New Jersey Energy Efficiency Market Potential Assessment

Report Number 1401

Volume 1: Executive Summary

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INTRODUCTION

Background

The New Jersey Board of Public Utilities (BPU or the Board) is commencing a proceeding to examine the appropriate funding level for energy efficiency (EE) programs over the next four years, 2013 through 2016. Pursuant to the 1999, Electric Discount and Energy Competition Act, this will be the BPU's fourth comprehensive resource analysis (CRA).

The BPU has contracted with EnerNOC to conduct a market assessment and energy efficiency potential study to assess the potential statewide impacts from energy efficiency resources for this time period.

Toward this end, EnerNOC conducted a detailed, bottom-up assessment of the New Jersey market to deliver forecasts of both electric and natural gas energy use, as well as forecasts of the electric and natural gas energy savings achievable through energy efficiency measures. The potential study addresses the residential, commercial, and industrial sectors.

Objectives

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

- Determines markets to address with EE programs
- Finds the potential for energy savings for the 2013–2016 period
- Provides high-level recommendations regarding programs

Report Organization

This report is presented in 3 volumes as outlined below. This document is **Volume 1: Executive Summary**.

- Volume 1, Executive Summary
- Volume 2, Report
- Volume 3, Appendices

Definitions of Potential

In this study, we estimate the potential for energy efficiency savings. The savings estimates represent gross savings[1] developed into three types of potential: technical potential, economic potential, and achievable potential. Technical and economic potential are both theoretical limits to efficiency savings. Achievable potential embodies a set of assumptions about the decisions consumers make regarding the efficiency of the equipment they purchase, the maintenance activities they undertake, the controls they use for energy-consuming equipment, and the elements of building construction. Because estimating achievable potential involves the inherent uncertainty of predicting human behaviors and responses to market conditions, we developed

[1] Savings in "gross" terms instead of "net" terms means that the baseline forecast does not include naturally occurring efficiency. In other words, the baseline assumes that energy efficiency levels remain fixed as they are today. This rule holds true except in cases where enactment of future codes and standards were on the books before January 2012, e.g. the effects of the EISA 2007 lighting efficiency standard.

low and high achievable potential as boundaries for a likely range. The various levels are described below.

- **Technical potential** is defined as the theoretical upper limit of energy efficiency potential. It assumes that customers adopt all feasible measures regardless of their cost. At the time of existing equipment failure, customers replace their equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option. Examples of measures that make up technical potential for electricity in the residential sector include:
    - Ductless mini-split air conditioners with variable refrigerant flow
    - Ground source (or geothermal) heat pumps
    - LED lighting

  Technical potential also assumes the adoption of every other available measure, where applicable. For example, it includes installation of high-efficiency windows in all new construction opportunities and air conditioner maintenance in all existing buildings with central and room air conditioning. These retrofit measures are phased in over a number of years, which is longer for higher-cost and complex measures.
- **Economic potential** represents the adoption of all ***cost-effective*** energy efficiency measures. In this analysis, the cost effectiveness is measured by the total resource cost (TRC) test, which compares lifetime energy and capacity benefits to the incremental cost of the measure. If the benefits outweigh the costs (that is, if the TRC ratio is greater than 1.0), a given measure is considered in the economic potential. Customers are then assumed to purchase the most cost-effective option applicable to them at any decision juncture.
- **Achievable High potential** estimates customer adoption of economic measures when delivered through efficiency programs under ideal market, implementation, and customer preference conditions. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with trade allies and delivery partners. Achievable High potential establishes a maximum target for the EE savings that an administrator 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.
- **Achievable Low potential** reflects expected program participation given significant barriers to customer acceptance, non-ideal implementation conditions, and limited program budgets. This represents a lower bound on achievable potential.

ANALYSIS APPROACH AND DATA DEVELOPMENT

This section briefly discusses the analysis approach taken for the study and the data sources used to develop the potential estimates.

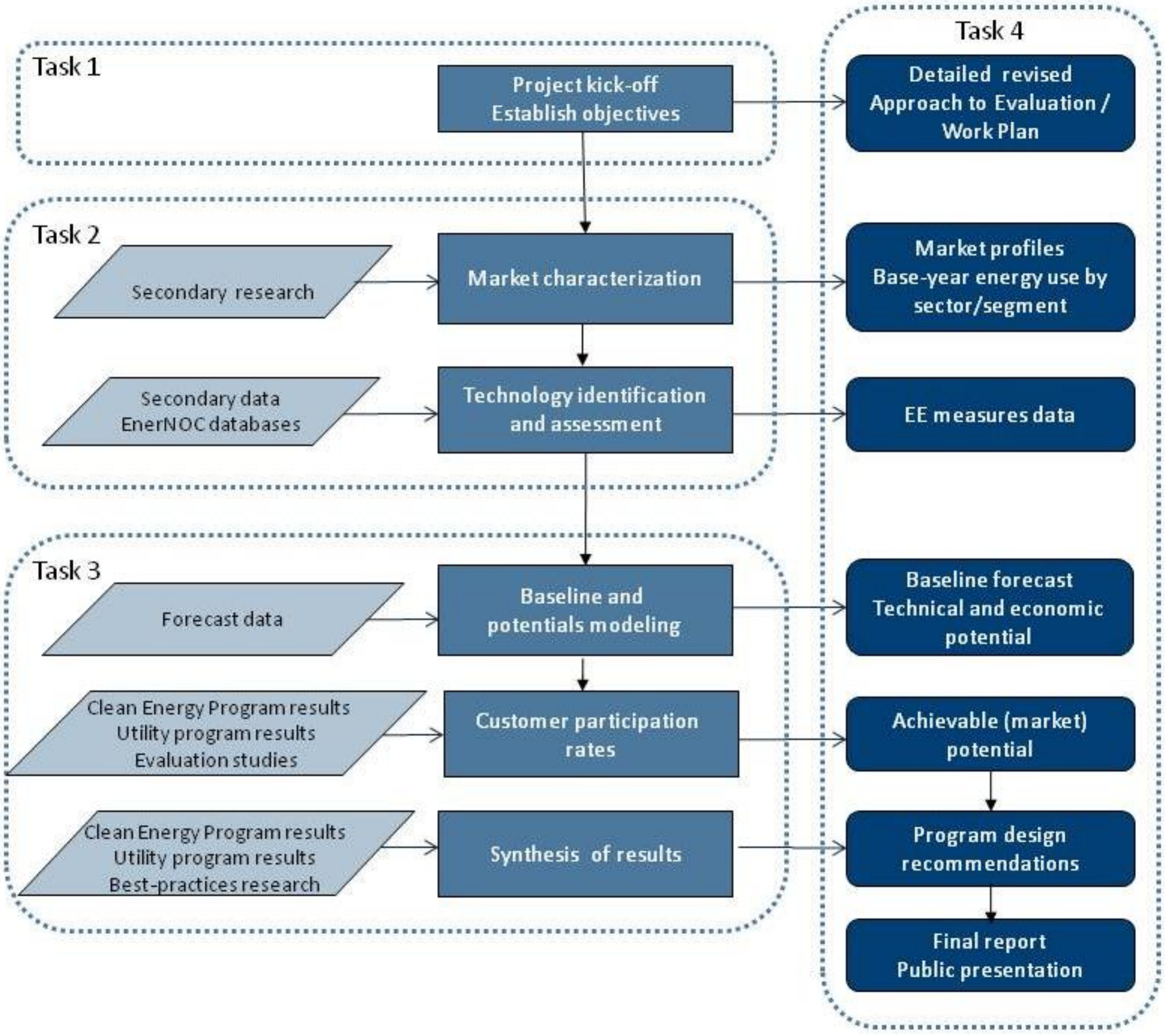
Analysis Approach

To perform the energy efficiency analysis, EnerNOC used a bottom-up analysis approach as shown in Figure 2-1. This involved the following steps.

1. Held a meeting with the client project team to refine the objectives of the project in detail. This resulted in a work plan for the study.
2. Performed a market characterization to describe sector-level electricity and natural gas use for the residential, commercial, and industrial sectors for the base year, 2010. This included using existing information contained in prior New Jersey studies, in EnerNOC's own databases and tools, and in other secondary data sources such as the American Community Survey (ACS) and the Energy Information Administration (EIA).
3. Developed a baseline electricity and natural gas forecast by sector, segment, and end use for 2013 through 2024. Results presented in this volume focus on the upcoming four-year implementation cycle of 2013 through 2016. Results beyond 2016 are available in the Appendices and are given at a high level in Chapter 12 of this document.
4. Identified several hundred measures and estimated their effects in four levels of energy-efficiency potential: *Technical, Economic, Achievable High,* and *Achievable Low*.
5. Reviewed the current programs offered in New Jersey in light of the study findings to make strategic program recommendations for achieving savings.

These steps are described in further detail in Chapter 2 of the main body of the report.

Figure 2-1 Overview of Analysis Approach



Data Development

A discussion of the data sources used in this study, as well as how they were applied, is found in Chapter 2 of the main body of the report. In general, data were used according to the hierarchy given below and adapted to local conditions whenever possible, for example, by using local sources for measure data and local weather for building simulations.

- New Jersey data first
- EnerNOC's databases and analysis tools
- Other secondary data and reports if necessary

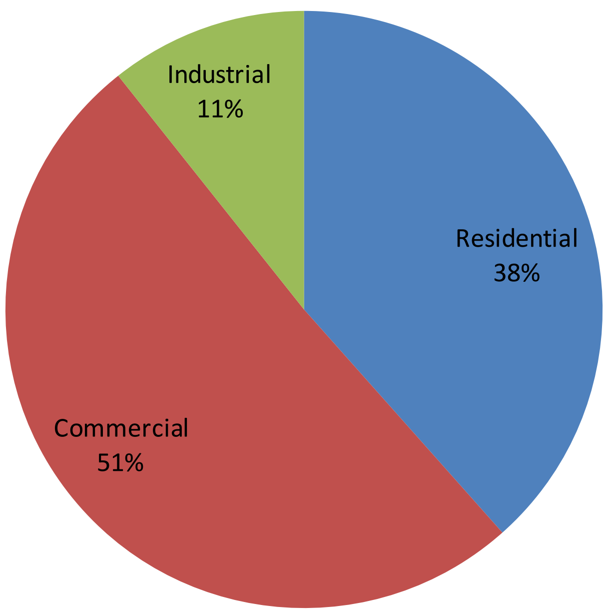
MARKET CHARACTERIZATION AND MARKET PROFILES

In this section, we describe how customers in New Jersey use electricity and natural gas in the base year of the study, 2010. It begins with a high-level summary of energy use by sector and then delves into each sector. More detail can be found in Chapter 3 of the main report.

Energy Use Summary

Total electricity use for the residential, commercial and industrial sectors for New Jersey in 2010 was 78,859 GWh.[2] As shown in Figure 3-1, the largest sector is commercial, accounting for 51%, or 40,123 GWh. The remaining use is split between the residential and industrial sectors, at 30,307 GWh and 8,429 GWh respectively.

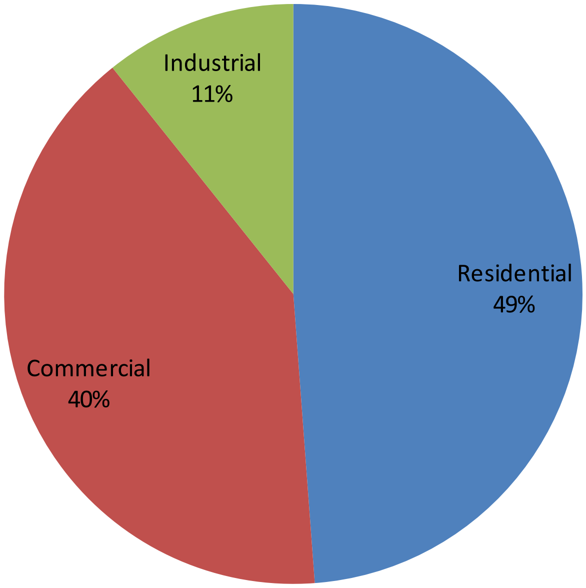
Figure 3-1 Sector-Level Electricity Use, 2010



Total natural gas use for all sectors in 2010 was 4,619 million therms.[3] As shown in Figure 3-2, the largest sector is residential, accounting for 49%, or 2,255 million therms. The remaining use is split between the commercial and industrial sectors, at 1,867 million therms and 497 million therms respectively.

[2] Energy given "at-the-meter," i.e. does not include line losses.
[3] Energy given "at-the-meter," i.e. does not include line losses.

Figure 3-2 Sector-Level Natural Gas Use, 2010



Residential Sector

The total number of households, electric sales, and natural gas sales for the State of New Jersey were obtained for the year 2010 from the US DOE Energy Information Administration website. In 2010, there were 3.45 million households in New Jersey. They used 30.3 TWh of electricity[4] and 2.25 billion therms of natural gas.[5]

Figure 3-3 shows the distribution of electricity and natural gas energy consumption by end use for all homes. Three main electricity end uses — cooling, lighting, and appliances — account for over 60% of total use. The remaining energy is allocated to space heating, water heating, electronics (computers, televisions, video game consoles, etc.) and miscellaneous. The miscellaneous category includes furnace fans, pool pumps, and other "plug" loads (hair dryers, power tools, coffee makers, etc.). Within the appliance category, 58% of electricity is used by refrigerators and freezers.

Natural gas usage is dominated by space heating (69%) and water heating (19%), with small amounts in appliances for cooking or clothes drying, as well as miscellaneous uses such as pool heaters.

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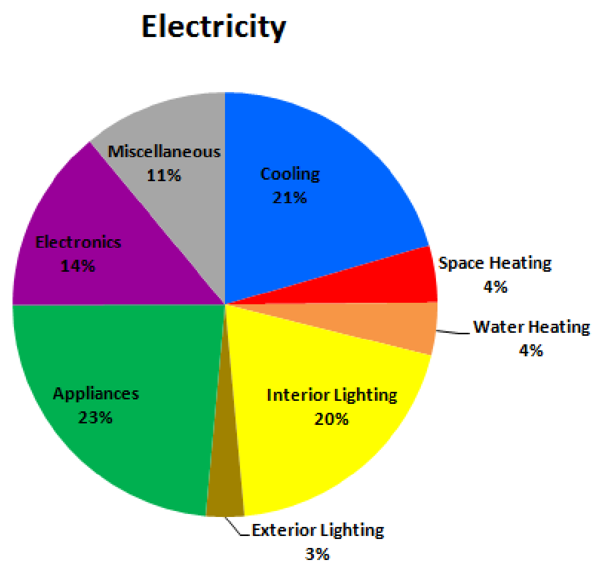
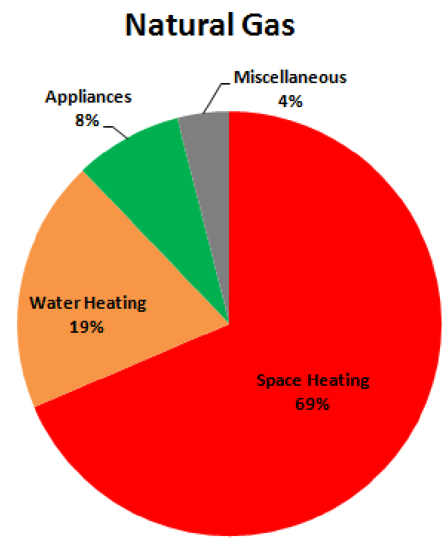
[4] U.S. DOE Energy Information Administration, See Table 2, http://www.eia.gov/electricity/sales_revenue_price/

[5] U.S. DOE Energy Information Administration, http://205.254.135.7/dnav/ng/ng_cons_sum_dcu_nus_a.htm

Figure 3-3 Residential Electricity and Natural Gas Use by End Use (2010), All Homes

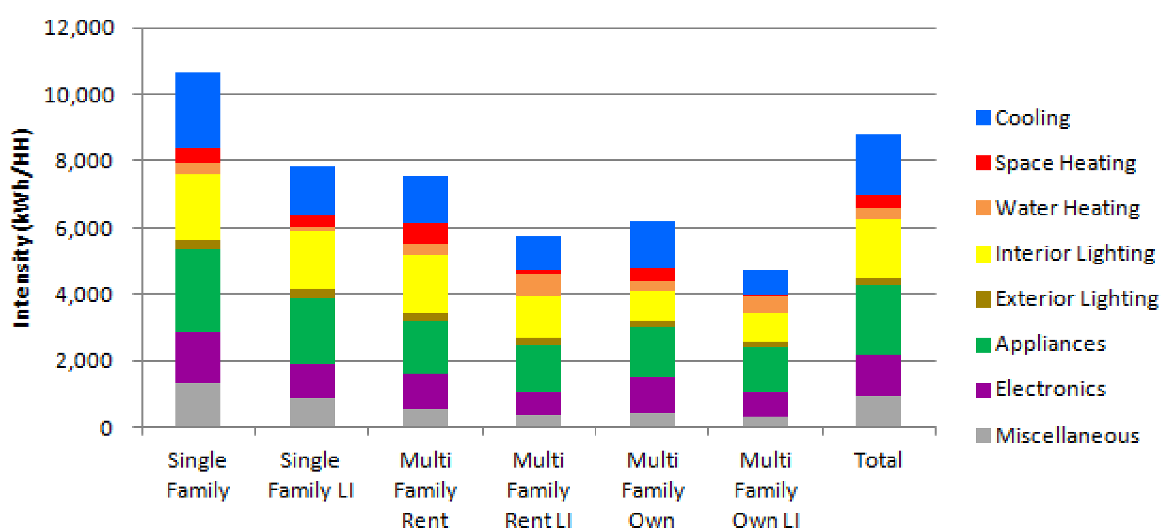




New Jersey has high saturations of natural gas heating equipment, resulting in an average annual electricity intensity that is relatively low at 8,772 kWh per household. Meanwhile, the natural gas intensity is 653 therms per household[6].

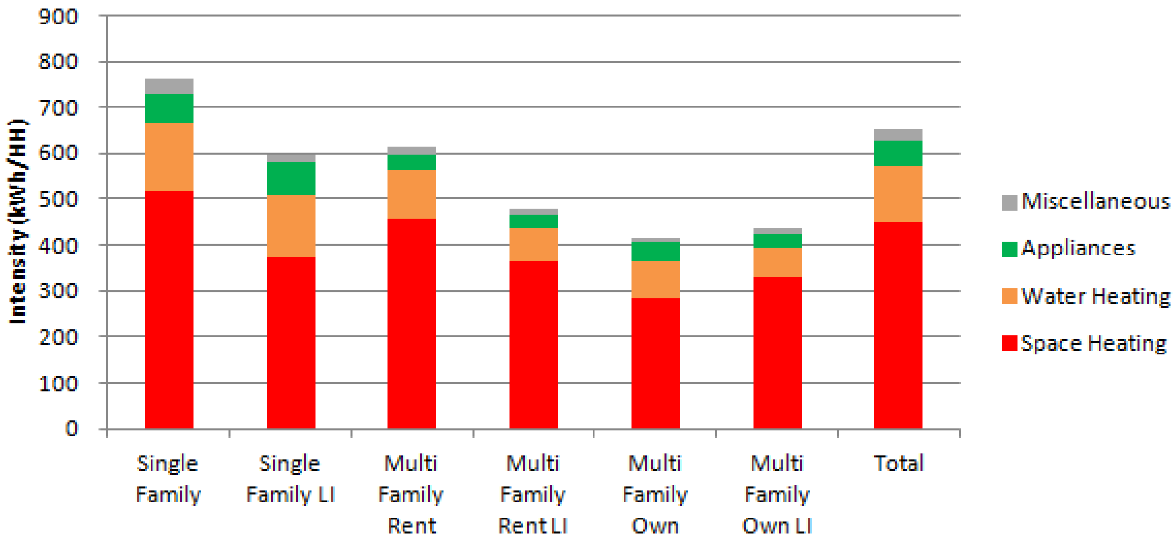
Figure 3-4 and Figure 3-5 present the electricity and natural gas intensities by end-use and housing type, as well as all homes on average.

Figure 3-4 Residential Electricity Intensity by End Use and Segment (kWh/household, 2010)



[6] This is average natural gas use across all homes, including both those with natural gas and those without.

Figure 3-5 Residential Natural Gas Intensity by End Use and Segment (therm/household, 2010)



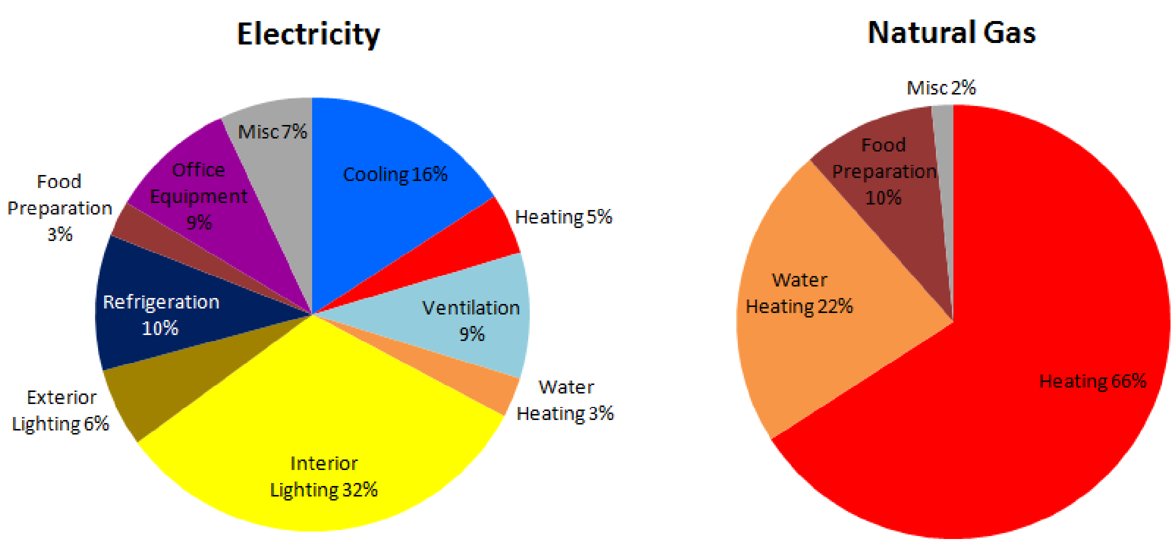
Commercial Sector

The total electric energy consumed by commercial customers in New Jersey in 2010 was 40,123 GWh[7] and the total natural gas energy consumed was 1,867 million therms.[8]

Figure 3-6 shows the distribution of electricity and natural gas energy consumption by end use for all commercial buildings. Electric usage is dominated by lighting, with interior and exterior varieties accounting for over one third of consumption. After lighting, the largest end uses are cooling, refrigeration, ventilation, and office equipment. The remaining end uses comprise 7% or less of total usage: miscellaneous, space heating, water heating, and food preparation.

Natural gas usage is dominated by space heating (66%) and water heating (22%), with a small amount in food preparation and miscellaneous.

Figure 3-6 Commercial Electricity and Natural Gas Use by End Use (2010), All Buildings



[7] U.S. DOE Energy Information Administration, See Table 2, http://www.eia.gov/electricity/sales_revenue_price/

[8] U.S. DOE Energy Information Administration, http://205.254.135.7/dnav/ng/ng_cons_sum_dcu_nus_a.htm

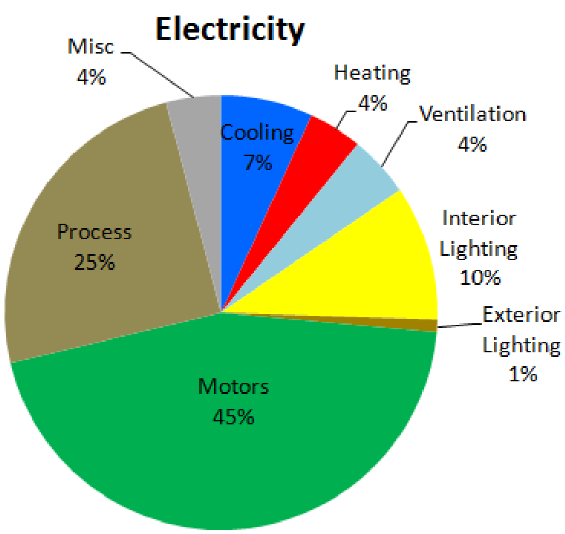
Industrial Sector

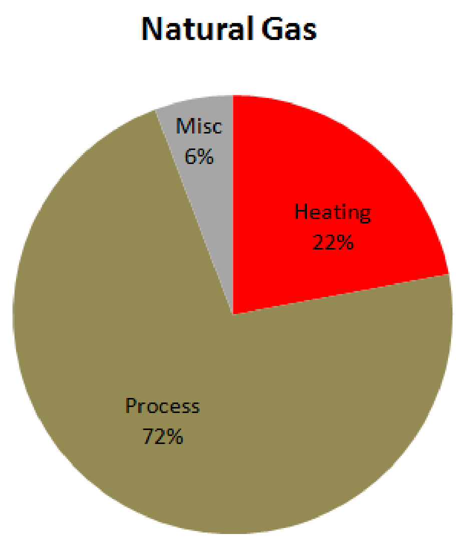
The total electric energy consumed by industrial customers in New Jersey in 2010 was 8,429 GWh[9] and the total natural gas energy consumed was 497 million therms.[10]

Figure 3-7 shows the distribution of electricity and natural gas energy consumption by end use for all industrial customers. Motors are clearly the largest overall end use for the industrial sector, accounting for 45% of energy use. Note that this end use includes a wide range of industrial equipment, such as air compressors and refrigeration compressors, pumps, conveyor motors, and fans. The process end use accounts for 25% of energy use, which includes heating, cooling, refrigeration, and electro-chemical processes. Lighting is the next highest, followed by cooling, space heating, ventilation, and miscellaneous.

Natural gas usage is dominated by process usage at 72%, most particularly process heating. Space heating (22%) and miscellaneous (6%) comprise the remainder of the sector's energy usage.

Figure 3-7 Industrial Electricity and Natural Gas Use by End Use (2010), All Industries





[9] U.S. DOE Energy Information Administration, See Table 2, http://www.eia.gov/electricity/sales_revenue_price/

[10] U.S. DOE Energy Information Administration, http://205.254.135.7/dnav/ng/ng_cons_sum_dcu_nus_a.htm

BASELINE FORECAST

Prior to developing estimates of energy-efficiency potential, a baseline end-use forecast was developed to quantify what the consumption is likely to be in the future in absence of new efficiency programs and naturally occurring efficiency. The baseline forecast serves as the metric against which energy efficiency potentials are measured. This chapter presents the baseline forecast for electricity and gas for each sector. More detail can be found in Chapter 4 of the main report.

Residential Sector

The baseline forecast incorporates assumptions about economic growth, electricity prices, and appliance/equipment standards and building codes that are already mandated as described in Chapter 2.

Figure 4-1 presents the baseline forecast for electricity at the end-use level for the residential sector as a whole. Overall, residential use decreases slightly from 30,307 GWh in 2010 to 29,502 GWh in 2016, a decrease of 2.7%, or an average reduction of 0.4% per year. This reflects the impact of the EISA lighting standard, additional appliance standards adopted in 2011, and modest customer growth.

Figure 4-1 Residential Electricity Baseline Forecast by End Use

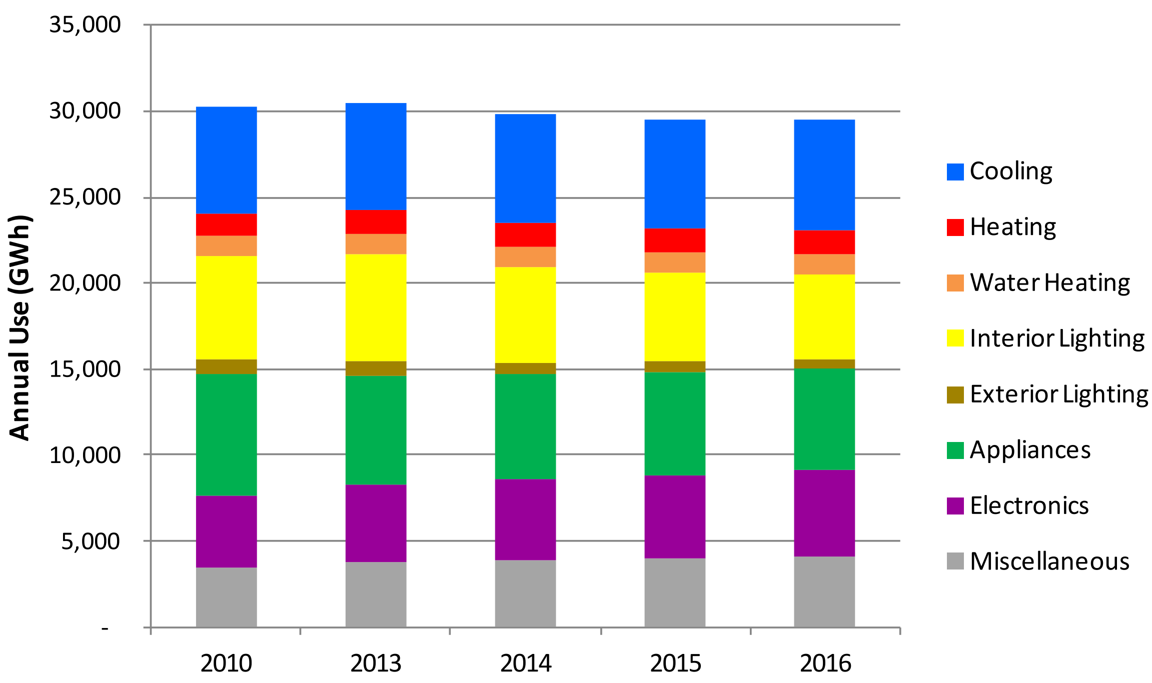
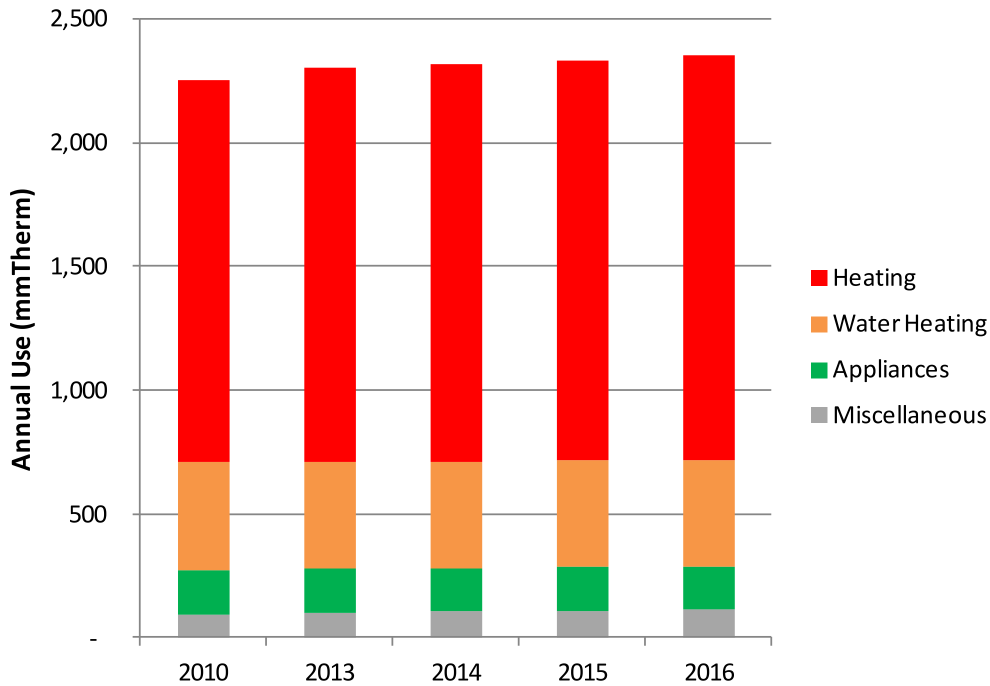


Figure 4-2 presents the residential sector baseline forecast for natural gas at the end use level. Natural gas use increases from 2,255 million therms in 2010 to 2,352 million therms in 2016, an overall increase of 4.3% and an average growth of 0.7% per year.

Figure 4-2 Residential Natural Gas Baseline Forecast by End Use



Commercial Sector

Electricity use in the commercial sector shows a decline of 10.8% overall during the forecast horizon, an average of 1.9% per year. Usage starts at 40,123 GWh in 2010, and decreases to 35,797 GWh in 2016. Figure 4-3 presents the electricity baseline forecast at the end-use level for the commercial sector as a whole. Usage is generally declining due to a sluggish economic recovery and the phasing in of codes and standards. The EISA 2007 lighting standards and EPACT 2005 refrigeration standards are also showing significant effects.

Figure 4-3 Commercial Electricity Baseline Forecast by End Use

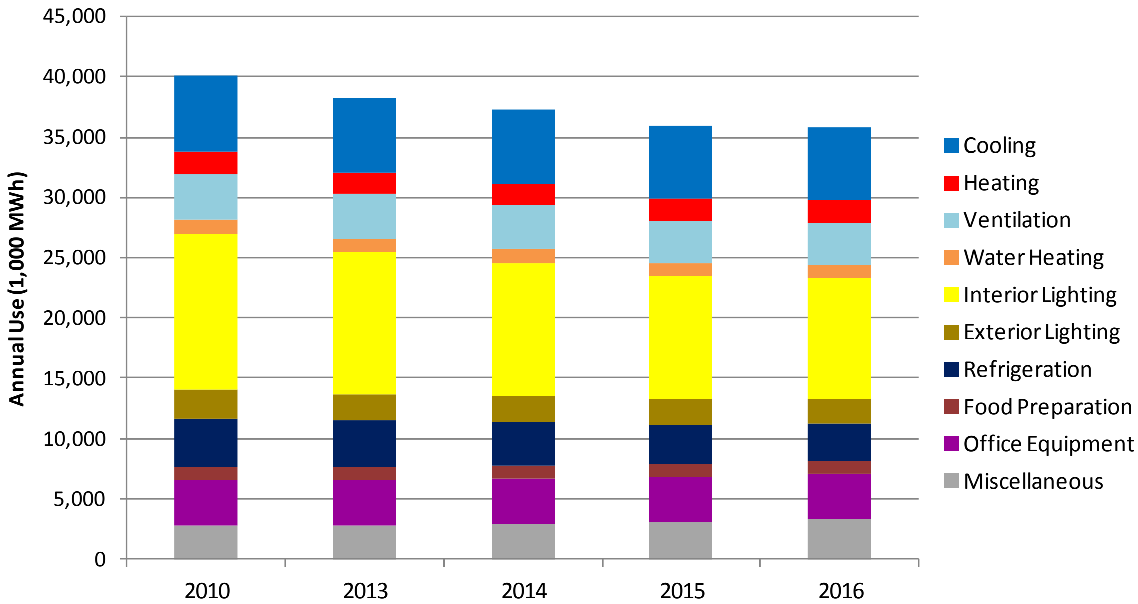
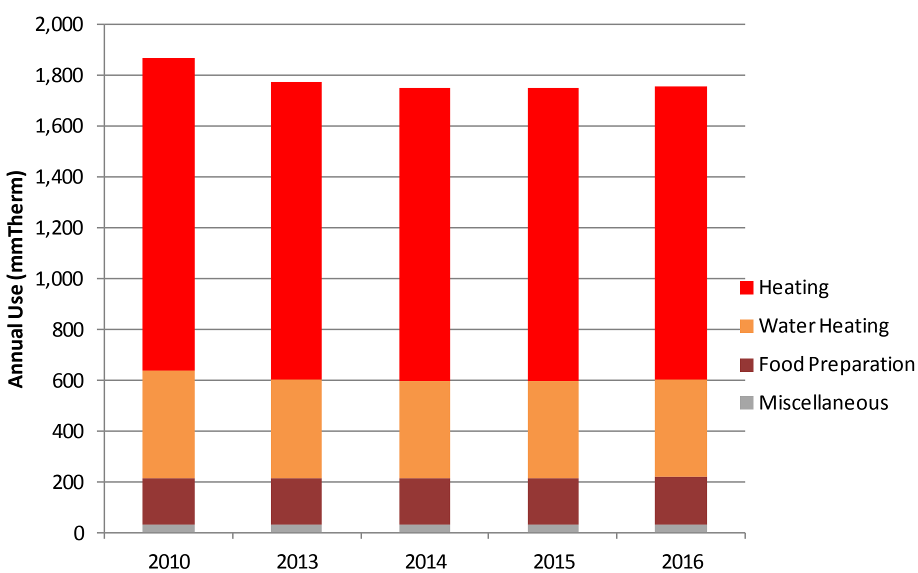


Figure 4-4 shows the baseline forecast for natural gas, which is expected to decline by 6% between 2010 and 2016. The sluggish economy and more efficient equipment in new construction and normal equipment replacement cycles account for this decline.

Figure 4-4 Commercial Natural Gas Baseline Forecast by End Use



Industrial Sector

Figure 4-5 presents the electricity baseline forecast at the end-use level for the industrial sector as a whole. Overall, industrial annual electricity use decreases from 8,429 GWh in 2010 to 7,732 GWh in 2016, an overall decrease of 8.3%, or 1.4% per year. This is largely driven by the economy and sluggish projections for recovery.

Figure 4-5 Industrial Electricity Baseline Forecast by End Use

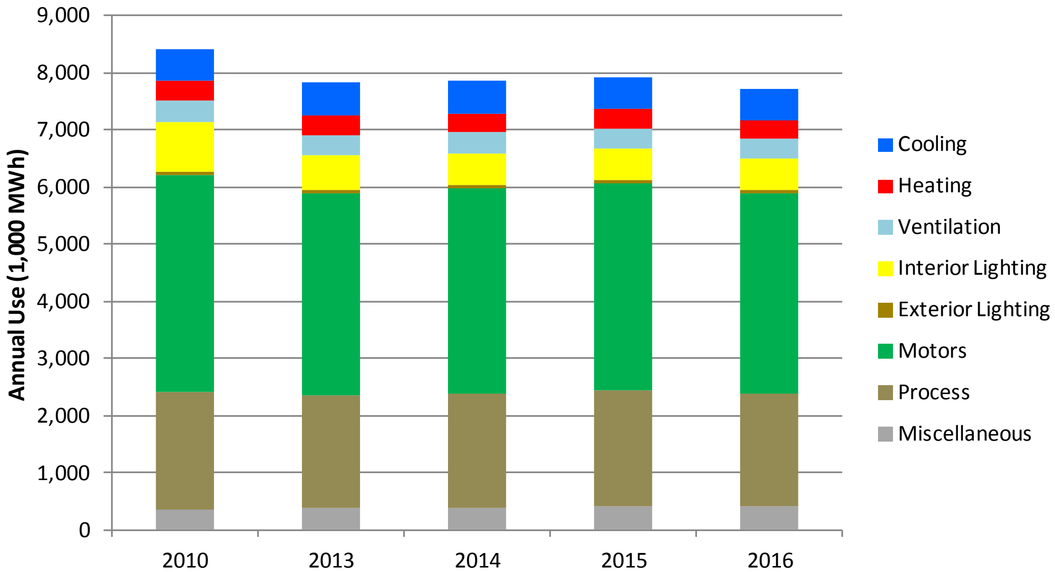
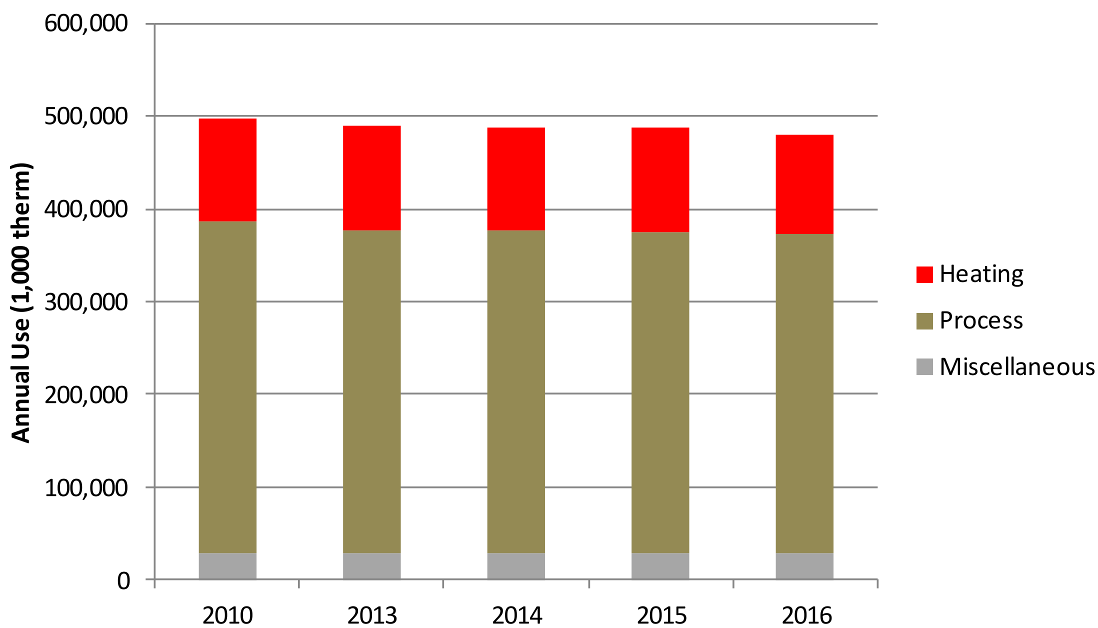


Figure 4-6 show a similar story for the industrial natural gas baseline forecast. The overall decrease from 2010 to 2016 is 3.2%, with an average decline of 0.5% per year.

Figure 4-6 Industrial Natural Gas Baseline Forecast by End Use



Baseline Forecast Summary

Table 4-1 and Figure 4-7 provide a summary of the baseline forecast for electricity by sector for the State of New Jersey. Overall, the forecast shows a slight to moderate decline in electricity use, due to a challenging macroeconomic environment and codes and standards.

Table 4-1 Electricity Baseline Forecast Summary (GWh)

Sector	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Residential	30,307	30,442	29,793	29,515	29,502	-2.7%	-0.4%
Commercial	40,123	36,511	35,964	35,699	35,797	-10.8%	-1.9%
Industrial	8,429	7,822	7,858	7,937	7,732	-8.3%	-1.4%
Total	**78,859**	**74,776**	**73,615**	**73,151**	**73,031**	**-7.4%**	**-1.3%**

Figure 4-7 Electricity Baseline Forecast Summary (GWh)

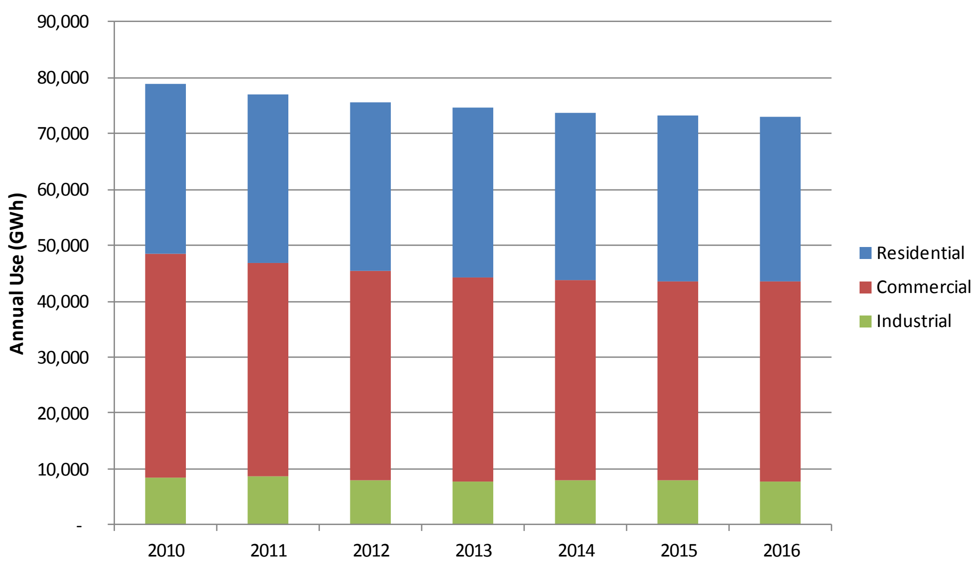
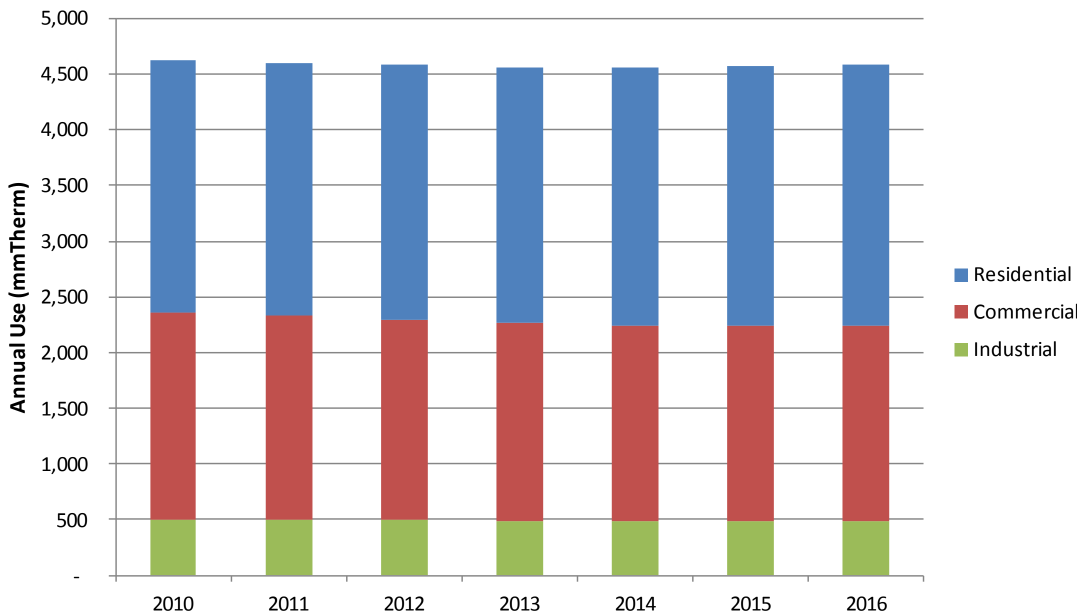


Table 4-2 and Figure 4-8 provide a summary of the natural gas baseline forecast by sector for New Jersey. Overall, the forecast is increasing slightly across all sectors.

Table 4-2 Natural Gas Baseline Forecast Summary (million therms)

Sector	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Residential	2,255	2,300	2,319	2,333	2,352	4.3%	0.7%
Commercial	1,867	1,771	1,753	1,748	1,756	-6.0%	-1.0%
Industrial	497	489	487	487	481	-3.2%	-0.5%
Total	**4,619**	**4,560**	**4,559**	**4,568**	**4,589**	**-0.7%**	**-0.1%**

Figure 4-8 Natural Gas Baseline Forecast Summary (million therms)



ENERGY EFFICIENCY MEASURES

The energy efficiency measures used in this analysis are detailed in Chapter 5 of the main report as well as Appendix B, C, and D. Table 5-1 summarizes the number of equipment and non-equipment measures evaluated for each segment within each sector.

Table 5-1 Number of Measures Evaluated

	Residential	Commercial	Industrial	Total Number of Measures
Equipment Measures Evaluated	165	179	125	**469**
Non-Equipment Measures Evaluated	49	94	87	**229**
Total Measures Evaluated	**214**	**273**	**212**	**699**

Appendix B gives results for the economic screening process by segment, vintage, end use and measure for the residential sector. Appendices C and D shows the equivalent information for the commercial and industrial sectors, respectively.

OVERALL ENERGY EFFICIENCY POTENTIAL

This chapter presents the overall results of the energy-efficiency analysis for the State of New Jersey. Key findings related to potentials are summarized below.

- **Achievable Low potential** forms a lower point on the range of achievable potential. Across all sectors, this metric is 5,678 BTU in 2013 and increases to 29,925 BTU by 2016. This represents 0.4% of the baseline forecast in 2013 and 2.3% in 2016.
- **Achievable High potential** forms the upper bound on the range of achievable potential. It is 11,799 BTU in 2013, which represents 0.9% of the baseline forecast. By 2016, the cumulative savings are 57,144 BTU, 4.4% of the baseline forecast, for an annual average of just over 1% per year.
- **Economic potential**, which reflects the savings when all cost-effective measures are taken, is 45,966 BTU in 2013. This represents 3.5% of the baseline energy forecast. By 2016, economic potential reaches 127,588 BTU, 9.9% of the baseline energy forecast.
- **Technical potential**, which reflects the adoption of all energy efficiency measures regardless of cost-effectiveness, is a theoretical upper bound on savings. In 2013, energy savings are 62,433 BTU, or 4.8% of the baseline energy forecast. By 2016, technical potential reaches 177,390 BTU, 13.7% of the baseline energy forecast.

Table 6-1 and Figure 6-1 summarize the energy-efficiency savings for the different levels of potential relative to the baseline forecast. Figure 6-2 displays the energy-efficiency forecasts. To combine the electric and natural gas energy efficiency potentials, kWhs and therms are both converted to a common unit, BTUs, in order to facilitate comparison.

Further detail can be found in Chapter 6 of the main report.

Table 6-1 Summary of Combined Electric and Natural Gas Energy Efficiency Potential

	2013	2014	2015	2016
Baseline Forecast (million BTU)	1,308,205	1,294,830	1,290,496	1,291,174
Cumulative Savings (million BTU)				
Achievable Low Potential	5,678	14,223	22,181	29,925
Achievable High Potential	11,799	28,680	43,780	57,144
Economic Potential	45,966	82,457	110,745	127,588
Technical Potential	62,433	109,812	148,665	177,390
Energy Savings (% of Baseline)				
Achievable Low Potential	0.4%	1.1%	1.7%	2.3%
Achievable High Potential	0.9%	2.2%	3.4%	4.4%
Economic Potential	3.5%	6.4%	8.6%	9.9%
Technical Potential	4.8%	8.5%	11.5%	13.7%

Figure 6-1 Summary of Combined Electric and Natural Gas Energy Savings

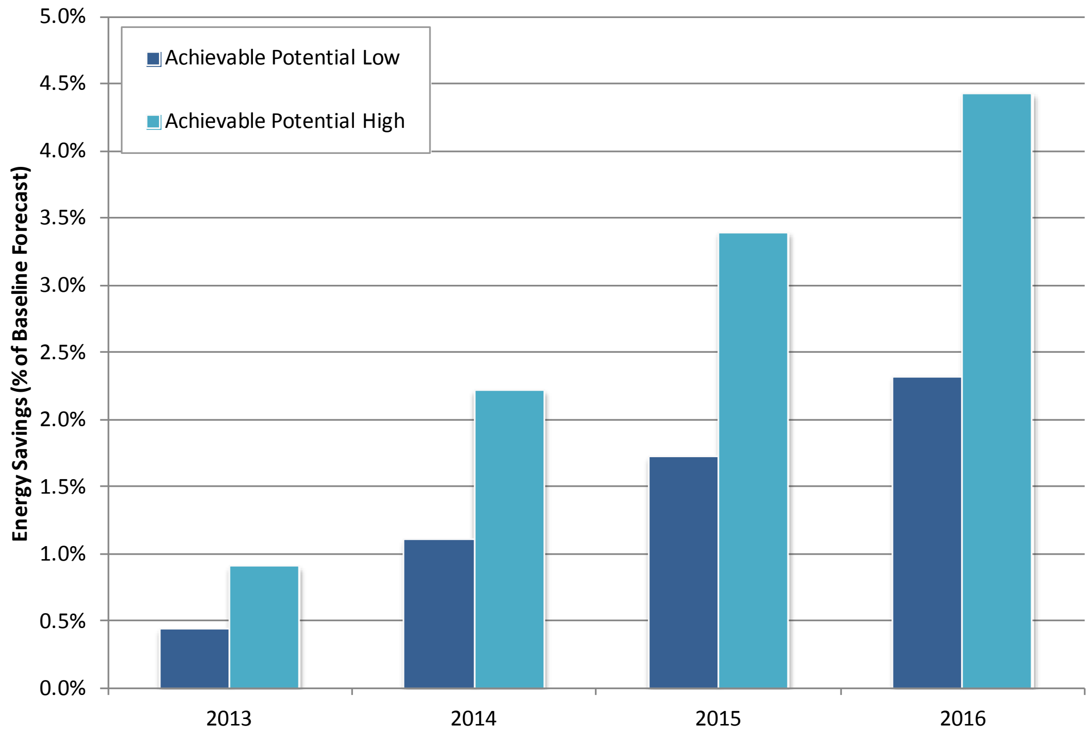
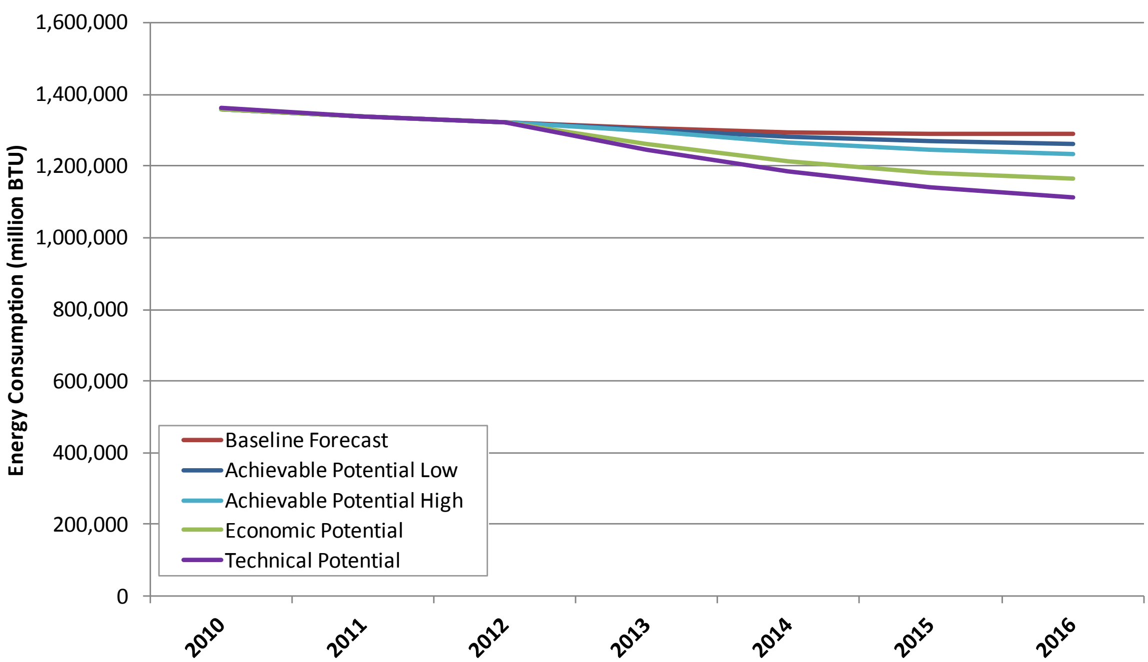


Figure 6-2 Combined Electric and Natural Gas Potential Forecasts (million BTU)



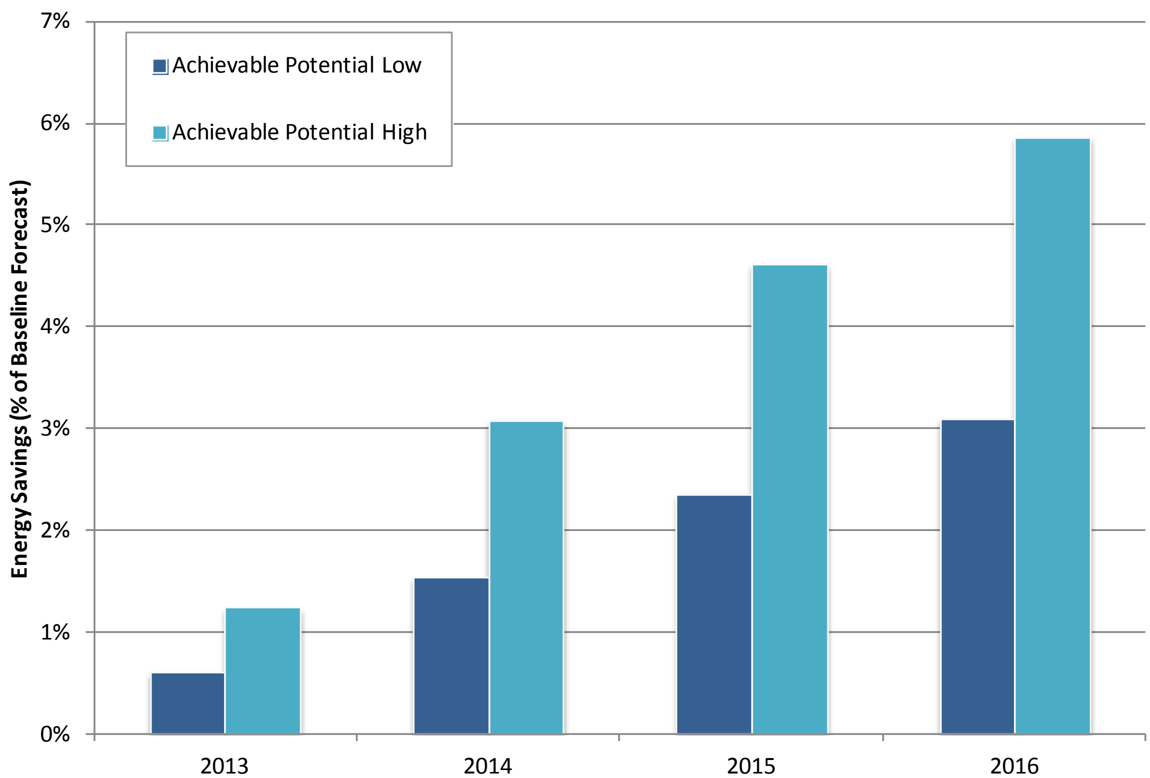
Electric Energy Efficiency – Overall Results

Table 6-2 and Figure 6-3 summarize the electric energy-efficiency savings for the different levels of potential relative to the baseline forecast.

Table 6-2 Summary of Electric Energy Efficiency Potential

	2013	2014	2015	2016
Baseline Forecast (GWh)	74,776	73,615	73,151	73,031
Cumulative Savings (GWh)				
Achievable Low Potential	446	1,125	1,718	2,255
Achievable High Potential	918	2,251	3,368	4,277
Economic Potential	3,418	6,255	8,316	9,369
Technical Potential	3,708	6,647	8,782	9,868
Energy Savings (% of Baseline)				
Achievable Low Potential	0.6%	1.5%	2.3%	3.1%
Achievable High Potential	1.2%	3.1%	4.6%	5.9%
Economic Potential	4.6%	8.5%	11.4%	12.8%
Technical Potential	5.0%	9.0%	12.0%	13.5%

Figure 6-3 Summary of Electric Energy Savings



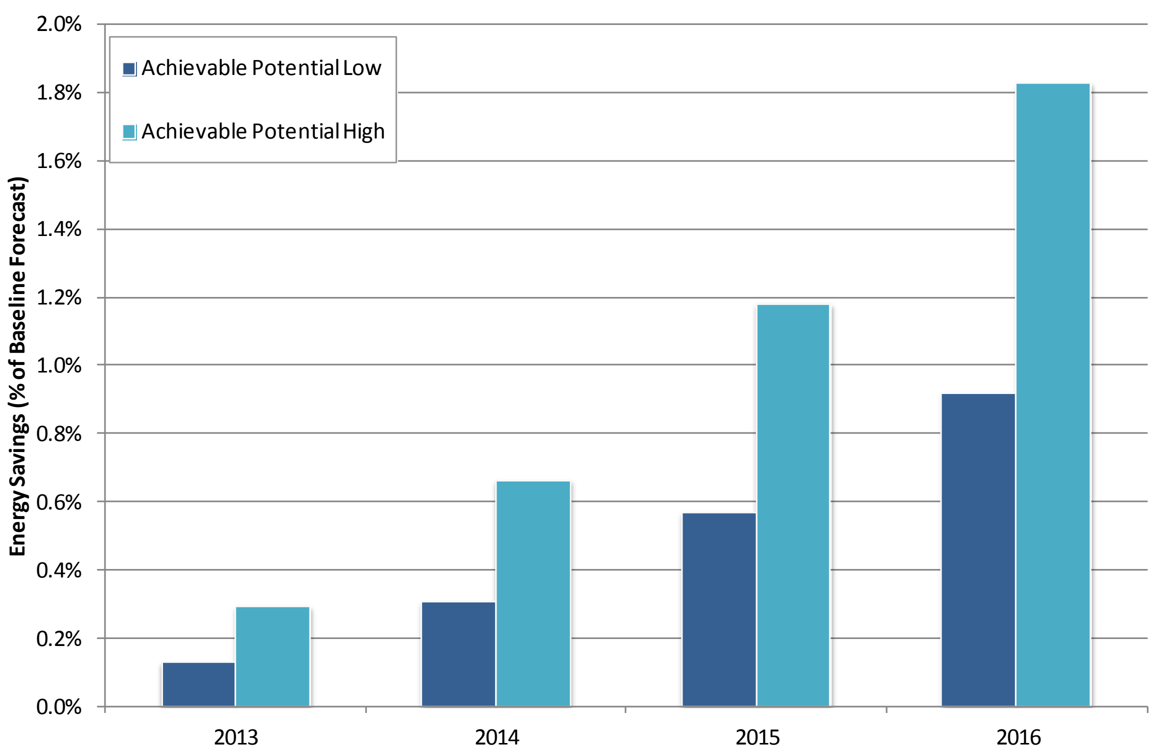
Natural Gas Energy Efficiency – Overall Results

Table 6-3 and Figure 6-4 summarize the natural gas energy-efficiency savings for the different levels of potential relative to the baseline forecast.

Table 6-3 Summary of Natural Gas Energy Efficiency Potential

	2013	2014	2015	2016
Baseline Forecast (1,000 therms)	4,560,186	4,558,750	4,568,218	4,588,711
Cumulative Savings (1,000 therms)				
Achievable Low Potential	5,906	14,004	26,066	42,208
Achievable High Potential	13,420	30,291	54,007	83,980
Economic Potential	70,161	111,704	159,709	208,193
Technical Potential	201,774	340,611	485,779	649,293
Energy Savings (% of Baseline)				
Achievable Low Potential	0.1%	0.3%	0.6%	0.9%
Achievable High Potential	0.3%	0.7%	1.2%	1.8%
Economic Potential	1.5%	2.5%	3.5%	4.5%
Technical Potential	4.4%	7.5%	10.6%	14.1%

Figure 6-4 Summary of Natural Gas Energy Savings



Overview of Energy Efficiency Potential by Sector and Fuel

Table 6-4 and Table 6-5 summarize the range of achievable potential by sector for electricity and natural gas respectively. The commercial sector accounts for the largest portion of the savings, followed by residential. The industrial sector contributes a relatively small amount of potential.

Table 6-4 Electric Achievable Potential by Sector (GWh)

	2013	2014	2015	2016
Achievable Low Savings (GWh)				
Residential	172.9	502.3	764.4	942.7
Commercial	248.6	578.9	872.6	1,189.3
Industrial	22.1	46.4	77.4	111.9
Total	**443.6**	**1,127.6**	**1,714.4**	**2,243.9**
Achievable High Savings (GWh)				
Residential	352.6	1,010.5	1,512.4	1,798.6
Commercial	513.0	1,150.4	1,696.4	2,243.5
Industrial	46.1	92.8	150.1	210.4
Total	**911.7**	**2,253.8**	**3,358.9**	**4,252.6**

Table 6-5 Natural Gas Achievable Potential by Sector (million therms)

	2013	2014	2015	2016
Achievable Low Savings (million therms)				
Residential	0.6	2.3	4.8	6.9
Commercial	5.2	11.4	20.6	34.3
Industrial	0.1	0.3	0.6	1.0
Total	**5.9**	**14.0**	**26.1**	**42.2**
Achievable High Savings (million therms)				
Residential	1.1	4.6	9.3	12.8
Commercial	12.0	25.1	43.5	69.2
Industrial	0.3	0.7	1.3	2.0
Total	**13.4**	**30.3**	**54.0**	**84.0**

CHAPTER | 7

ENERGY EFFICIENCY POTENTIAL BY SECTOR

This chapter presents the results of the energy efficiency analysis at the sector level. First, the residential potential is presented, followed by the commercial, and lastly, industrial. Within each sector, electric results are presented first and natural gas results second.

Further detail can be found in Chapter 7 of the main report. Year by year savings for electric energy, electric peak demand, and natural gas energy are available in Appendix F.

Residential Electricity Potential

Figure 7-1 depicts estimates for the four types of potential for the residential electricity sector. Figure 7-2 presents the residential achievable potential by end use. The measures that account for the majority of savings are:

- 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
- Behavioral feedback tools

Figure 7-1 Residential Electric Energy Efficiency Potential Savings

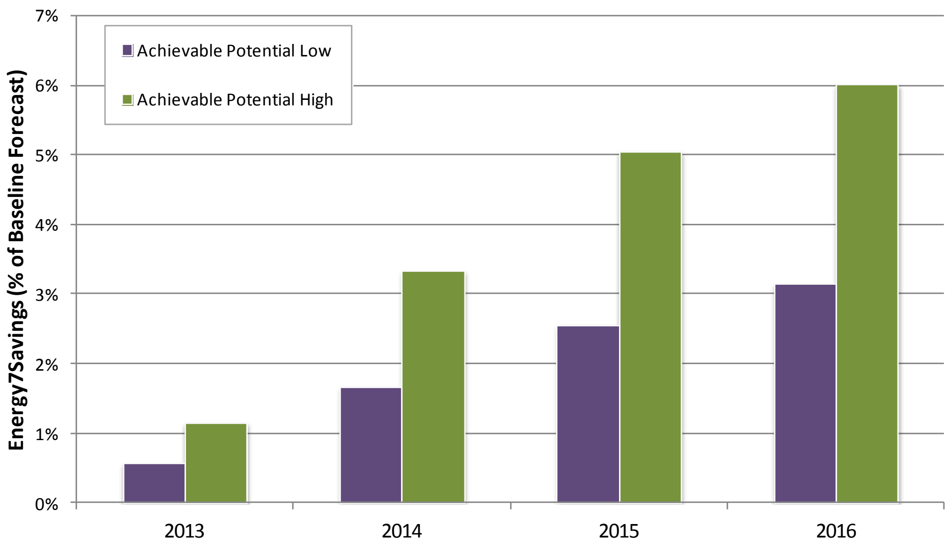
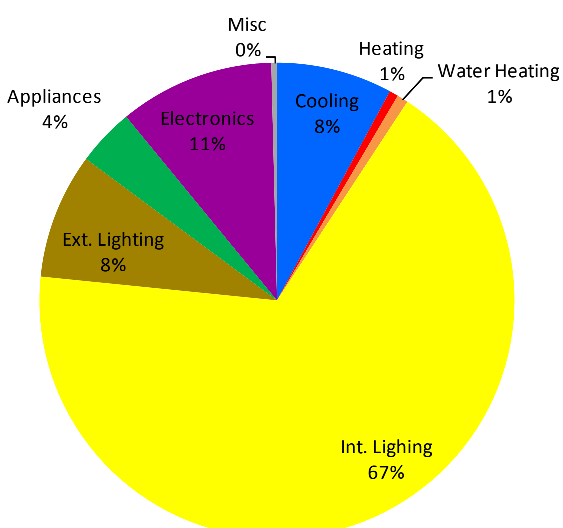


Figure 7-2 Residential Electric Achievable Low Potential by End Use in 2016



Residential Natural Gas Potential

Figure 7-3 presents estimates for the four types of potential for natural gas usage in the residential sector. Figure 7-4 presents the residential achievable potential by end use. The measures that account for the largest savings are:

- 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
- Behavioral feedback tools.

Figure 7-3 Residential Natural Gas Potential Savings

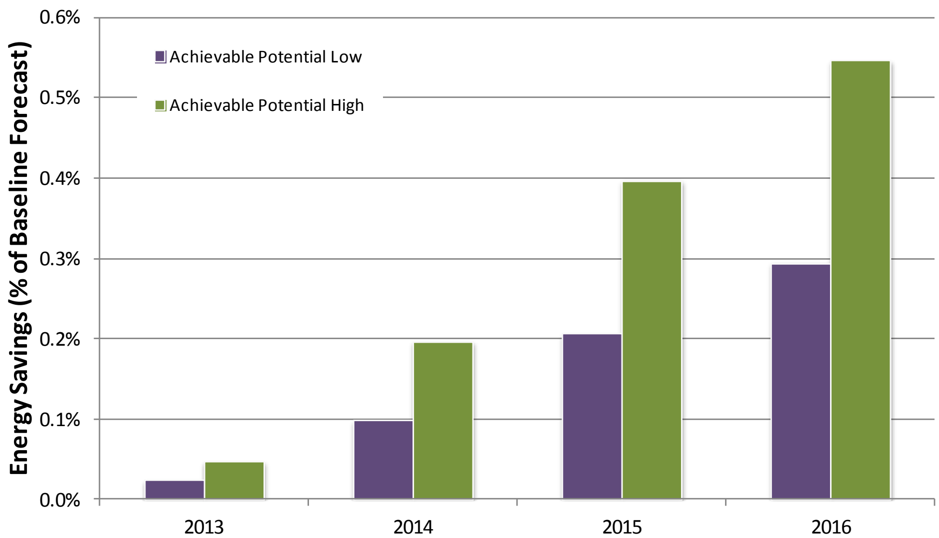
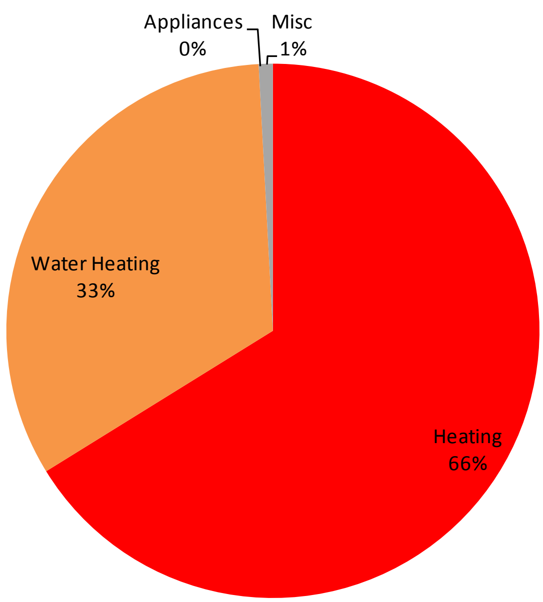


Figure 7-4 Residential Natural Gas Achievable Low Potential by End Use in 2016



Commercial Electricity Potential

Figure 7-5 presents estimates for the four types of potential for the residential electricity sector. Figure 7-6 shows the achievable potential savings by end use. The measures with the highest savings are:

- 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, decommissioning
- Efficient office equipment – computers, servers

Figure 7-5 Commercial Energy Efficiency Potential Savings

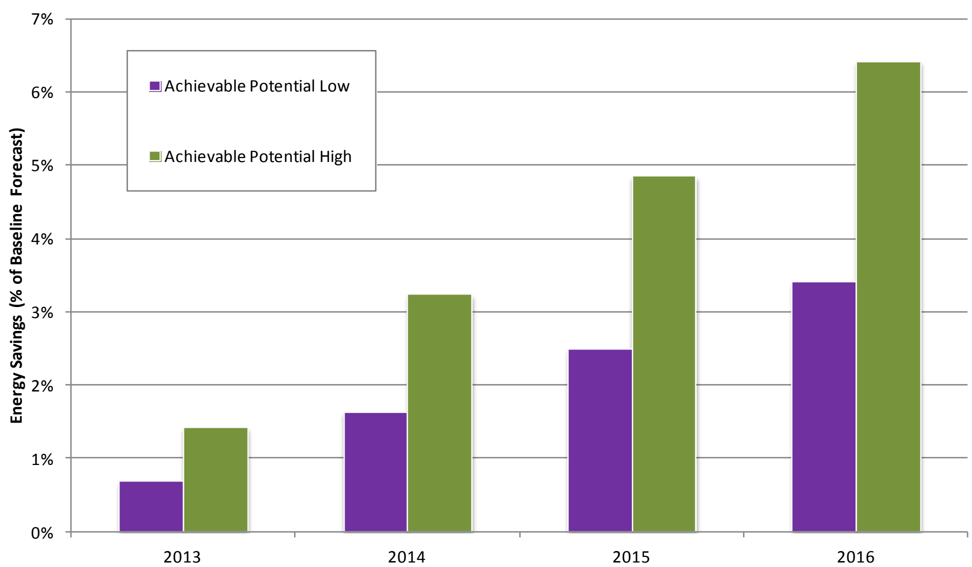
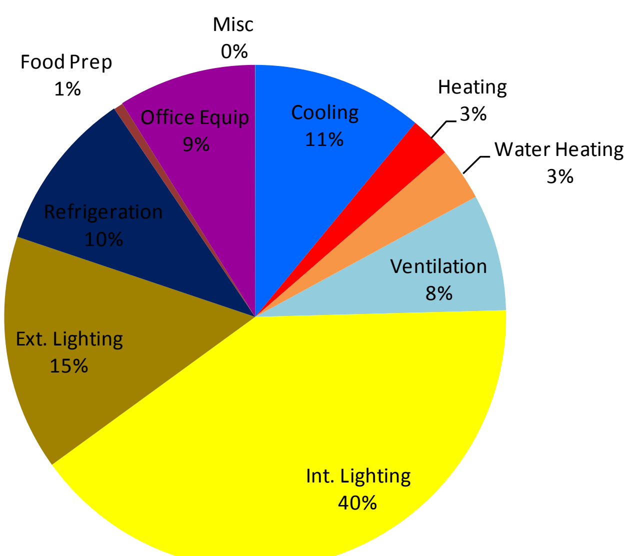


Figure 7-6 Commercial Achievable Low Potential Electricity Savings by End Use in 2016



Commercial Natural Gas Potential

Figure 7-7 presents the savings associated with the commercial natural gas achievable potential. Figure 7-8 below shows achievable potential savings by end use. The measures with the highest savings are:

- 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 7-7 Commercial Natural Gas Potential Savings

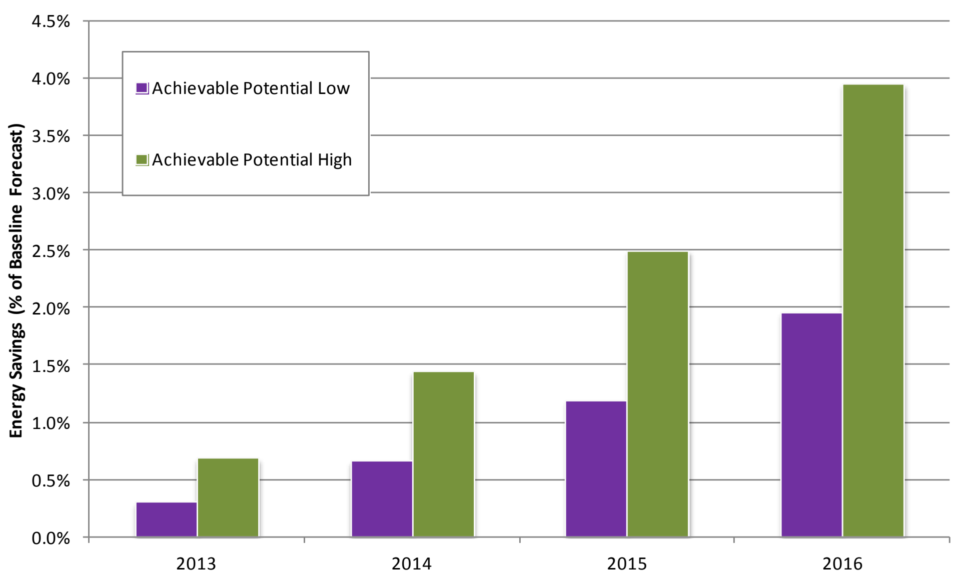
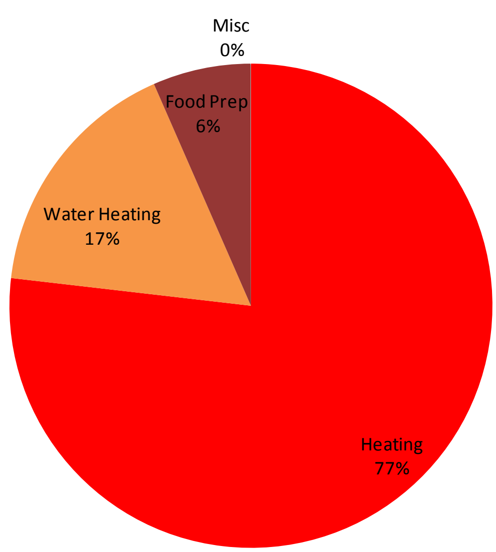


Figure 7-8 Commercial Natural Gas Achievable Low Potential Savings by End Use in 2016



Industrial Electricity Potential

The industrial sector in New Jersey only accounts for 11% of total energy consumption, but there are prime efficiency opportunities nonetheless. Figure 7-9 presents the potential savings for the industrial sector. Figure 7-10 illustrates the achievable potential savings by end use for the industrial sector. Measures with the largest savings are: motor drives and controls, process timers and controls, application optimization and control (fans, pumps, compressed air), efficient high bay lighting, efficient ventilation systems, energy management systems and programmable thermostats.

Figure 7-9 Industrial Electric Potential Savings

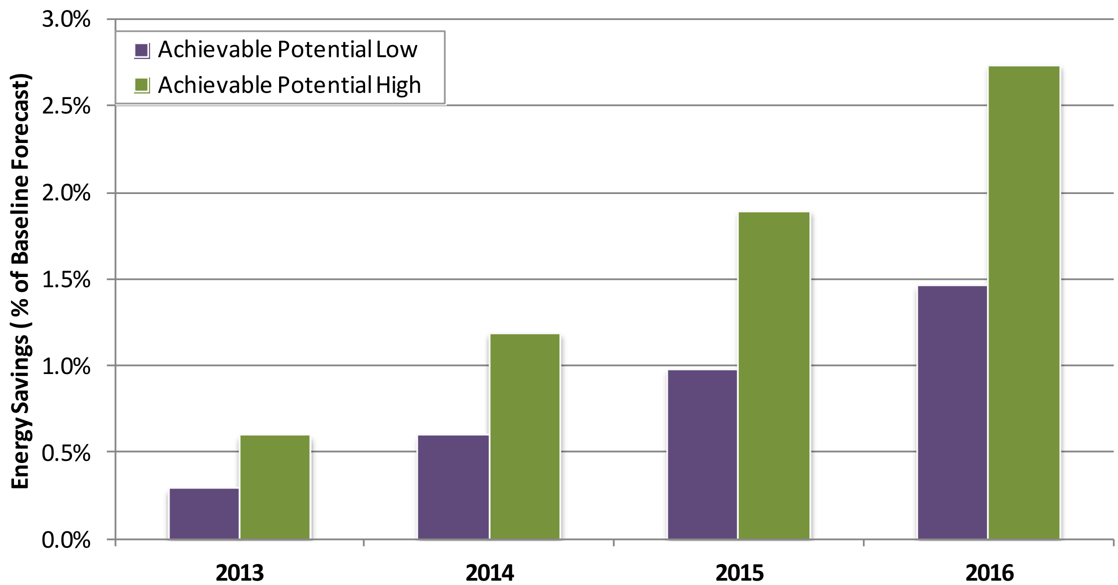
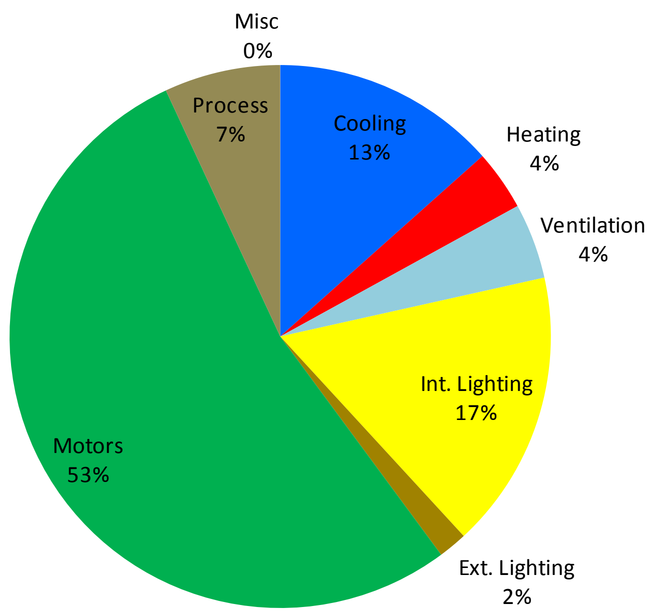


Figure 7-10 Industrial Achievable Low Electricity Potential Savings by End Use in 2016



Industrial Natural Gas Potential

Figure 7-11 present the savings for the various types of potential considered in this study for the industrial sector. Figure 7-12 illustrates the achievable potential savings by natural gas end use. Measures with the highest savings are: energy management systems, programmable thermostats, efficient boilers and furnaces, and insulation.

Figure 7-11 Industrial Natural Gas Potential Savings

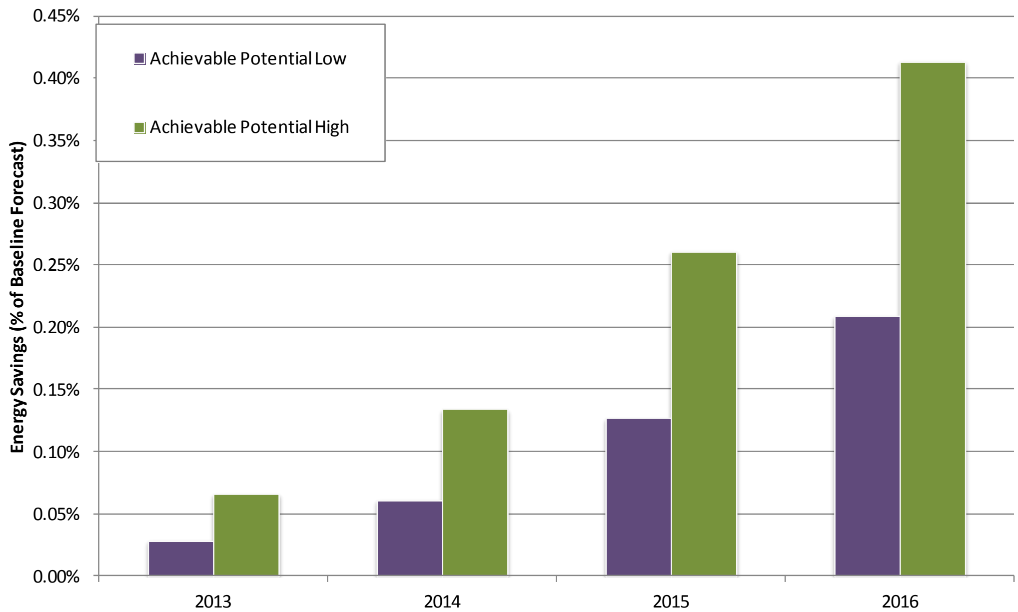
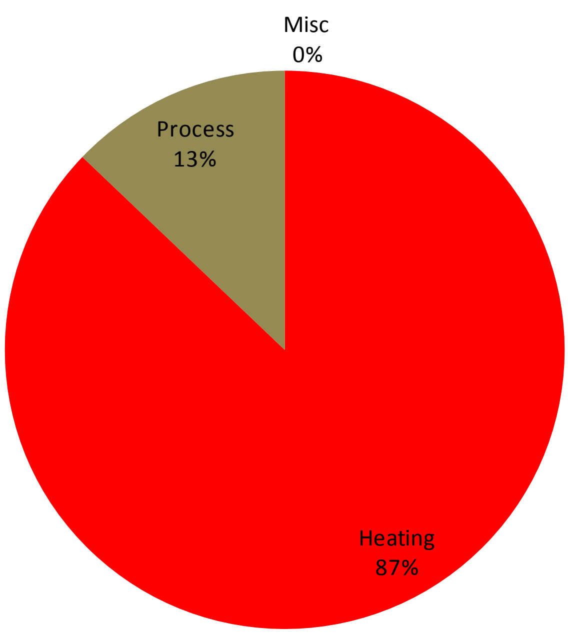


Figure 7-12 Industrial Natural Gas Achievable Low Potential Savings by End Use in 2016



CONCLUSIONS AND RECOMMENDATIONS

The results of this study reveal that significant energy efficiency opportunities exist in New Jersey, despite appliance and efficiency standards and a challenging macroeconomic environment. Our analysis has shown that New Jersey can realize an achievable range of reductions from 3.1% to 5.8% of the forecasted 2016 electric load, as well as 0.9% to 1.9% of the forecasted 2016 natural gas load, by implementing the measures presented in this report.

New Jersey's energy-efficiency programs have a strong legacy, ample market momentum, and a good platform to deliver joint electric and natural gas programs on a uniform, statewide basis. The suite of programs is being evaluated for the next four-year planning cycle, and based on this study, EnerNOC provides the following recommendations for the programs.

General Recommendations

- **Capitalize on joint electric and natural gas programs**: Since the New Jersey Office of Clean Energy manages the statewide energy efficiency portfolio in all New Jersey electric and natural gas utility territories, there is a good opportunity to create cross-cutting programs with uniform marketing messages for combined electric and natural gas savings opportunities for customers. This should allow for cost savings and administrative savings.
- **Increase focus on business programs:** Our study shows that the majority of energy efficiency potential exists in the commercial and industrial sectors. Historically, 60-70% of the New Jersey EE budgets have been allocated to residential programs. The NJOCE should consider increasing program efforts in the C&I sectors, not only to harvest larger EE savings, but to increase business competitiveness and decrease operating costs. Additionally, these sectors offer larger projects, which can be bundled more easily with creative financing and incentives.
- **Collaboration among stakeholders:** The discourse and information sharing between NJOCE, CEEEPS, stakeholders, implementers, and EnerNOC on this study has been efficient and transparent. Continuing this trend to cultivate a mutual understanding of continuous improvement and development is of paramount importance to the future success of programs. We recommend a continued interaction among these parties with regular touch points and workshops. Possible workshop topics are: technical resource manual with deemed measure databases; evaluation, measurement, and verification protocols; emerging technologies; innovative program strategies; periodic reviews of program results; and sharing success stories from individual programs or customers.

Residential Recommendations

- **Focus on lighting:** The largest share of achievable energy efficiency potential in the residential sector continues to come from CFLs. This is in spite of the forthcoming EISA standards that will reduce their per-unit savings compared to the new baseline. Also, New Jersey should focus strong attention on specialty lamps, as they are not addressed in the EISA standard.
- **Appliance recycling programs show considerable promise**: Recycling programs for appliances such as second refrigerators and room air conditioners show a considerable amount of potential, and should be considered for the New Jersey market. Consider ways to combine this offering with trade allies or market partners who are delivering other appliance related programs.

- **Develop whole-house opportunities:** Measures such as duct sealing, insulation, energy management systems, and programmable thermostats offer opportunities for a jointly delivered electric and natural gas program for whole-house savings.
- **Investigate behavioral feedback programs:** Behavioral change programs have traditionally not been formal components of energy efficiency portfolios, largely due to difficulties in measuring and attributing savings. However, there is mounting evidence that these programs do produce measurable savings and program administrators around the country are beginning to aim personalized messaging, energy reports, and other media at customers in an effort to reduce their energy usage. This study includes fairly conservative assumptions regarding savings, penetration rates, and program rollouts for a "behavioral feedback tools" measure for the residential sector. The measure passed the cost effectiveness screen and contributed meaningful savings to the portfolio. While the impacts are relatively small compared to other measures (< 1% of total energy savings), this is a new and emerging opportunity that may undergo meaningful change in the coming years. For New Jersey, this would be an interesting opportunity to keep in mind, as it is a program that lends itself well to the combined statewide electric and natural gas delivery framework.
- **Consider social media avenues for targeted program delivery:** As internet social media paradigms become the norm in today's wired society, companies like Groupon, Amazon Local Deals, and Living Social have assembled a nationwide network of businesses into a well-oiled, rebate-issuing machine. NJOCE should consider if there are opportunities to link their energy efficiency trade ally network to one of these companies to facilitate the target marketing, processing, and delivery of rebates. These vendors have sophisticated tracking systems and databases that may facilitate EM&V reporting on the back end as well.

Commercial and Industrial Recommendations

- **Aggressively pursue lighting savings:** The commercial sector in particular has significant savings potential in lighting, both interior, exterior, screw-in, and high bay. Savings are also available through occupancy sensors, timers, and energy management systems. NJOCE should strongly pursue lighting savings to accelerate the phase out of T12 fluorescent lighting. In particular, program efforts can help intercept building operators before they make purchase and stocking decisions that could lead to the hoarding of T12 lamps.
- **Create customized, multi-year plans for large, complex customers**: For large customers, strategic energy management (SEM)[11] initiatives can deliver savings over longer time horizons. This means a larger tracking and time commitment, but many jurisdictions are finding this to be a more effective method than a "one and done" installation and rebate approach. These relationships involve personalized plans, identification of metrics, goal-setting, technical assistance, and attention from dedicated account executives or energy coaches. This is similar to the current "Energy Savings Improvement Plan" program, and administrators should consider expanding or refining it to cater to New Jersey's largest C&I customers.
- **Focus industrial program efforts on motor controls and system optimizations***:* The savings for the industrial sector are all about control and optimization of motors and processes. Low-cost retrofits can often have significant energy impacts with minimal disruption of (and often times improvement of) business processes.
- **Target niches with segment specific programs***:* There are specific segments that offer considerable savings potential, but will not typically be reached by standard rebate programs and generic business programs. Consider whether it makes sense to initiate a specifically targeted program such as one for food preparation equipment in restaurants or refrigeration equipment in grocery stores.

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[11] Sometimes called Continuous Energy Improvement (CEI).

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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