key terms are defined:

- **Technical potential** is a theoretical construct that assumes all feasible measures are adopted by customers, regardless of cost or customer preferences.
- **Economic potential** is also a theoretical construct that assumes all *cost-effective* measures are adopted by customers, regardless of customer preferences. This is a subset of technical potential.
- **Maximum achievable potential (MAP)** takes into account expected program participation, based on customer preferences resulting from ideal implementation conditions. MAP establishes a maximum target for the EE savings that a utility can hope to achieve through its EE programs and involves incentives that represent a substantial portion of the incremental cost combined with high administrative and marketing costs. It is commonly-accepted in the industry that MAP is considered the hypothetical upper-boundary of achievable savings potential simply because it presumes conditions that are ideal and not typically observed in real-world experience. This is a subset of economic potential.
- **Realistic achievable potential (RAP)** represents what is considered to be realistic estimates of EE potential based on realistic parameters associated with EE program implementation (i.e., limited budgets, customer acceptance barriers, etc.). This is also a subset of economic potential.
- **Baseline projection** is a reference end-use forecast developed specifically for this study. This estimates what would happen in the absence of any DSM programs, and includes naturally occurring energy efficiency and savings from equipment standards and building codes that were active and on the books for future enactment as of January 31, 2013. It is the metric against which savings are measured. The approach used to develop this projection is an end-use forecast approach and it is fundamentally different than the statistically-adjusted end-use approach used by Ameren to develop its official load forecasts. However, as much as possible, the forecast assumptions are the same and the resulting forecasts are close.
- **Net savings** represents the energy efficiency potential savings potential that is after naturally occurring energy efficiency has been taken into consideration. Unless specified, all savings listed in this report represent net savings, as opposed to gross savings.
- **Incremental savings** refers to the amount of potential savings that can be achieved in that one particular year. **Cumulative savings** refers to the sum of the incremental savings. Unless specified, all savings listed in the report are cumulative savings.

## Overall Conclusions

This study has enlightened Ameren Illinois about its customer base and the potential for electric and natural gas energy savings that are possible through energy-efficiency (EE) programs. The key highlights are as follows:

- With a thorough review of 699 possible efficiency measures<sup>1</sup>, the estimated program potential is somewhat higher than past program achievements.
- In general, however, attaining the maximum achievable program potential in the Cycle 3 plan will not meet the Illinois state savings targets and will cost significantly more than the spending caps, for both electric and natural gas programs.

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<sup>1</sup> A list of all the measures and the corresponding costs, savings, and lifetimes can be found in in Volume 6: Appendices.

- The study identifies that a majority of savings are to be had in the commercial and industrial sectors as opposed to the residential sector. This represents a significant change from previous studies and reflects the recent wave of Federal appliance standards

High-level details on savings and costs are provided in the Key Findings sections below.

## Key Findings for Electricity

The key findings of the potential analysis are presented first in terms of measure-level results, where program delivery and implementation concerns have not been considered. Subsequently, program-level savings are developed by considering appropriate program delivery mechanisms and measure bundling strategies based on real-world implementation and evaluation experience.

### Measure-level Energy Efficiency Potential

Key findings related to measure-level electric potentials are summarized as follows:

- **Realistic achievable potential.** In 2014 realistic achievable savings are 483 GWh which is 1.3% of the baseline projection. By 2016 cumulative realistic achievable savings grow to 1,093 GWh which represents 3.0% of the baseline projection.
- **Maximum achievable potential.** In 2014 savings for this case are 630 GWh or 1.8% of the baseline and by 2016 cumulative savings reach 1,432 GWh or 4.0% of the baseline projection.
- **Economic potential** reflects the savings when all cost-effective measures are taken. The savings for this case in 2014 are 1,149 GWh or 3.2% of the baseline projection and by 2016 the cumulative savings reach 2,650, about 7.4% of the baseline.
- **Technical potential**, which reflects the adoption of all energy efficiency measures regardless of cost-effectiveness, is a theoretical upper bound on savings. Savings in 2014 for the technical case are 1,584 GWh or 4.4% of the baseline and by 2016 these savings reach a cumulative number of 3,516 GWh or about 9.8% of the baseline.

Table 1 and Figure 1 summarize the electric energy-efficiency savings for the different levels of potential relative to the baseline projection.

**Table 1** *Summary of Cumulative, Net, Measure-Level Electric Energy Efficiency Potential*

	2014	2015	2016
<b>Baseline Projection (GWh)</b>	35,865	35,810	35,999
<b>Cumulative Savings (GWh)</b>			
Realistic Achievable Potential	483	803	1,093
Maximum Achievable Potential	630	1,051	1,432
Economic Potential	1,149	1,958	2,650
Technical Potential	1,584	2,604	3,516
<b>Energy Savings (% of Baseline)</b>			
Realistic Achievable Potential	1.3%	2.2%	3.0%
Maximum Achievable Potential	1.8%	2.9%	4.0%
Economic Potential	3.2%	5.5%	7.4%
Technical Potential	4.4%	7.3%	9.8%

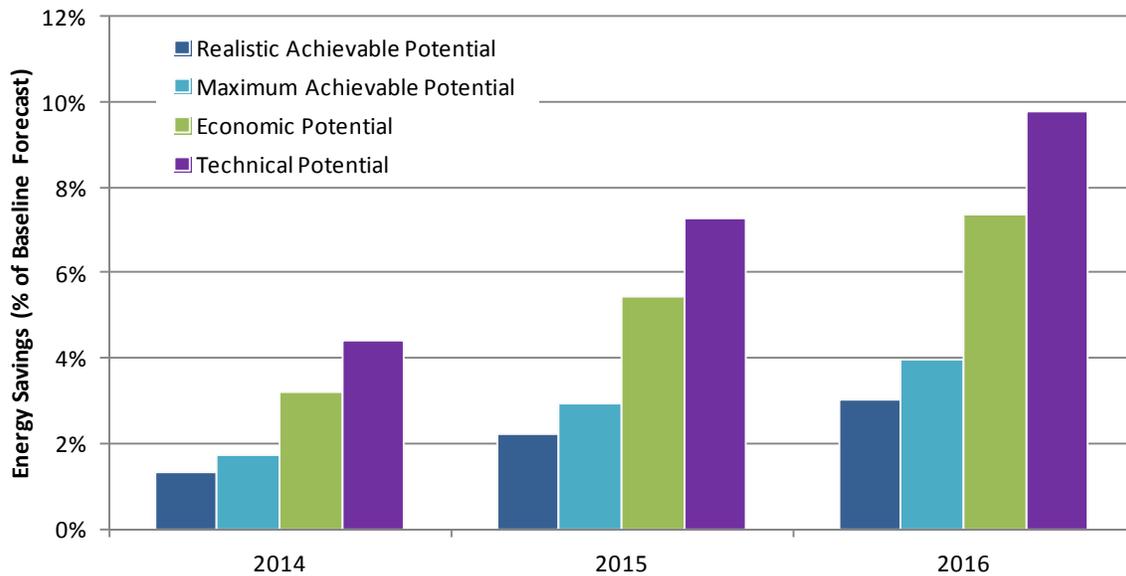
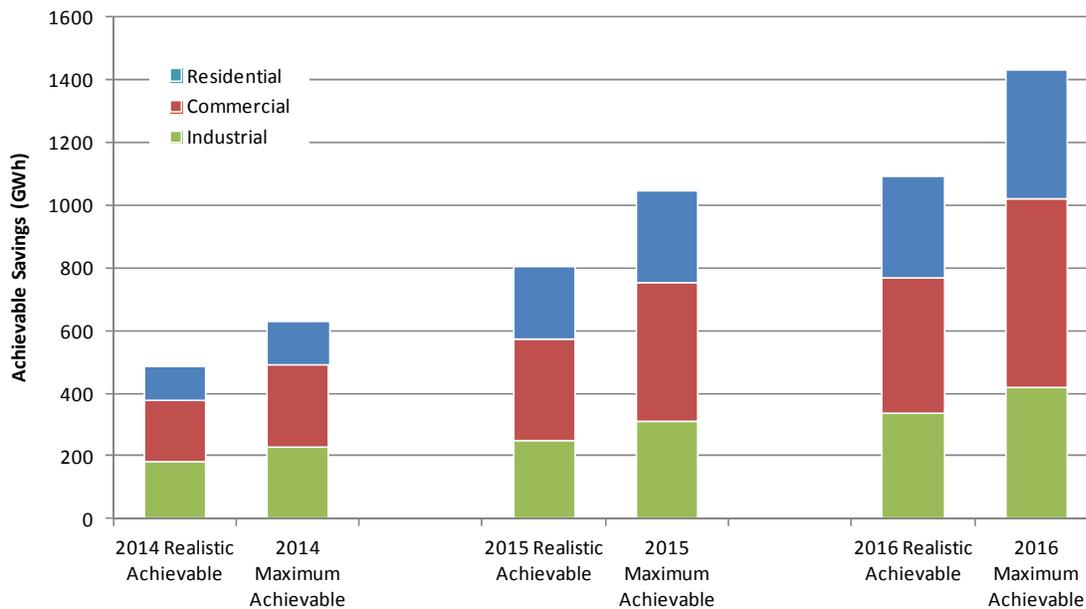
**Figure 1** *Summary of Cumulative, Net, Measure-Level Electric Energy Savings*

Figure 2 summarizes the range of electric achievable potential by sector. The commercial sector accounts for the largest portion of the savings, followed by residential and industrial.

**Figure 2** *Cumulative, Net, Measure-Level Potential by Sector (GWh)*

### Program-level Potential

The program-level results here consider program delivery strategies, real-world limitations, and the associated administrative costs and economics. (Please note that measure-level savings are provided above in cumulative terms, but are translated here to incremental or annual terms to align better with the language and expectations of program implementation and annual targets.)

In order to more accurately assign realistic program costs, measure-level results were synthesized to group measures into programs that can realistically be delivered to Ameren Illinois customers. The key steps and differences between the measure-level analysis and program-level analysis are:

- Installation Smoothing: Measure installations from the program-level analysis were “smoothed” to account for even implementation across three program years.
  - For example, the measure-level analysis estimates the installation of 1,000 units in 2014, 800 units in 2015, and 600 units in 2016 of Measure X. In order to provide consistency for implementers and align with the ramp rate of legislative targets, the program-level analysis would estimate 800 installations of Measure X in 2014, 2015, and 2016.
- Measure Removal/Reduction: Specific measures or measure types were from the program-level analysis due to either the realistic potential installations being too high to implement over the three program years or the measures cannot be delivered through traditional Ameren Illinois programs. There were two main segments where electric measure were removed/reduced:
  - Residential Consumer Electronics: Past program experience and evaluation has shown the consumer electronics market is extremely difficult to reach and has had limited participation in past programs.
  - Business Energy Management Systems: The measure-level model predicts installations of Energy Management Systems for most commercial and industrial buildings in the Ameren Illinois service territory. The levels of installations were reduced to more realistic implementation levels and to control program costs (Energy Management Systems have very high costs with relatively low energy savings).

Key findings related to program-level electric potentials are summarized as follows:

- **Program Low achievable potential.** In 2014 program low achievable savings are 341 GWh which is 0.9% of the baseline projection at a cost of \$86.1 million. By 2016 cumulative realistic achievable savings grow to 992 GWh which represents 2.8% of the baseline projection at a cumulative cost of \$263.9 million.
- **Program High achievable potential.** In 2014 savings for this case are 449 GWh or 1.3% of the baseline at a cost of \$177.7 million. By 2016 cumulative savings reach 1,308 GWh or 3.6% of the baseline projection at a cumulative cost of \$542.8.

Table 2 summarizes the electric energy-efficiency program savings for the different levels of potential relative to the baseline projection.

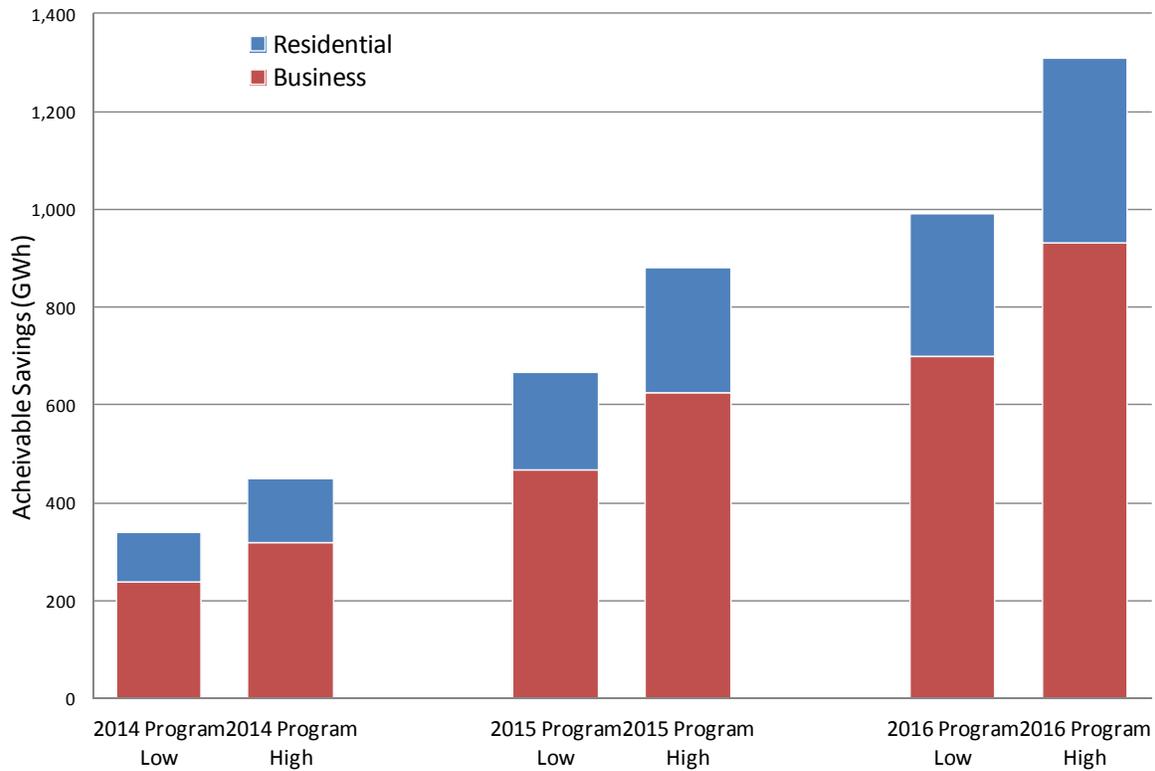
**Table 2** *Summary of Cumulative, Net, Program-Level Electric Energy Efficiency Potential*

	2014	2015	2016
<b>Baseline Projection (GWh)</b>	35,861	35,792	35,973
<b>Annual Savings (GWh)</b>			
Program Low Potential	341	667	992
Program High Potential	449	880	1,308
<b>Energy Savings (% of Baseline)</b>			
Program Low Potential	0.9%	1.9%	2.8%
Program High Potential	1.3%	2.5%	3.6%
<b>Energy Costs (Million \$)</b>			
Program Low Potential	\$86.1	\$171.2	\$263.9
Program High Potential	\$177.7	\$353.0	\$542.8

Figure 3 summarizes the range of electric program-level achievable potential by sector. Sectors were adjusted to Residential and Business (which includes both Commercial and Industrial) to

align with Ameren Illinois program sectors. The business sector accounts for the largest portion of the savings, followed by residential.

**Figure 3** *Cumulative, Net, Program-Level Potential by Sector (GWh)*

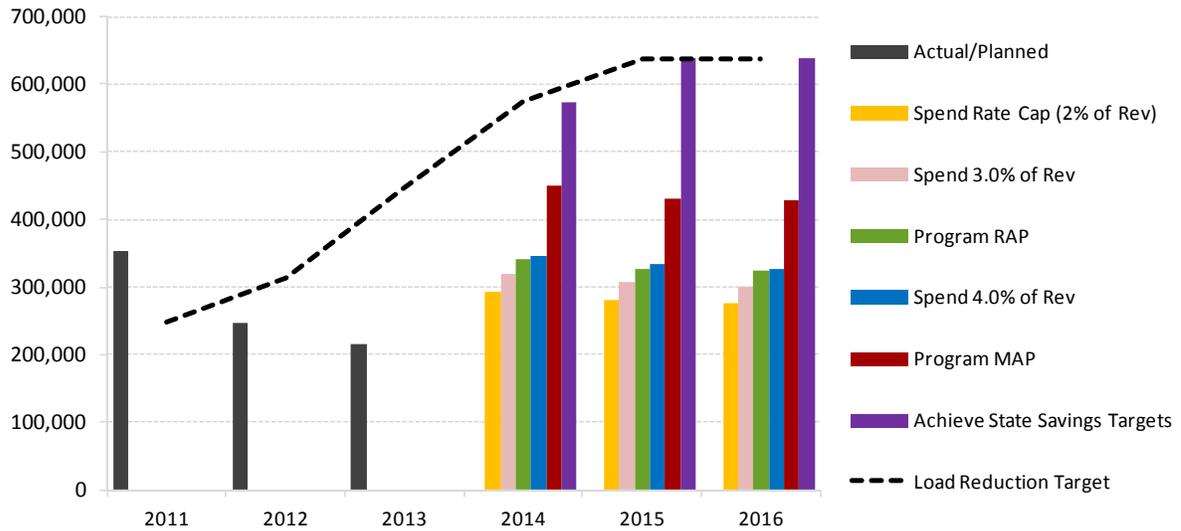


### Supply Curves

The program analysis provided guidelines for creating various portfolio scenarios by interpolating between Program RAP and Program MAP, optimizing to consider a number of other scenarios relevant to planning considerations. These include attainment of the Illinois state goals, spending exactly at the rate caps, and 0.5% increments of spending until the estimated limit of MAP is reached.

Figure 4 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 Illinois state targets in any year. Figure 5 shows the total program costs to achieve these electricity savings.

**Figure 4 Summary of Achievable Electricity Savings (Net, Incremental MWh)**



**Figure 5 Costs to Achieve Electricity Savings (\$000)**

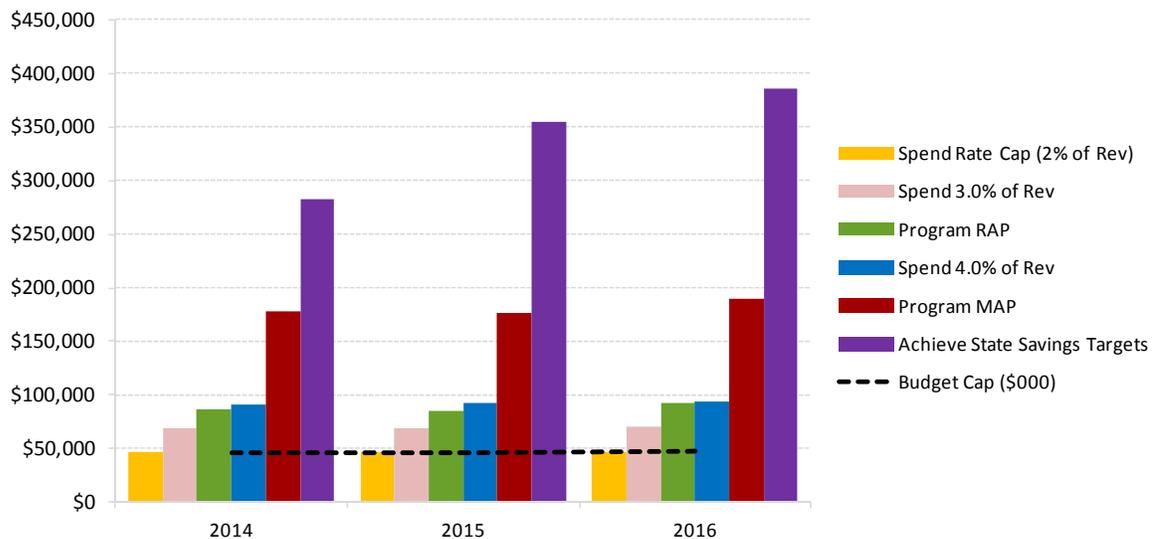


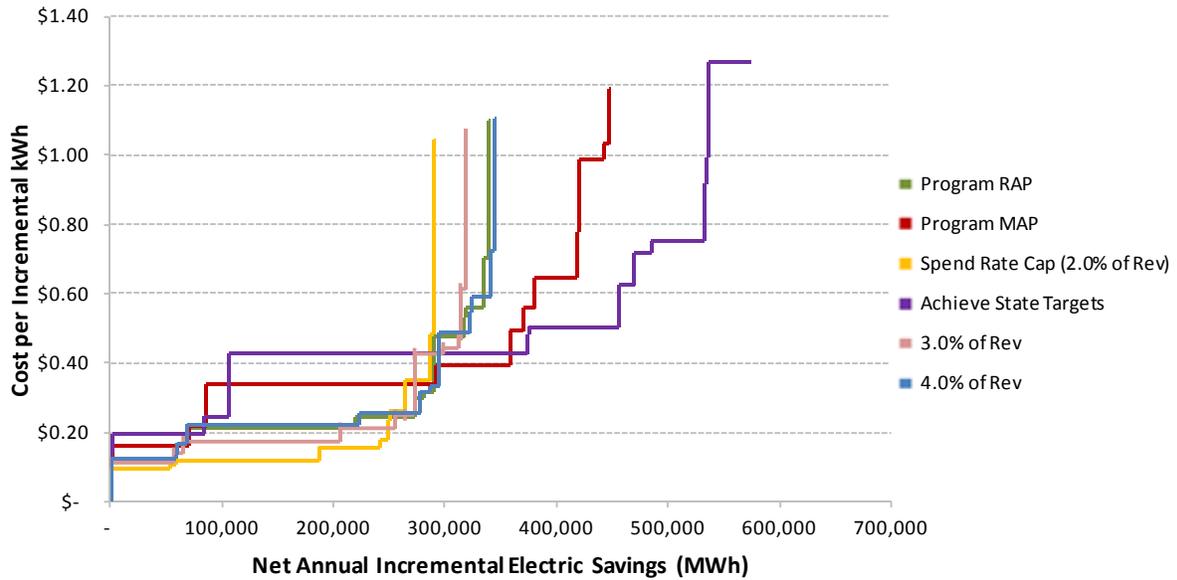
Figure 6 through Figure 8 show the supply curves for electric EE programs at various implementation levels for the program years 2014-2016. Each horizontal line is a discrete program with a bundle of measures and an explicit delivery mechanism and cost structure. Several program levels are shown, as well as the supply curve for achieving the state target.

- 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 Low level from the EE potential analysis.

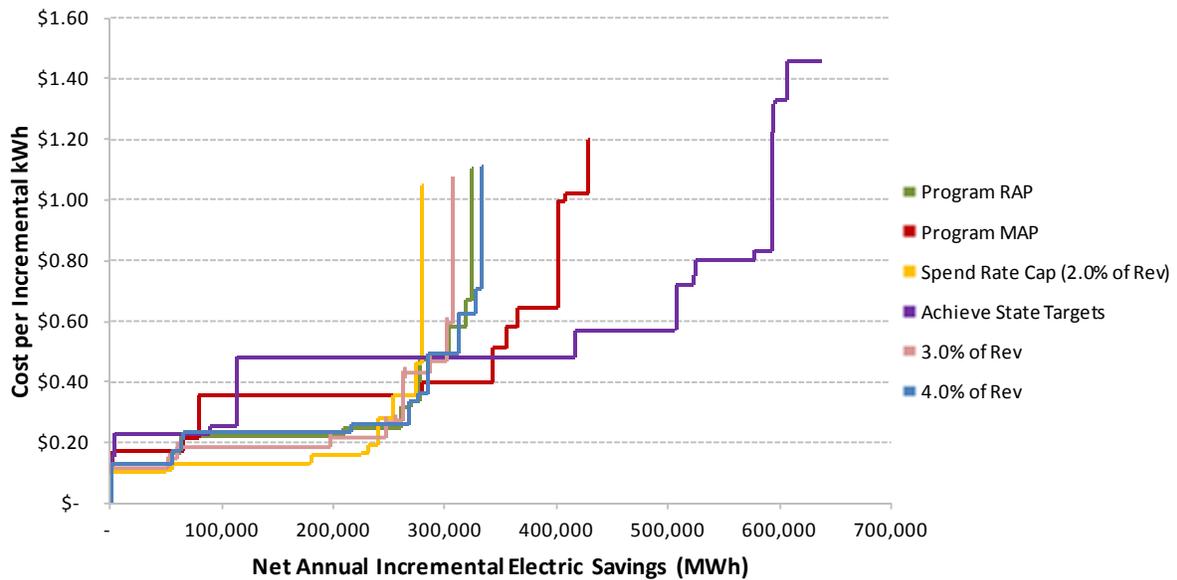
Overall, any portfolio between the Rate Cap and the Program RAP portfolio will offer the best opportunity for Ameren Illinois to achieve a cost-effective portfolio with levels of electric savings greater than the current Cycle 2 portfolio, while also having less risk and uncertainty than the Program 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 spending level required to achieve the savings in the Program RAP scenario.

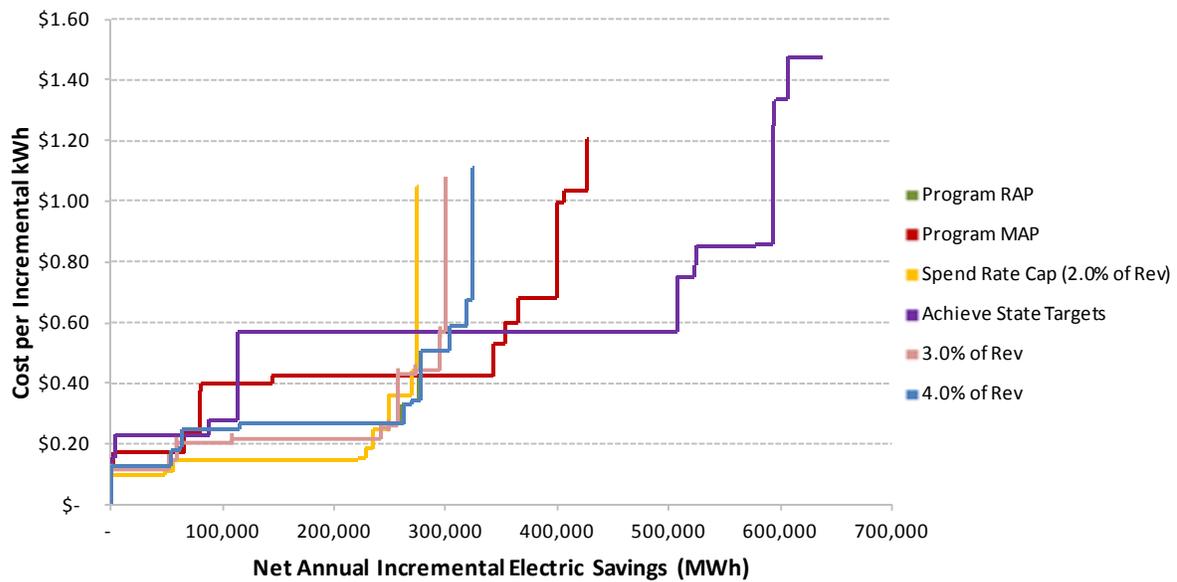
**Figure 6** *Electric Energy Efficiency Program Supply Curves—Potential in 2014*



**Figure 7** *Electric Energy Efficiency Program Supply Curves—Potential in 2015*



**Figure 8** *Electric Energy Efficiency Program Supply Curves—Potential in 2016*



## Key Findings for Natural Gas

Like the electricity findings above, the key findings of the natural gas potential analysis are presented first in terms of measure-level results, where program delivery and implementation concerns have not been considered. Subsequently, the results are refined to the program level by considering appropriate program delivery mechanisms and measure bundling strategies based on real-world implementation and evaluation experience.

### Measure-level Energy Efficiency Potential

Key findings related to measure-level natural gas potentials are summarized below.

- **Realistic achievable potential.** In 2014 realistic achievable savings are 6.1 million therms which is 0.5% of the baseline projection. By 2016, cumulative realistic achievable savings grow to 14.1 million therms which represent 1.3% of the baseline projection.
- **Maximum achievable potential.** In 2014 savings for this case are 9.0 million therms or 0.8% of the baseline and by 2016 cumulative savings reach 20.8 million therms or 1.9% of the baseline projection.
- **Economic potential.** The savings for this case in 2014 are 17.4 million therms or 1.6% of the baseline projection and by 2016 the cumulative savings reach 39.6 million therms, about 3.6% of the baseline.
- **Technical potential.** Savings in 2014 for the technical case are 29.1 million therms, 2.6% of the baseline and by 2016 these cumulative savings reach 65.3 million therms, about 5.9% of the baseline.

Table 3 and Figure 9 summarize the natural gas energy-efficiency savings for the different levels of potential relative to the baseline projection.

**Table 3** *Summary of Cumulative, Net, Measure-Level Natural Gas Energy Efficiency Potential*

	2014	2015	2016
<b>Baseline Energy Forecasts (million therms)</b>	<b>1,102</b>	<b>1,109</b>	<b>1,109</b>
<b>Cumulative Energy Savings (million therms)</b>			
Realistic Achievable Potential	6.1	9.5	14.1
Maximum Achievable Potential	9.0	14.1	20.8
Economic Potential	17.4	27.0	39.6
Technical Potential	29.1	45.2	65.3
<b>Energy Savings (% of Baseline)</b>			
Realistic Achievable Potential	0.5%	0.9%	1.3%
Maximum Achievable Potential	0.8%	1.3%	1.9%
Economic Potential	1.6%	2.4%	3.6%
Technical Potential	2.6%	4.1%	5.9%

**Figure 9** *Summary of Cumulative, Net, Measure-Level Natural Gas Energy Savings*

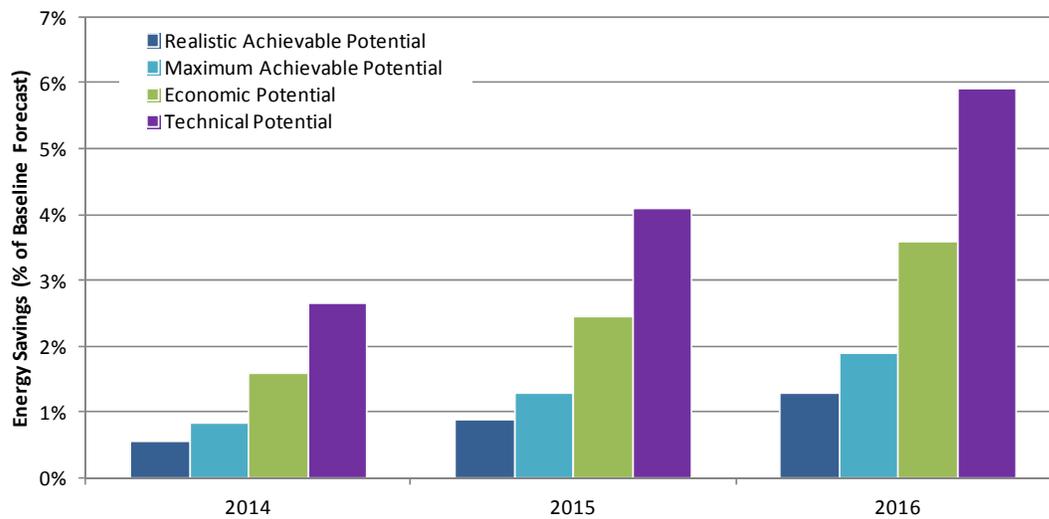
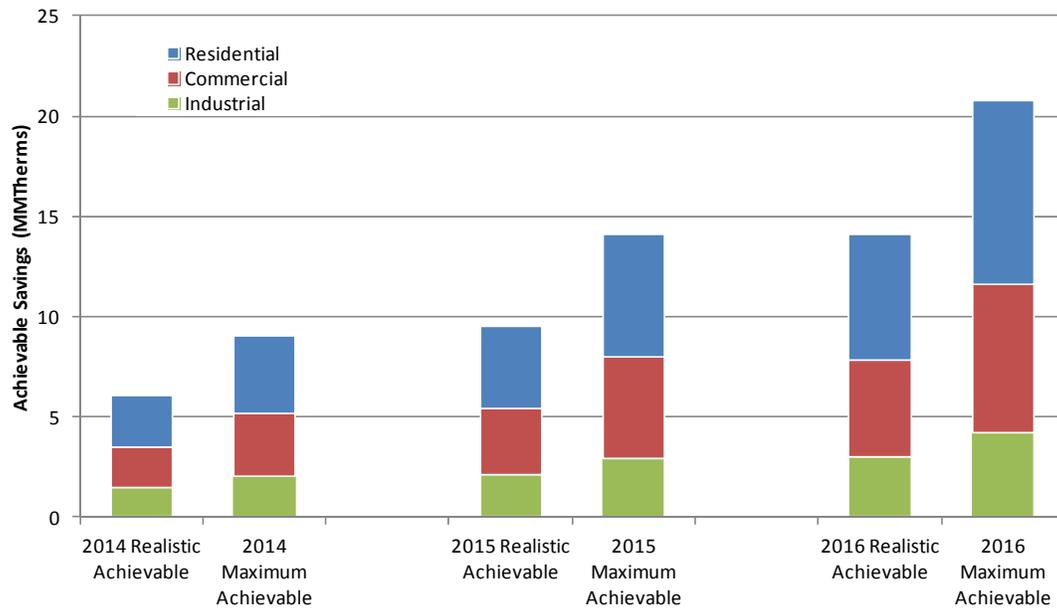


Figure 10 presents the range of natural gas achievable potential by sector. Unlike the electric analysis, the residential sector accounts for the largest portion of the natural gas savings, followed by the commercial and then the industrial sectors.

**Figure 10** *Cumulative, Net, Measure-Level Natural Gas Potential by Sector (million therms)*

### Program-level Potential

As with the electricity analysis, the program-level results here consider program delivery strategies, real-world limitations, and the associated administrative costs and economics. Please note that measure-level savings are provided above in cumulative terms, but are translated here to incremental or annual terms to align better with the language and expectations of program implementation and annual targets.

In order to more accurately assign realistic program costs, measure-level results were synthesized to group measures into programs that can realistically be delivered to Ameren Illinois customers. The key steps and differences between the measure-level analysis and program-level analysis are discussed above. Key findings related to program-level natural gas potentials are summarized as follows:

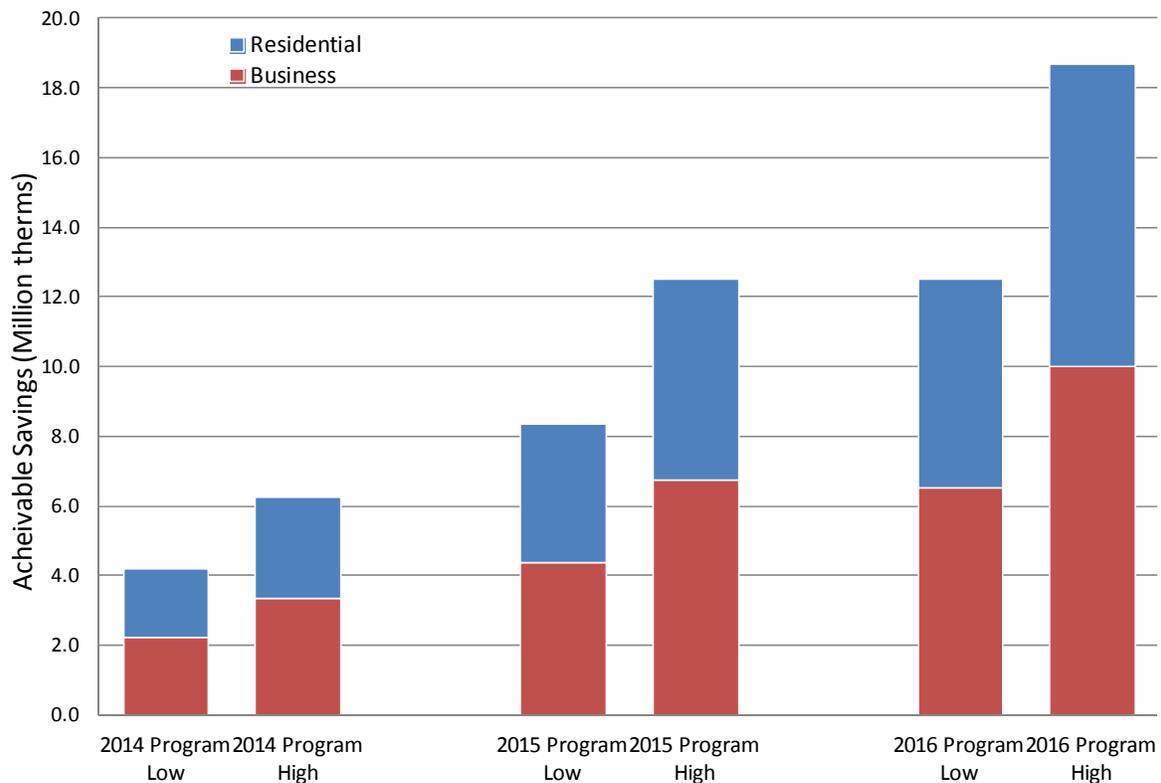
- Program Low achievable potential.** In 2014 program low achievable savings are 4.2 million therms which is 0.4% of the baseline projection at a cost of \$13.3 million. By 2016 cumulative program low achievable savings grow to 12.5 million therms or 1.1% of the baseline projection at a cumulative cost of \$40.7 million.
- Program High achievable potential.** In 2014 savings for this case are 6.3 million therms or 0.6% of the baseline at a cost of \$28.9 million. By 2016 cumulative savings reach 18.7 million therms or 1.7% of the baseline projection at a cumulative cost of \$89.0 million.

Table 4 summarizes the electric energy-efficiency savings for the different levels of potential relative to the baseline projection.

**Table 4** *Summary of Cumulative, Net, Program-Level Electric Energy Efficiency Potential*

	2014	2015	2016
<b>Baseline Energy Forecasts (million therms)</b>	<b>1,102</b>	<b>1,109</b>	<b>1,109</b>
<b>Annual Savings (million therms)</b>			
Program Low Potential	4.2	8.3	12.5
Program High Potential	6.3	12.5	18.7
<b>Energy Savings (% of Baseline)</b>			
Program Low Potential	0.4%	0.8%	1.1%
Program High Potential	0.6%	1.1%	1.7%
<b>Energy Costs (Million \$)</b>			
Program Low Potential	\$13.3	\$26.6	\$40.7
Program High Potential	\$28.9	\$58.1	\$89.0

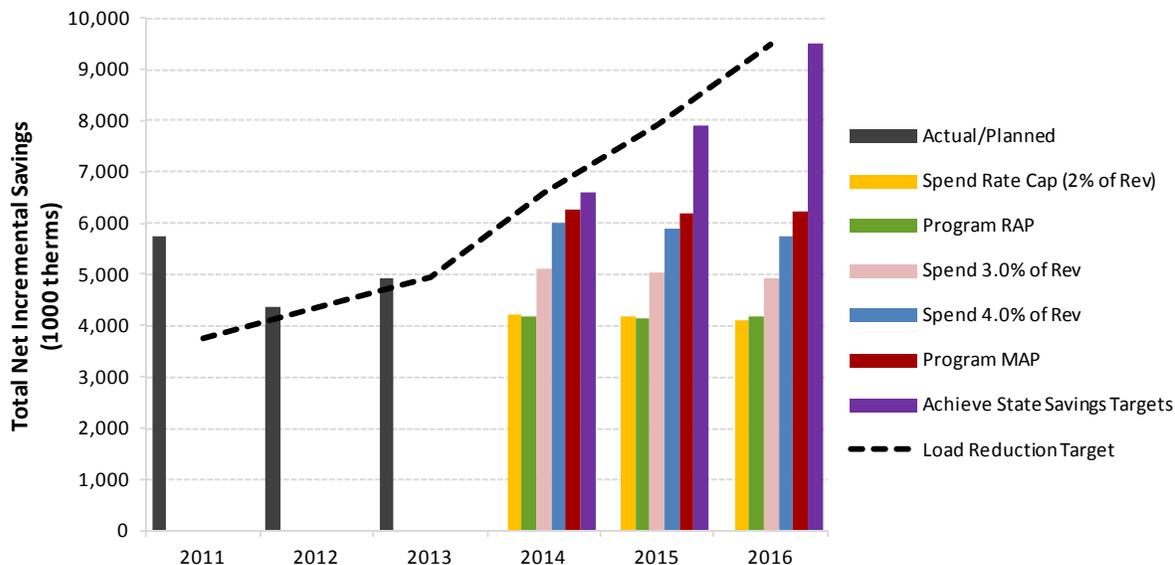
Figure 11 summarizes the range of natural gas program-level achievable potential by sector. Sectors were adjusted to Residential and Business (which includes both Commercial and Industrial) to align with Ameren Illinois program sectors. The business sector accounts for the largest portion of the savings, followed by residential.

**Figure 11** *Cumulative, Net, Program-Level Potential by Sector (million therms)*

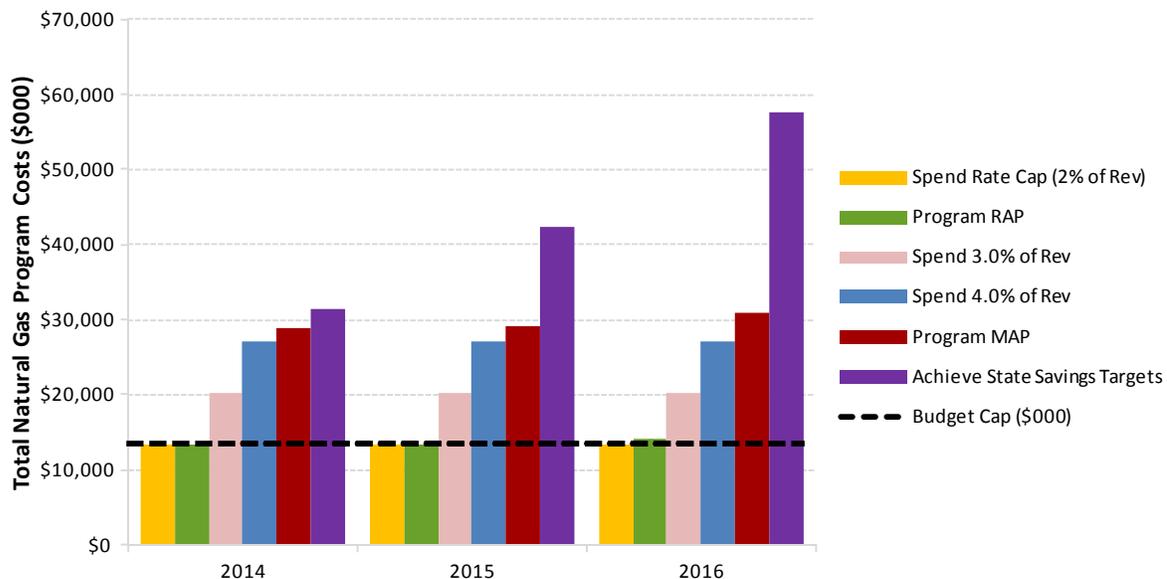
## Supply Curves

For the natural gas portfolios, the resulting Net Incremental therm savings per year are shown in Figure 12. The respective costs to achieve the savings are shown in Figure 13.

**Figure 12 Summary of Achievable Natural Gas Savings (Net, Incremental 1000 Therms)**



**Figure 13 Costs to Achieve Natural Gas Savings (\$000)**



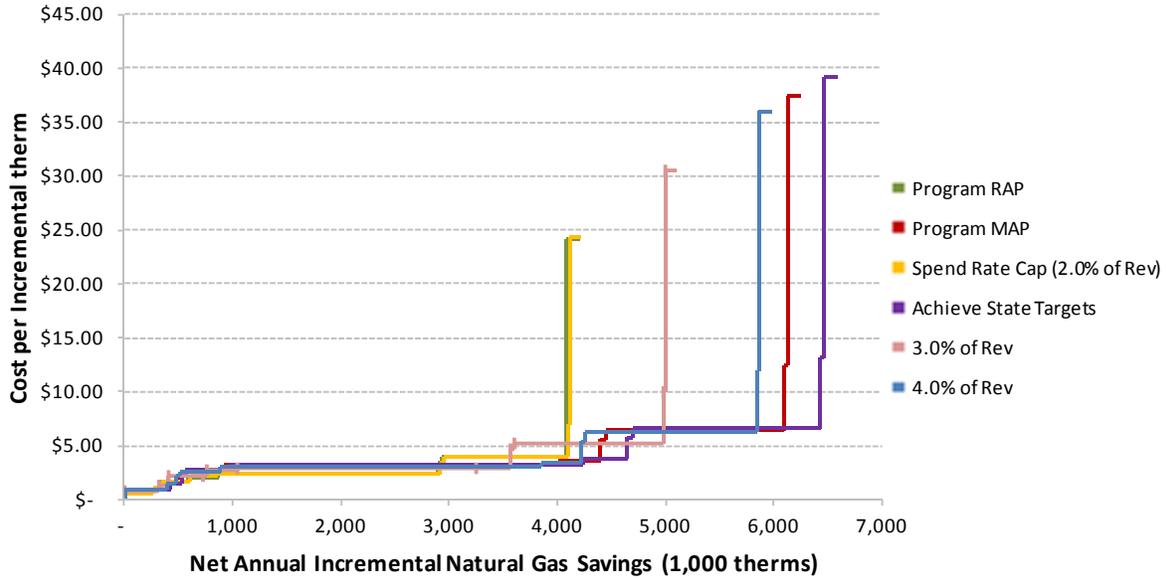
The supply curves for the various natural gas EE portfolios are presented below in Figure 14 through Figure 16 for the program years 2014-2016.

- 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 was in the electric analysis.

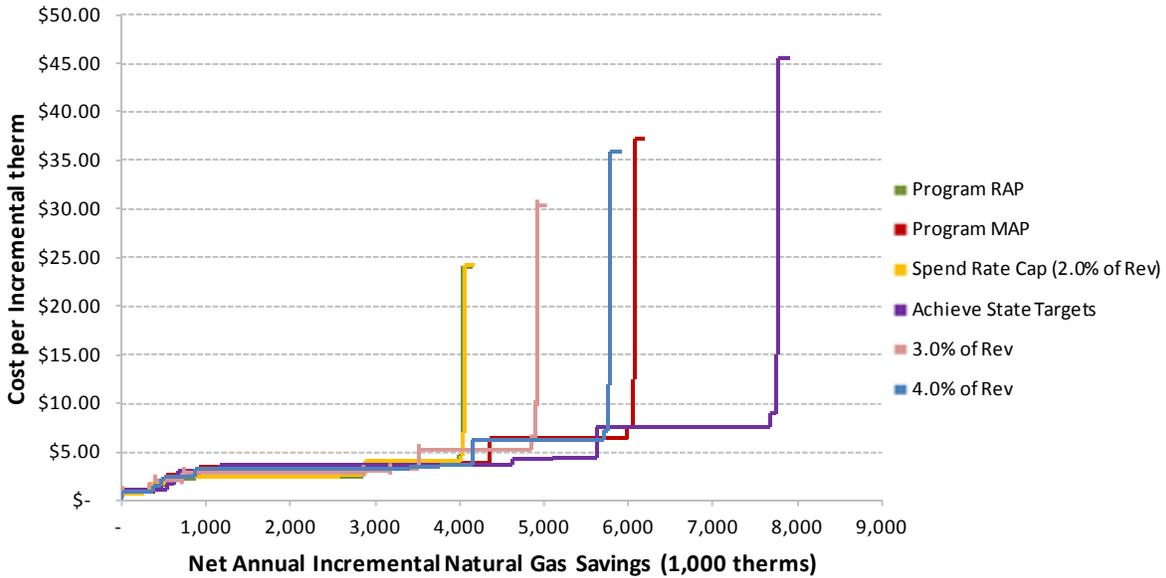
- There are a few very high cost programs that skew the end of the supply curve with a nearly vertical spike, including: Residential ENERGY STAR Homes, Residential Moderate Income, and Retro Commissioning.

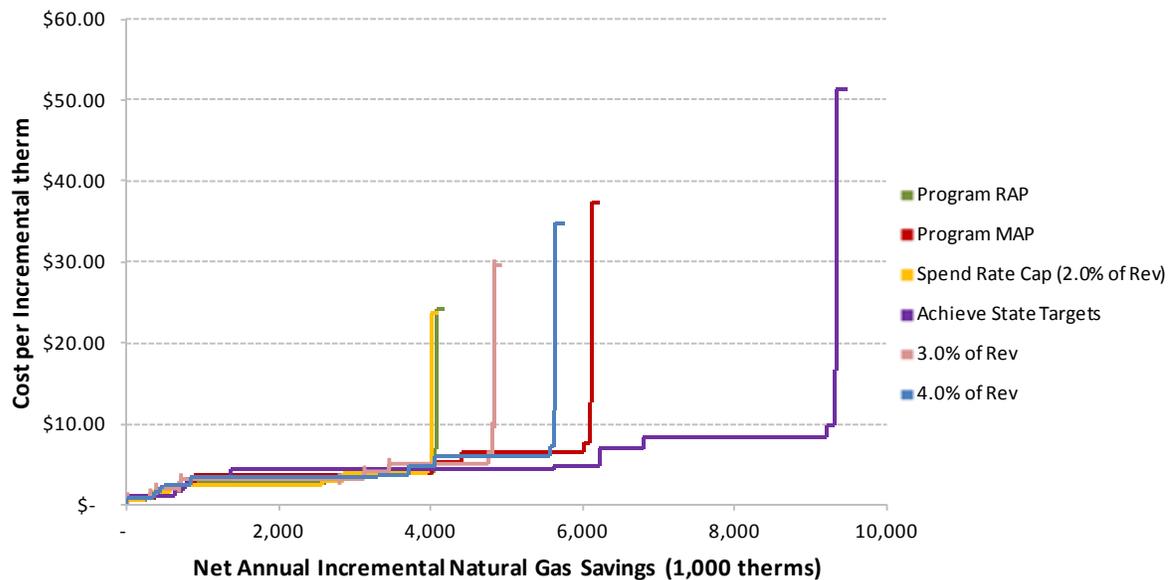
Overall, the Program RAP portfolio offers the most cost-effective natural gas portfolio for Ameren Illinois, maintaining spending levels close to the "Spend Rate Cap" portfolio and providing slightly lower \$/therm cost.

**Figure 14** *Natural Gas Energy Efficiency Program Supply Curves—Potential in 2014*



**Figure 15** *Natural Gas Energy Efficiency Program Supply Curves—Potential in 2015*



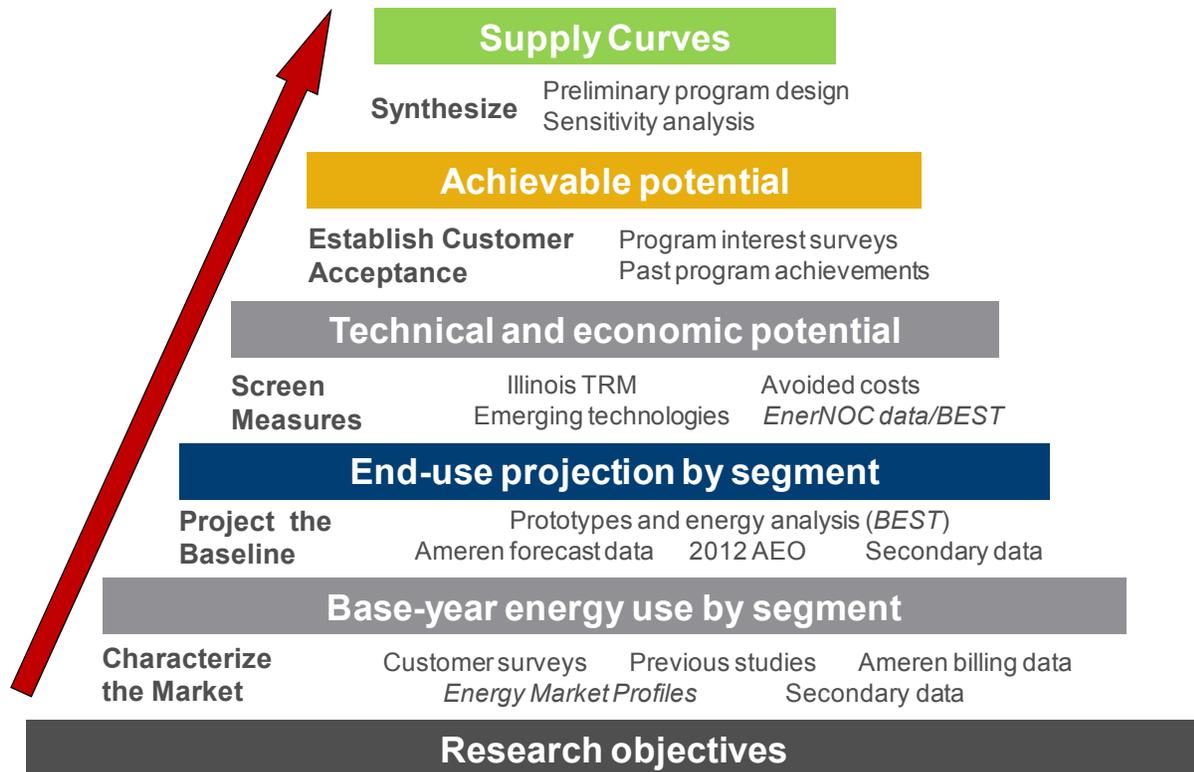
**Figure 16** *Natural Gas Energy Efficiency Program Supply Curves—Potential in 2016*

## Study Approach

This study followed industry best practices in assessment of EE market potential. An overview of the analysis approach is illustrated in Figure 17 below. Key features of this approach include the following:

1. Conduct primary market research that includes comprehensive saturation and program-interest surveys with residential, commercial and industrial customers. Volume 2 describes the market research in detail.
2. Perform a market characterization to describe sector-level electricity and natural gas use for the residential, commercial and industrial sectors for a recent "base year" (2011). We further segmented by housing type, building type and industry.
3. Utilize a wide variety of data sources to estimate how customers in the region currently use electricity and natural gas. We developed energy market profiles for each segment that describe appliance/equipment saturation and use for new and existing buildings.
4. Develop a baseline end-use projection by sector, segment, end use and technology for electricity and natural gas for a 10-year time horizon. This projection accounts for building codes and appliance standards that are "on the books."
5. Identify and analyze energy efficiency measures appropriate for the Ameren Illinois service area, including measures currently covered by programs offered by Ameren and other entities as well as emerging technologies.
6. Estimate three levels of measure-level energy-efficiency potential, *Technical*, *Economic*, and *Achievable*. We used EnerNOC's analytical model, LoadMAP, to develop the baseline projection and the estimates of EE potential. We delivered LoadMAP to Ameren so staff can continue to use it on their own for additional analyses. Steps 2 through 6 are documented in Volume 3. Detailed appendices are provided in Volume 6.
7. Transfer measure-level results to Applied Energy Group who used this information to develop program designs (documented in Volume 4).
8. Use program-level results from Step 7 to develop supply curves (see Volume 5).

Additional information and results are provided below.

**Figure 17 Analysis Approach for Ameren Illinois Market Potential Study**

Throughout the project, the Ameren and EnerNOC project teams engaged with Ameren Illinois' stakeholders (the SAG) in meetings and by webinar to review each major step in the study.

## Market Research

The market research component collected electricity and natural gas end-use data, end-use saturation data, customer demographics, and psychographic information that provides insight on how Ameren Illinois customers make decisions related to electric and natural gas usage and energy-efficiency investment decisions.

Comprehensive primary market research about Ameren Illinois customers was conducted for this project. This research provides a solid foundation for the analyses performed in this study and it also provides a wealth of information for future analyses across many departments at Ameren. The market research included:

- Residential customers – online saturation surveys with 726 customers
- Residential customers – online program interest surveys with 749 customers
- Small and medium C&I customers – online saturation surveys with 691 customers
- Large C&I customers – 101 site visits distributed strategically among campuses/locations of Ameren Illinois' largest customers
- C&I customers – online program interest surveys with 610 customers

Volume 2 of the report series presents the detailed results of the primary market research.

## Energy-use Surveys

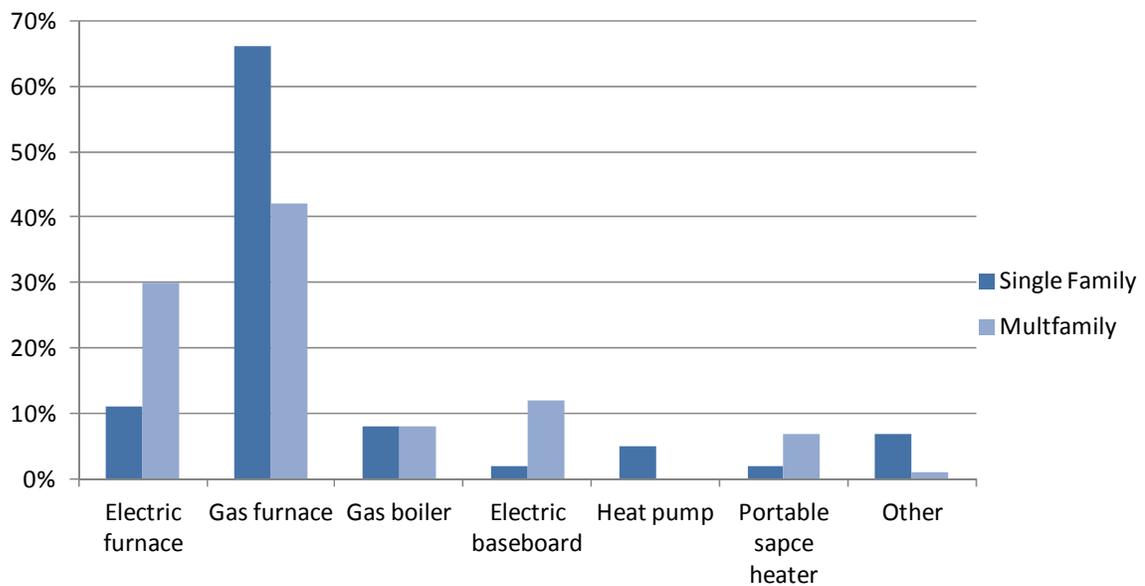
Energy-use (or saturation) surveys were conducted across all customer classes. Topics included:

- Characteristics of households/homes and businesses/buildings and their occupants
- Heating, cooling and water heating equipment
- Lighting, refrigeration and food service equipment
- Office equipment, electronics and miscellaneous plug loads
- Motors and process uses
- Energy-efficiency measures taken and planned

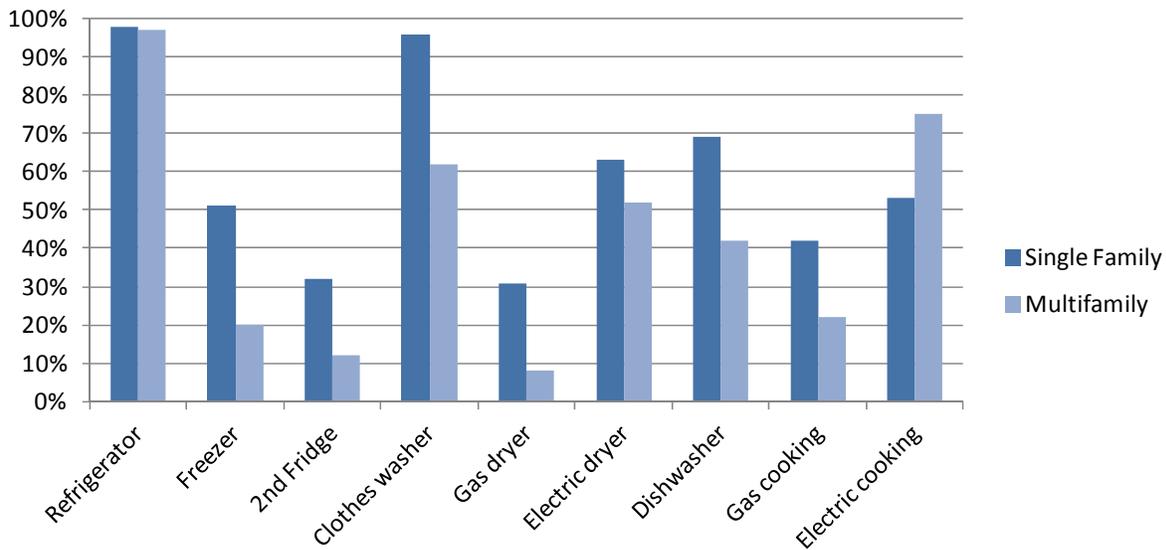
Figure 18 and Figure 19 present two examples of results from the residential saturation survey.

In the residential sector, the majority of respondents in single-family homes have a gas furnace (66%) and eleven percent (11%) have an electric furnace (Figure 18). Most respondents in multi-family homes have either a gas or an electric furnace. Several respondents reported using supplemental heating such as portable space heaters and fireplaces as their main type of space heating; 9% of single-family and 8% of multi-family homes use these other types of space heating.

**Figure 18**      **Type of Space Heating**



Almost all respondents living in single-family homes have a refrigerator (Figure 19). In addition, more than half have a stand-alone freezer and 32% have a second refrigerator. In the previous study the saturation of a second refrigerator was 29%. While the difference is not statistically significant, we had expected the percentage to decrease based on the success of the program the past three years. We speculate that the ARRA rebate encouraged more customers to purchase new refrigerators and therefore customers that had already recycled a second refrigerator or never had one in the first place moved the existing refrigerator to the garage after purchasing a new one through the ARRA rebate. Sixty-nine percent of respondents in single-family homes have a dishwasher and 53% use electric for cooking. Ninety-six percent of respondents in single-family homes also have a clothes washer, and 94% have a clothes dryer. Sixty-three percent of respondents have an electric dryer; while 31% have a gas unit.

**Figure 19**      **Appliance Saturation**

### Program-interest Research

A hallmark of this study is the research of customer attitudes and behaviors toward energy efficiency measures and programs. The objectives of this research were to:

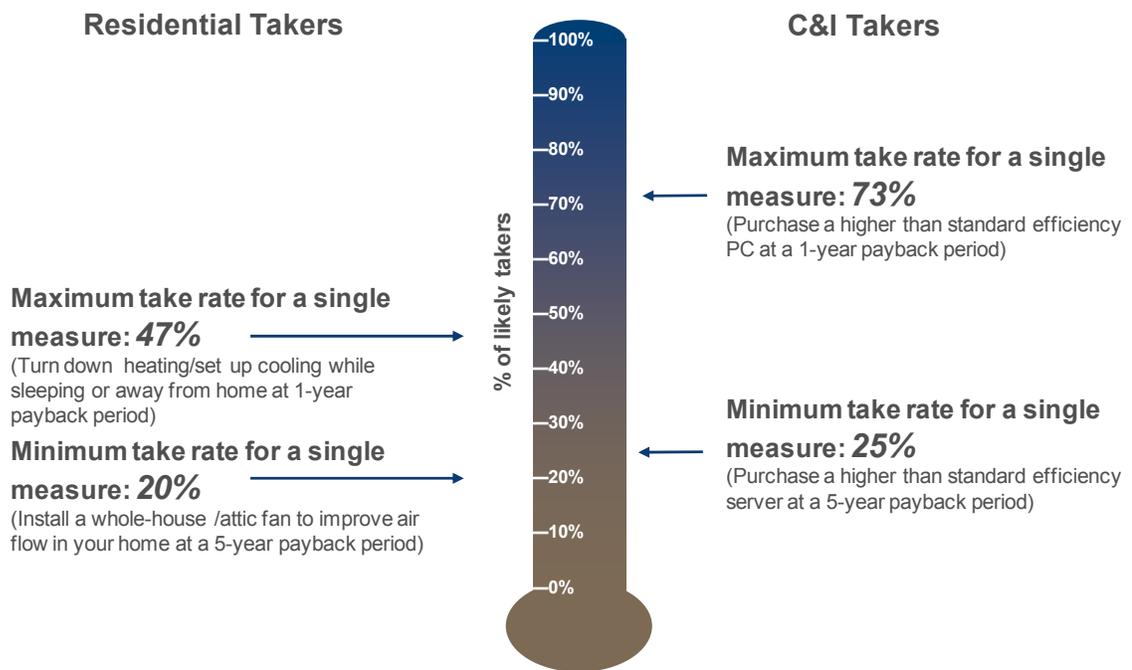
1. Help Ameren estimate achievable potential
  - How likely are customers within each sector to participate in various energy efficiency programs Ameren Illinois is considering offering?
  - Which energy efficiency measures offer the highest likely participation rates?
  - How does likelihood to participate differ by payback period for the customer?
2. Help Ameren Illinois understand unique customer segments to support customer marketing and outreach

Other relevant questions embedded in this phase of the research to help Ameren Illinois better understand achievable potential include:

- What overall demographic and psychographic characteristics correspond to a higher likelihood to participate in energy efficiency programs?
- What attitudinal or market segments can be derived within the residential sector, and how do these segments differ in terms of their impact on the likelihood to participate, as well as on customer demographic and psychographic characteristics?
- Which of these segments represent the best opportunities for Ameren Illinois to focus their marketing on?
- What messaging strategies would likely be useful to help foster participation among these high opportunity segments?

Key results from the program interest research included “take rates” for various program concepts. Take rates represent the likelihood that customers will participate in specific programs and they reflect a snapshot of current behavior and circumstances. They have been adjusted for response bias using industry standard techniques to reflect what customers *actually* do rather than what they *say* they will do. Figure 20 illustrates the range of take rates for the residential and business sectors.

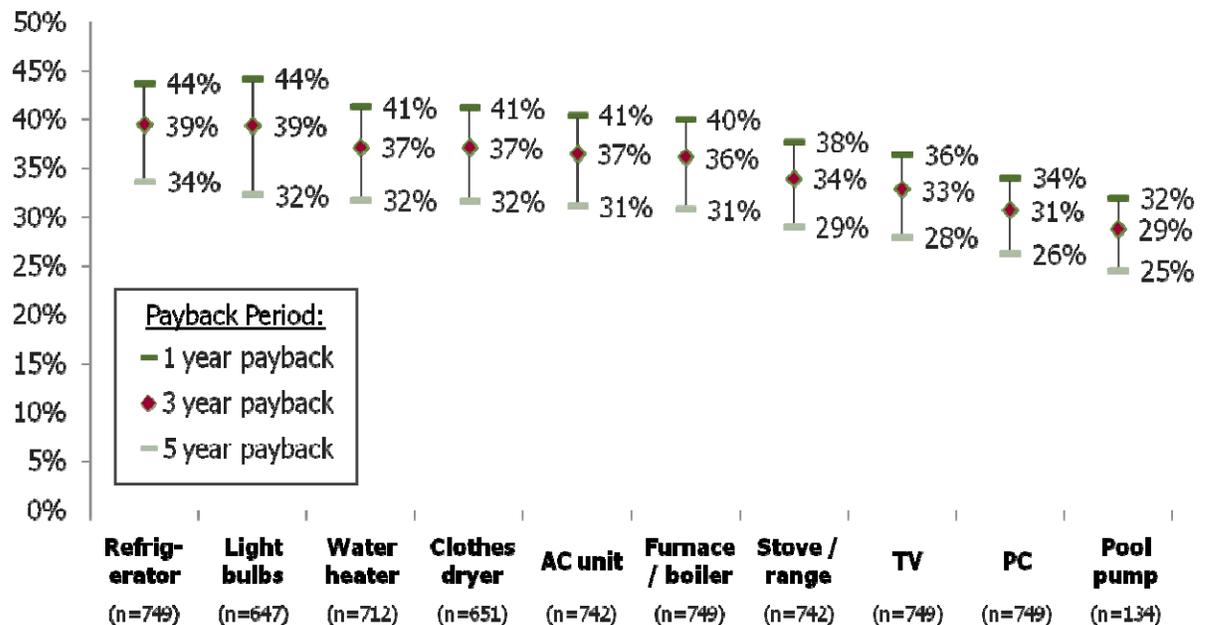
**Figure 20 Range of Take Rates**



**Residential Sector Program Interest Research Results**

Figure 21 presents likely take rates for specific appliances or equipment measures in the residential sector. This is a subset of the take rates for the residential sector; additional rates were developed for a second category of non-equipment measures such as insulation or low-flow showerheads.

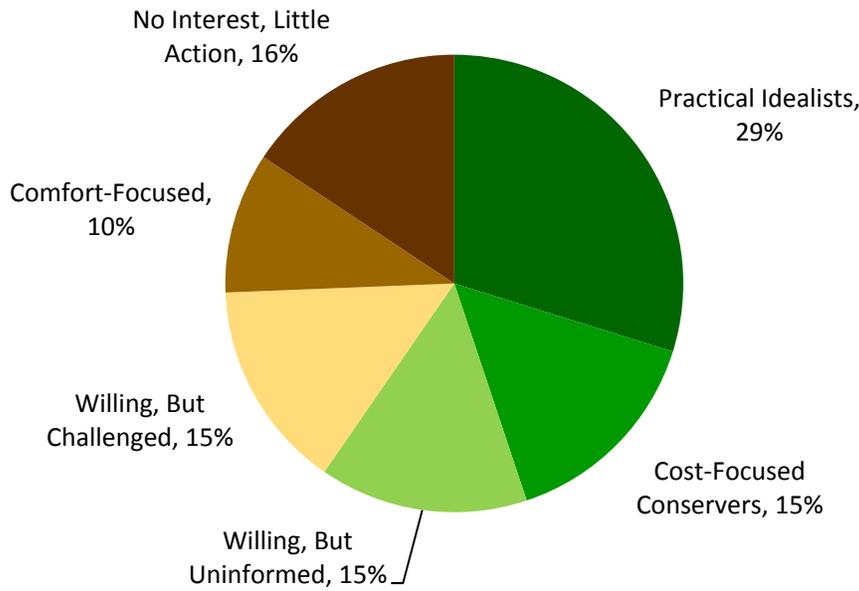
**Figure 21 Likely Residential Take Rates for Purchasing High-efficiency Equipment**



In addition to estimating take rates, the study also developed an attitudinal segmentation model that disaggregated residential customers into groups that differ in terms of whether, and why, they might be interested in pursuing energy efficiency options. The goal of the segmentation

analysis was to define groups of customers that were different in ways that would allow Ameren Illinois to prioritize customer targets for EE program marketing, and to develop targeted messages for each of those segments. Using a variety of attitudinal and behavioral inputs, six residential customer segments that seemed to best represent the differences in this population on these issues were identified. The segments and relative sizes are outlined in Figure 22 and described in detail in Volume 2.

**Figure 22 Residential Attitudinal Segment Distribution**



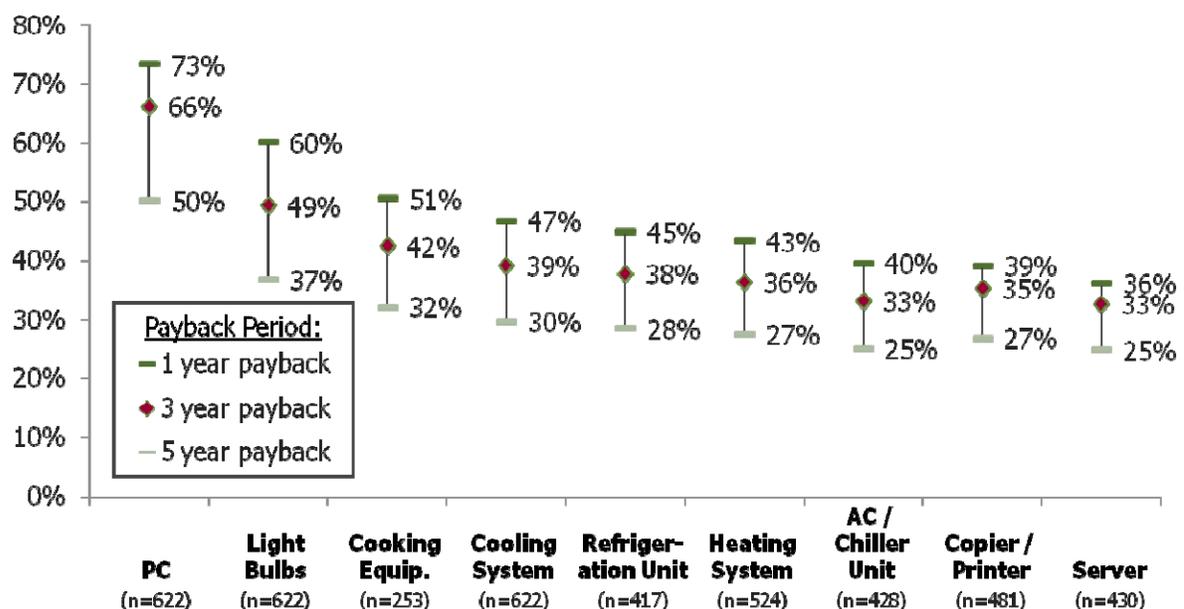
- Practical Idealists (30%)** are concerned with conserving energy, both from a cost-focus and an environmental perspective (they are the “greenest” segment). They are tech and feature oriented when considering appliances, but they also say they research options and compare prices. Higher education and income, and with the largest homes (though with only average total annual kWh usage), but tend to say their economic situation is worse than it was a year ago. Tend to be high on familiarity, and experience, with EE / conservation measures to date, and are very likely to say that they would adopt new EE / conservation measures.
- Cost-Focused Conservers (15%)** are informed about, and interested in, conservation / EE measures, but for cost reasons rather than environmental reasons. This group believes in the value of EE as a way to save money, and has taken many prior EE actions. They do not trust Ameren Illinois very highly, however, and do not see it as the job of the company to encourage customers to save energy or money. They would prefer the company reduce rates than spend money on EE or green options. They have higher than average education and income levels, and the second largest homes on average, and the second highest average kWh. They have the second highest program take rate.
- Willing, But Uninformed (15%).** This group is positive in its assessment of Ameren Illinois, and green in their environmental perspectives (though this is not a daily, top-of-mind issue). They are relatively less experienced with EE / conservation measures to-date, however, and unsure of what they could be doing in this area, or if any of their actions would actually lead them to save money. They prefer simple, functional appliances that are on sale, and which they can purchase locally, rather than online. They have average sized homes and average annual kWh usage, as well as have lower than average income and education levels. They are moderate on take rates across programs, but are the lowest on familiarity / experience with EE conservation measures currently.

- Willing, But Challenged (15%).** This group has relatively high opinions of Ameren Illinois and believes that the company should be pursuing EE options for its customers, while also supporting green initiatives. They are relatively low on EE / conservation information currently, however, and have implemented fewer such measures than others to-date. Appliance cost is critical to them and it appears that they do not think that they can afford to purchase higher quality / higher EE appliances. They live in the smallest homes, and have lower than average income and education levels, as well as the lowest annual kWh usage. They are moderate to low in their interest in participating in new EE / conservation options.
- Comfort Focused (10%).** This group is quite positive in its overall assessment of Ameren Illinois, but does not see the company as a leader in energy efficiency, nor do they think the company should be a leader in this area (i.e., in encouraging customers to be more efficient), or in green energy. Rather, the company should just focus on keeping costs low. Comfort is important to them, and they just want to be left alone to use energy as they please. They are concerned about appliance cost, but worry more about functionality (particularly as this relates to comfort) than about environmental / energy saving considerations. They tend to live in average sized homes, but have the highest annual kWh levels, along with higher than average incomes and educations. They are moderate on both familiarity with EE programs / options to-date, and their likelihood to participate in new programs.
- Low Interest, Little Action (16%).** This group has very little interest in conservation or EE. This group actively dislikes Ameren Illinois, particularly on the dimensions of trust and being a leader in EE. They do not want the company to encourage customers to save energy, nor do they want it to pursue green options. They do want the company to keep costs low as its sole focus. They have smaller than average homes, but average kWh levels, and are more likely to live in multi-family structures and to have somewhat lower levels of education and income. They are the lowest on likelihood to adopt new EE programs and one of the lowest on existing familiarity / experience with EE / conservation options.

**Business Sector Program Interest Research Results**

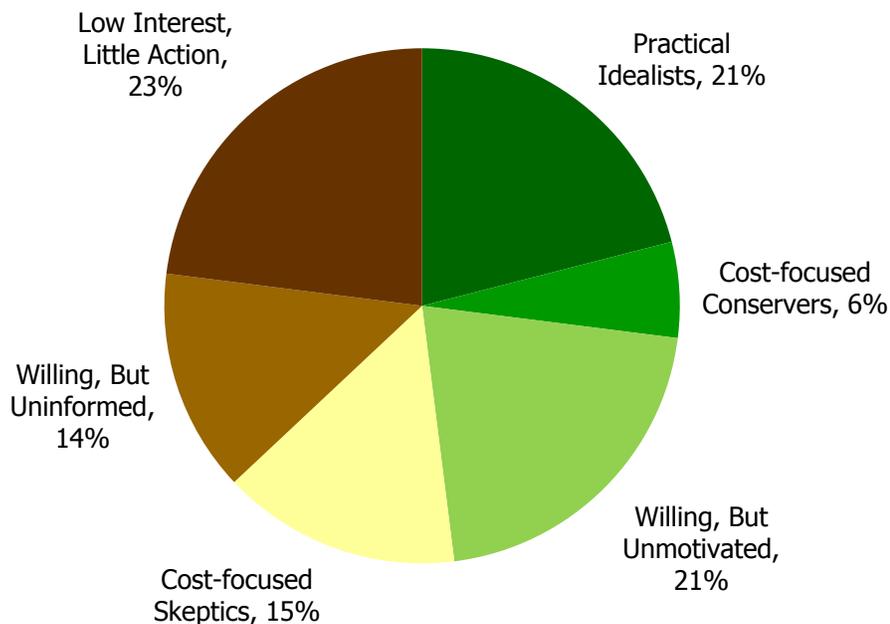
Figure 23 presents likely take rates for high-efficiency equipment in the business sector, a subset of measures considered in the program interest surveys. For the estimation of achievable potential, the take rates at the one-year payback period were used.

**Figure 23** Likely C&I Take Rates for Purchasing High-efficiency Equipment



As with the residential sector, the team developed a segmentation model that disaggregated business customers into groups that differ in terms of whether, and why, they might be interested in pursuing energy efficiency options. This segmentation will allow Ameren Illinois to prioritize customer targets for EE program marketing, and to develop targeted messages for each of those segments. The segments and relative sizes are outlined in Figure 24 and described in detail in Volume 2.

**Figure 24 Business Attitudinal Segment Distribution**



- Practical Idealists (21%)** are concerned with conserving energy, both from a cost-focus and an environmental perspective. They are feature focused when considering equipment, but they also say they research options and compare prices. They have the highest opinion of Ameren Illinois, particularly on the dimensions of trust and being a leader in EE. They tend to be high on familiarity with EE / conservation measures to date, and are most likely to say that they would adopt new EE / conservation measures in the future.
- Cost-Focused Conservers (6%)** are informed about, and interested in, conservation / EE measures, but for cost reasons rather than environmental reasons. This group believes in the value of EE as a way to save money, and has taken many prior EE actions. They trust Ameren Illinois and believe the company should keep costs low for their customers while also pursuing green options. They have the highest average kWh, higher than average building size and number of employees, and the second highest program take rate.
- Willing, But Unmotivated (21%)**. This group believes in conserving energy, for both environmental and cost reasons, and has the highest familiarity with EE / conservation measures. Despite this, they aren't as active as you might expect in conserving energy, which could be due to the fact that they already have lower than average kWh. They are, however, likely to say they would adopt new EE programs in the future.
- Cost-Focused Skeptics (15%)**. Skeptical about global warming and the need for EE, this group is only focused on saving energy if it will in turn save them money. They have a positive opinion of Ameren Illinois, but believe their priority should be keeping costs low for their customers rather than focusing on conservation. While unfamiliar with EE measures, they have higher than average kWh and would be somewhat likely to adopt new EE / conservation measures in the future if they thought it would save them money.

- **Willing, But Uninformed (14%).** This group is relatively less experienced with EE / conservation measures to-date, and unsure of what they could be doing in this area, but they believe that conservation is important and that Ameren Illinois should be focused on pursuing green options in addition to keeping energy costs low. They have an average building size and number of employees, as well as have lower than average kWh. They are low on take rates across programs, and are the lowest on familiarity / experience with EE conservation measures currently.
- **Low Interest, Little Action (23%).** This group has very little interest in conservation or EE. This group actively dislikes Ameren Illinois, particularly on the dimensions of trust and being a leader in EE. They do not want the company to encourage customers to save energy, nor do they want it to pursue green options. They do want the company to keep costs low as its sole focus. They operate in smaller than average size buildings, and have smaller than average company size (more than half have less than 10 employees). They are the lowest on likelihood to adopt new EE programs and second lowest on existing familiarity.

## Market Characterization and Energy-Use Profiles

The primary market research was a key source of information for the development of energy market profiles, base-year electricity use by end use and the baseline projection. For this study, 2011 was defined as the base-year because it was the most recent year for which complete billing data were available when the study began.

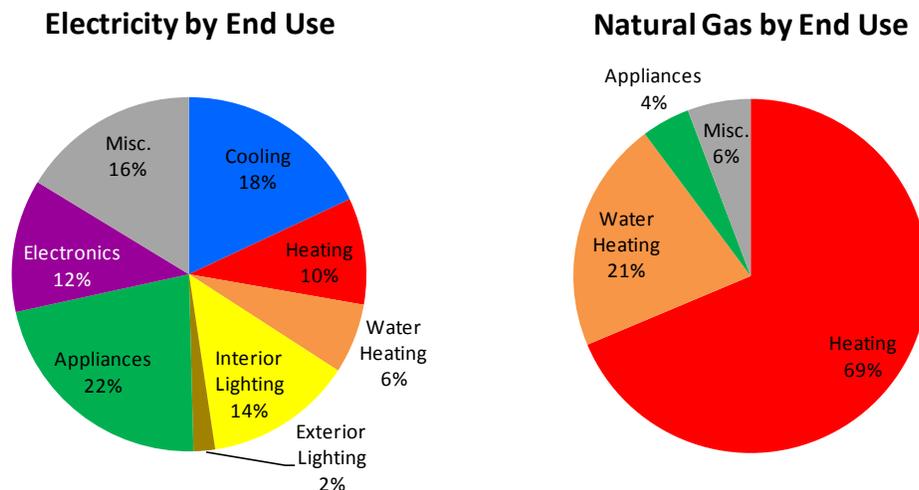
Total electricity use for the residential, commercial and industrial sectors for Illinois in 2011 was 36,571 GWh and 569 (million therms) of natural gas.

### Residential Sector

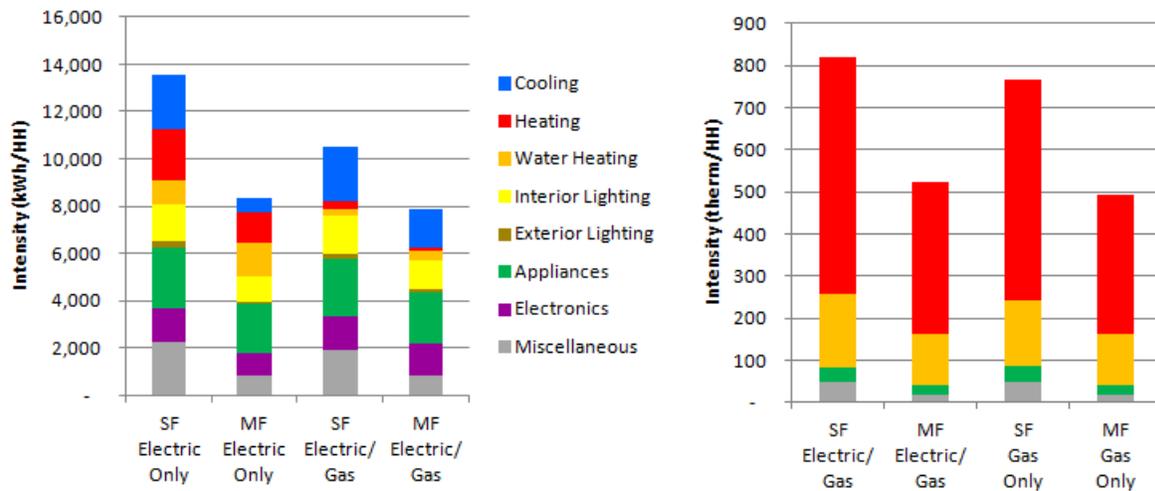
In 2011, there were 1.25 million households in Ameren’s service area. They used 11.6 GWh of electricity and 569 million therms of natural gas. For the analysis, this energy consumption was allocated to six residential segments based on the Ameren Illinois customer database and the saturation survey data. Since the Ameren Illinois electric and natural gas service territories overlap in some areas, but not all; the resulting customer segments are characterized by which fuels they receive from Ameren Illinois: electricity only, natural gas only, or both electricity and natural gas. These three segments are further subdivided into single family and multi-family homes.

Figure 25 shows the distribution of electricity and natural gas energy consumption by end use for all homes. Figure 26 shows the electricity and natural gas intensities (annual use per household) for these segments.

**Figure 25 Residential Electricity and Natural Gas Use by End Use (2011), All Homes**



**Figure 26 Residential Electricity and Natural Gas Use per Household by Housing Type**



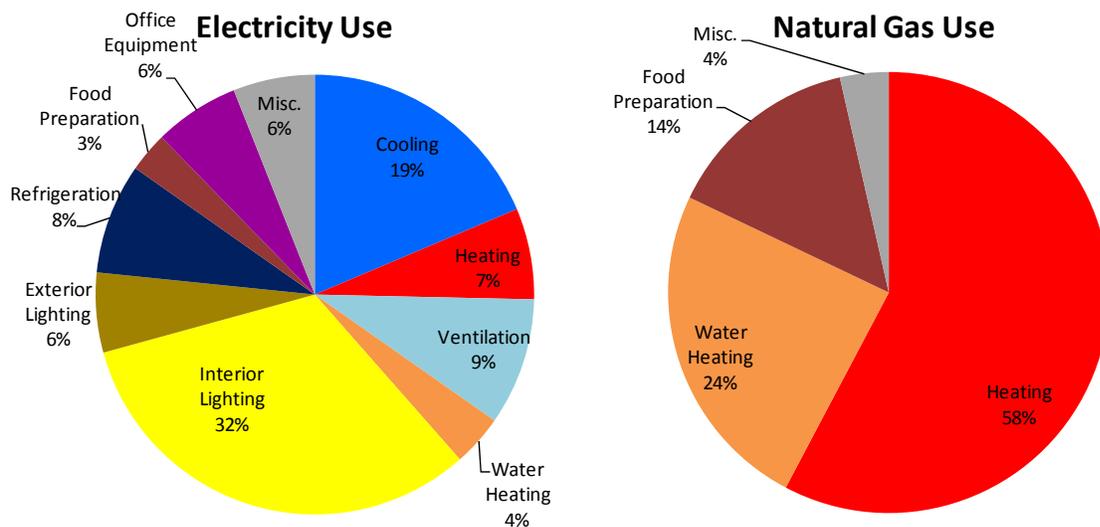
**Commercial**

The total amount of electricity consumed by Ameren Illinois commercial customers in 2011 was 12,414 GWh and the total natural gas energy consumed was 207 (million therms).

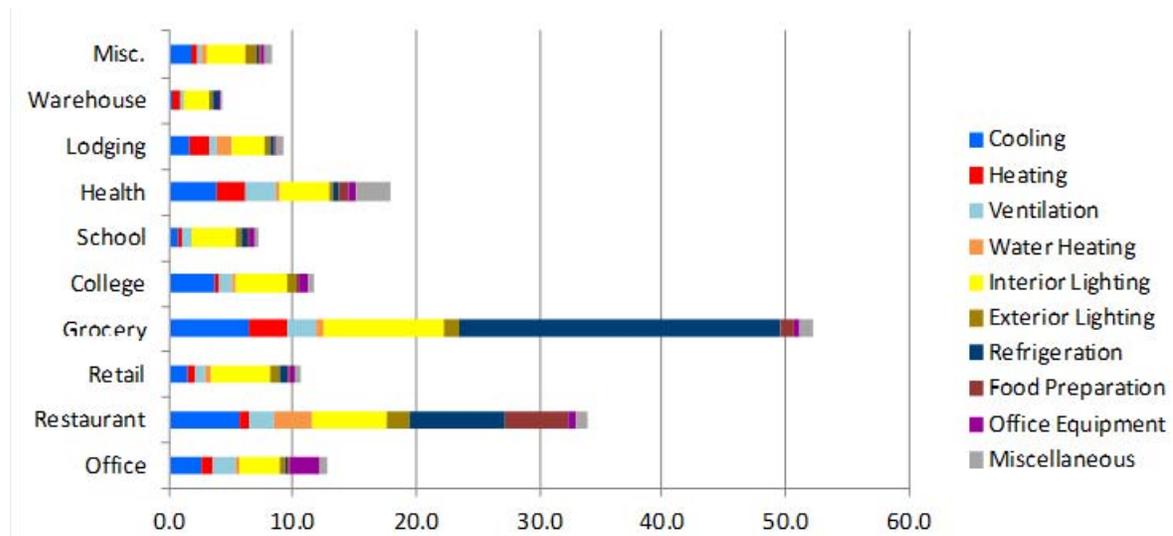
Figure 27 shows the distribution of electricity and natural gas energy consumption by end use for all commercial buildings served by Ameren Illinois. Electric usage is dominated by lighting, with interior and exterior varieties accounting for over one third of consumption. Natural gas usage is dominated by space heating (58%) and water heating (24%), with a small amount in food preparation and miscellaneous.

Figure 28 presents the electricity intensity in kWh per square foot by end use and building type. As is true across the entire commercial sector, lighting is a major end use in each building type, as is cooling. Figure 29 present the natural gas intensity in therms per square foot by end use and building type. Space heating is a significant end use across all building types but food preparation dominates in restaurants.

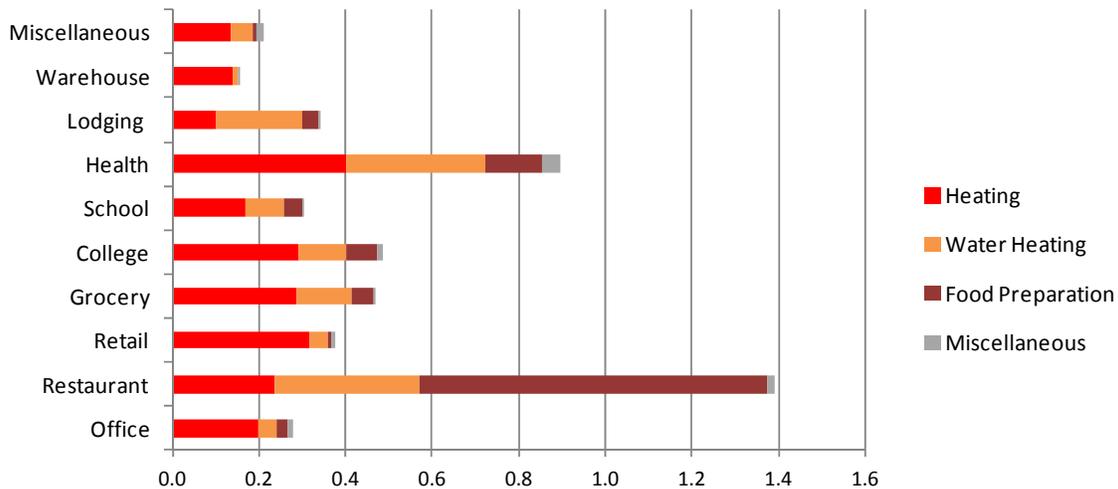
**Figure 27 Commercial Electricity and Natural Gas Use by End Use (2011), All Buildings**



**Figure 28 Commercial Electricity Intensity (kWh/sq ft, 2011)**



**Figure 29 Commercial Natural Gas Intensity (therms/sq ft, 2011)**



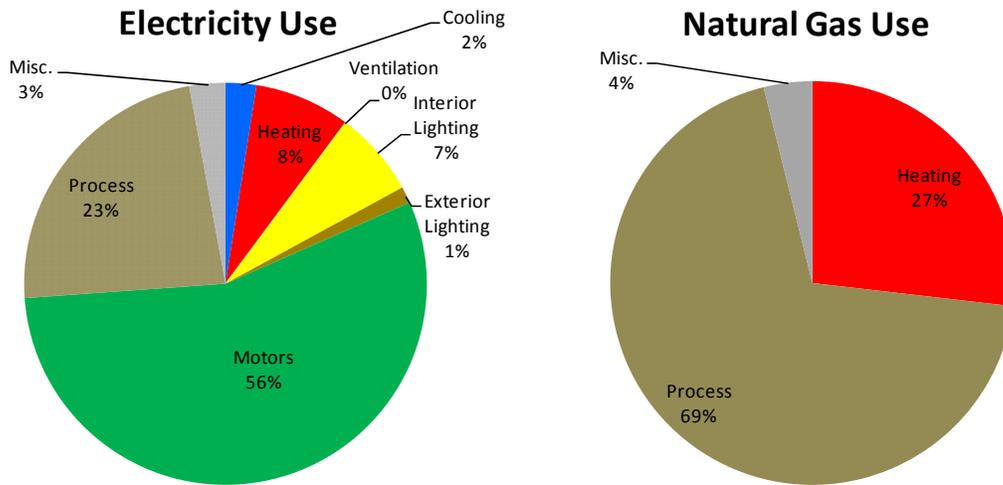
## Industrial

The total electric energy consumed by industrial customers in Ameren service territory in 2011 was 12,580 GWh and the total natural gas energy consumed was 330 (million therms)<sup>2</sup>. Figure 30 shows the distribution of electricity and natural gas energy consumption by end use for all industrial customers. Motors are clearly the largest overall electric end use for the industrial sector, accounting for 56% of energy use. Note that this end use includes a wide range of industrial equipment, such as air compressors, refrigeration compressors, pumps, conveyor motors, and fans. The process end use accounts for 23% of electricity use, which includes refrigeration, and electro-chemical processes. Heating is the next highest, followed by interior lighting, miscellaneous, and cooling.

Natural gas usage is dominated by the process end use at 69%, primarily coming from process heating. Space heating (27%) and miscellaneous (4%) comprise the remainder of the sector's natural gas usage.

<sup>2</sup> This does not include the natural gas use for Self-Direct Customers.

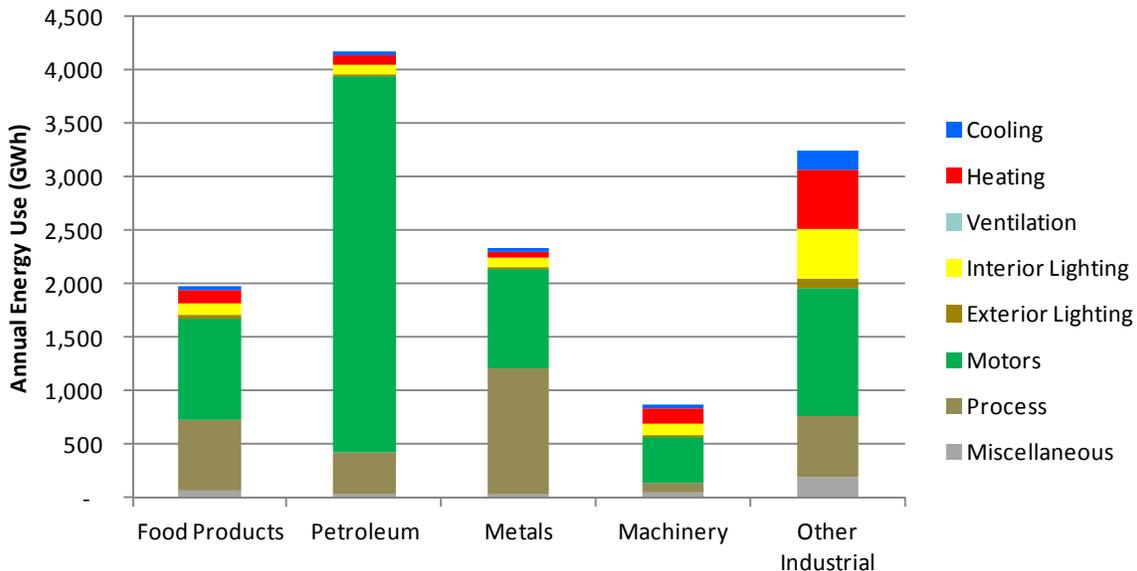
**Figure 30 Industrial Electricity and Natural Gas Use by End Use (2011), All Industries**



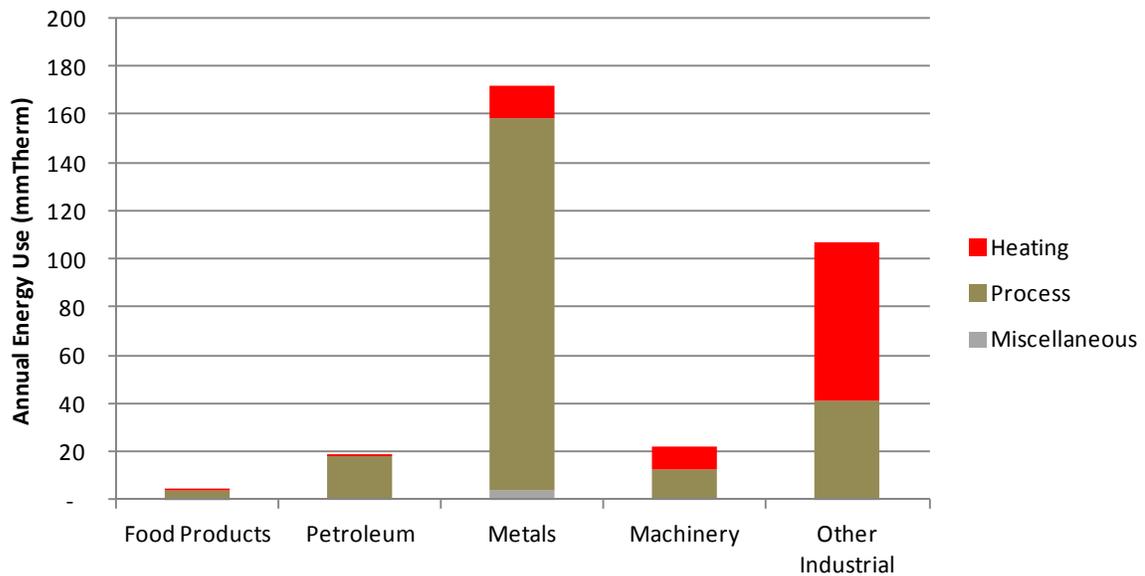
Total energy use was allocated to four key industries: petroleum, metals, food products and machinery. The remaining industries were grouped together in the “other industrial” category. Figure 31 presents the electric consumption by end-use and industry type. The petroleum industry is the largest user of electricity and motors are the dominant end use across all segments.

Figure 32 presents the natural gas consumption by end-use and industry type. The metals industry is largest in terms of natural gas use.

**Figure 31 Industrial Electricity Use by End Use and Segment (GWh, 2011)**



**Figure 32 Industrial Natural Gas Use by End Use and Segment (Actual million therms, 2011)**



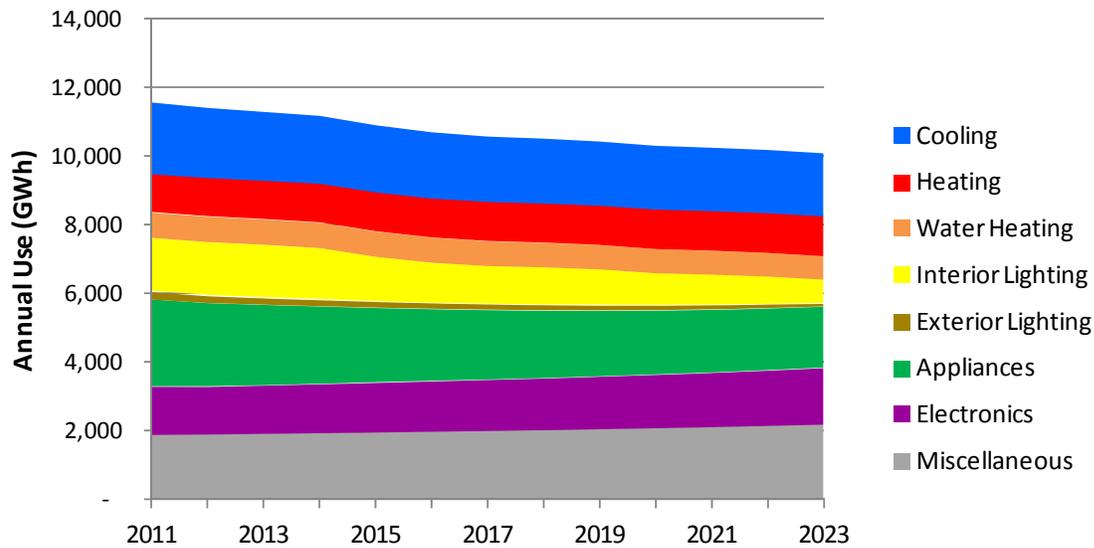
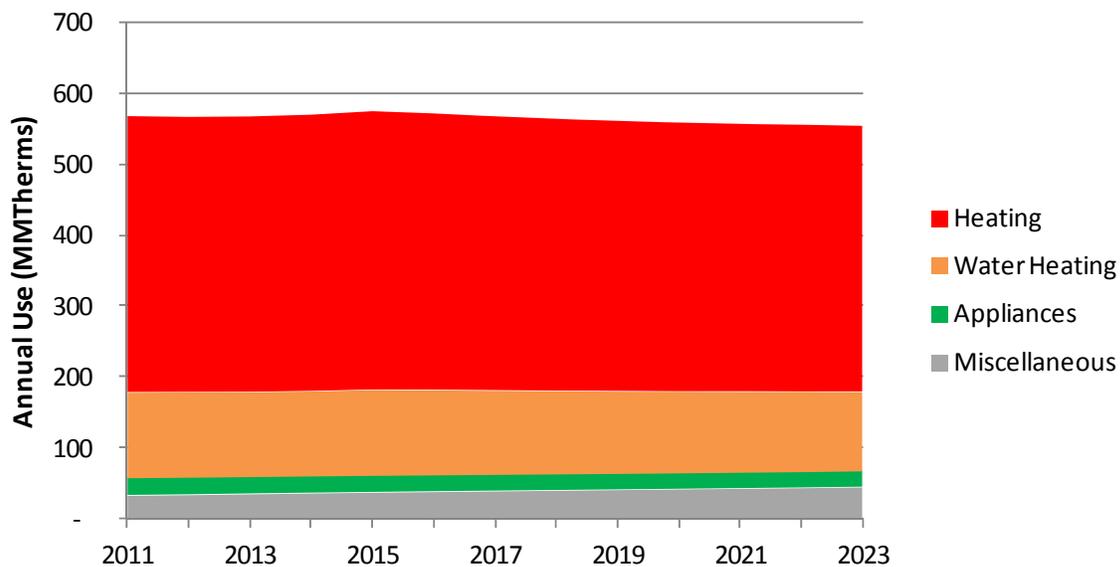
## Baseline Projection

The baseline projection is an end-use load forecast that incorporates a forecast of customer growth, changes in electricity and natural gas prices and trends in fuel shares. It also includes expected impact of appliance/equipment standards and building codes. For this study, we developed two baseline projections: one without naturally occurring efficiency and a second with naturally occurring efficiency. The baseline projections represent what the consumption is likely to be in the future in absence of new efficiency programs and it serves as the metric against which energy efficiency potentials are measured. In the following, we present the baseline forecast with naturally occurring efficiency.

### Residential

Figure 33 presents the baseline projection for electricity at the end-use level for the residential sector as a whole. Residential use decreases from 11,577 GWh in 2011 to 10,712 GWh in 2016, a decrease of 4.2%, or an average reduction of 1.4% during the program years. This projection reflects the most recent wave of federal appliance efficiency standards, including the EISA lighting standard. The naturally occurring efficiency savings come primarily from interior lighting and exterior lighting, as customers adopt CFL light bulbs instead of the minimum standard.

Figure 34 presents the residential sector baseline projections for natural gas at the end use level.

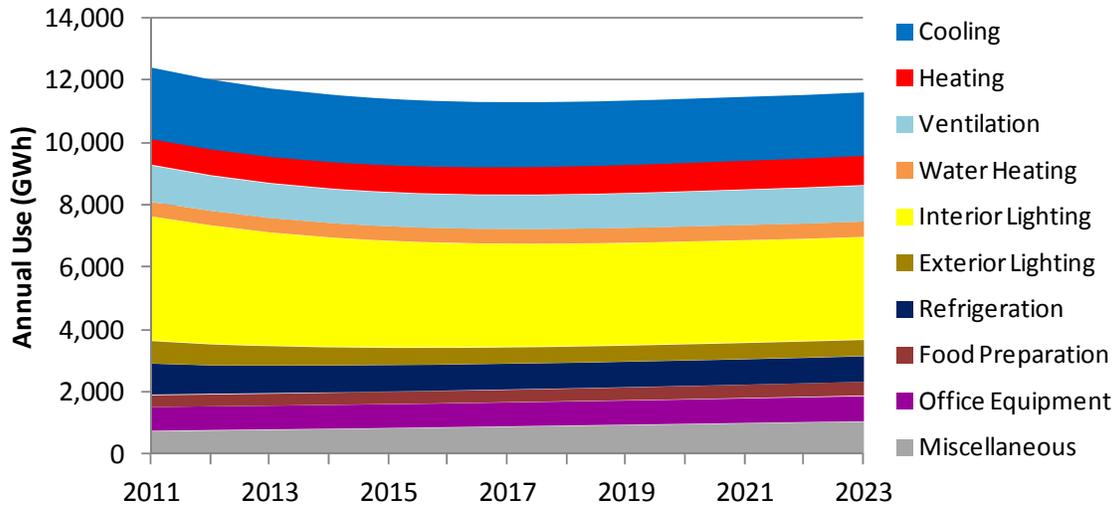
**Figure 33 Residential Electricity Baseline with Naturally Occurring Efficiency****Figure 34 Residential Natural Gas Baseline with Naturally Occurring Efficiency**

## Commercial

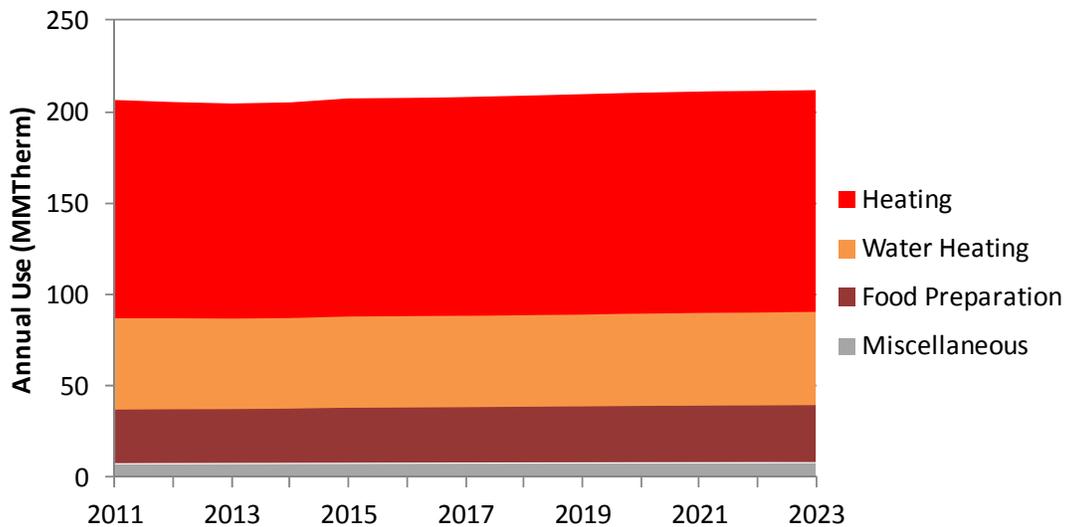
Figure 35 presents the electricity baseline projection at the end-use level for the commercial sector as a whole. Electricity use shows a decline of 2% overall during the program years. Commercial usage starts at 12,414 GWh in 2011, and decreases to 11,332 GWh in 2016. This is a result of the EISA standard and customers adopting the higher efficiency lighting options that are currently available.

The natural gas baseline projection is shown in Figure 36. Natural gas use is projected to increase by only 1.8% between 2011 and 2016.

**Figure 35** *Commercial Electricity Baseline with Naturally Occurring Efficiency*



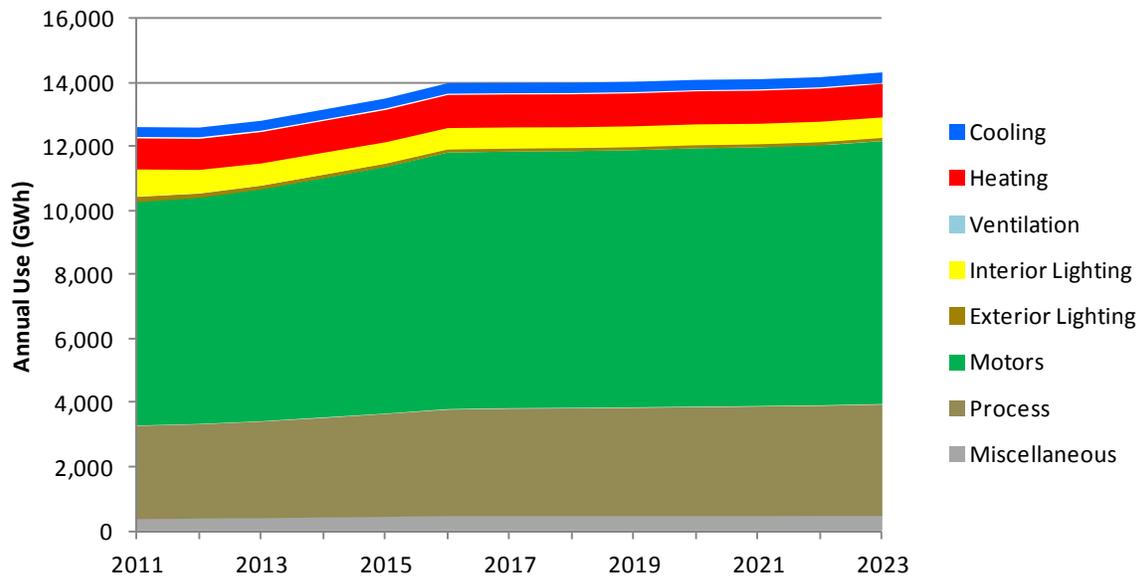
**Figure 36** *Commercial Natural Gas Baseline with Naturally Occurring Efficiency*



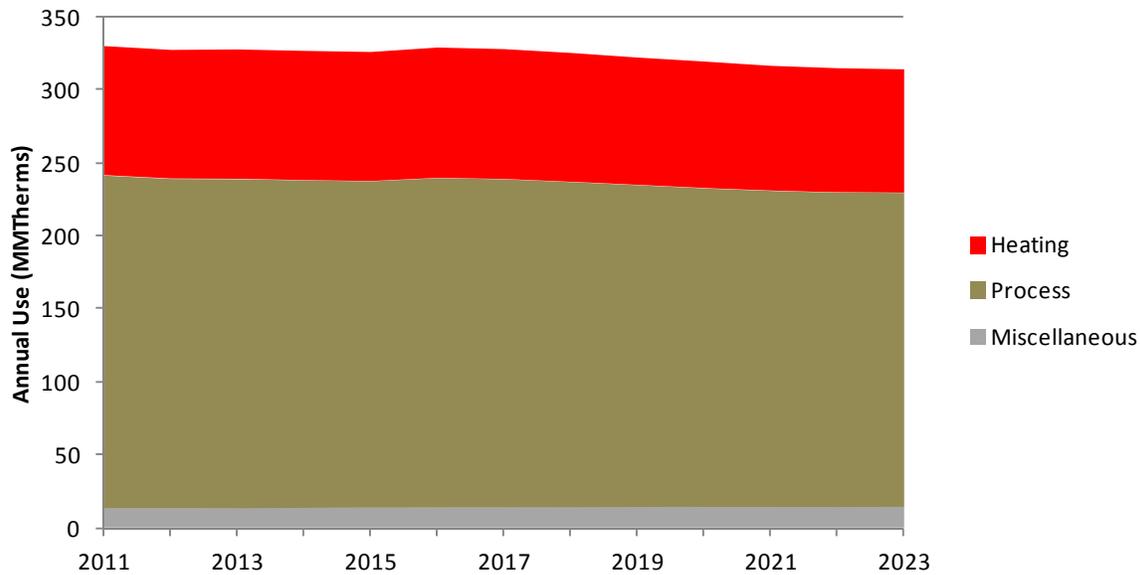
**Industrial**

Figure 37 presents the industrial sector electricity baseline projection. Growth in this sector is projected to be fairly robust. Figure 38 shows a different story for the industrial natural gas baseline projection, which remains essentially flat from 2011 to 2016.

**Figure 37 Industrial Electricity Baseline Projection with Naturally Occurring**



**Figure 38 Industrial Natural Gas Baseline with Naturally Occurring Efficiency**



Combining the three sectors, overall electricity and natural gas use are projected to be flat over the next program cycle (see Table 5 and Table 6).

**Table 5 Electricity Baseline Projection Summary (GWh)**

Sector	2011	2014	2015	2016	2023	% Change	Avg. Growth Rate
Residential	11,577	11,188	10,915	10,712	10,104	-7.5%	-1.6%
Commercial	12,414	11,547	11,415	11,332	11,613	-8.7%	-1.8%
Industrial	12,580	13,130	13,480	13,955	14,295	10.9%	2.1%
<b>Total</b>	<b>36,571</b>	<b>35,865</b>	<b>35,810</b>	<b>35,999</b>	<b>36,012</b>	<b>-1.6%</b>	<b>-0.3%</b>

**Table 6** *Natural Gas Baseline Projection Summary (million therms)*

Sector	2011	2014	2015	2016	2023	% Change	Average Growth Rate
Residential	569	570	575	572	555	0.7%	0.1%
Commercial	207	205	207	208	212	0.6%	0.1%
Industrial	330	326	326	329	314	-0.3%	-0.1%
<b>Total</b>	<b>1,105</b>	<b>1,102</b>	<b>1,109</b>	<b>1,109</b>	<b>1,081</b>	<b>0.4%</b>	<b>0.1%</b>

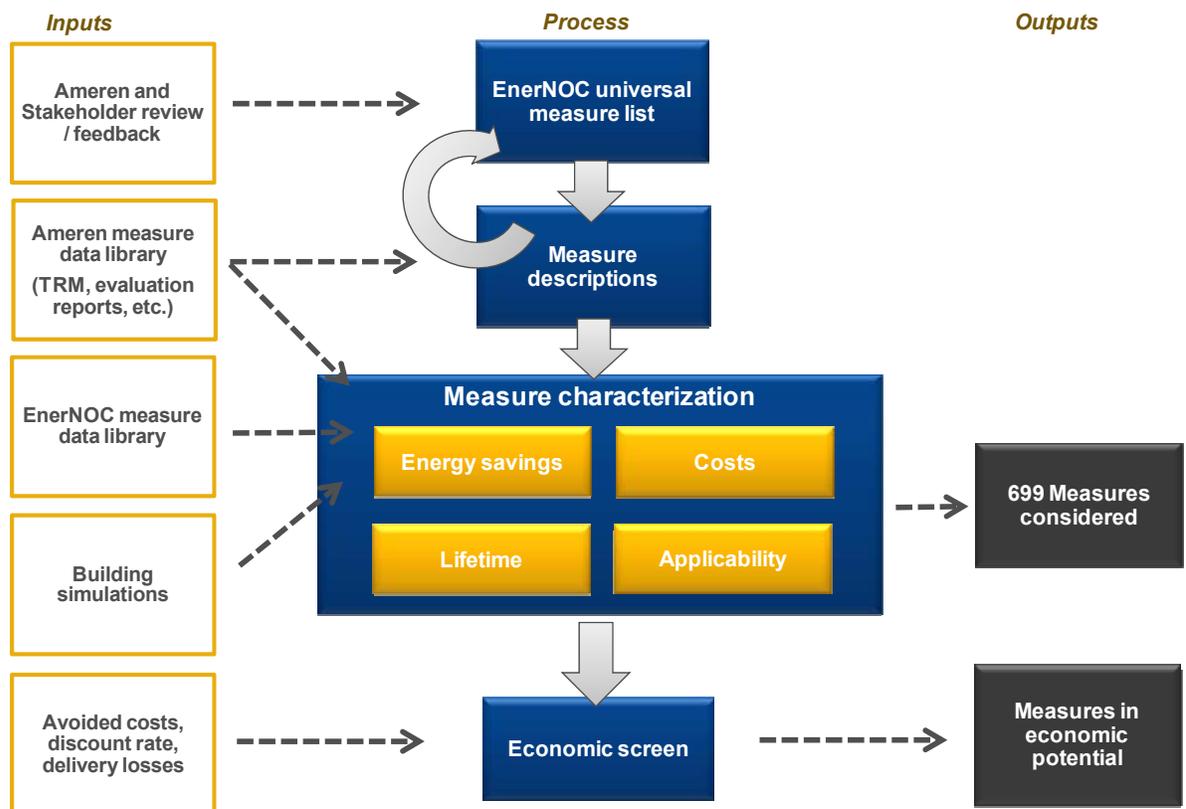
## Potential Savings from Energy Efficiency Measures

Once the baseline projections were developed, analysis of energy-efficiency potential proceeded. This activity began with the identification and screening of energy-efficiency measures and continued with estimation of potential as described below.

### EE Measure Database

The process for developing and characterizing energy-efficiency measures is depicted in Figure 39. The first step of the energy efficiency measure analysis is to identify the list of all relevant energy efficiency measures that should be considered for the Ameren Illinois potential assessment. The project team assembled this list of measures and it was vetted by stakeholders. Sources for the measure assumptions were primarily drawn from the Illinois TRM. Additional sources included Ameren Illinois past program experience, EnerNOC’s building simulation tool (BEST), EnerNOC’s measure database (DEEM), California’s measure database (DEER), measure workbooks from the Northwest Power and Conservation Council, other secondary sources, and data from EnerNOC’s previous studies and program work. Full measure characterization for each sector and segment can be found in Volume 6.

**Figure 39** *EE Measure Development Process*



## Measure-Level Energy Efficiency Potential

**Electricity efficiency potential** is summarized above in Figure 1 and recapped as follows:

- **Realistic Achievable Potential for Electricity.** In 2014, net realistic achievable savings are 483 GWh which is 1.3% of the baseline projection. By 2016, cumulative net realistic achievable savings grow to 1,093 GWh which represents 3.0% of the baseline projection.
- **Maximum Achievable Potential for Electricity.** In 2014, savings for this case are 630 GWh or 1.8% of the baseline and by 2016 cumulative net savings reach 1,432 GWh or 4.0% of the baseline projection.

**Natural gas efficiency potential** is summarized above in Figure 2. Achievable potential is summarized below.

- **Realistic Achievable Potential for Natural Gas.** In 2014, net realistic achievable savings are 6.1 (million therms) which is 0.5% of the baseline projection. By 2016, cumulative net realistic achievable savings grow to 14.1 (million therms) which represent 1.3% of the baseline.
- **Maximum Achievable Potential for Natural Gas.** In 2014 net savings for this case are 9.0 million therms or 0.8% of the baseline and by 2016 cumulative net savings reach 20.8 (million therms) or 1.9% of the baseline projection.

Below, we present results of the measure-level potential analysis for each sector.

### ***Residential Measure Potential***

**Electricity potential** for the residential sector is shown in Table 7.

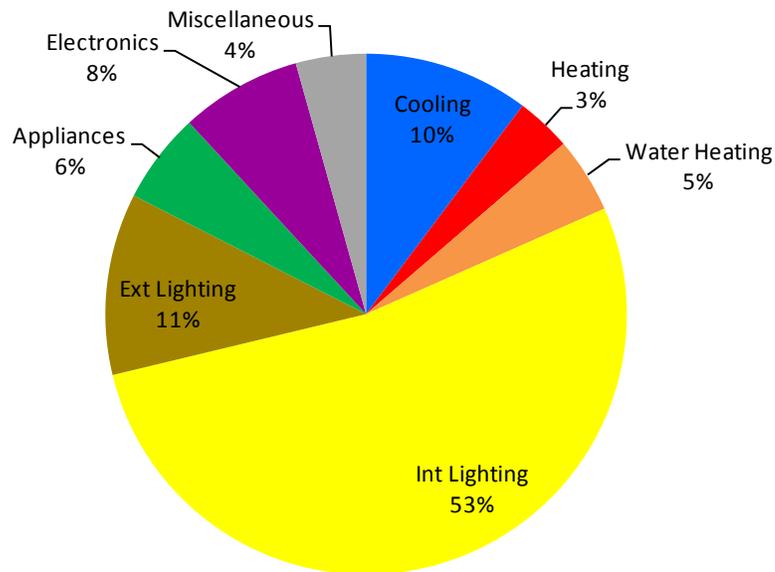
**Table 7** *Electricity Energy Efficiency Potential for the Residential Sector*

	2014	2015	2016
<b>Baseline Projection (GWh)</b>	11,188	10,915	10,712
<b>Cumulative Net Energy Savings (GWh)</b>			
Realistic Achievable Potential	103	233	322
Maximum Achievable Potential	135	296	409
Economic Potential	317	721	996
Technical Potential	520	1,069	1,478
<b>Energy Savings (% of Baseline)</b>			
Realistic Achievable Potential	0.9%	2.1%	3.0%
Maximum Achievable Potential	1.2%	2.7%	3.8%
Economic Potential	2.8%	6.6%	9.3%
Technical Potential	4.7%	9.8%	13.8%

Figure 40 focuses on the net realistic achievable potential in program year 2016. Lighting equipment replacement accounts for the highest portion of the savings in the near term as a result of the efficiency gap between CFL lamps and advanced incandescent lamps, even those that will meet the EISA 2007 standard. Although Ameren Illinois has achieved significant savings in lighting already, there are still significant savings available by encouraging customers to adopt CFL lighting and more efficient specialty bulbs that are not affected by the EISA standard. Electronics, cooling, and appliances also contribute significantly to the savings. Detailed measure information is available in Volume 6, Appendix B. The key measures comprising the potential are listed below:

- Lighting: mostly CFL lamps and specialty bulbs
- Electronics (reduce standby wattage, televisions, set top boxes, PCs)
- Second refrigerator/ freezer removal
- HVAC: Removal of second room AC unit, efficient air conditioners, ducting repair/sealing, insulation, home energy management system and programmable thermostats

**Figure 40 Residential Electric Realistic Achievable Potential by End Use in 2016**



**Natural gas efficiency potential** is presented in Table 8 below.

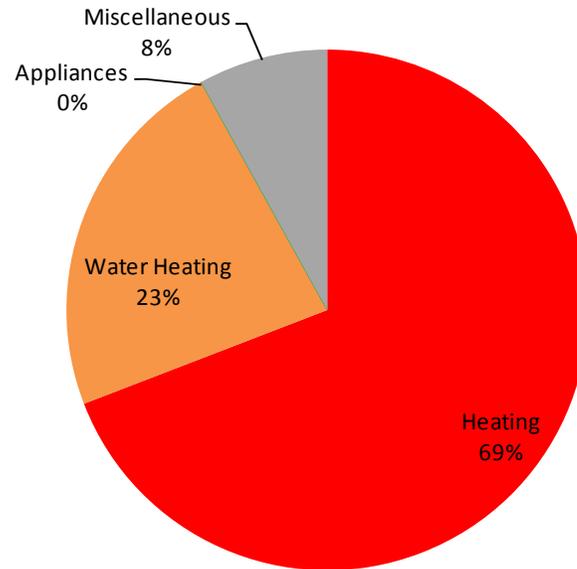
**Table 8 Natural Gas Energy Efficiency Potential for the Residential Sector**

	2014	2015	2016
<b>Energy Projections (million therms)</b>	570	575	572
<b>Cumulative Net Energy Savings (million therms)</b>			
Realistic Achievable Potential	2.6	4.1	6.3
Maximum Achievable Potential	3.8	6.1	9.2
Economic Potential	8.9	13.9	20.8
Technical Potential	15.1	23.9	34.8
<b>Energy Savings (% of Baseline Projection)</b>			
Realistic Achievable Potential	0.4%	0.7%	1.1%
Maximum Achievable Potential	0.7%	1.1%	1.6%
Economic Potential	1.6%	2.4%	3.6%
Technical Potential	2.6%	4.2%	6.1%

Figure 41 focuses on the range of net realistic achievable potential in 2016. As expected, space heating and water heating savings are the largest opportunities. The key measures comprising the potential are listed below:

- Efficient furnaces & boilers, boiler hot water reset ,ducting repair/sealing, insulation, home energy management system & programmable thermostats
- Efficient water heaters, low-flow showerheads, faucet aerators, and water heater tank blankets

**Figure 41 Residential Natural Gas Realistic Achievable Potential by End Use in 2016**



### **Commercial Potential**

**Electricity Efficiency Potential.** The baseline projection for the commercial sector only grows slightly, which reflects the sluggish near-term economy and forthcoming codes and standards. Nevertheless, the opportunity for energy-efficiency savings is still significant for the commercial sector. Table 9 presents estimates for the four types of potential for the residential sector.

**Table 9 Electricity Efficiency Potential for the Commercial Sector**

	2014	2015	2016
<b>Baseline Projection (GWh)</b>	11,547	11,415	11,332
<b>Cumulative Net Energy Savings (GWh)</b>			
Realistic Achievable Potential	197	319	434
Maximum Achievable Potential	269	442	604
Economic Potential	440	704	950
Technical Potential	610	915	1,211
<b>Savings (% of Baseline)</b>			
Realistic Achievable Potential	1.7%	2.8%	3.8%
Maximum Achievable Potential	2.3%	3.9%	5.3%
Economic Potential	3.8%	6.2%	8.4%
Technical Potential	5.3%	8.0%	10.7%

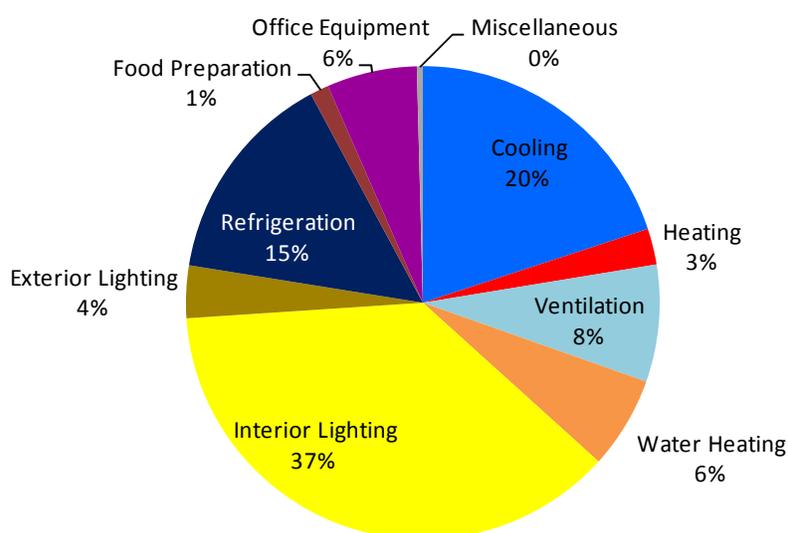
Figure 42 focuses on realistic achievable potential savings by end use. Not surprisingly, interior lighting delivers the highest achievable savings throughout the study period. In 2016, exterior

lighting is second, and refrigeration is third, followed in descending order by cooling, ventilation, office equipment, and small amounts of the other end uses.

Detailed measure information is available in Volume 6, Appendix C. The key measures comprising the potential are listed below:

- Lighting – CFLs, LED lamps, linear fluorescent, daylighting controls, occupancy sensors, and HID lamps for exterior lighting
- Energy management systems & programmable thermostats
- Ventilation – variable speed control
- Refrigeration – efficient equipment, control systems, and anti-sweat door heater
- Custom measures

**Figure 42 Commercial Realistic Achievable Potential Electricity Savings by End Use in 2016**



**Natural Gas Efficiency Potential.** Table 10 presents the net savings associated with each level of potential in the commercial sector.

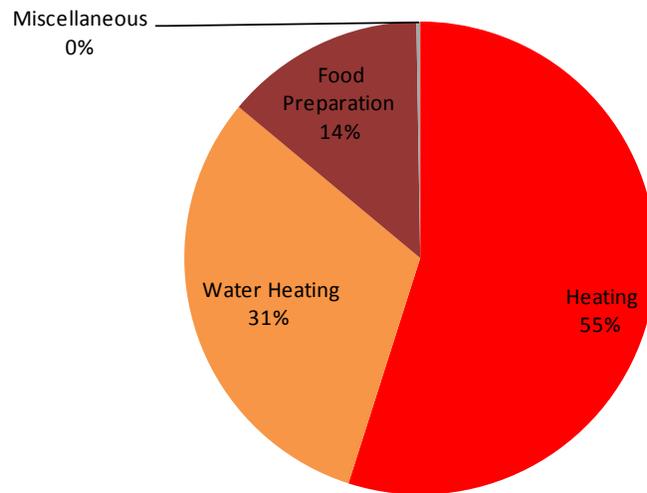
**Table 10 Natural Gas Efficiency Potential for the Commercial Sector (million therms)**

	2014	2015	2016
<b>Energy Projections (million therms)</b>	205	207	208
<b>Cumulative Net Energy Savings (million therms)</b>			
Realistic Achievable Potential	2.0	3.3	4.8
Maximum Achievable Potential	3.1	5.0	7.4
Economic Potential	5.0	8.1	11.8
Technical Potential	6.5	10.4	15.0
<b>Energy Savings (% of Baseline Projection)</b>			
Realistic Achievable Potential	1.0%	1.6%	2.3%
Maximum Achievable Potential	1.5%	2.4%	3.6%
Economic Potential	2.5%	3.9%	5.7%
Technical Potential	3.2%	5.0%	7.2%

Figure 43 below shows net realistic achievable potential savings by end use. Water heating provides the largest share of the savings, with heating and food preparation each successively smaller. The key measures comprising the potential are listed below:

- Energy management systems, programmable thermostats, HVAC occupancy sensors
- Efficient boilers, boiler maintenance, steam trap repair and hot water reset
- Efficient water heaters
- Efficient food preparation equipment for the restaurant segment
- Insulation and high efficiency windows

**Figure 43 Commercial Natural Gas Realistic Achievable Potential Savings by End Use in 2016**



### **Industrial EE Measure Potential**

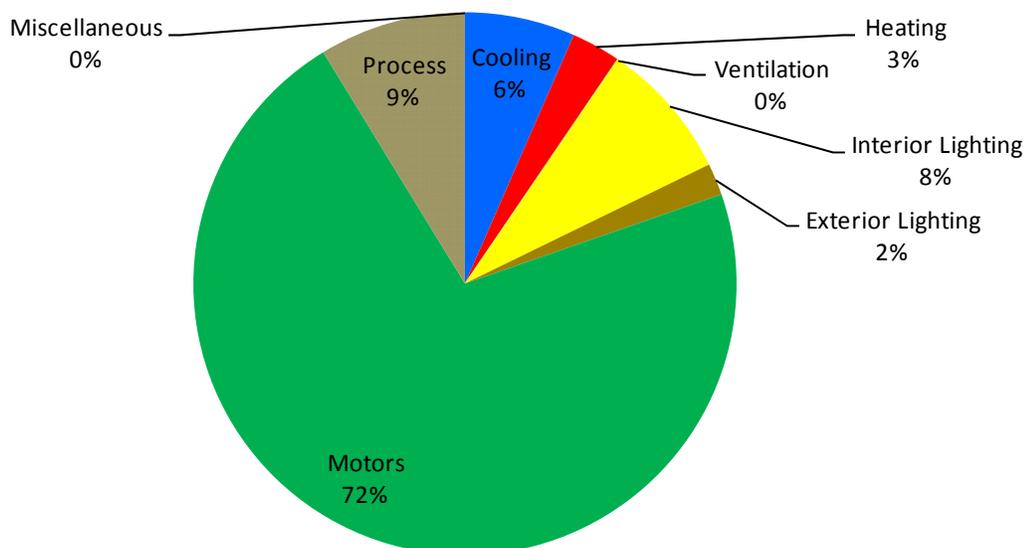
**Electricity Efficiency Potential.** The industrial sector in Ameren Illinois accounts for about one-third of total energy consumption, but slightly more than one-third of the potential electricity savings. Table 11 presents the net savings for the various types of potential considered in this study.

**Table 11 Electric Efficiency Potential for the Industrial Sector**

	2014	2015	2016
<b>Energy Projections (GWh)</b>	13,130	13,480	13,955
<b>Cumulative Net Energy Savings (GWh)</b>			
Realistic Achievable Potential	182	251	336
Maximum Achievable Potential	226	312	418
Economic Potential	392	533	705
Technical Potential	453	620	828
<b>Energy Savings (% of Baseline Projection)</b>			
Realistic Achievable Potential	1.4%	1.9%	2.4%
Maximum Achievable Potential	1.7%	2.3%	3.0%
Economic Potential	3.0%	4.0%	5.0%
Technical Potential	3.5%	4.6%	5.9%

Figure 44 illustrates the cumulative realistic achievable potential savings by electric end use in 2016 for the industrial sector. The largest shares of savings opportunities are in the motors and machine drives. Potential savings for straight equipment change-outs are diminishing due to the National Electrical Manufacturer’s Association (NEMA) standards, which now make premium efficiency motors the baseline efficiency level. As a result, there are not substantially more efficient upgrade options to drive incremental efficiency improvements. Many of the savings opportunities in this end use come from controls, timers, and variable speed drives, which improve system efficiencies where motors are utilized. Beyond the replacement of motors, there are significant opportunities for savings in cooling, high-bay lighting, process timers and controls, ventilation, and finally space heating.

**Figure 44 Industrial Realistic Achievable Electricity Potential Savings by End Use in 2016**



**Natural Gas Efficiency Potential.** Table 12 presents the net cumulative savings for the various types of potential considered in this study for the industrial sector.

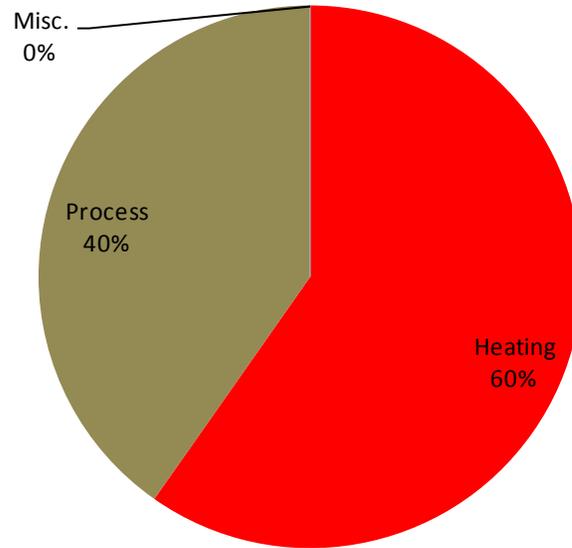
**Table 12 Natural Gas Efficiency Potential for the Industrial Sector**

	2014	2015	2016
<b>Energy Projections (million therms)</b>	326	326	329
<b>Cumulative Net Energy Savings</b>			
Realistic Achievable Potential	1.5	2.1	3.0
Maximum Achievable Potential	2.0	2.9	4.2
Economic Potential	3.5	4.9	6.9
Technical Potential	7.5	11.0	15.6
<b>Energy Savings as a % of Baseline</b>			
Realistic Achievable Potential	0.5%	0.6%	0.9%
Maximum Achievable Potential	0.6%	0.9%	1.3%
Economic Potential	1.1%	1.5%	2.1%
Technical Potential	2.3%	3.4%	4.7%

Figure 45 illustrates the net realistic achievable potential savings by natural gas end use in 2016 for the industrial sector. Space heating and process heating are the only opportunities to speak of. The key measures comprising the potential are listed below:

- Energy management systems & programmable thermostats
- Efficient boilers & furnaces
- Insulation

**Figure 45** *Industrial Natural Gas Realistic Achievable Potential Savings by End Use in 2016*



## Program Analysis

The measure-level estimates shown above for technical, economic, and achievable potential in this report were determined by screening measure for cost-effectiveness at the measure-level. This method does not take into account the program costs of delivering measures to end-use customers. The additional costs associated with the delivery of energy efficiency measures includes: Measure Incentives, Program Administration, Education and Marketing, Implementation, and Evaluation. For budgeting and cost-effectiveness purposes, the major categories are broken down into Incentives and Non-Incentives.

**Utility Program Cost Assumptions.** Utility program costs were developed for each program-level achievable potential scenario, with estimates of incentives and non-incentives required to achieve the related savings levels. The cost estimates were based on past program costs for Ameren Illinois, evaluations of past programs, and industry best practices.

Table 13 presents the program spending levels for each program-level achievable scenario. Also presented are Ameren Illinois' first year costs per energy saved for each scenario by fuel type. Key cost assumptions include:

- Incentives required to achieve savings ranged from 53-75% of measure incremental cost
- Non-Incentive costs required to achieve savings ranged from 23-37% of measure incremental cost
- First year electricity cost per kWh saved ranged from \$0.25-0.40 per first year kWh saved
- First year natural gas cost per therm saved ranged from \$3.16-4.63 per first year therm saved

**Table 13** *Cost Assumptions for Program Achievable Potential Scenarios*

Achievable Scenario	Average Costs as Percent of Measure Cost		Average Utility cost per First-Year Unit of Energy Saved	
	Incentive	Non-Incentive	Electricity (\$/kWh)	Natural Gas (\$/therm)
Program Low	52%	23%	\$0.25	\$3.16
Program High	75%	37%	\$0.40	\$4.63

**Costs to Achieve Program Potential.** The costs associated with achieving energy efficiency potential are broken down into Incentive and Non-Incentive (Administration, Marketing, Delivery, and Evaluation) costs. The costs to achieve the electric and natural gas program-level potential are detailed in Table 14 and Table 15.

**Table 14** *Cost to Achieve Electric Program-Level Achievable Potential Scenarios*

	2014	2015	2016
<b>Incentive Costs</b>			
Program Low	\$59,572,278	\$59,037,129	\$64,800,584
Program High	\$118,720,702	\$117,397,971	\$127,993,118
<b>Non-Incentive Costs</b>			
Program Low	\$26,536,190	\$26,077,992	\$27,915,274
Program High	\$58,991,921	\$57,906,786	\$61,777,189
<b>Total Utility Costs</b>			
Program Low	<b>\$86,108,468</b>	<b>\$85,115,121</b>	<b>\$92,715,858</b>
Program High	<b>\$177,712,622</b>	<b>\$175,304,757</b>	<b>\$189,770,307</b>

**Table 15** *Cost to Achieve Natural Gas Program-Level Achievable Potential Scenarios*

	2014	2015	2016
<b>Incentive Costs</b>			
Program Low	\$9,510,317	\$9,576,566	\$10,093,826
Program High	\$19,740,073	\$19,907,091	\$21,227,937
<b>Non-Incentive Costs</b>			
Program Low	\$3,771,990	\$3,797,531	\$3,930,407
Program High	\$9,203,424	\$9,274,397	\$9,654,207
<b>Total Utility Costs</b>			
<b>Program Low</b>	<b>\$13,282,307</b>	<b>\$13,374,097</b>	<b>\$14,024,233</b>
<b>Program High</b>	<b>\$28,943,497</b>	<b>\$29,181,488</b>	<b>\$30,882,143</b>





## About EnerNOC

EnerNOC's Utility Solutions Consulting team is part of EnerNOC's Utility Solutions, 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's Utility Solutions deliver value to our utility clients through two separate practice areas – Implementation and Consulting.

- Our 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 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 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 EnerNOC's experts as trusted advisors, and we work together collaboratively to make any DSM initiative a success.