New Jersey Energy Efficiency Market Potential Assessment

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Volume 2: Report

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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 2: Report**.

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

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[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.

- **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.

Abbreviations and Acronyms

Throughout the report we use several abbreviations and acronyms. Table 1-1 shows the abbreviation or acronym, along with an explanation.

Table 1-1 Explanation of Abbreviations and Acronyms

Acronym	Explanation
ACS	American Community Survey
AEO	Annual Energy Outlook forecast developed annual by the Energy Information Administration of the DOE
AHAM	Association of Home Appliance Manufacturers
B/C Ratio	Benefit to cost ratio
BEST	EnerNOC's Building Energy Simulation Tool
CEEEP	Rutgers University's Center for Energy, Economic and Environmental Policy
CAC	Central air conditioning
C&I	Commercial and industrial
CFL	Compact fluorescent lamp
DEEM	EnerNOC's Database of Energy Efficiency Measures
DEER	State of California Database for Energy-Efficient Resources
DSM	Demand side management
DR	Demand response
EE	Energy efficiency
EIA	Energy Information Administration
EISA	Energy Efficiency and Security Act of 2007
EPACT	Energy Policy Act of 2005
EPRI	Electric Power Research Institute
EUEA	Efficient Use of Energy Act
EUI	Energy-use index
HH	Household
HID	High intensity discharge lamps
HPWH	Heat pump water heater
LED	Light emitting diode lamp
LoadMAP	EnerNOC's Load Management Analysis and Planning™ tool
NJCEP	New Jersey Clean Energy Program
NJOCE	New Jersey Office of Clean Energy
NWPCC	Northwest Power and Conservation Council
RTU	Roof top unit
Sq. ft.	Square feet
TRC	Total resource cost
UEC	Unit energy consumption

CHAPTER 2

ANALYSIS APPROACH AND DATA DEVELOPMENT

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

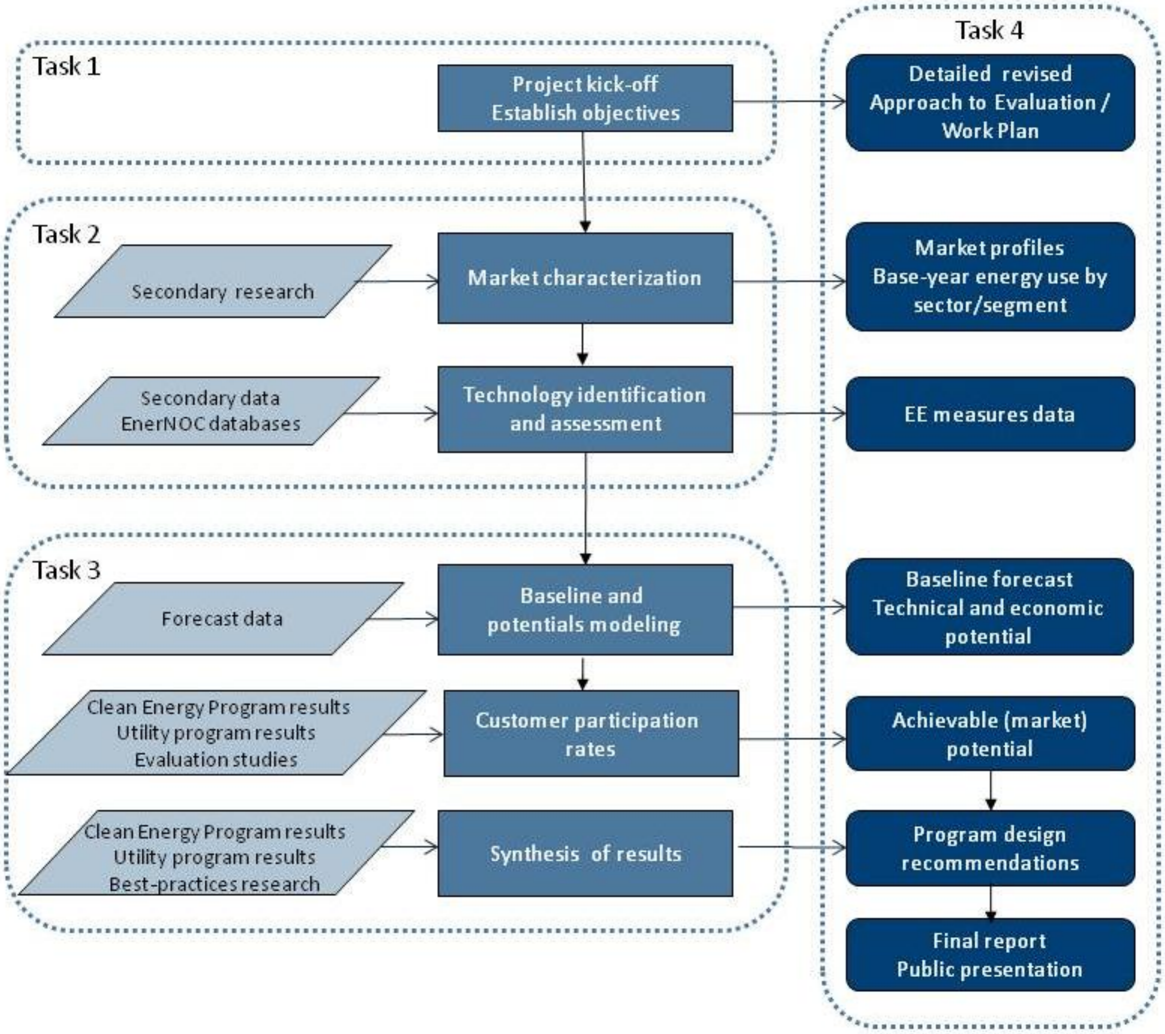
Analysis Approach

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 throughout the remainder of this chapter.

Figure 2-1 Overview of Analysis Approach



LoadMAP Model

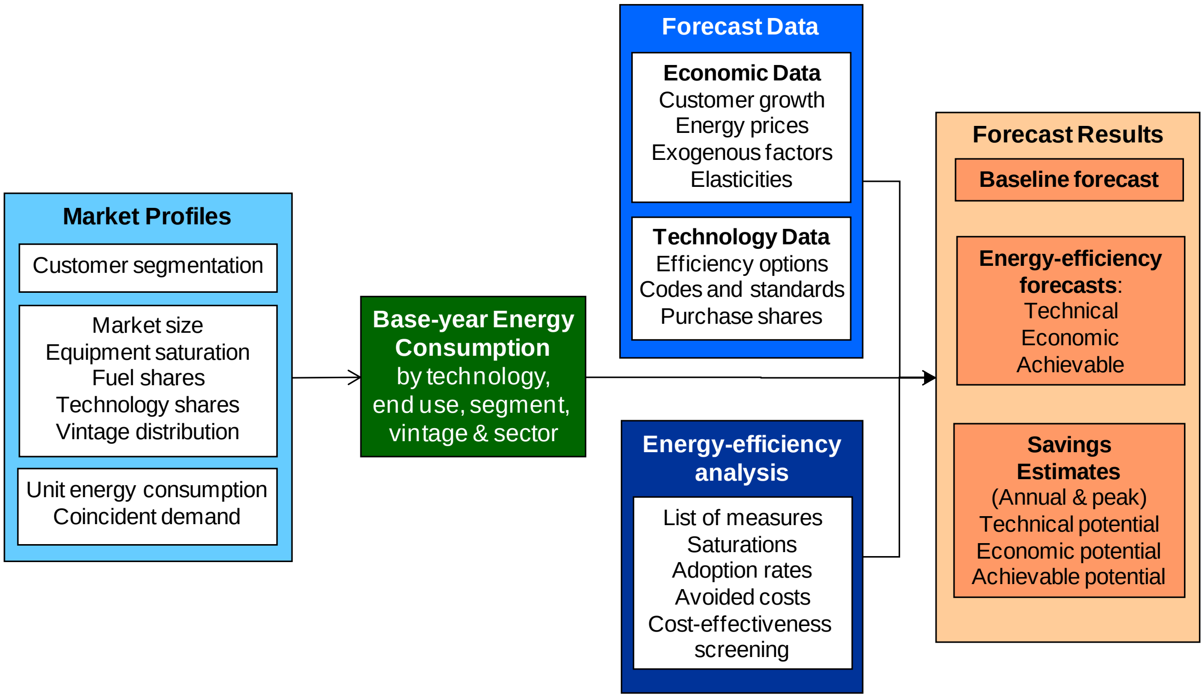
We used EnerNOC's Load Management Analysis and Planning tool (LoadMAP^{TM}) version 3.0 to develop both the baseline forecast and the estimates of energy efficiency potential. EnerNOC developed LoadMAP in 2007 and has enhanced it over time, using it for the EPRI National Potential Study and numerous utility-specific forecasting and potential studies. Built in Excel, the LoadMAP framework (see Figure 2-2) is both accessible and transparent and has the following key features.

- Embodies the basic principles of rigorous end-use models (such as EPRI's REEPS and COMMEND) but in a more simplified, accessible form.
- Includes stock-accounting algorithms that treat older, less efficient appliance/equipment stock separately from newer, more efficient equipment. Equipment is replaced according to the measure life and appliance vintage distributions defined by the user.
- Balances the competing needs of simplicity and robustness by incorporating important modeling details related to equipment saturations, efficiencies, vintage, and the like, where market data are available, and treats end uses separately to account for varying importance and availability of data resources.
- Isolates new construction from existing equipment and buildings and treats purchase decisions for new construction and existing buildings separately.

- Uses a simple logic for appliance and equipment decisions. Other models available for this purpose embody complex decision choice algorithms or diffusion assumptions, and the model parameters tend to be difficult to estimate or observe and sometimes produce anomalous results that require calibration or even overriding. The LoadMAP approach allows the user to drive the appliance and equipment choices year by year directly in the model. This flexible approach allows users to import the results from diffusion models or to input individual assumptions. The framework also facilitates sensitivity analysis.
- Includes appliance and equipment models customized by end use. For example, the logic for lighting is distinct from refrigerators and freezers.
- Can accommodate various levels of segmentation. Analysis can be performed at the sector level (e.g., total residential) or for customized segments within sectors (e.g., housing type or income level).

Consistent with the segmentation scheme and the market profiles we describe below, the LoadMAP model provides forecasts of baseline energy use by sector, segment, end use, and technology for existing and new buildings. It also provides forecasts of total energy use and energy-efficiency savings associated with the four types of potential.[2]

Figure 2-2 LoadMAP Analysis Framework



Market Characterization

In order to estimate the savings potential from energy-efficient measures, it is necessary to understand how much energy is used today and what equipment is currently being used. This characterization begins with a segmentation of New Jersey's energy footprint to quantify energy use by sector, segment, fuel, end-use application, and the current set of technologies used. We incorporate information from the secondary research sources to advise the market characterization.

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[2] The model computes energy and peak-demand forecasts for each type of potential for each end use as an intermediate calculation. Annual-energy and peak-demand savings are calculated as the difference between the value in the baseline forecast and the value in the potential forecast (e.g., the technical potential forecast).

Segmentation for Modeling Purposes

The market assessment first defined the market segments (building types, end uses and other dimensions) that are relevant in New Jersey. The segmentation scheme for this project is presented in Table 2-1.

Table 2-1 Overview of Segmentation Scheme for Potentials Modeling

Market Dimension	Segmentation Variable	Dimension Examples
1	Sector	Residential, commercial, industrial
2	Building type	Residential (housing type, income level, ownership) Commercial (Office, Restaurant, Retail, etc.) Industrial (Chemicals & Pharmaceuticals, Paper Products, Food Products, and Other industrial)
3	Vintage	Existing and new construction
4	Fuel	Electricity, natural gas
5	End uses	Cooling, lighting, water heat, motors, etc. (as appropriate by sector)
6	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, motors by application, etc.
7	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

Following this scheme, the residential sector was segmented as described below, starting with customer segments by building type:

- Single family (including duplexes)
- Limited income single family (including duplexes)
- Multi family renters
- Limited income multi family renters
- Multi family owners
- Limited income multi family owners

For the purposes of this study, Limited Income refers to homes having income below $35,000 per year, or approximately twice the federal poverty level.[3]

In addition to segmentation by housing type, we identified the set of end uses and technologies that are appropriate for New Jersey. These are shown in Table 2-2 and Table 2-3.

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[3] This definition aligns with categories in available data sources from the US Department of Energy. It is also similar to the qualification criteria for households to participate in the New Jersey Comfort Partners program, which are currently set at 225% of the federal poverty level, and change based on household size. See: http://www.njcleanenergy.com/residential/programs/comfort-partners/comfort-partners

Table 2-2 Residential Electric End Uses and Technologies

End Use	Technology
Cooling	Central Air Conditioning (CAC)
Cooling	Room Air Conditioning (RAC)
Cooling/Heating	Air-Source Heat Pump
Cooling/Heating	Geothermal Heat Pump
Space Heating	Electric Resistance
Space Heating	Electric Furnace
Water Heating	Water Heater <= 55 gal
Water Heating	Water Heater > 55 gal
Interior Lighting	Screw-in Lamps
Interior Lighting	Linear Fluorescent Lamps
Exterior Lighting	Screw-in Lamps
Appliances	Clothes Washer
Appliances	Clothes Dryer
Appliances	Dishwasher
Appliances	Refrigerator
Appliances	Freezer
Appliances	Second Refrigerator
Appliances	Stove
Appliances	Microwaves
Electronics	Personal Computers
Electronics	Monitor
Electronics	Laptops
Electronics	TVs
Electronics	Printer/Fax/Copier
Electronics	Set-top Boxes/DVR
Electronics	Devices and Gadgets
Miscellaneous	Pool Pump
Miscellaneous	Pool Heater
Miscellaneous	Hot Tub / Spa
Miscellaneous	Well Pump
Miscellaneous	Furnace Fan
Miscellaneous	Miscellaneous

Table 2-3 Residential Natural Gas End Uses and Technologies

End Use	Technology
Space Heating	Furnace
Space Heating	Boiler
Space Heating	Other Heating
Water Heating	Water Heater <= 55 gal
Water Heating	Water Heater > 55 gal
Appliances	Clothes Dryer
Appliances	Stove/Oven
Miscellaneous	Pool Heater
Miscellaneous	Hot Tub / Spa
Miscellaneous	Miscellaneous

For the commercial sector, it is useful to analyze the segments based on the unique characteristics of the building type. For this study, we used the following building types.

- Small Office—all types of offices, including medical/dental offices
- Large Office—all types of offices, including large government facilities
- Restaurant—fast-food, sit-down and cafeteria-style restaurants
- Retail—retail establishments such as small boutiques, and large box retailers
- Grocery—convenience stores, small markets, and supermarkets
- College—colleges, universities and technical colleges
- School—primary and secondary schools
- Health—hospitals and nursing homes
- Lodging—motels, hotels, resorts and small inns
- Warehouse—storage facilities, refrigerated and unrefrigerated
- Miscellaneous—all remaining building types, such as police stations, parking garages, public assembly, amusement parks, etc.

In addition to segmentation by building type, we identified the set of end uses and technologies that are appropriate for New Jersey. Table 2-4 and Table 2-5 list the end uses and technologies used in this study.

Table 2-4 Commercial Electric End Uses and Technologies

End Use	Technology
Cooling	Air-Cooled Chiller
Cooling	Water-Cooled Chiller
Cooling	Roof top AC
Cooling	Other Cooling
Cooling/Heating	Air-Source Heat Pump
Cooling/Heating	Geothermal Heat Pump
Heating	Electric Room Heat
Heating	Electric Furnace
Ventilation	Ventilation
Water Heating	Water Heater
Interior Lighting	Screw-in
Interior Lighting	High-Bay Fixtures
Interior Lighting	Linear Fluorescent
Exterior Lighting	Screw-in
Exterior Lighting	HID
Exterior Lighting	Linear Fluorescent
Refrigeration	Walk-in Refrigerator
Refrigeration	Reach-in Refrigerator
Refrigeration	Glass Door Display
Refrigeration	Open Display Case
Refrigeration	Icemaker
Refrigeration	Vending Machine
Food Preparation	Oven
Food Preparation	Fryer
Food Preparation	Dishwasher
Food Preparation	Hot Food Container
Office Equipment	Desktop Computer
Office Equipment	Laptop
Office Equipment	Server
Office Equipment	Monitor
Office Equipment	Printer/Copier/Fax
Office Equipment	POS Terminal
Miscellaneous	Non-HVAC Motors
Miscellaneous	Pool Pump
Miscellaneous	Pool Heater
Miscellaneous	Miscellaneous

Table 2-5 Commercial Natural Gas End Uses and Technologies

End Use	Technology
Heating	Furnace
Heating	Boiler
Heating	Other Heating
Water Heating	Water Heater
Food Preparation	Oven
Food Preparation	Fryer
Food Preparation	Broiler
Food Preparation	Griddle
Food Preparation	Range
Food Preparation	Steamer
Miscellaneous	Pool Heater
Miscellaneous	Miscellaneous

For the industrial sector, the study isolated the top few industries in New Jersey by energy consumption, which accounted for 57% of the total 2010 industrial electricity sales and 65% of natural gas sales. The remaining group of industrial customers is considered in aggregate as "other industrial." While the commercial sector has a relatively small set of building types that have relatively uniform characteristics, the sheer number of unique industry types makes it infeasible to perform a deep dive into all but the largest ones. This results in larger "other" or "miscellaneous" segment than that which exists in the commercial sector. Nonetheless, these "other" industries typically have energy use characteristics that are similar enough to perform an accurate potential assessment.

The resulting segmentation is as follows:

- Chemical and Pharmaceutical Products (analyzed together due to similar allocation of energy within end uses and processes)
- Paper Products
- Food Products
- Other Industrial

In addition to segmentation by industry, we identified the set of end uses and technologies that are appropriate for New Jersey. These are shown in Table 2-6 and Table 2-7.

Table 2-6 Industrial Electric End Uses and Technologies

End Use	Technology
Cooling	Air-Cooled Chiller
Cooling	Water-Cooled Chiller
Cooling	Roof top AC
Cooling	Other Cooling
Cooling/Heating	Air-Source Heat Pump
Cooling/Heating	Geothermal Heat Pump
Heating	Electric Room Heat
Heating	Electric Furnace
Ventilation	Ventilation
Water Heating	Water Heater
Interior Lighting	Screw-in
Interior Lighting	High-Bay Fixtures
Interior Lighting	Linear Fluorescent
Exterior Lighting	Screw-in
Exterior Lighting	HID
Exterior Lighting	Linear Fluorescent
Motors	Pumps
Motors	Fans & Blowers
Motors	Compressed Air
Motors	Material Handling
Motors	Material Processing
Motors	Other Motors
Process	Process Heating
Process	Process Cooling and Refrigeration
Process	Electro-Chemical Processes
Process	Other Process
Miscellaneous	Miscellaneous

Table 2-7 Industrial Natural Gas End Uses and Technologies

End Use	Technology
Heating	Furnace
Heating	Boiler
Heating	Other Heating
Process	Process Heating
Process	Process Boiler
Process	Process Cooling
Process	Other Process
Miscellaneous	Miscellaneous

With the segmentation scheme defined, we then performed a high-level market characterization of electricity and natural gas sales in the base year to allocate sales to each customer segment. We used various data sources to identify the annual sales in each customer segment, as well as the market size for each segment. This information provided control totals at a sector level for calibrating the LoadMAP model to known data for the base-year.

Market Profiles

The next step was to develop market profiles for each sector, customer segment, end use, and technology. A market profile includes the following elements:

- **Market size** is a representation of the number of customers in the segment. For the residential sector, it is number of households. In the commercial sector, it is floor space measured in square feet. For the industrial sector, it is number of employees.
- **Saturations** define the fraction of homes and square feet with the various technologies. (e.g., homes with electric space heating, commercial floor space with gas water heating).
- **UEC (unit energy consumption) or EUI (energy-use index)** describes the amount of energy consumed in 2010 by a specific technology in buildings that have the technology. For electricity, UECs are expressed in kWh/household for the residential sector, and EUIs are expressed in kWh/square foot or kWh/employee for the commercial and industrial sectors, respectively.
- **Intensity** for the residential sector represents the average energy use for the technology across all homes in 2010. It is computed as the product of the saturation and the UEC and is defined as kWh/household for electricity. For the commercial and industrial sectors, intensity, computed as the product of the saturation and the EUI, represents the average use for the technology across all floor space or all employees in 2010.
- **Usage** is the annual energy use by a technology/end use in the segment. It is the product of the market size and intensity and is quantified in GWh for electricity and MMTherms for natural gas.

The market assessment results and the market profiles are presented in Chapter 3.

Baseline Forecast

The next step was to develop the baseline forecast of annual electricity and natural gas usage for 2010 through 2016 by customer segment and end use without new utility programs or naturally occurring efficiency. The end-use forecast does include the relatively certain impacts of codes and standards that will unfold over the study timeframe. All such mandates that were defined as of January 2012 are included in the baseline. The baseline forecast is the foundation for the analysis of savings from future EE efforts as well as the metric against which potential savings are measured.

Inputs to the baseline forecast include:

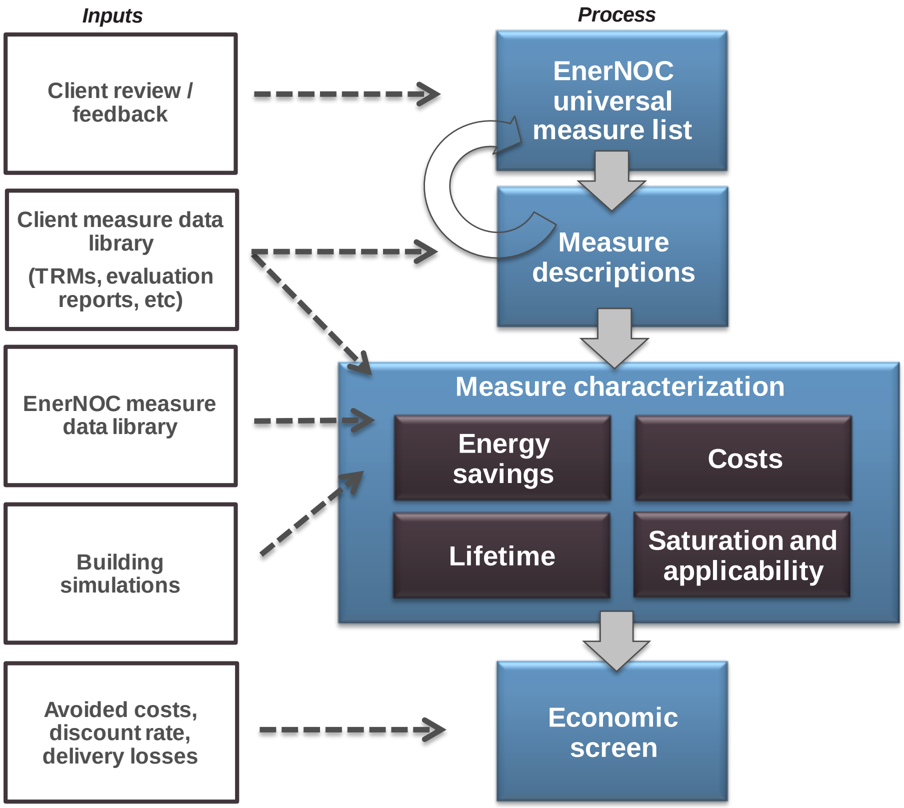
- Current economic growth forecasts (i.e., customer growth, income growth)
- Electricity and natural gas price forecasts
- Trends in fuel shares and equipment saturations
- Existing and approved changes to building codes and equipment standards

We present the results of the baseline forecast development in Chapter 4.

Energy Efficiency Measure Analysis

This section describes the framework used to assess the savings, costs, and other attributes of energy-efficiency measures. These characteristics form the basis for measure-level cost-effectiveness analyses as well as for determining measure-level savings. For all measures, EnerNOC assembled information to reflect equipment performance, incremental costs, and equipment lifetimes. We used this information, along with New Jersey's avoided costs data, in the economic screen to determine economically feasible measures. Figure 2-3 outlines the framework for measure analysis.

Figure 2-3 Approach for Measure Assessment



The framework for assessing savings, costs, and other attributes of energy efficiency measures involves identifying the list of energy efficiency measures to include in the analysis, determining their applicability to each market sector and segment, fully characterizing each measure, and performing cost-effectiveness screening.

We compiled a robust list of energy efficiency measures for each customer sector, drawing upon the New Jersey program experience and protocols, EnerNOC's own measure databases and building simulation models, and secondary sources. This universal list of EE measures covers all major types of end-use equipment, as well as devices and actions to reduce energy consumption. If considered today, some of these measures would not pass the economic screens initially, but may pass in future years as a result of lower projected equipment costs or higher avoided costs.

The selected measures are categorized into two types according to the LoadMAP taxonomy: equipment measures and non-equipment measures.

- **Equipment measures** are efficient energy-consuming pieces of equipment that save energy by providing the same service with a lower energy requirement than a standard unit. An example is an ENERGY STAR refrigerator that replaces a standard efficiency refrigerator. For equipment measures, many efficiency levels may be available for a given technology, ranging from the baseline unit (often determined by code or standard) up to the most efficient product commercially available. For instance, in the case of central air conditioners, this list begins with the current federal standard SEER 13 unit and spans a broad spectrum up to a maximum efficiency of a SEER 21 unit.
- **Non-equipment measures** save energy by reducing the need for delivered energy, but do not involve replacement or purchase of major end-use equipment (such as a refrigerator or air conditioner). An example would be a programmable thermostat that is pre-set to run heating and cooling systems only when people are home. Non-equipment measures can

apply to more than one end use. For instance, addition of wall insulation will affect the energy use of both space heating and cooling. Non-equipment measures typically fall into one of the following categories:

- Building shell (windows, insulation, roofing material)
- Equipment controls (thermostat, energy management system)
- Equipment maintenance (cleaning filters, changing setpoints)
- Whole-building design (building orientation, passive solar lighting)
- Lighting retrofits (included as a non-equipment measure because retrofits are performed prior to the equipment's normal end of life)
- Displacement measures (ceiling fan to reduce use of central air conditioners)
- Commissioning and retrocommissioning

We developed a preliminary list of EE measures, which was distributed to the BPU and CEEEP for review. The list was finalized after incorporating comments, and can be found in Chapter 5 of this report.

Once we assembled the list of EE measures, the project team assessed their energy-saving characteristics. For each measure we also characterized incremental cost, service life, and other performance factors. Following the measure characterization, we performed an economic screening of each measure, which serves as the basis for developing the economic and achievable potential.

Representative Measure Data Inputs

To provide an example of the measure data, Table 2-8 and Table 2-9 present samples of the detailed data inputs behind both equipment and non-equipment measures, respectively, for the case of residential CAC in single-family homes. Table 2-8 displays the various efficiency levels available as equipment measures, as well as the corresponding useful life, energy usage, and cost estimates. The columns labeled On Market and Off Market reflect equipment availability due to codes and standards or the entry of new products to the market.

Table 2-8 Sample Equipment Measures for Central Air Conditioning – Single Family Home

Efficiency Level	Useful Life	Equipment Cost	Energy Usage(kWh/yr)	On Market	Off Market
SEER 13	15	$1,640	2,483	2010	n/a
SEER 14 (ENERGY STAR)	15	$1,766	2,278	2010	n/a
SEER 15 (CEE Tier 2)	15	$1,892	2,202	2010	n/a
SEER 16 (CEE Tier 3)	15	$2,018	2,137	2010	n/a
SEER 17 (Ductless Mini-split)	15	$3,863	2,083	2010	n/a
SEER 21	15	$3,784	1,686	2010	n/a

Table 2-9 lists some of the non-equipment measures applicable to CAC in an existing single-family home. All measures are evaluated for cost effectiveness based on the lifetime benefits relative to the cost of the measure. The total savings and costs are calculated for each year of the study and depend on the base year saturation of the measure, the applicability[4] of the measure, and the savings as a percentage of the relevant energy end uses.

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[4] The applicability factors take into account whether the measure is applicable to a particular building type and whether it is feasible to install the measure. For instance, attic fans are not applicable to homes where there is insufficient space in the attic or there is no attic at all.

Table 2-9 Sample Non-Equipment Measures – Single Family Home, Existing

End Use	Measure	Saturation in 2010[5]	Applica-bility	Lifetime (yrs)	Measure Installed Cost	Energy Savings (%)
Cooling	Central AC - Maintenance	37%	100%	4	$125	9.9%
Cooling	Repair and Sealing – Ducting	16%	50%	18	$500	8.8%
Cooling	Insulation - Ceiling	16%	72%	20	$1000	15.5%
Cooling	Windows – Install Reflective Film	20%	45%	10	$895	26.2%
Cooling	Windows - ENERGY STAR	47%	90%	25	$7500	7.2%
Cooling	Thermostat - Clock/Programmable	54%	56%	12	$73	7.3%

Screening Measures for Cost-Effectiveness

Only measures that are cost-effective are included in economic and achievable potential. Therefore, for each individual measure, LoadMAP performs an economic screen. This study uses the TRC test that compares the lifetime energy benefits (and peak demand for electricity) of each applicable measure with its incremental installed cost, including material and labor. There is no program administration cost considered in this analysis, and therefore, no specific program delivery methods or mechanisms are assumed. The lifetime benefits are calculated by multiplying the annual energy and demand savings for each measure by all appropriate avoided costs for each year, and discounting the dollar savings to the present value equivalent. The analysis uses each measure's values for savings, costs, and lifetimes that were developed as part of the measure characterization process described above.

The LoadMAP model performs this screening dynamically, taking into account changing savings and cost data over time. Thus, some measures pass the economic screen for some — but not all — of the years in the forecast.

It is important to note the following about the economic screen:

- The economic evaluation of every measure in the screen is conducted relative to a baseline condition. For instance, in order to determine the kilowatt-hour (kWh) savings potential of a measure, kWh consumption with the measure applied must be compared to the kWh consumption of a baseline condition.
- The economic screening was conducted only for measures that are applicable to each building type and vintage; thus if a measure is deemed to be irrelevant to a particular building type and vintage, it is excluded from the respective economic screen.

Table 2-10 shows the results of the economic screen for CAC and select other measures. Throughout the time frame shown, the most cost-effective CAC option is SEER 16. For pool heaters, the heat pump unit becomes cost effective in 2015 due to changing market conditions and avoided costs, and eclipses the electric resistance unit as the highest efficiency economic unit. For refrigerators, however, the AHAM federal efficiency standards cause existing Energy Star units to become unavailable in 2014. Units compliant with AHAM 2014 thus become the new minimum efficiency baseline and are therefore assigned a benefit-to-cost (B/C) ratio of 1. Since there is not a more efficient, cost-effective unit available, they become the economic unit by default. If the measure passes the screen (has a B/C ratio greater than or equal to 1), the measure is included in economic potential. Otherwise, it is screened out for that year. If multiple

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[5] Note that saturation levels reflected for the base year change over time as more measures are adopted.

equipment measures have B/C ratios greater than or equal to 1.0, the most efficient technology is selected by the economic screen.

Table 2-10 Economic Screen Results for Selected Residential Equipment Measures

Technology	2013	2014	2015	2016
Central AC	SEER 16	SEER 16	SEER 16	SEER 16
Pool Heater	Electric Resistance	Electric Resistance	Heat Pump (COP = 5.0)	Heat Pump (COP = 5.0)
Refrigerator	Energy Star	AHAM (2014)	AHAM (2014)	AHAM (2014)

Energy-Efficiency Potential

The approach we used for this study adheres to the approaches and conventions outlined in the National Action Plan for Energy-Efficiency (NAPEE) Guide for Conducting Potential Studies (November 2007).[6] The NAPEE Guide represents the most credible and comprehensive industry practice for specifying energy-efficiency potential. As described in Chapter 1, four types of potentials were developed as part of this effort: Technical potential, Economic potential, Achievable High potential and Achievable Low potential

The calculation of Technical and Economic potential is a straightforward algorithm. To develop estimates for **Achievable potential**, we develop market adoption rates for each measure that specify the percentage of customers that will select the highest–efficiency economic option. The Achievable High adoption rates are based on the ramp rates from the Northwest Power & Conservation Council's Sixth Plan as a starting point. The NWPCC has been running programs in the Pacific Northwest for many years, and the portfolio of programs reflects a similar profile of market maturity. The ramp rates are then adjusted with actual New Jersey program history and information from program evaluations. The Achievable Low adoption rates start with the Achievable High rates and decrement them by 40% to 75% based on where measures lie in the time horizon of the study or whether they are already familiar inclusions in existing programs. Finally, reasonableness checks are applied by comparing the adoption rates to those from other relevant potential studies and market research.

The overall energy efficiency potential results are available in Chapter 6, and the results by sector are given in Chapter 7.

Alternative Avoided Cost Scenario

To observe the sensitivity of study results to changes in forecast market prices of electricity and natural gas, we ran a scenario in which the avoided costs for each fuel in each year of the study were increased by 20%. The models were then re-run with all other variables held constant. The results of this review are presented in Chapter 8.

Fuel Switching Analysis

Typically, energy-efficiency potential studies may not explore the effects of switching technologies between system types and fuel types. In this context, where both electricity and natural gas are being studied on a statewide basis, we investigate these effects, including the switch from fuel oil furnaces to natural gas furnaces, which is particularly relevant to the New Jersey market.

The equipment stock accounting inside the LoadMAP modeling tool supports fuel switching, and this analysis has been incorporated for the residential sector. The switching forecast is integrated with the traditional potential analysis, and operates on the same principles to calculate technical, economic, and achievable cases in turn. Several important adjustments are made to account for

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[6] National Action Plan for Energy Efficiency (2007). *National Action Plan for Energy Efficiency Vision for 2025: Developing a Framework for Change*. www.epa.gov/eeactionplan.

comparison of technical potential on a same-fuel, BTU basis; to account for increased switching costs; and to account for the increased complexity of the market decision and corresponding decreased customer adoption rates. These factors and the results are discussed and presented in Chapter 9.

Conclusions and Recommendations

In this final step, we review the potential estimates by measure, customer segment, and sector to develop a set of conclusions and recommendations to guide program efforts toward optimal pursuit of energy efficiency savings. The results of this review are presented in Chapter 10.

Data Development

This section details the data sources used in this study, followed by a discussion of how these sources were applied. In general, data were adapted to local conditions, for example, by using local sources for measure data and local weather for building simulations.

Data Sources

The data sources are organized into the following categories:

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

New Jersey Data

Our highest priority data sources for this study were those that were specific to New Jersey.

- **Residential Energy Consumption Survey (RECS).** In the most recent RECS survey conducted by the U.S. DOE, New Jersey was one of a handful of states singled out for a larger sample size and State-level estimates. We used these data extensively to develop residential market profiles as described below. http://www.eia.gov/consumption/residential/data/2009/
- **American Community Survey:** The US Census American Community Survey is an ongoing survey that provides data every year on household characteristics. Data for New Jersey were available for this study. http://www.census.gov/acs/www/
- **EIA-826 data and EIA-176 forms from New Jersey utilities:** These data sets were used to determine the state-wide current electricity and natural gas use for the study. http://www.eia.gov/electricity/sales_revenue_price/ and http://www.eia.gov/dnav/ng/ng_cons_sum_dcu_SNJ_a.htm
- **New Jersey Clean Energy Library:** The NJOCE website provides a comprehensive library of past research reports, program results, and evaluation studies, which were used to inform program recommendations and provide updated information on measure adoption and penetration. http://www.njcleanenergy.com/library
- **New Jersey Economic Projections:** Projections of key economic indicators were obtained from the Rutgers Economic Advisory Service (R/ECON). http://policy.rutgers.edu/cupr/recon/ Employment forecasts were obtained from the US Bureau of Labor Statistics. http://bls.gov/ Forecasts of avoided costs were obtained from a 2012 analysis performed by the New Jersey Rate Counsel.
- **New Jersey Weather Data:** Weather from NOAA's National Climatic Data Center for Hightstown, NJ was used as the basis for building simulations.

EnerNOC Databases, Analysis Tools, and Reports

EnerNOC maintains several databases and modeling tools that we use for forecasting and potential studies.

- **EnerNOC Energy Market Profiles:** For more than 10 years, EnerNOC staff have maintained profiles of end-use consumption for the residential, commercial, and industrial sectors. These profiles include market size, fuel shares, unit consumption estimates, and annual energy use by fuel (electricity and natural gas), customer segment and end use for 10 regions in the U.S. The Energy Information Administration surveys (RECS, CBECS and MECS) as well as state-level statistics and local customer research provide the foundation for these regional profiles.
- **Building Energy Simulation Tool (BEST)**. EnerNOC's BEST is a derivative of the DOE 2.2 building simulation model, used to estimate base-year UECs and EUIs, as well as measure savings for the HVAC-related measures.
- **EnerNOC's EnergyShape™:** This database of load shapes includes the following: Residential – electric load shapes for 10 regions, 3 housing types, 13 end uses; Commercial – electric load shapes for 9 regions, 54 building types, 10 end uses; Industrial – electric load shapes, whole facility only, 19 2-digit SIC codes, as well as various 3-digit and 4-digit SIC codes
- **EnerNOC's Database of Energy Efficiency Measures (DEEM):** EnerNOC maintains an extensive database of measure data for our studies. Our database draws upon reliable sources including the California Database for Energy Efficient Resources (DEER), the EIA Technology Forecast Updates – Residential and Commercial Building Technologies – Reference Case, RS Means cost data, and Grainger Catalog Cost data**.**
- **Recent studies**. EnerNOC has conducted numerous studies of EE potential in the last five years. We checked our input assumptions and analysis results against the results from these other studies, which include AmerenUE, Los Angeles Department of Water and Power, Consolidated Edison of New York, Avista Utilities, the State of New Mexico, Tennessee Valley Authority, and Seattle City Light. In addition, we used the information about impacts of building codes and appliance standards from a recent report for the Institute for Energy Efficiency.[7]

Other Secondary Data and Reports

Finally, a variety of secondary data sources and reports were used for this study. The main sources are identified below.

- **New Jersey and regional data from past EnerNOC projects:** EnerNOC referenced data from our project with MISO, as well as regional data from similar studies for Con Edison of NY, PECO Energy, and the Connecticut Energy Efficiency Board (CEEB).
- **California Statewide Surveys**. The Residential Appliance Saturation Survey (RASS) and the Commercial End Use Survey (CEUS) are comprehensive market research studies conducted by the California Energy Commission. These databases provide a wealth of information on appliance use in homes and businesses. RASS is based on information from almost 25,000 homes and CEUS is based on information from a stratified random sample of almost 3,000 businesses in California.
- **Annual Energy Outlook**. The Annual Energy Outlook (AEO), conducted each year by the U.S. Energy Information Administration (EIA), presents yearly projections and analysis of energy topics. For this study, we used data from the 2011 AEO.

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[7] "Assessment of Electricity Savings in the U.S. Achievable through New Appliance/Equipment Efficiency Standards and Building Efficiency Codes (2010 – 2025)." Global Energy Partners, LLC for the Institute for Electric Efficiency, May 2011. http://www.edisonfoundation.net/iee/reports/IEE_CodesandStandardsAssessment_2010-2025_UPDATE.pdf

- **Electric Power Research Institute – Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S.**, also known as the EPRI National Potential Study (2009). In 2009, EPRI hired EnerNOC to conduct an assessment of the national potential for energy efficiency, with estimates derived for the four DOE regions (including the Mid Atlantic region that includes New Jersey).
- **EPRI End-Use Models (REEPS and COMMEND)**. These models provide the elasticities we apply to electricity prices, household income, home size and heating and cooling.
- **Database for Energy Efficient Resources (DEER).** The California Energy Commission and California Public Utilities Commission (CPUC) sponsor this database, which is designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) for the state of California. We used the DEER database to cross check the measure savings we developed using BEST and DEEM.
- **Northwest Power and Conservation Council Sixth Plan workbooks.** To develop its Power Plan, the Council maintains workbooks with detailed information about measures.
- **Other relevant regional sources:** These include reports from the Consortium for Energy Efficiency, the Northeast Energy Efficiency Partnership, the EPA, and the American Council for an Energy-Efficient Economy.

Data Application

We now discuss how the data sources described above were used for each step of the study.

Data Application for Market Characterization

To construct the high-level market characterization of electricity use and households/floor space for the residential, commercial, and industrial sectors, we applied the following data sources:

- RECS 2009 and the American Community Survey to allocate residential customers by housing type
- EIA, AEO 2011 and our Energy Market Profiles Database to allocate sales and square footage by building type for the commercial sector
- EIA data on energy use by industry type, Bureau of Labor Statistics and AEO 2011 data to allocate sales and employment for the industrial sector

Data Application for Market Profiles

The specific data elements for the market profiles, together with the key data sources, are shown in Table 2-11. To develop the market profiles for each segment, we used the following approach:

1. Developed control totals for each segment. These include market size, segment-level annual electricity use, and annual intensity.
2. Used RECS 2009 and the American Housing Survey to incorporate information on existing appliance saturations, appliance and equipment characteristics, and building characteristics.
3. Incorporated secondary data sources to supplement and corroborate the data from items 1 and 2 above.
4. Compared and cross-checked with regional data obtained as part of the EPRI National Potential Study and with the Energy Market Profiles Database.
5. Ensured calibration to control totals for annual electricity and natural gas sales in each sector and segment.
6. Worked with BPU and CEEEP staff to vet the data against their knowledge and experience.

Table 2-11 Data Applied for the Market Profiles

Model Inputs	Description	Key Sources
Market size	Base-year residential dwellings commercial floor space, and industrial employment	• EIA Form 826 and 176 data • American Community Survey • Energy Market Profiles • AEO
Annual intensity	Residential: Annual energy use (kWh/household) Commercial: Annual energy use (kWh/sq ft) Industrial: Annual energy use (kWh/employee)	• Energy Market Profiles • AEO • Previous studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology Percentage of C&I floor space/employment with equipment/technology	• RECS 2009 • Energy Market Profiles
UEC/EUI for each end-use technology	UEC: Annual electricity use for a technology in dwellings that have the technology EUI: Annual electricity use per square foot/employee for a technology in floor space that has the technology	• HVAC uses: BEST simulations using prototypes developed for NJ • Engineering analysis • DEEM • Previous EnerNOC studies • California RASS and CEUS
Appliance/equipment vintage distribution	Age distribution for each technology	• RECS 2009 • Previous EnerNOC studies
Efficiency options for each technology	List of available efficiency options and annual energy use for each technology	• DEEM • DEER • NWPCC workbooks • Annual Energy Outlook • Previous studies
Peak factors	Share of technology energy use that occurs during the peak hour	• EnergyShape database

Data Application for Baseline Forecast

Table 2-12 summarizes the LoadMAP model inputs required for the baseline forecast. These inputs are required for each segment within each sector, as well as for new construction and existing dwellings/buildings.

Table 2-12 Data Needs for the Baseline Forecast and Potentials Estimation in LoadMAP

Model Inputs	Description	Key Sources
Customer growth forecasts	Forecasts of new construction in residential and C&I sectors	• AEO 2011 growth forecast • R/ECON • US BLS
Equipment purchase shares for baseline forecast	For each equipment/technology, purchase shares for each efficiency level; specified separately for existing equipment replacement and new construction	• Shipments data from AEO • AEO 2011 regional forecast assumptions[8] • Appliance/efficiency standards analysis • NJOCE program results and evaluation reports
Electricity and natural gas prices	Forecast of average energy and capacity avoided costs and retail prices	• CEEEP July 2012 analysis • AEO 2011
Utilization model parameters	Price elasticities, elasticities for other variables (income, weather)	• EPRI's REEPS and COMMEND models • AEO 2011 • NOAA data for normal cooling & heating degree days for Hightstown, NJ

The avoided cost forecasts implemented in the models, sourced from a 2012 CEEEP analysis, are available in Appendix G. The discount rate used for NPV analysis is a nominal rate of 8%, the same rate used in the 2012 CEEEP analysis and the previous EE potential studies done for the State of New Jersey. When adjusted for an average inflation rate of 2.92%, the discount rate is 4.94% in real terms.

We also implemented assumptions for known future equipment standards as of January, 2012, as shown in the tables below.

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[8] We developed baseline purchase decisions using the Energy Information Agency's *Annual Energy Outlook* report (2011), which utilizes the National Energy Modeling System (NEMS) to produce a self-consistent supply and demand economic model. We calibrated equipment purchase options to match manufacturer shipment data for recent years and then held values constant for the study period. This removes any effects of naturally occurring conservation or effects of future DSM programs that may be embedded in the AEO forecasts.

Table 2-13 Residential Electric Equipment Standards Applicable to New Jersey

▭ Today's Efficiency or Standard Assumption
▭ 1st Standard (relative to today's standard)
▭ 2nd Standard (relative to today's standard)

End Use	Technology	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Central AC	SEER 13														
	Room AC	EER 9.8			EER 11.0											
	Evaporative Central AC	Conventional														
	Evaporative Room AC	Conventional														
Cooling/Heating	Heat Pump	SEER 13.0/HSPF 7.7				SEER 14.0/HSPF 8.0										
Space Heating	Electric Resistance	Electric Resistance														
Water Heating	Water Heater (<=55 gallons)	EF 0.90				EF 0.95										
	Water Heater (>55 gallons)	EF 0.90				Heat Pump Water Heater										
Lighting	Screw-in/Pin Lamps	Incandescent			Advanced Incandescent - tier 1						Advanced Incandescent - tier 2					
	Linear Fluorescent	T8														
Appliances	Refrigerator/2nd Refrigerator	NAECA Standard			25% more efficient											
	Freezer	NAECA Standard			25% more efficient											
	Dishwasher	Conventional (355		14% more efficient (307 kWh/yr)												
	Clothes Washer	Conventional (MEF 1.26 for top loader)				MEF 1.72 for top loader			MEF 2.0 for top loader							
	Clothes Dryer	Conventional (EF 3.01)				5% more efficient (EF 3.17)										
	Range/Oven	Conventional														
	Microwave	Conventional														
Electronics	Personal Computer	Conventional/Energy Star														
	Monitor	Conventional														
	Laptop Computer	Conventional/Energy Star														
	TV	Conventional/Energy Star														
	Copier/Printer/Fax	Conventional														
	DVD/VCR/Audio	Conventional														
	Devices and Gadgets	Conventional														
Miscellaneous	Pool Pump	Conventional														
	Well Pump	Conventional														
	Furnace Fan	Conventional														

Table 2-14 Commercial Electric Equipment Standards Applicable to New Jersey

▢ Today's Efficiency or Standard Assumption
🟦 1st Standard (relative to today's standard)
🟫 2nd Standard (relative to today's standard)

<table>
<tr><th>End Use</th><th>Technology</th><th>2011</th><th>2012</th><th>2013</th><th>2014</th><th>2015</th><th>2016</th><th>2017</th><th>2018</th><th>2019</th><th>2020</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th><th>2025</th></tr>
<tr><td rowspan="3">Cooling</td><td>Chillers</td><td colspan="15">2007 ASHRAE 90.1</td></tr>
<tr><td>Roof Top Units</td><td colspan="15">EER 11.0/11.2</td></tr>
<tr><td>Packaged Terminal AC/HP</td><td>EER 9.8</td><td colspan="14">EER 11.0</td></tr>
<tr><td>Cooling/Heating</td><td>Heat Pump</td><td colspan="15">EER 11.0/COP 3.3</td></tr>
<tr><td rowspan="2">Space Heating</td><td>Electric Resistance</td><td colspan="15">Electric Resistance</td></tr>
<tr><td>Electric Furnace</td><td colspan="15">Electric Furnace</td></tr>
<tr><td>Ventilation</td><td>Ventilation</td><td colspan="15">Constant Air Volume/Variable Air Volume</td></tr>
<tr><td rowspan="3">Lighting</td><td>Screw-in/Pin Lamps</td><td colspan="3">Incandescent</td><td colspan="6">Advanced Incandescent - tier 1</td><td colspan="6">Advanced Incandescent - tier 2</td></tr>
<tr><td>Linear Fluorescent</td><td>T12</td><td colspan="14">T8</td></tr>
<tr><td>High Intensity Discharge</td><td colspan="15">Metal Halide</td></tr>
<tr><td>Water Heating</td><td>Water Heater</td><td colspan="15">EF 0.97</td></tr>
<tr><td rowspan="6">Refrigeration</td><td>Walk-in Refrigerator/Freezer</td><td colspan="15">EISA 2007 Standard</td></tr>
<tr><td>Reach-in Refrigerator</td><td colspan="15">EPACT 2005 Standard</td></tr>
<tr><td>Glass Door Display</td><td>EPACT 2005 Standard</td><td colspan="14">42% more efficient</td></tr>
<tr><td>Open Display Case</td><td>EPACT 2005 Standard</td><td colspan="14">18% more efficient</td></tr>
<tr><td>Vending Machines</td><td>EPACT 2005 Standard</td><td colspan="14">33% more efficient</td></tr>
<tr><td>Icemaker</td><td colspan="15">2010 Standard</td></tr>
<tr><td rowspan="2">Office Equipment</td><td>Desktop Computer</td><td colspan="15">Conventional/Energy Star</td></tr>
<tr><td>Laptop Computer</td><td colspan="15">Conventional/Energy Star</td></tr>
<tr><td rowspan="2">Miscellaneous</td><td>Non-HVAC Motors</td><td colspan="4">62.3% Efficiency</td><td colspan="11">70% Efficiency</td></tr>
<tr><td>Commercial Laundry</td><td colspan="2">MEF 1.26</td><td colspan="13">MEF 1.6</td></tr>
</table>

Table 2-15 Residential Gas Appliance Standards Applicable to New Jersey

⬜	**Today's Efficiency or Standard Assumption**
🟦	**Next Standard (relative to today's standard)**
🟫	**2nd Standard (relative to today's standard)**

End Use	Technology	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Space Heating	Furnace	AFUE 80%		AFUE 90% -Non-weathered		AFUE 90% -Weatherized										
	Boiler	EF 0.81		EF 0.82												
Water Heating	Water Heater (<=55 gallons)	EF 0.59				EF 0.62										
	Water Heater (>55 gallons)	EF 0.59				Condensing Technology										
Appliances	Clothes Dryer	Conventional				5% more efficient										
	Range/Oven	Conventional	No Standing Pilot Light													
Miscellaneous	Pool Heater	Conventional		EF 0.82												

Table 2-16 Commercial Gas Appliance Standards Applicable to New Jersey

⬜	**Today's Efficiency or Standard Assumption**
🟦	**Next Standard (relative to today's standard)**

End Use	Technology	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Space Heating	Furnace	AFUE 76%														
	Boiler	EF 0.76	EF 0.82													
Water Heating	Water Heater	EF 0.80														
Miscellaneous	Pool Heater	Conventional		EF 0.82												

Energy Efficiency Measure Data Application

Table 2-17 details the data sources used for measure characterization.

Table 2-17 Data Needs for the Measure Characteristics in LoadMAP

Model Inputs	Description	Key Sources
Energy Impacts	The annual reduction in consumption attributable to each specific measure. Savings were developed as a percentage of the energy end use that the measure affects.	• BEST • DEEM • DEER • NWPCC workbooks • Other secondary sources
Peak Demand Impacts	Savings during the peak demand periods are specified for each electric measure. These impacts relate to the energy savings and depend on the extent to which each measure is coincident with the system peak.	• BEST • EnergyShape
Costs	Equipment Measures: Includes the full cost of purchasing and installing the equipment on a per-household, per-square-foot, or per employee basis for the residential, commercial, and industrial sectors, respectively. Non-equipment measures: Existing buildings – full installed cost. New Construction - the costs may be either the full cost of the measure, or as appropriate, it may be the incremental cost of upgrading from a standard level to a higher efficiency level.	• DEEM • DEER • NWPCC workbooks • RS Means • Other secondary sources
Measure Lifetimes	Estimates derived from the technical data and secondary data sources that support the measure demand and energy savings analysis.	• DEEM • DEER • NWPCC workbooks • Other secondary sources
Applicability	Estimate of the percentage of either dwellings in the residential sector or square feet/employment in the C&I sectors where the measure is applicable and where it is technically feasible to implement.	• DEEM • DEER • NWPCC workbooks • Other secondary sources
On Market and Off Market Availability	Expressed as years for equipment measures to reflect when the equipment technology is available or no longer available in the market.	• EnerNOC appliance standards and building codes analysis

Data Application for Cost-effectiveness Screening

To perform the cost-effectiveness screening, a number of economic assumptions were needed. All cost and benefit values were analyzed as real 2010 dollars. A discount rate of 8% in nominal terms was used, as developed in the CEEEP 2008 cost-effectiveness analysis. This is equivalent to a 4.93% discount rate in real terms when adjusting for 2.92% inflation.[9] As mentioned above, avoided costs were obtained from an analysis performed by the New Jersey Rate Counsel. Electric delivery losses of 7.6% were obtained from an EIA 10-year New Jersey average[10] , whereas natural gas delivery losses of 1.4% are based on an EIA engineering estimate, as the gas distribution system is not tracked and monitored as rigorously as the electric system.[11]

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[9] Inflation adjuster of 2.92% based on the average annual growth forecast in US Consumer Price Index from the 2012 Annual Energy Outlook for 2010-2035.

[10] http://www.eia.gov/electricity/state/newjersey

[11] http://www.eia.gov/pub/itg/ghgp9.htm

Achievable Potential Estimation

To estimate achievable potentials, three sets of parameters were required to account for the decision making behavior of humans in the efficiency marketplace.

- **Adoption curves for non-equipment measures**. Equipment measures are installed when existing units fail. Non-equipment measures do not have this natural periodicity, so rather than installing all available non-equipment measures in the first year of the forecast (instantaneous potential), they are phased in according to adoption schedules that vary based on cost and complexity. The adoption rates used in this analysis take several factors into account to determine how quickly the market can absorb these measures. Typically, measures that cause disruption to the building, such as wall insulation in existing buildings, receive longer adoption curves, while those with drop-in installations, such as programmable thermostats in new buildings, receive shorter ones. High capital cost measures will also receive longer adoption curves than ones with low capital cost. These adoption rates are used within LoadMAP to generate the Technical and Economic potentials. In general, the rates align with the diffusion of similar equipment measures.
- **Achievable High adoption rates**. These factors are applied to Economic potential to estimate the upper bound: Achievable High. These estimate 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. The Achievable High adoption rates are based on the ramp rates from the Northwest Power & Conservation Council's Sixth Plan as a starting point. The NWPCC has been running programs in the Pacific Northwest for many years, and the portfolio of programs reflects a similar profile of market maturity. The ramp rates are then adjusted with actual New Jersey program history and information from program evaluations. 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 adoption rates**. These factors are applied to Achievable High potential to calculate Achievable Low potential, decrementing them by a range of 40% to 75% based on where measures lie in the time horizon of the study or whether they are already familiar inclusions in existing programs. These rates reflect 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.

Achievable Low and Achievable High adoption rates are presented in Appendix E.

CHAPTER | **3**

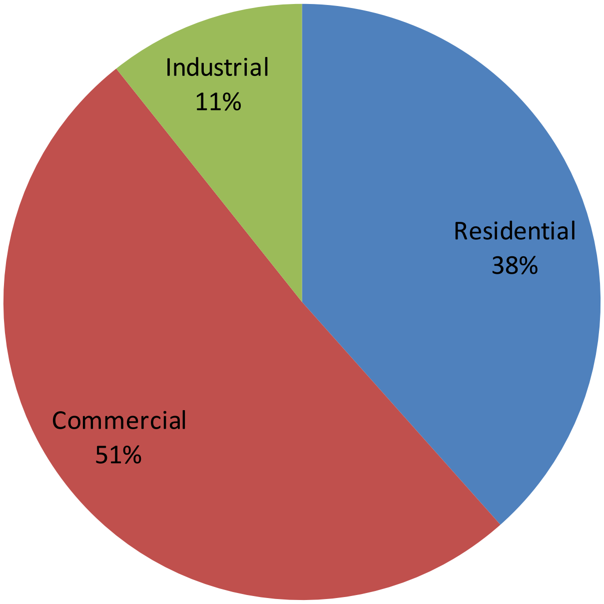
MARKET CHARACTERIZATION AND MARKET PROFILES

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 in detail.

Energy Use Summary

Total electricity use for the residential, commercial and industrial sectors for New Jersey in 2010 was 78,859 GWh.[12] 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.[13] 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.

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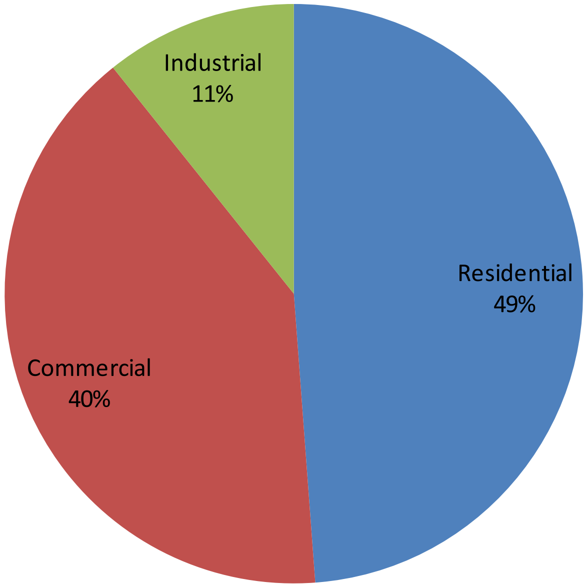
[12] Energy given "at-the-meter," i.e. does not include line losses.

[13] 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[14] and 2.25 billion therms of natural gas.[15] We allocated these totals into the six residential segments based on survey data from the DOE's latest Residential Energy Consumption Survey (RECS 2009), which has an oversample for New Jersey. The values are shown in Table 3-1 below, and referred to throughout the study as the *control totals* to which all energy usage is calibrated in the base year of the study.

Table 3-1 Residential Sector Energy Usage and Intensity by Segment Type, 2010

Segment	No. of Households	Electricity Use (GWh)	Electricity Avg Use (kWh/hh)	Natural Gas Use (million therms)	Natural Gas Avg Use (therms/hh)
Single Family	1,682,988	17,946	10,663	1,286	764
Single Family LI	579,087	4,540	7,840	346	598
Multi Family Rent	500,082	3,785	7,570	307	614
Multi Family Rent LI	429,995	2,464	5,731	206	478
Multi Family Own	222,199	1,380	6,212	92	415
Multi Family Own LI	40,489	191	4,729	18	437
Total	**3,454,840**	**30,307**	**8,772**	**2,255**	**653**

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

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

Figure 3-3 and Figure 3-4 show the size of each of the segments as a percentage of customers and percentage of residential sector energy use.

Figure 3-3 Residential Market Segmentation by Housing Type – Percent of Households

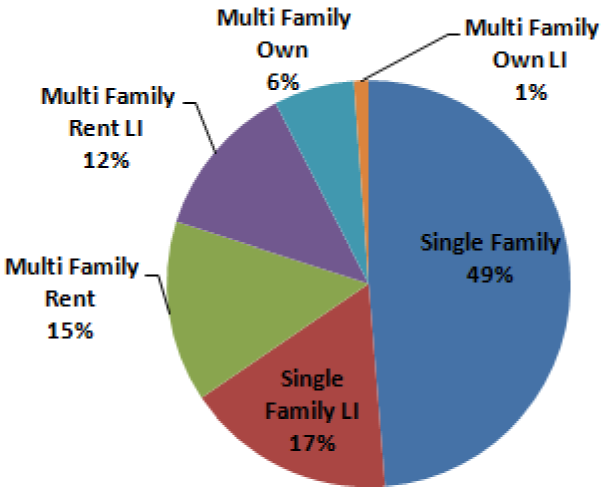
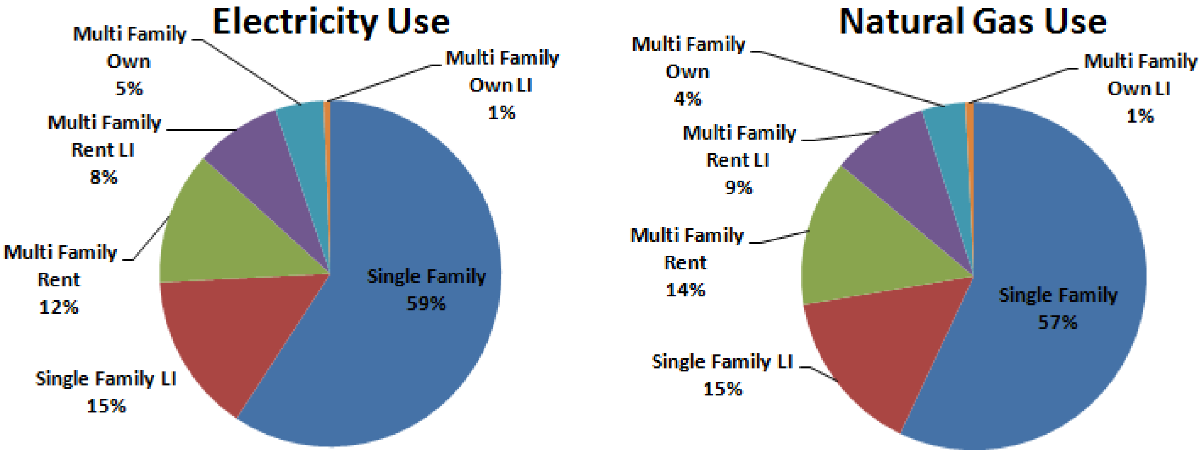


Figure 3-4 Residential Market Segmentation by Housing Type – Percent of Energy Use



As we describe in the previous chapter, the market profiles provide the foundation upon which we develop the baseline forecast. The market profile for the residential sector as a whole is presented in Table 3-2 and Table 3-3. The residential market profiles for each housing segment are presented in Appendix A.

Table 3-2 Electric Market Profile for the Residential Sector

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	58.5%	2,356	1,379	4,764.3
Cooling	Room AC	34.6%	1,176	407	1,406.8
Cooling	Air-Source Heat Pump	0.5%	2,408	13	44.3
Cooling	Geothermal Heat Pump	0.0%	0	0	0.0
Heating	Electric Resistance	2.6%	8,182	214	738.6
Heating	Electric Furnace	1.7%	7,518	129	447.3
Heating	Air-Source Heat Pump	0.5%	7,068	38	130.2
Heating	Geothermal Heat Pump	0.0%	0	0	0.0
Water Heating	Water Heater <=55 gal	13.7%	2,419	331	1,142.4
Water Heating	Water Heater > 55 gal	0.7%	3,152	22	74.9
Interior Lighting	Screw-in	100.0%	1,050	1,050	3,627.0
Interior Lighting	Linear Fluorescent	100.0%	131	131	453.4
Interior Lighting	Specialty	100.0%	547	547	1,889.3
Exterior Lighting	Screw-in	100.0%	253	253	875.1
Appliances	Clothes Washer	78.4%	109	86	296.4
Appliances	Clothes Dryer	33.1%	822	272	939.9
Appliances	Dishwasher	68.6%	416	285	986.2
Appliances	Refrigerator	100.0%	778	778	2,688.1
Appliances	Freezer	20.8%	616	128	443.3
Appliances	Second Refrigerator	30.5%	918	280	966.4
Appliances	Stove	22.6%	469	106	366.4
Appliances	Microwave	94.8%	133	126	435.8
Electronics	Personal Computers	75.1%	283	212	733.1
Electronics	Monitor	75.1%	56	42	145.9
Electronics	Laptops	70.4%	116	82	282.9
Electronics	TVs	286.1%	160	459	1,584.9
Electronics	Printer/Fax/Copier	109.9%	41	46	157.4
Electronics	Set-top Boxes/DVR	238.8%	110	262	903.9
Electronics	Devices and Gadgets	100.0%	102	102	351.5
Miscellaneous	Pool Pump	11.4%	1,500	171	590.6
Miscellaneous	Pool Heater	0.6%	4,981	30	102.7
Miscellaneous	Hot Tub / Spa	4.2%	950	40	136.8
Miscellaneous	Well Pump	10.4%	561	59	202.1
Miscellaneous	Furnace Fan	54.0%	396	214	739.0
Miscellaneous	Miscellaneous	100.0%	480	480	1,659.8
	Total			**8,772**	**30,307.0**

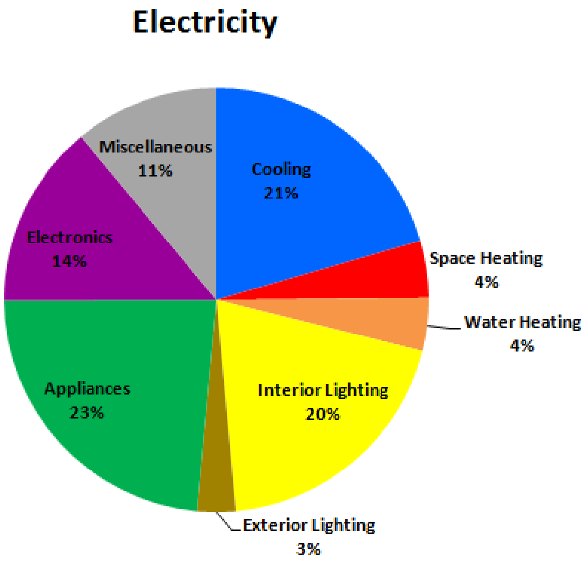
Table 3-3 Natural Gas Market Profile for the Residential Sector

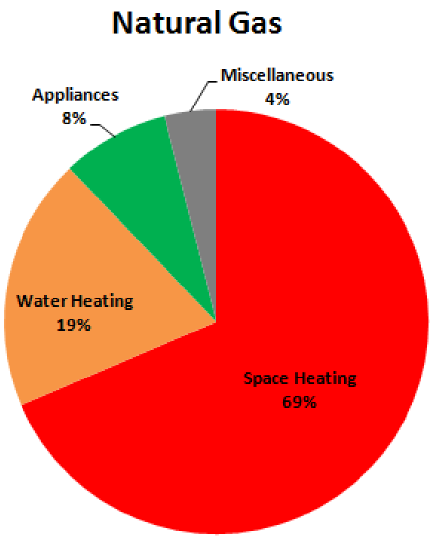
End Use	Technology	Saturation	UEC (therm)	Intensity (therm/HH)	Usage (MMtherm)
Heating	Furnace	52.3%	475	249	858.6
Heating	Boiler	30.0%	649	195	673.0
Heating	Other Heating	1.0%	411	4	14.8
Water Heating	Water Heater <=55 gal	76.7%	151	116	401.4
Water Heating	Water Heater > 55 gal	4.9%	196	10	33.2
Appliances	Clothes Dryer	42.4%	34	14	49.6
Appliances	Stove/Oven	75.6%	52	39	135.7
Miscellaneous	Pool Heater	4.9%	154	8	26.0
Miscellaneous	Hot Tub / Spa	7.6%	36	3	9.6
Miscellaneous	Miscellaneous	100.0%	15	15	53.1
Total				**653**	**2,255.0**

Figure 3-5 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.

Figure 3-5 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[16].

Figure 3-6 and Table 3-4 present the electricity intensities by end-use and housing type, as well as all homes on average. Figure 3-7 shows the same data as a percentage of total energy use.

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

Figure 3-6 Residential Electricity Intensity by End Use and Segment (kWh/household, 2010)

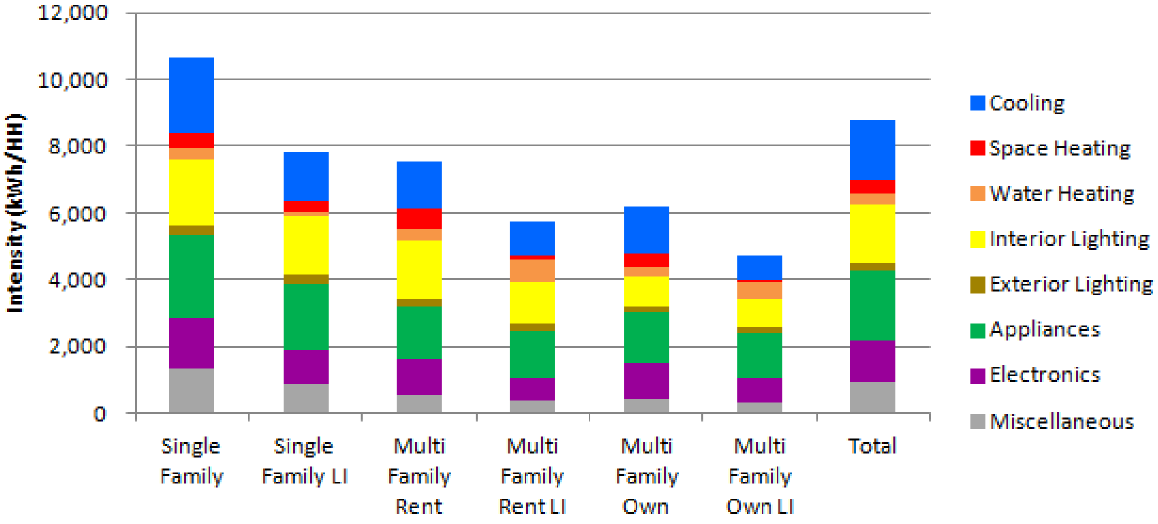


Table 3-4 Residential Electricity Use by End Use and Segment (kWh/HH/year, 2010)

End Use	Single Family	Single Family LI	Multi Family Rent	Multi Family Rent LI	Multi Family Own	Multi Family Own LI	All Homes
Cooling	2,286	1,467	1,454	1,020	1,456	716	1,799
Space Heating	408	352	597	94	373	85	381
Water Heating	367	94	350	684	255	479	352
Interior Lighting	1,965	1,778	1,732	1,224	926	866	1,728
Exterior Lighting	273	260	238	232	176	164	253
Appliances	2,497	1,968	1,571	1,405	1,517	1,335	2,062
Electronics	1,503	1,056	1,093	696	1,047	772	1,230
Miscellaneous	1,363	865	536	375	463	313	967
Total	**10,663**	**7,840**	**7,570**	**5,731**	**6,212**	**4,729**	**8,772**

Figure 3-7 Breakdown of Residential Electricity Use by End Use and Segment (2010)

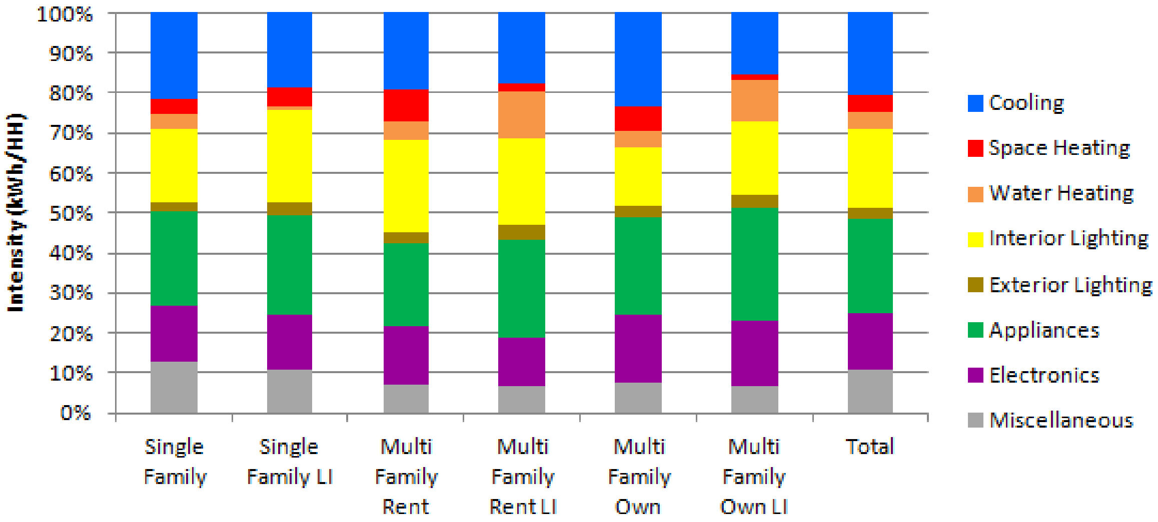


Figure 3-8 and Table 3-5 present the natural gas intensities by end-use and housing type, as well as all homes on average. Figure 3-9 shows the same data as a percentage of total energy use.

Figure 3-8 Residential Natural Gas Intensity by End Use and Segment (therm/household, 2010)

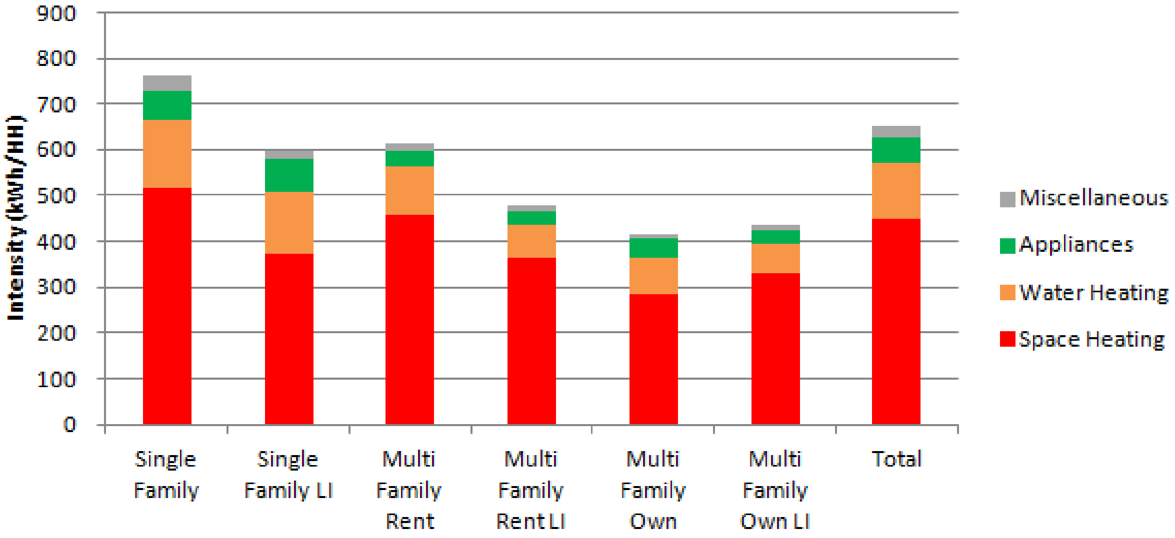
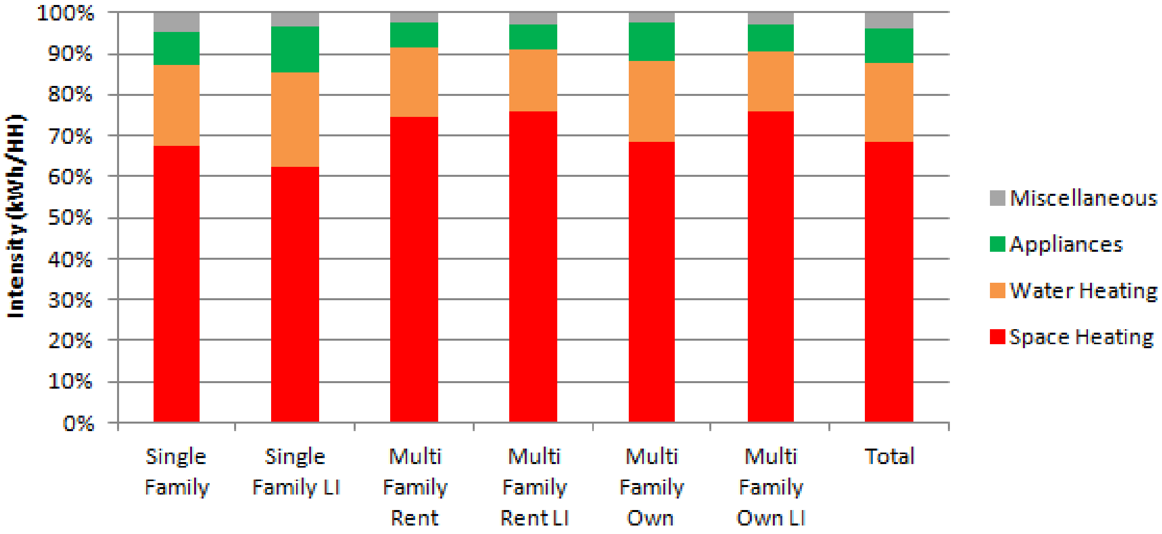


Table 3-5 Residential Natural Gas Use by End Use and Segment (therm/HH/year, 2010)

End Use	Single Family	Single Family LI	Multi Family Rent	Multi Family Rent LI	Multi Family Own	Multi Family Own LI	All Homes
Space Heating	516	373	458	364	284	332	448
Water Heating	149	137	105	72	81	63	126
Appliances	62	69	36	29	40	30	54
Miscellaneous	36	20	15	14	10	13	26
Total	**764**	**598**	**614**	**478**	**415**	**437**	**653**

Figure 3-9 Breakdown of Residential Natural Gas Use by End Use and Segment (2010)



Commercial Sector

The total electric energy consumed by commercial customers in New Jersey in 2010 was 40,123 GWh[17] and the total natural gas energy consumed was 1,867 million therms.[18] We used EnerNOC's database of Energy Market Profiles for the Mid-Atlantic region to allocate this energy usage to the various building types according to regional average square footage and energy intensity data. The values are shown in Table 3-6 below, and referred to throughout the study as the *control totals* to which all energy usage is calibrated in the base year of the study.

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

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

Table 3-6 Commercial Market Segmentation by Building Type, Base Year 2010

Segment	Floor Space (million sq. ft.)	Electricity 2010 Use (GWh)	Natural Gas 2010 Use (million therms)
Small Office	384	4,470	196
Large Office	433	6,054	152
Restaurant	52	1,971	103
Retail	551	7,985	318
Grocery	97	4,421	61
College	209	2,188	109
School	325	2,011	149
Health	198	4,084	302
Lodging	100	1,113	64
Warehouse	365	2,640	102
Miscellaneous	407	3,187	311
Total	**3,121**	**40,123**	**1,867**

Figure 3-10 shows the size of each of the building-types as a percentage of commercial sector energy sales.

Figure 3-10 Commercial Market Segmentation by Building Type – Percent of Energy Use

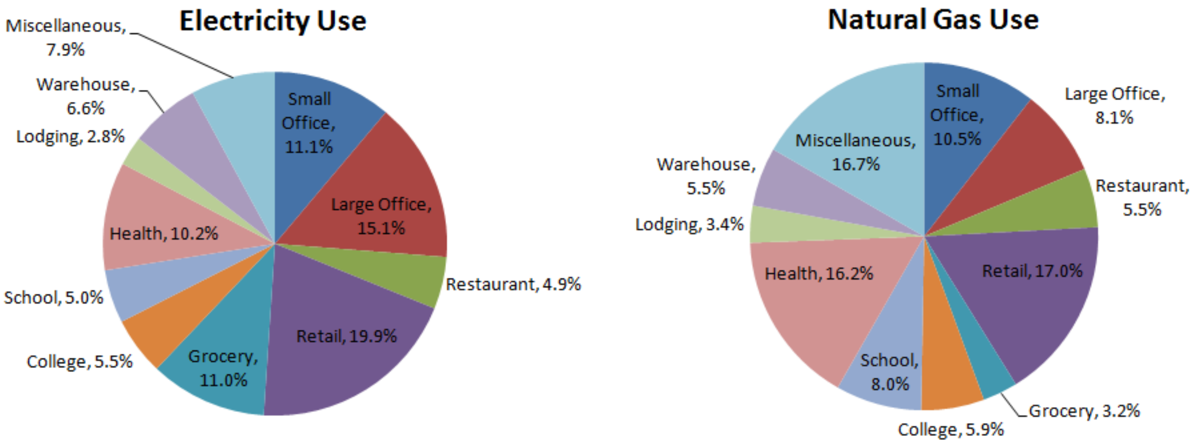


Table 3-7 shows the market profile for electricity of the commercial sector as a whole, representing a composite of all the building types. Overall, about 55% of commercial floor space is cooled. Only about 13% of commercial floor space is heated using electric equipment, either some form of resistance heating or heat pumps. Linear fluorescent lighting and screw-in lamps are the largest energy-consuming technologies in the commercial sector, followed by ventilation and roof top AC units.

Table 3-8 shows the natural gas market profile for the commercial sector as a whole. Boilers are the largest natural gas-consuming technology, followed by water heaters, and furnaces.

Market profiles for each building type are presented in Appendix A.

Table 3-7 Commercial Sector Composite Electric Market Profile, 2010

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)
Cooling	Air-Cooled Chiller	4.5%	4.22	0.19	598
Cooling	Water-Cooled Chiller	3.6%	4.57	0.17	520
Cooling	Roof top AC	27.5%	3.83	1.06	3,295
Cooling	Air-Source Heat Pump	5.0%	3.83	0.19	593
Cooling	Geothermal Heat Pump	1.2%	2.56	0.03	99
Cooling	Other Cooling	12.9%	3.10	0.40	1,247
Heating	Air-Source Heat Pump	5.0%	4.88	0.24	755
Heating	Geothermal Heat Pump	1.2%	3.25	0.04	126
Heating	Electric Room Heat	0.6%	4.51	0.03	90
Heating	Electric Furnace	5.8%	4.73	0.27	854
Ventilation	Ventilation	100.0%	1.20	1.20	3,760
Water Heating	Water Heating	36.2%	1.07	0.39	1,207
Interior Lighting	Screw-in	100.0%	1.69	1.69	5,280
Interior Lighting	High-Bay Fixtures	100.0%	0.60	0.60	1,868
Interior Lighting	Linear Fluorescent	100.0%	1.85	1.85	5,767
Exterior Lighting	Screw-in	100.0%	0.18	0.18	576
Exterior Lighting	HID	100.0%	0.52	0.52	1,633
Exterior Lighting	Linear Fluorescent	100.0%	0.05	0.05	149
Refrigeration	Walk-in Refrigerator	48.5%	0.77	0.38	1,172
Refrigeration	Reach-in Refrigerator	48.5%	0.08	0.04	127
Refrigeration	Glass Door Display	48.5%	1.02	0.49	1,545
Refrigeration	Open Display Case	48.5%	0.46	0.22	697
Refrigeration	Icemaker	48.5%	0.17	0.08	263
Refrigeration	Vending Machine	48.5%	0.17	0.08	263
Food Preparation	Oven	28.5%	0.26	0.07	227
Food Preparation	Fryer	28.5%	0.34	0.10	302
Food Preparation	Dishwasher	28.5%	0.48	0.14	428
Food Preparation	Hot Food Container	28.5%	0.12	0.03	108
Office Equipment	Desktop Computer	100.0%	0.62	0.62	1,927
Office Equipment	Laptop	100.0%	0.09	0.09	291
Office Equipment	Server	100.0%	0.28	0.28	881
Office Equipment	Monitor	100.0%	0.11	0.11	357
Office Equipment	Printer/Copier/Fax	100.0%	0.08	0.08	261
Office Equipment	POS Terminal	47.3%	0.04	0.02	65
Misc	Non-HVAC Motors	53.9%	0.10	0.05	166
Misc	Pool Pump	1.9%	0.01	0.00	0
Misc	Pool Heater	0.5%	0.02	0.00	0
Misc	Misc	100.0%	0.84	0.84	2,622
Total				**12.85**	**40,123**

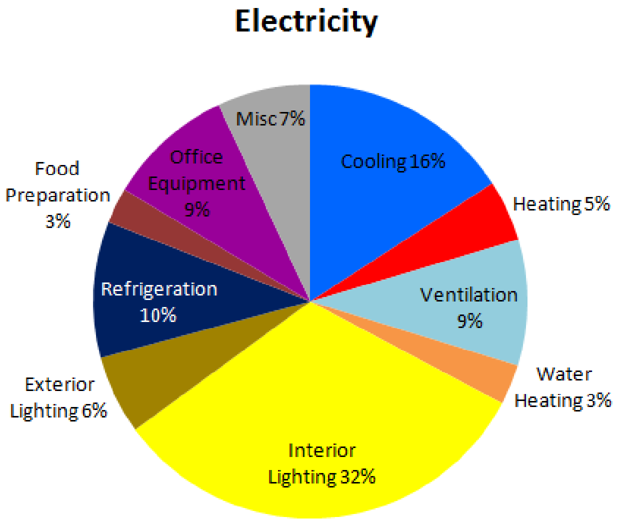
Table 3-8 Commercial Sector Composite Natural Gas Market Profile, 2010

End Use	Technology	Saturation	EUI (therm)	Intensity (thrm/Sqft)	Usage (MMthrm)
Heating	Furnace	22.0%	0.34	0.07	231
Heating	Boiler	28.6%	0.93	0.27	834
Heating	Other Heating	15.7%	0.34	0.05	166
Water Heating	Water Heating	46.1%	0.29	0.13	421
Food Preparation	Oven	27.0%	0.03	0.01	22
Food Preparation	Fryer	27.0%	0.04	0.01	33
Food Preparation	Broiler	27.0%	0.04	0.01	33
Food Preparation	Griddle	27.0%	0.04	0.01	33
Food Preparation	Range	27.0%	0.04	0.01	33
Food Preparation	Steamer	27.0%	0.04	0.01	33
Misc	Pool Heater	0.6%	0.11	0.00	2
Misc	Misc	5.9%	0.15	0.01	28
Total				**0.60**	**1,867**

Figure 3-11 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 3-11 Commercial Electricity and Natural Gas Use by End Use (2010), All Buildings



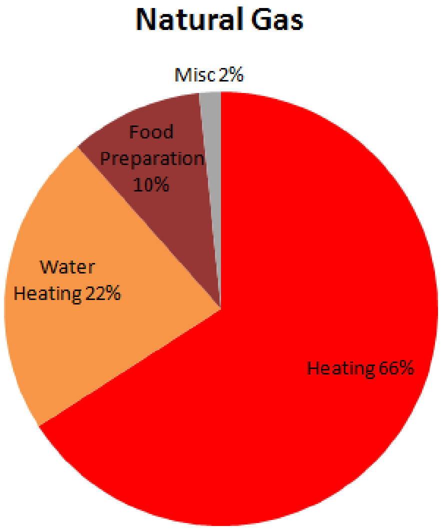


Figure 3-12 and Table 3-9 present the electricity intensity in kWh per square foot by end use and building type. Figure 3-13 shows the same data as a percentage of total energy use for each segment.

Figure 3-12 Commercial Electricity Intensity by End Use and Segment (kWh/sq ft, 2010)

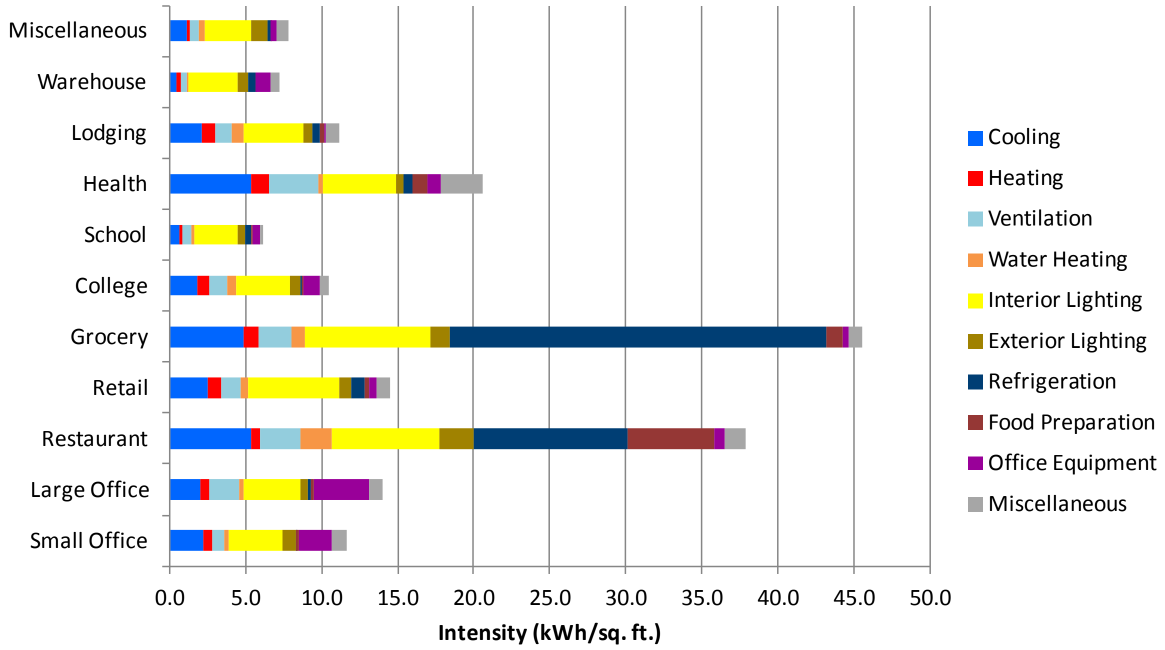


Table 3-9 Commercial Electricity Intensity by End Use and Segment (kWh/sq ft, 2010)

End Use	Small Office	Large Office	Restaurant	Retail	Grocery	College
Cooling	2.20	2.00	5.31	2.52	4.84	1.84
Heating	0.60	0.64	0.66	0.84	0.97	0.77
Ventilation	0.81	1.94	2.65	1.33	2.16	1.21
Water Heating	0.27	0.29	2.03	0.46	0.95	0.56
Interior Lighting	3.49	3.77	7.03	5.99	8.25	3.49
Exterior Lighting	0.91	0.49	2.30	0.79	1.22	0.68
Refrigeration	0.03	0.15	10.13	0.91	24.82	0.12
Food Preparation	0.18	0.20	5.67	0.32	1.04	0.14
Office Equipment	2.21	3.58	0.72	0.49	0.38	1.02
Misc	0.94	0.90	1.41	0.84	0.92	0.64
Total	**11.63**	**13.98**	**37.92**	**14.48**	**45.55**	**10.48**
End Use	**School**	**Health**	**Lodging**	**Warehouse**	**Misc.**	**All Buildings**
Cooling	0.65	5.32	2.14	0.48	1.16	2.04
Heating	0.17	1.23	0.88	0.28	0.20	0.58
Ventilation	0.57	3.23	1.08	0.32	0.56	1.20
Water Heating	0.19	0.30	0.74	0.13	0.40	0.39
Interior Lighting	2.92	4.86	3.97	3.25	3.07	4.14
Exterior Lighting	0.48	0.46	0.57	0.73	1.02	0.76
Refrigeration	0.32	0.60	0.54	0.48	0.19	1.30
Food Preparation	0.17	0.96	0.24	0.01	0.09	0.34
Office Equipment	0.46	0.86	0.13	0.94	0.37	1.21
Misc	0.24	2.83	0.88	0.62	0.79	0.89
Total	**6.18**	**20.63**	**11.16**	**7.24**	**7.83**	**12.85**

Figure 3-13 Breakdown of Commercial Electricity Consumption by End Use and Segment (2010)

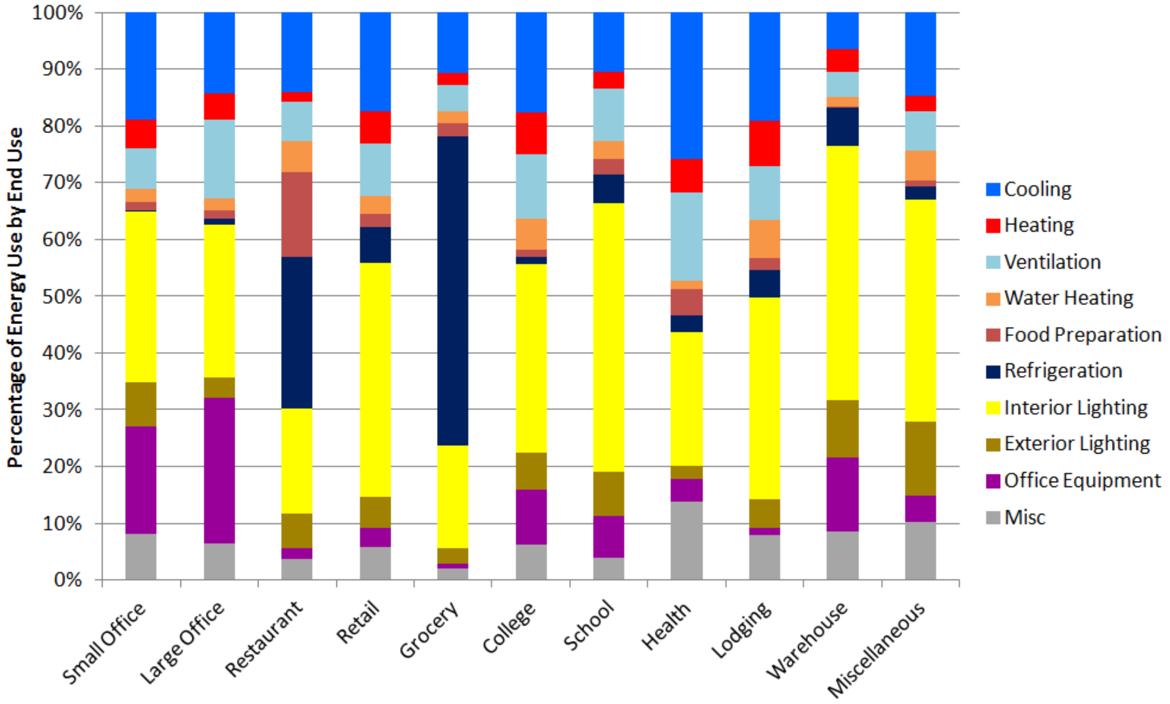


Figure 3-14 and Table 3-10 present the natural gas intensity in therms per square foot by end use and building type. Figure 3-15 shows the same data as a percentage of total energy use for each segment.

Figure 3-14 Commercial Natural Gas Intensity by End Use and Segment (therms/sq ft, 2010)

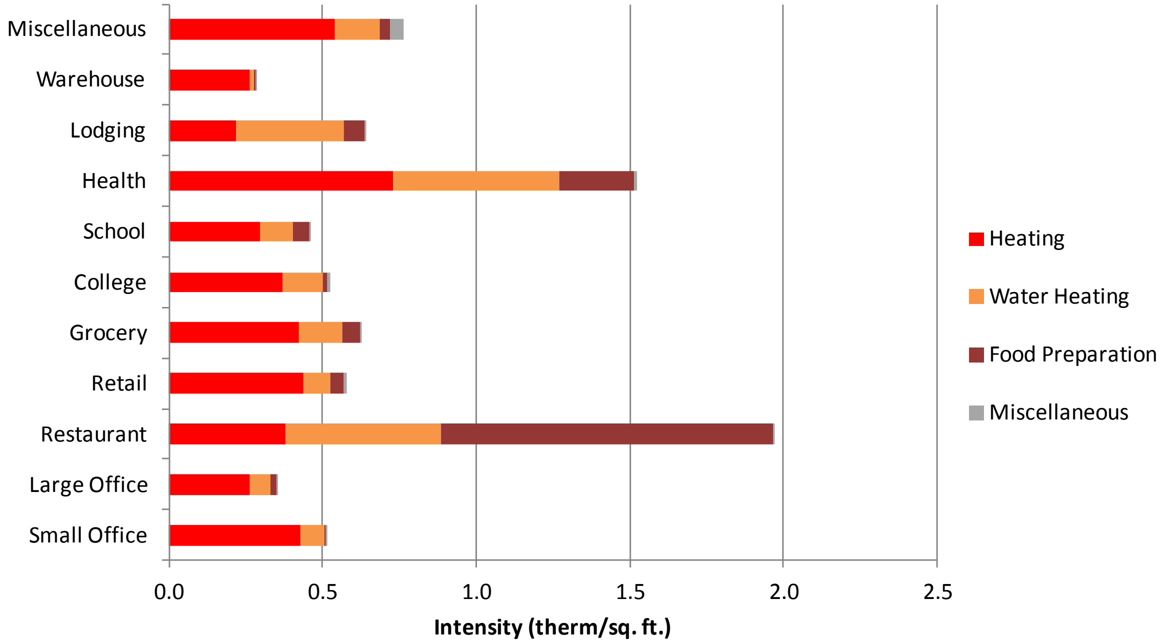
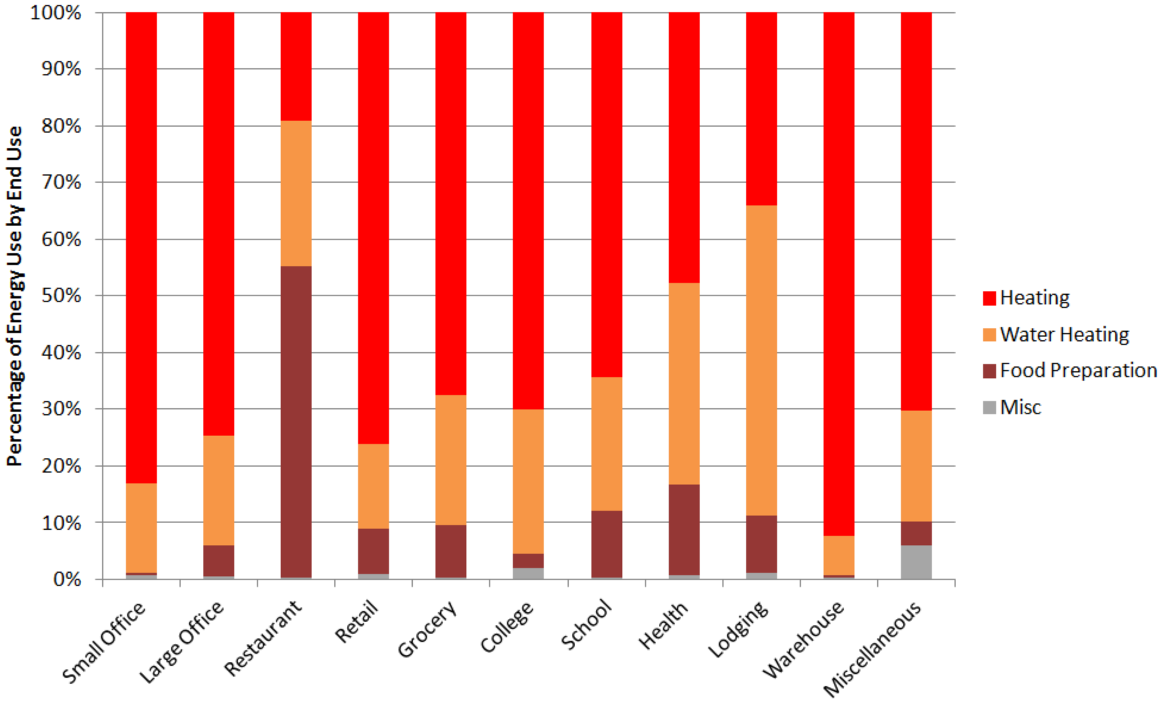


Table 3-10 Commercial Natural Gas Intensity by End Use and Segment (therms/sq ft, 2010)

End Use	Small Office	Large Office	Restaurant	Retail	Grocery	College
Heating	0.425	0.262	0.378	0.439	0.422	0.367
Water Heating	0.081	0.067	0.506	0.086	0.143	0.134
Food Preparation	0.002	0.019	1.082	0.046	0.059	0.013
Misc	0.004	0.002	0.008	0.006	0.001	0.010
Total	**0.511**	**0.351**	**1.973**	**0.576**	**0.625**	**0.524**
End Use	**School**	**Health**	**Lodging**	**Warehouse**	**Misc.**	**All Buildings**
Heating	0.295	0.727	0.218	0.259	0.537	0.394
Water Heating	0.108	0.542	0.352	0.019	0.149	0.135
Food Preparation	0.055	0.244	0.065	0.001	0.033	0.059
Misc	0.001	0.012	0.008	0.001	0.046	0.010
Total	**0.458**	**1.524**	**0.643**	**0.281**	**0.765**	**0.598**

Figure 3-15 Breakdown of Commercial Natural Gas Use by End Use and Segment (2010)



Industrial Sector

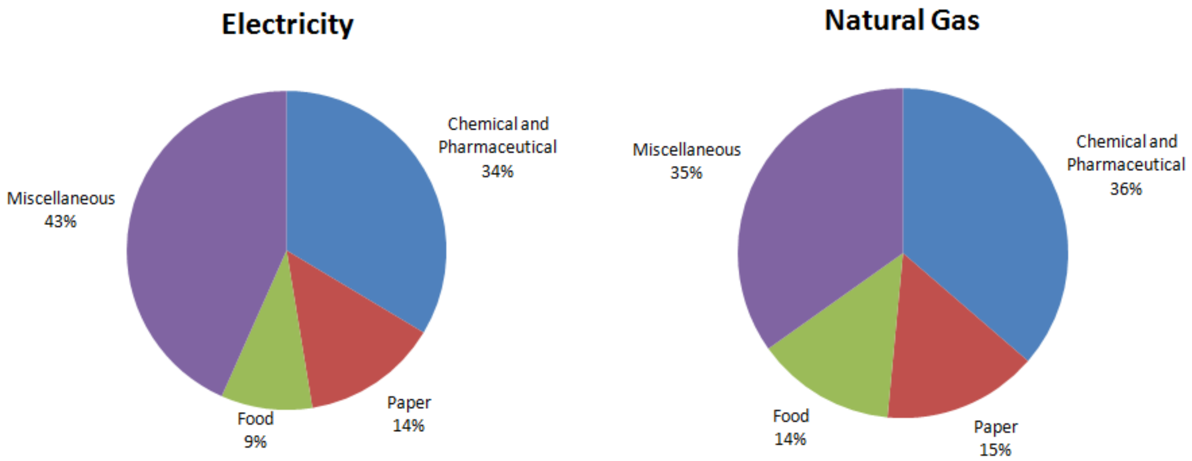
The total electric energy consumed by industrial customers in New Jersey in 2010 was 8,429 GWh[19] and the total natural gas energy consumed was 497 million therms.[20] To allocate this energy usage to the various industries, we used energy per employee data from our internal Energy Market Profiles for the Mid-Atlantic region in combination with employee data from the Bureau of Labor Statistics. The resulting allocations are shown in Table 3-11 and referred to throughout the study as the *control totals* to which all energy usage is calibrated in the base year of the study.

Table 3-11 Industrial Market Segmentation by Industry Type, Base Year 2010

Segment	Employees	Electricity 2010 Use (GWh)	Natural Gas 2010 Use (million therms)
Chemical and Pharmaceutical	88,800	2,830	180
Paper	11,500	1,166	76
Food	30,000	783	68
Miscellaneous	126,900	3,651	173
Total	**257,200**	**8,429**	**497**

Figure 3-16 shows the size of each of the segments as a percentage of industrial sector energy sales.

Figure 3-16 Industrial Market Segmentation – Percentage of Energy Use



As with the residential and commercial sectors, the industrial market profiles characterize electricity use in terms of end use and technology for the base year 2010. Table 3-12 and Table 3-13 show the composite market profiles for the industrial sector.

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

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

Table 3-12 Industrial Sector Composite Electric Market Profile, 2010

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Employee)	Usage (GWh)
Cooling	Air-Cooled Chiller	2.5%	16,285	407	105
Cooling	Water-Cooled Chiller	2.5%	15,806	395	102
Cooling	Roof top AC	5.6%	15,747	879	226
Cooling	Air Source Heat Pump	1.2%	14,235	164	42
Cooling	Geothermal Heat Pump	0.3%	9,495	27	7
Cooling	Other Cooling	3.1%	12,065	369	95
Heating	Air Source Heat Pump	1.2%	37,385	431	111
Heating	Geothermal Heat Pump	0.3%	24,936	72	18
Heating	Electric Room Heat	0.2%	44,627	77	20
Heating	Electric Furnace	1.6%	46,859	730	188
Ventilation	Ventilation	100.0%	1,505	1,505	387
Interior Lighting	Screw-in	100.0%	569	569	146
Interior Lighting	High-Bay Fixtures	100.0%	2,222	2,222	572
Interior Lighting	Linear Fluorescent	100.0%	506	506	130
Exterior Lighting	Screw-in	100.0%	0	0	0
Exterior Lighting	HID	100.0%	309	309	79
Exterior Lighting	Linear Fluorescent	100.0%	1	1	0
Motors	Pumps	100.0%	3,396	3,396	873
Motors	Fans & Blowers	100.0%	2,060	2,060	530
Motors	Compressed Air	100.0%	2,646	2,646	681
Motors	Matl Handling	100.0%	1,511	1,511	389
Motors	Matl Processing	100.0%	4,434	4,434	1,140
Motors	Other Motors	100.0%	642	642	165
Process	Process Heating	100.0%	3,912	3,912	1,006
Process	Process Cooling and Refrigeration	100.0%	2,660	2,660	684
Process	Electro-Chemical Processes	100.0%	1,231	1,231	317
Process	Other Process	100.0%	280	280	72
Miscellaneous	Miscellaneous	100.0%	1,335	1,335	343
Total				**32,772**	**8,429**

Table 3-13 Industrial Sector Composite Natural Gas Market Profile, 2010

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Employee)	Usage (GWh)
Heating	Furnace	24.0%	814	195	50
Heating	Boiler	5.5%	1,463	80	21
Heating	Other Heating	18.4%	814	150	39
Process	Process Heating	100.0%	465	465	120
Process	Process Boiler	100.0%	890	890	229
Process	Process Cooling	100.0%	5	5	1
Process	Other Process	100.0%	35	35	9
Miscellaneous	Miscellaneous	100.0%	111	111	29
Total				**1,931**	**497**

Figure 3-17 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 3-17 Industrial Electricity and Natural Gas Use by End Use (2010), All Industries

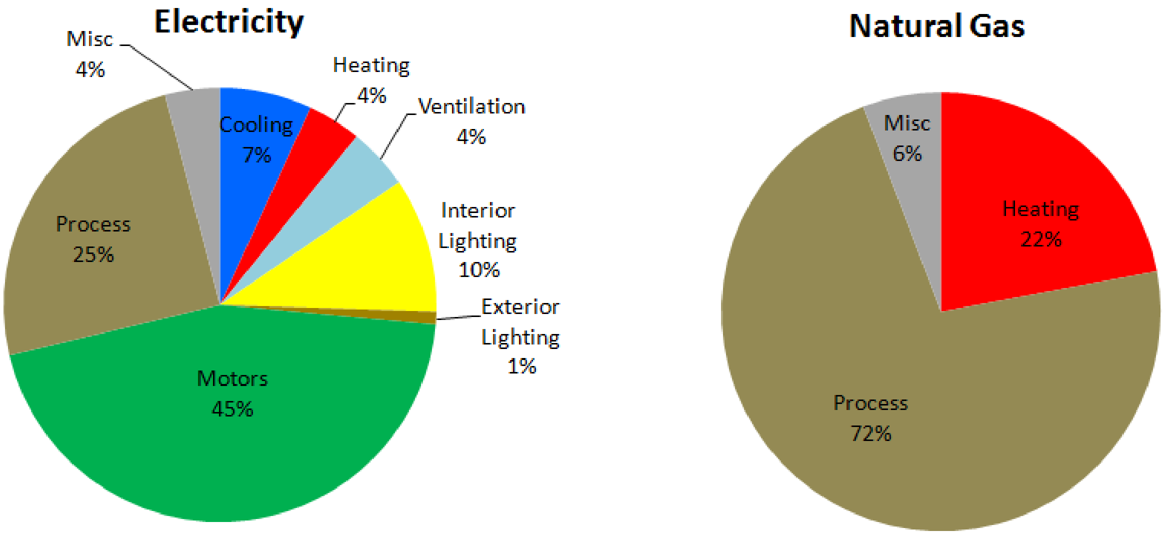


Figure 3-18 and Table 3-14 present the electric consumption by end-use and industry type. Figure 3-19 shows the same data as a percentage of total energy use for each segment.

Figure 3-18 Industrial Electricity Use by End Use and Segment (GWh, 2010)

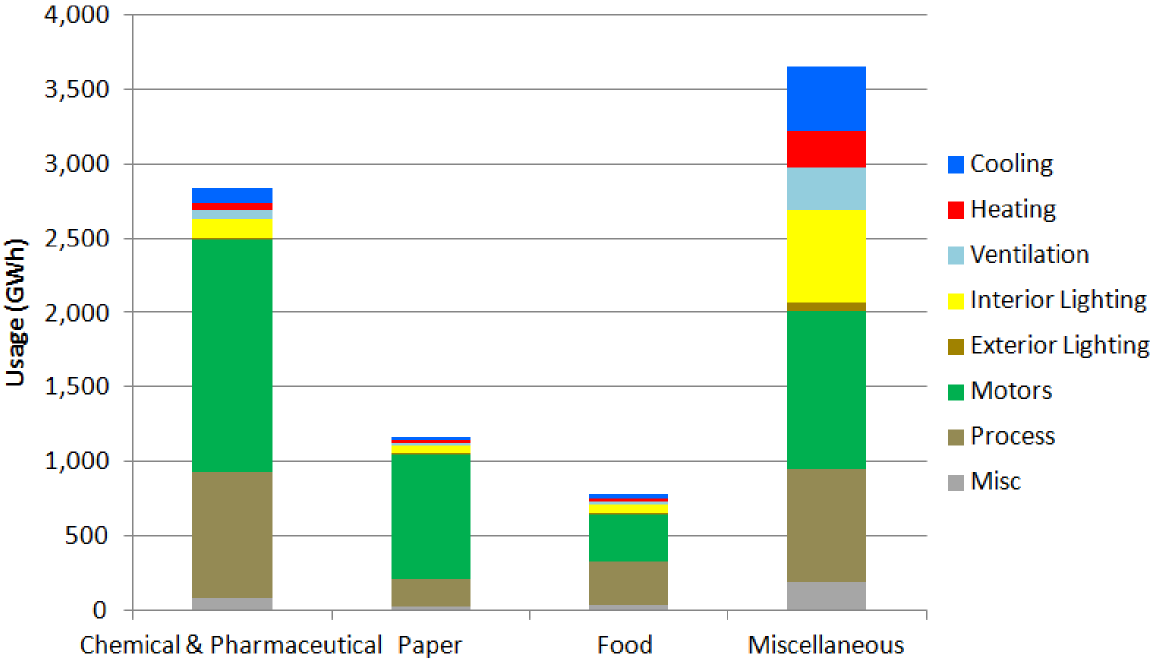


Table 3-14 Industrial Electricity Use by End Use and Segment (GWh, 2010)

End Use	Chemical & Pharmaceutical	Paper	Food	Misc.	All Industries Combined
Cooling	90	26	32	429	577
Heating	53	15	19	250	337
Interior Lighting	124	53	59	613	848
Exterior Lighting	12	5	6	58	80
Motors	1,559	839	316	1,063	3,778
Process	845	182	294	758	2,079
Misc.	88	27	36	192	343
Totals	**2,830**	**1,166**	**783**	**3,651**	**8,429**

Figure 3-19 Breakdown of Industrial Electricity Use by End Use and Segment (2010)

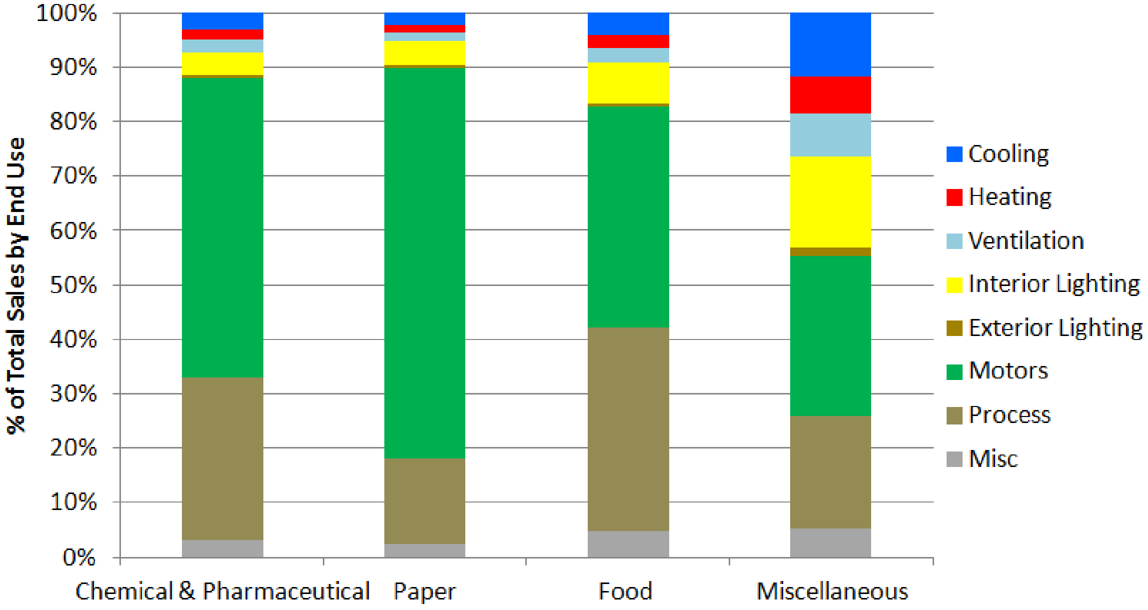


Figure 3-20 and Table 3-15 present the natural gas consumption by end-use and industry type. Figure 3-21 shows the same data as a percentage of total energy use.

Figure 3-20 Industrial Natural Gas Use by End Use and Segment (million therms, 2010)

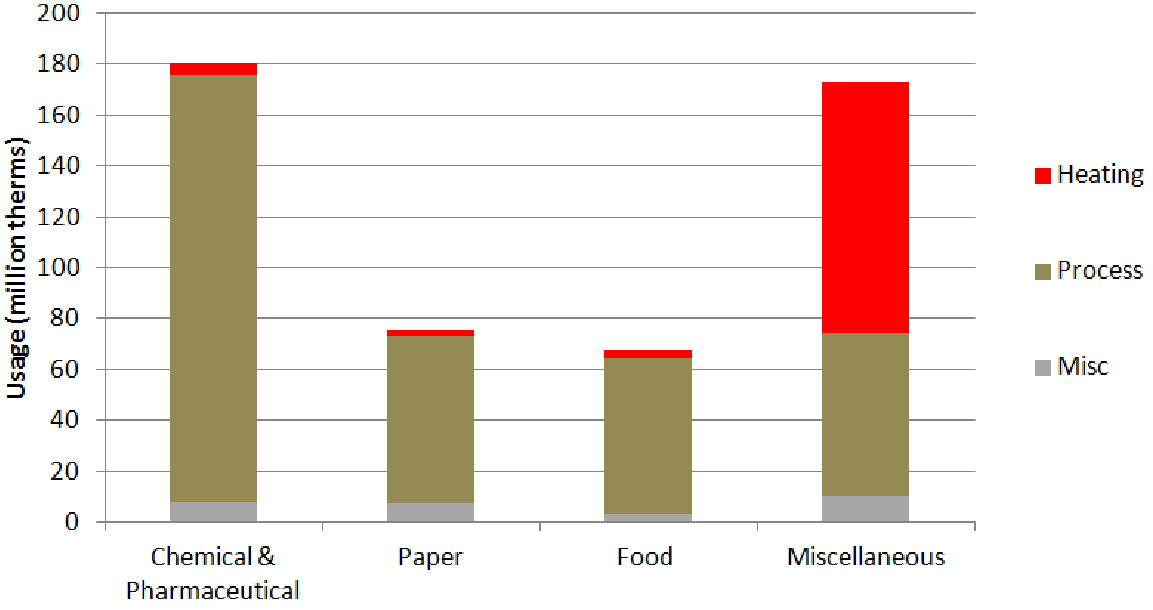
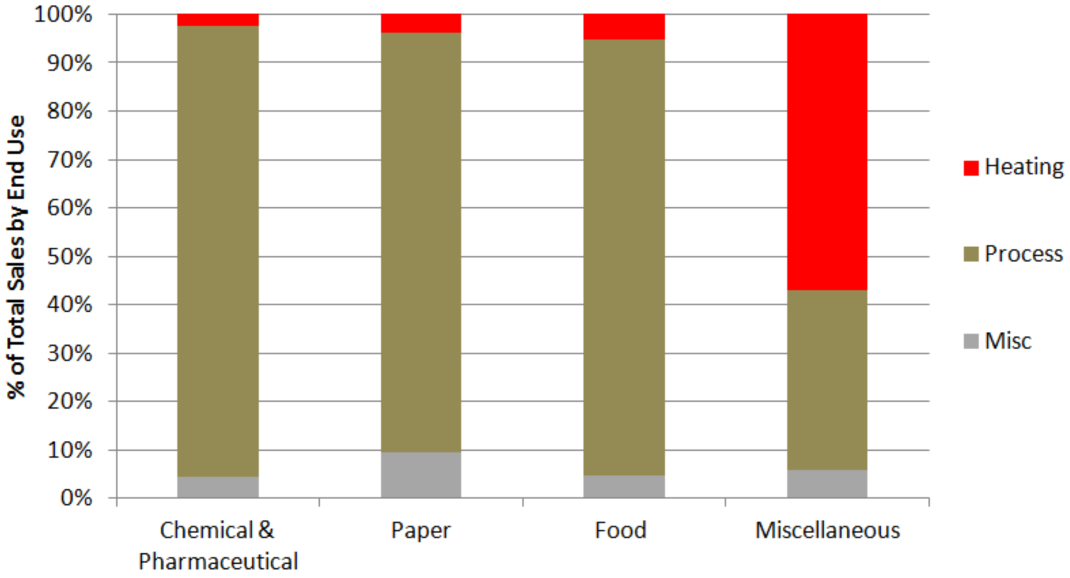


Table 3-15 Industrial Natural Gas Use by End Use and Segment (million therms, 2010)

End Use	Chemical & Pharmaceutical	Paper	Food	Misc.	All Industries Combined
Heating	4.6	2.8	3.5	98.5	109.4
Process	167.7	65.5	61.2	64.2	358.6
Misc.	8.1	7.1	3.2	10.2	28.6
Totals	180.3	75.5	67.9	172.8	496.6

Figure 3-21 Breakdown of Industrial Natural Gas Use by End Use and Segment (2010)



CHAPTER | 4

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.

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.

Table 4-1 and Figure 4-1 present 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 4-2 presents the forecast of use per household. Most noticeable is that lighting use decreases significantly throughout the time period as the lighting efficiency standards from EISA come into effect.

Table 4-1 Residential Electricity Consumption by End Use (GWh)

End Use	2010	2013	2014	2015	2016	%Change	Avg. Growth Rate
Cooling	6,215	6,210	6,250	6,300	6,372	3%	0.4%
Heating	1,316	1,364	1,385	1,407	1,432	9%	1.4%
Water Heating	1,217	1,198	1,202	1,204	1,207	-1%	-0.1%
Interior Lighting	5,970	6,245	5,576	5,183	4,923	-18%	-3.2%
Exterior Lighting	875	800	675	603	555	-37%	-7.6%
Appliances	7,123	6,350	6,158	5,996	5,872	-18%	-3.2%
Electronics	4,160	4,539	4,688	4,837	5,016	21%	3.1%
Miscellaneous	3,431	3,737	3,859	3,986	4,126	20%	3.1%
Total	**30,307**	**30,442**	**29,793**	**29,515**	**29,502**	**-2.7%**	**-0.4%**

Figure 4-1 ***Residential Electricity Baseline Forecast by End Use***

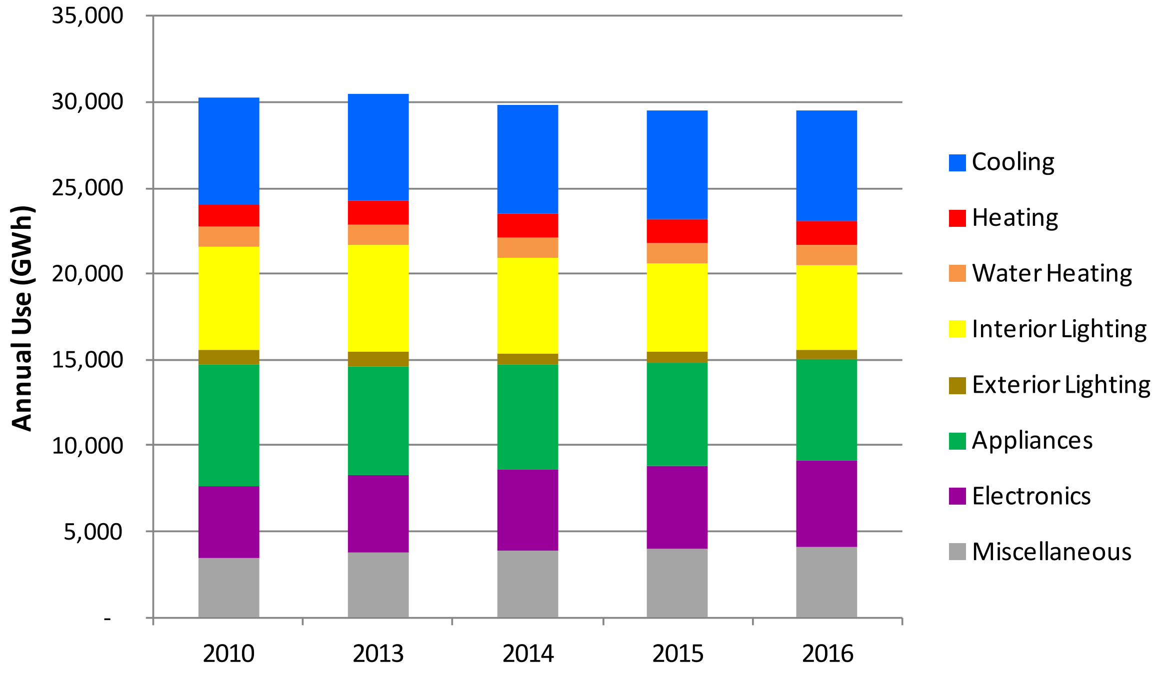


Figure 4-2 ***Residential Baseline Electricity Use per Household by End Use***

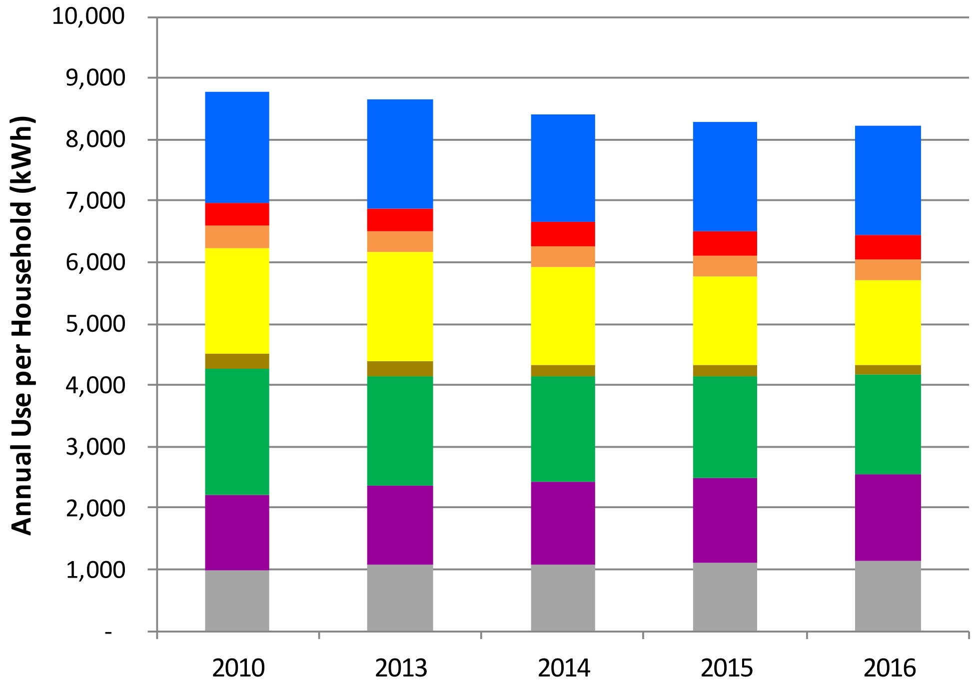


Table 4-2 shows the end-use forecast at the technology level. Specific observations include:

1. The primary reason for the reduction in the baseline forecast beginning in 2012 is the federal lighting standards. The standard phases general service incandescent lamps out of the market over a three-year period, causing a decline in interior screw-in lighting use by 37.6% over the forecast period.

2. Appliance energy use decreases markedly, reflecting efficiency gains from standards.
3. Growth in use in electronics is substantial and reflects an increase in the saturation of electronics and the trend toward higher-powered computers.
4. Growth in miscellaneous use is also substantial. This use includes various plug loads not elsewhere classified (e.g., hair dryers, power tools, coffee makers, etc.). This end use has grown consistently in the past and we incorporate future growth assumptions that are consistent with the Annual Energy Outlook.

Table 4-2 Residential Electricity Baseline Forecast by End Use and Technology (GWh)

End Use	Technology	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Cooling	Central AC	4,764	4,765	4,804	4,851	4,916	3.2%	0.5%
	Room AC	1,407	1,400	1,401	1,404	1,409	0.2%	0.0%
	Air-Source Heat Pump	44	45	45	46	46	4.3%	0.7%
	Geothermal Heat Pump	-	-	-	-	-	0.0%	0.0%
Heating	Electric Room Heat	739	768	781	793	808	9.3%	1.5%
	Electric Furnace	447	465	472	480	488	9.1%	1.5%
	Air-Source Heat Pump	130	131	133	134	136	4.6%	0.7%
	Geothermal Heat Pump	-	-	-	-	-	0.0%	0.0%
Water Heating	Water Heater <=55 gal	1,142	1,123	1,128	1,131	1,136	-0.5%	-0.1%
	Water Heater > 55 gal	75	74	75	73	71	-5.8%	-1.0%
Interior Lighting	Screw-in	3,627	3,525	2,878	2,509	2,265	-37.6%	-7.9%
	Linear Fluorescent	453	475	484	493	503	10.8%	1.7%
	Specialty	1,889	2,245	2,214	2,181	2,156	14.1%	2.2%
Ext. Lighting	Screw-in	875	800	675	603	555	-36.5%	-7.6%
Appliances	Clothes Washer	296	250	240	228	218	-26.3%	-5.1%
	Clothes Dryer	940	835	816	800	789	-16.1%	-2.9%
	Dishwasher	986	854	829	807	790	-19.9%	-3.7%
	Refrigerator	2,688	2,372	2,273	2,189	2,119	-21.2%	-4.0%
	Freezer	443	389	374	362	354	-20.2%	-3.8%
	Second Refrigerator	966	826	792	766	747	-22.7%	-4.3%
	Stove	366	380	385	391	397	8.3%	1.3%
	Microwave	436	445	449	453	458	5.1%	0.8%
Electronics	Personal Computers	733	803	826	843	870	18.7%	2.9%
	Monitor	146	156	161	166	172	17.9%	2.7%
	Laptops	283	309	315	324	334	18.1%	2.8%
	TVs	1,585	1,715	1,768	1,822	1,882	18.7%	2.9%
	Printer/Fax/Copier	157	154	154	154	153	-2.5%	-0.4%
	Set-top Boxes/DVR	904	1,012	1,059	1,106	1,164	28.8%	4.2%
	Devices and Gadgets	352	390	406	422	440	25.1%	3.7%
Miscellaneous	Pool Pump	591	616	627	638	651	10.1%	1.6%
	Pool Heater	103	103	104	105	106	3.3%	0.5%
	Hot Tub / Spa	137	143	145	148	151	10.1%	1.6%
	Well Pump	202	211	215	218	222	10.1%	1.6%
	Furnace Fan	739	771	784	798	813	10.0%	1.6%
	Miscellaneous	1,660	1,893	1,984	2,079	2,183	31.5%	4.6%
Total		**30,307**	**30,369**	**29,731**	**29,459**	**29,448**	**-2.8%**	**-0.5%**

Table 4-3 and Figure 4-3 present 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 4-4 shows that natural gas usage grows slightly, reflecting lower fuel prices.

Table 4-3 Residential Natural Gas Consumption by End Use (million therms)

End Use	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Heating	1,546	1,592	1,607	1,619	1,634	6%	0.9%
Water Heating	435	429	430	429	429	-1%	-0.2%
Appliances	185	179	178	178	178	-4%	-0.7%
Miscellaneous	89	99	103	107	111	25%	3.8%
Total	**2,255**	**2,300**	**2,319**	**2,333**	**2,352**	**4.3%**	**0.7%**

Figure 4-3 Residential Natural Gas Baseline Forecast by End Use

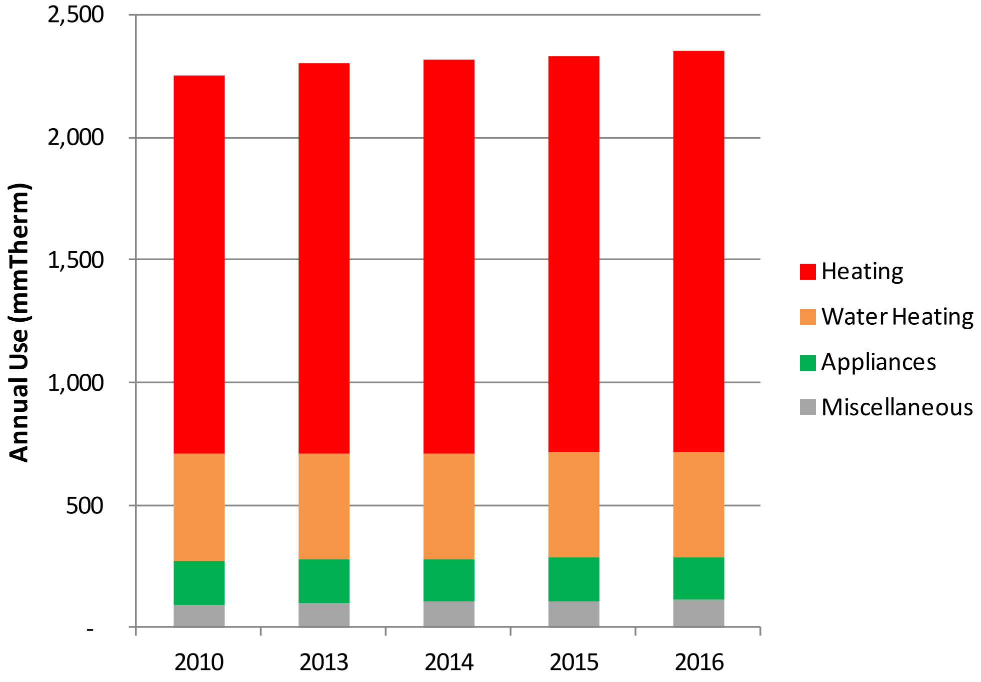


Figure 4-4 Residential Baseline Natural Gas Use per Household by End Use

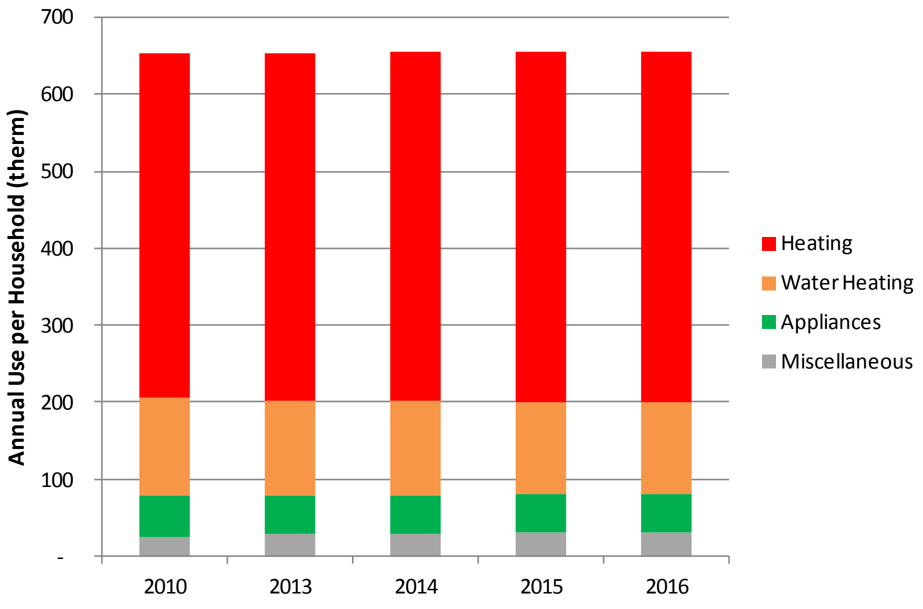


Table 4-4 shows the end use forecast for natural gas at the technology level. Gas water heating has a high saturation relative to other areas around the country, but grows only modestly over the forecast period.

Table 4-4 Residential Natural Gas Baseline Forecast by End Use and Technology (million therms)

End Use	Technology	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Heating	Furnace	859	880	886	891	897	4.5%	0.7%
	Boiler	673	696	705	712	721	7.1%	1.1%
	Other Heating	15	16	16	16	17	11.5%	1.8%
Water Heating	Water Heater <=55 gal	401	396	397	397	397	-1.1%	-0.2%
	Water Heater > 55 gal	33	33	33	32	32	-4.2%	-0.7%
Appliances	Clothes Dryer	50	40	38	37	35	-28.7%	-5.6%
	Stove	136	138	140	141	142	5.0%	0.8%
Miscellaneous	Pool Heater	26	28	28	29	29	12.3%	1.9%
	Hot Tub / Spa	10	10	10	11	11	12.3%	1.9%
	Miscellaneous	53	62	65	68	71	34.1%	4.9%
Total		**2,255**	**2,300**	**2,319**	**2,333**	**2,352**	**4.3%**	**0.7%**

Commercial Sector

Electricity use in the commercial sector shows a decline of 11% 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. Table 4-5 and Figure 4-5 present 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.

Table 4-5 Commercial Electricity Consumption by End Use (GWh)

End Use	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Cooling	6,353	6,212	6,185	6,088	6,082	-4%	-0.7%
Heating	1,826	1,798	1,800	1,786	1,798	-2%	-0.3%
Ventilation	3,760	3,665	3,634	3,506	3,463	-8%	-1.4%
Water Heating	1,207	1,179	1,178	1,170	1,185	-2%	-0.3%
Interior Lighting	12,915	11,719	10,981	10,190	9,948	-23%	-4.3%
Exterior Lighting	2,359	2,243	2,181	2,064	2,020	-14%	-2.6%
Refrigeration	4,067	3,847	3,666	3,346	3,178	-22%	-4.1%
Food Preparation	1,066	1,049	1,054	1,043	1,063	0%	-0.1%
Office Equipment	3,782	3,728	3,736	3,672	3,749	-1%	-0.1%
Miscellaneous	2,788	2,842	2,939	3,099	3,310	19%	2.9%
Total	**40,123**	**38,281**	**37,354**	**35,964**	**35,797**	**-11%**	**-1.9%**

Figure 4-5 Commercial Electricity Baseline Forecast by End Use

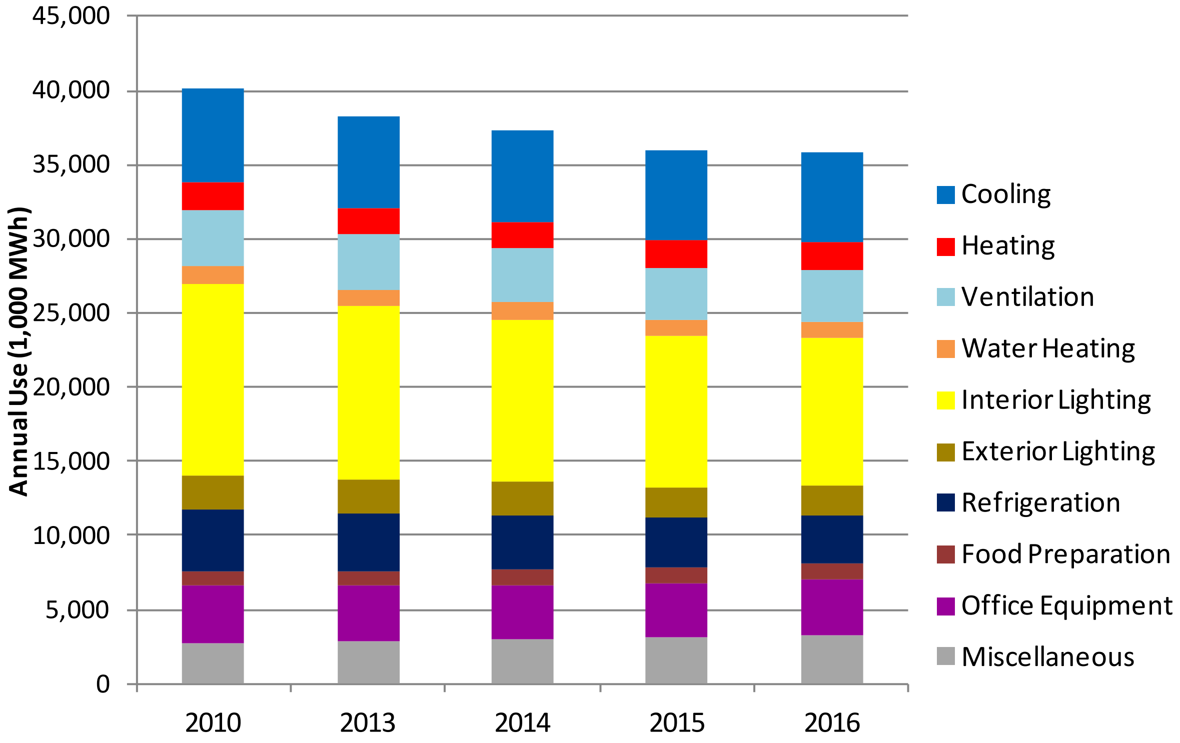


Table 4-6 presents the commercial sector electricity forecast by technology. Interior screw-in lighting and refrigeration decrease significantly over the forecast period as a result of efficiency standards.

Table 4-6 Commercial Baseline Electricity Forecast by End Use and Technology (GWh)

End Use	Technology	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Cooling	Air-Cooled Chiller	598	588	589	585	592	-1.1%	-0.2%
	Water-Cooled Chiller	520	512	513	511	517	-0.6%	-0.1%
	Roof top AC	3,295	3,204	3,173	3,099	3,068	-6.9%	-1.2%
	Air-Source Heat Pump	593	578	573	563	559	-5.8%	-1.0%
	Geothermal Heat Pump	99	98	99	99	101	2.3%	0.4%
	Other Cooling	1,247	1,232	1,237	1,231	1,245	-0.1%	0.0%
Heating	Air-Source Heat Pump	755	740	738	731	731	-3.2%	-0.5%
	Geothermal Heat Pump	126	123	124	123	124	-1.1%	-0.2%
	Electric Room Heat	90	89	90	89	90	-0.2%	0.0%
	Electric Furnace	854	845	848	843	853	-0.2%	0.0%
Ventilation	Ventilation	3,760	3,665	3,634	3,506	3,463	-7.9%	-1.4%
Water Heating	Water Heater	1,207	1,179	1,178	1,170	1,185	-1.9%	-0.3%
Interior Lighting	Screw-in	5,280	4,366	3,769	3,263	3,063	-42.0%	-9.1%
	High-Bay Fixtures	1,868	1,660	1,504	1,270	1,189	-36.4%	-7.5%
	Linear Fluorescent	5,767	5,693	5,708	5,656	5,697	-1.2%	-0.2%
Exterior Lighting	Screw-in	576	545	533	507	480	-16.8%	-3.1%
	HID	1,633	1,547	1,494	1,397	1,364	-16.5%	-3.0%
	Linear Fluorescent	149	151	155	161	176	18.1%	2.8%
Refrigeration	Walk-in Refrigerator	1,172	1,037	938	787	699	-40.4%	-8.6%
	Reach-in Refrigerator	127	114	105	91	83	-34.3%	-7.0%
	Glass Door Display	1,545	1,509	1,444	1,329	1,265	-18.1%	-3.3%
	Open Display Case	697	689	690	677	681	-2.4%	-0.4%
	Icemaker	263	247	245	244	249	-5.0%	-0.9%
	Vending Machine	263	251	244	218	200	-23.8%	-4.5%
Food Preparation	Oven	227	228	233	240	253	11.4%	1.8%
	Fryer	302	303	309	318	333	10.2%	1.6%
	Dishwasher	428	416	412	396	393	-8.3%	-1.4%
	Hot Food Container	108	103	99	90	84	-22.6%	-4.3%
Office Equipment	Desktop Computer	1,927	1,919	1,927	1,888	1,911	-0.8%	-0.1%
	Laptop	291	292	296	295	304	4.8%	0.8%
	Server	881	858	858	844	876	-0.6%	-0.1%
	Monitor	357	348	348	347	358	0.2%	0.0%
	Printer/Copier/Fax	261	252	250	243	244	-6.6%	-1.1%
	POS Terminal	65	59	57	55	56	-12.7%	-2.3%
Miscellaneous	Non-HVAC Motors	166	163	163	161	164	-1.2%	-0.2%
	Pool Pump	0	0	0	0	1	2.5%	0.4%
	Pool Heater	0	0	0	0	0	2.1%	0.4%
	Miscellaneous	2,622	2,679	2,776	2,937	3,145	20.0%	3.0%
Total		**40,123**	**38,281**	**37,354**	**35,964**	**35,797**	**-10.8%**	**-1.9%**

Table 4-7 and Figure 4-6 show 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.

Table 4-7 ***Commercial Natural Gas Consumption by End Use (million therms)***

End Use	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Heating	1,230.7	1,171	1,155	1,150	1,153	-6%	-1.1%
Water Heating	421	386	383	382	385	-9%	-1.5%
Food Preparation	185	184	184	185	187	1%	0.1%
Miscellaneous	30	31	31	31	31	4%	0.6%
Total	**1,867**	**1,771**	**1,753**	**1,748**	**1,756**	**-6%**	**-1.0%**

Figure 4-6 ***Commercial Natural Gas Baseline Forecast by End Use***

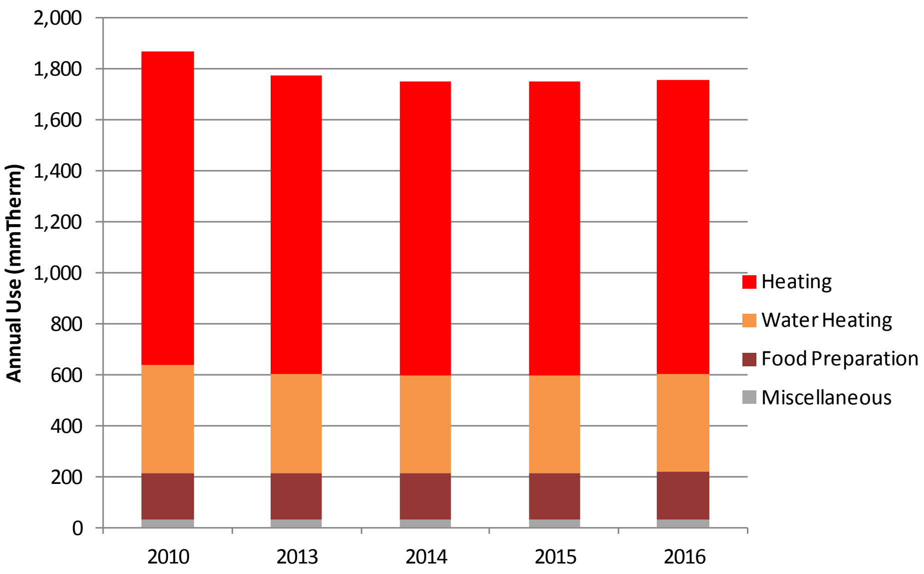


Table 4-8 shows the commercial baseline gas forecast at the technology level.

Table 4-8 ***Commercial Baseline Electricity Forecast by End Use and Technology (GWh)***

End Use	Technology	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Heating	Furnace	231	229	228	227	229	-1.1%	-0.2%
	Boiler	834	814	798	769	766	-8.1%	-1.4%
	Other Heating	166	163	162	159	158	-4.4%	-0.8%
Water Heating	Water Heater	421	401	391	383	385	-8.6%	-1.5%
Food Preparation	Oven	22	22	22	22	23	1.0%	0.2%
	Fryer	33	32	32	32	33	1.1%	0.2%
	Broiler	33	32	33	33	33	2.6%	0.4%
	Griddle	33	32	32	33	33	2.0%	0.3%
	Range	33	32	32	33	33	2.5%	0.4%
	Steamer	33	32	32	31	31	-4.8%	-0.8%
Miscellaneous	Pool Heater	2	2	2	2	2	0.2%	0.0%
	Miscellaneous	28	28	28	28	29	3.9%	0.6%
Total		**1,867**	**1,821**	**1,794**	**1,753**	**1,756**	**-6.0%**	**-1.0%**

Industrial Sector

Table 4-9 and Figure 4-7 present 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%, or 1.4% per year. This is largely driven by the economy and sluggish projections for recovery.

Table 4-9 Industrial Electricity Consumption by End Use (GWh)

End Use	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Cooling	577	565	561	566	551	-4%	-0.7%
Heating	337	340	340	345	338	0%	0.1%
Ventilation	387	372	365	364	352	-9%	-1.6%
Interior Lighting	848	595	559	549	530	-38%	-7.8%
Exterior Lighting	80	61	58	58	56	-30%	-5.8%
Motors	3,778	3,536	3,588	3,626	3,531	-7%	-1.1%
Process	2,079	1,978	1,999	2,026	1,967	-5%	-0.9%
Miscellaneous	343	377	387	402	407	18%	2.8%
Total	**8,429**	**7,822**	**7,858**	**7,937**	**7,732**	**-8%**	**-1.4%**

Figure 4-7 Industrial Electricity Baseline Forecast by End Use

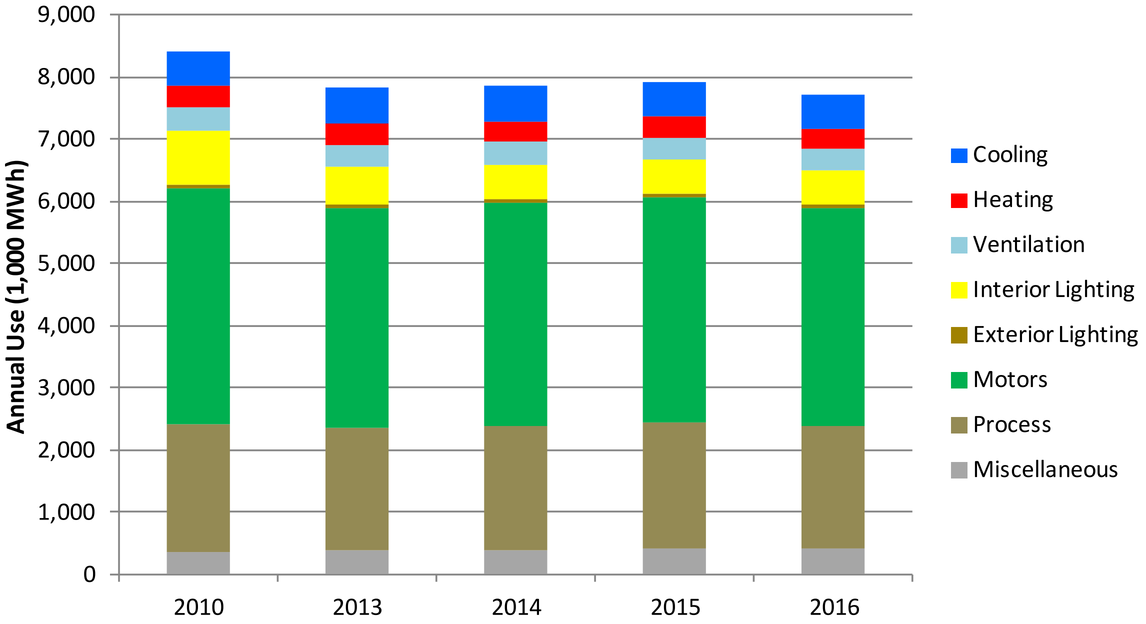
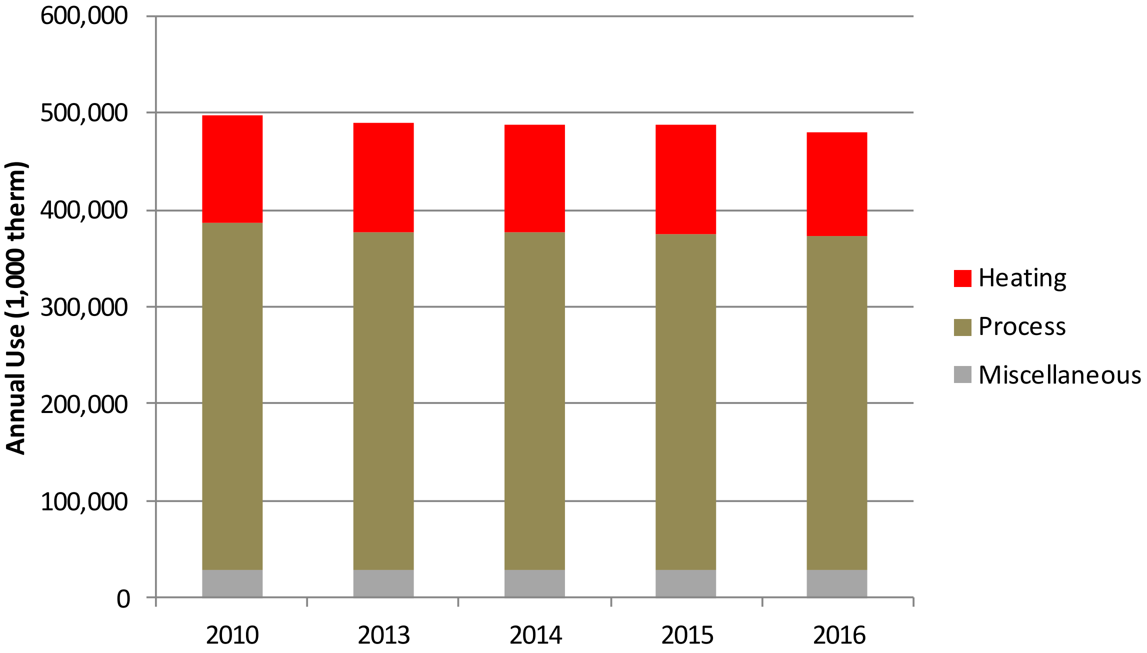


Table 4-10 and Figure 4-8 show a similar story for the industrial natural gas baseline forecast. The overall decrease from 2010 to 2016 is 3%, with an average decline of 0.5% per year.

Table 4-10 Industrial Natural Gas Consumption by End Use (million therms)

End Use	2010	2013	2014	2015	2016	% Change	Avg. Growth Rate
Heating	109,437	111,708	110,834	112,106	108,831	-1%	-0.1%
Process	358,634	348,987	347,894	346,215	343,679	-4%	-0.7%
Miscellaneous	28,576	28,391	28,437	28,615	28,388	-1%	-0.1%
Total	**496,647**	**489,086**	**487,165**	**486,936**	**480,898**	**-3%**	**-0.5%**

Figure 4-8 Industrial Natural Gas Baseline Forecast by End Use



Baseline Forecast Summary

Table 4-11 and Figure 4-9 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 4-11 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 4-9 Electricity Baseline Forecast Summary (GWh)

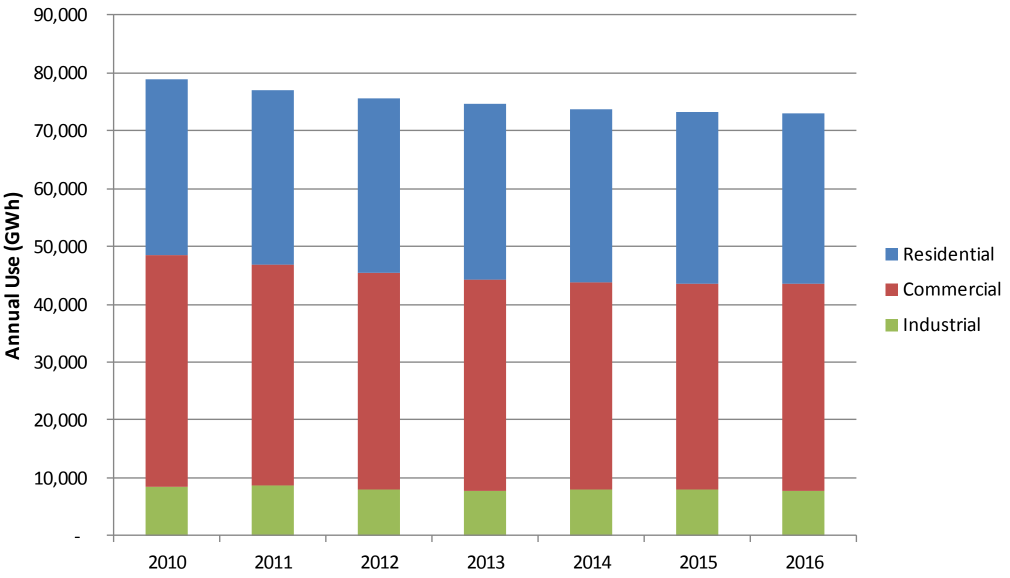
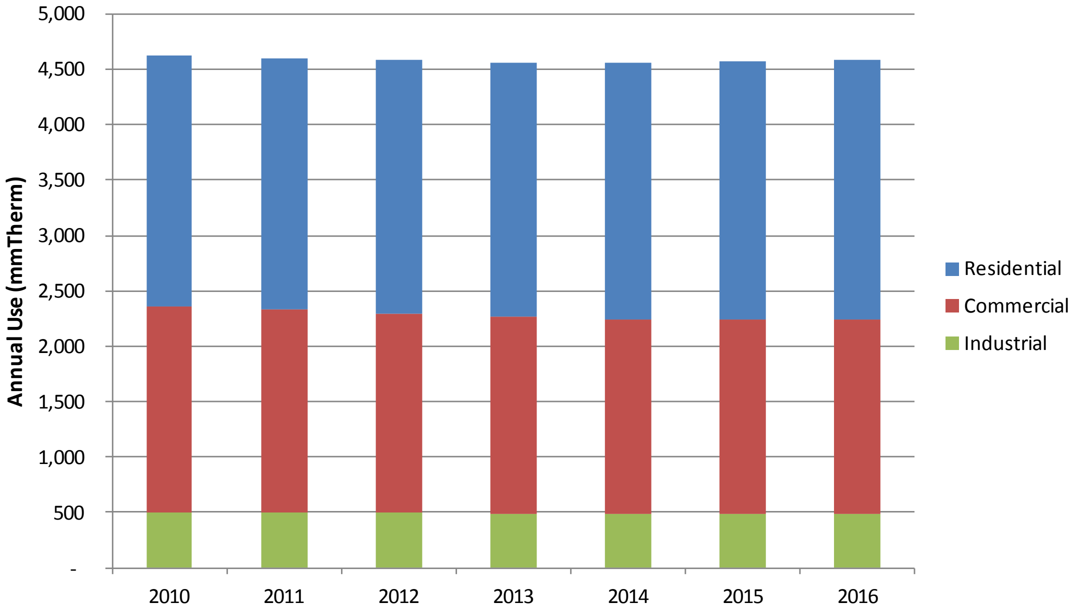


Table 4-12 and Figure 4-10 provide a summary of the natural gas baseline forecast by sector for New Jersey. Overall, the forecast is increasing slightly across all sectors.

Table 4-12 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 4-10 Natural Gas Baseline Forecast Summary (million therms)



CHAPTER | **5**

ENERGY EFFICIENCY MEASURES

List of Energy Efficiency Measures

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 New Jersey potential assessment.

For this study, EnerNOC prepared a preliminary list of measures for BPU and CEEEP staff to review. After incorporating feedback, we populated the full databases for the three sectors.

Sources for the measure assumptions were drawn from past New Jersey program experience, EnerNOC's building simulation tool (BEST), EnerNOC's measure database (DEEM), DEER, NWPCC workbooks, other secondary sources, and other data from EnerNOC's previous studies and program work.

- **Residential Measures**. The residential measures span all end uses and vary significantly in the manner in which they impact energy consumption. Table 5-1shows the residential equipment measure options and the segments for which they were modeled. Table 5-2 shows the residential non-equipment measure options. All residential measures considered for this study are described in Appendix B.
- **Commercial Measures**. Table 5-3 and Table 5-4 present a summary of the commercial equipment and non-equipment measures, respectively. The measures shown were modeled for nearly all of the commercial building types, both new and existing, with only a few exceptions. For instance, hotel guestroom controls were only modeled for the lodging sector. All commercial measures considered for this study are described in Appendix C.
- **Industrial Measures**. Table 5-5 and Table 5-6 present a summary of the industrial equipment and non-equipment measures, respectively. All industrial measures considered for this study are described in Appendix D.

Table 5-1 Summary of Residential Equipment Measures

End Use	Fuel	Technology	Efficiency Option
Cooling	Electric	Central AC	SEER 13
Cooling	Electric	Central AC	SEER 14 (Energy Star)
Cooling	Electric	Central AC	SEER 15 (CEE Tier 2)
Cooling	Electric	Central AC	SEER 16 (CEE Tier 3)
Cooling	Electric	Central AC	Ductless Minisplit
Cooling	Electric	Central AC	SEER 21
Cooling	Electric	Room AC	EER 9.8
Cooling	Electric	Room AC	EER 10.8 (Energy Star)
Cooling	Electric	Room AC	EER 11.0
Cooling	Electric	Room AC	EER 11.5
Cooling	Electric	Room AC	EER 12.0
Cooling/Heating	Electric	Air-Source Heat Pump	SEER 13
Cooling/Heating	Electric	Air-Source Heat Pump	SEER 14 (Energy Star)
Cooling/Heating	Electric	Air-Source Heat Pump	SEER 15 (CEE Tier 2)
Cooling/Heating	Electric	Air-Source Heat Pump	SEER 16 (CEE Tier 3)
Cooling/Heating	Electric	Air-Source Heat Pump	Ductless Minisplit
Cooling/Heating	Electric	Geothermal Heat Pump	EER 14.1, COP 3.3
Cooling/Heating	Electric	Geothermal Heat Pump	EER 16, COP 3.5
Cooling/Heating	Electric	Geothermal Heat Pump	EER 18, COP 3.8
Cooling/Heating	Electric	Geothermal Heat Pump	EER 30, COP 5.0
Heating	Electric	Electric Room Heat	Standard
Heating	Electric	Electric Furnace	Standard
Water Heating	Electric	Water Heater <=55 gal	EF 0.9
Water Heating	Electric	Water Heater <=55 gal	EF 0.95
Water Heating	Electric	Water Heater <=55 gal	EF 2.3 (HP)
Water Heating	Electric	Water Heater > 55 gal	EF 0.9
Water Heating	Electric	Water Heater > 55 gal	EF 0.95
Water Heating	Electric	Water Heater > 55 gal	EF 2.3 (HP)
Interior Lighting	Electric	Screw-in	Incandescent
Interior Lighting	Electric	Screw-in	Infrared Halogen
Interior Lighting	Electric	Screw-in	Infrared Halogen (2020)
Interior Lighting	Electric	Screw-in	CFL
Interior Lighting	Electric	Screw-in	LED
Interior Lighting	Electric	Screw-in	LED (2020)
Interior Lighting	Electric	Linear Fluorescent	T12
Interior Lighting	Electric	Linear Fluorescent	T8
Interior Lighting	Electric	Linear Fluorescent	Super T8
Interior Lighting	Electric	Linear Fluorescent	T5
Interior Lighting	Electric	Linear Fluorescent	LED
Interior Lighting	Electric	Specialty	Incandescent
Interior Lighting	Electric	Specialty	Infrared Halogen
Interior Lighting	Electric	Specialty	Infrared Halogen (2020)
Interior Lighting	Electric	Specialty	CFL
Interior Lighting	Electric	Specialty	LED
Interior Lighting	Electric	Specialty	LED (2020)
Exterior Lighting	Electric	Screw-in	Incandescent
Exterior Lighting	Electric	Screw-in	Infrared Halogen
Exterior Lighting	Electric	Screw-in	Infrared Halogen (2020)
Exterior Lighting	Electric	Screw-in	CFL
Exterior Lighting	Electric	Screw-in	LED
Exterior Lighting	Electric	Screw-in	LED (2020)
Appliances	Electric	Clothes Washer	Standard (1.26)
Appliances	Electric	Clothes Washer	Energy Star (1.72)
Appliances	Electric	Clothes Washer	AHAM (MEF 1.72)
Appliances	Electric	Clothes Washer	Energy Star (MEF 2.0)

Table 5-1 Summary of Residential Equipment Measures (cont.)

End Use	Fuel	Technology	Efficiency Option
Appliances	Electric	Clothes Washer	AHAM (MEF 2.0)
Appliances	Electric	Clothes Washer	Compact (MEF 2.79)
Appliances	Electric	Clothes Dryer	Baseline
Appliances	Electric	Clothes Dryer	High Efficiency
Appliances	Electric	Clothes Dryer	Baseline (2015+)
Appliances	Electric	Clothes Dryer	High Efficiency (2015+)
Appliances	Electric	Clothes Dryer	HP (EF 4.52)
Appliances	Electric	Dishwasher	Standard (EF 0.63)
Appliances	Electric	Dishwasher	Energy Star (EF 0.69)
Appliances	Electric	Dishwasher	Energy Star (EF 0.73)
Appliances	Electric	Dishwasher	AHAM (EF 0.73)
Appliances	Electric	Dishwasher	Ultra Efficient (EF 1.1)
Appliances	Electric	Refrigerator	Standard
Appliances	Electric	Refrigerator	Energy Star
Appliances	Electric	Refrigerator	High Efficiency
Appliances	Electric	Refrigerator	AHAM (2014)
Appliances	Electric	Refrigerator	High Efficiency (2014)
Appliances	Electric	Freezer	Standard
Appliances	Electric	Freezer	Energy Star
Appliances	Electric	Freezer	High Efficiency
Appliances	Electric	Freezer	AHAM (2014)
Appliances	Electric	Freezer	High Efficiency (2014)
Appliances	Electric	Second Refrigerator	Standard
Appliances	Electric	Second Refrigerator	Energy Star
Appliances	Electric	Second Refrigerator	High Efficiency
Appliances	Electric	Second Refrigerator	AHAM (2014)
Appliances	Electric	Second Refrigerator	High Efficiency (2014)
Appliances	Electric	Stove	Baseline
Appliances	Electric	Stove	Convection
Appliances	Electric	Stove	Halogen Burner
Appliances	Electric	Stove	Induction
Appliances	Electric	Microwave	Standard
Electronics	Electric	Personal Computers	Standard
Electronics	Electric	Personal Computers	Energy Star
Electronics	Electric	Monitor	Standard
Electronics	Electric	Monitor	Energy Star
Electronics	Electric	Laptops	Standard
Electronics	Electric	Laptops	Energy Star
Electronics	Electric	TVs	Standard
Electronics	Electric	TVs	Energy Star (3.1)
Electronics	Electric	TVs	Energy Star (4.1)
Electronics	Electric	TVs	Energy Star (5.1)
Electronics	Electric	Printer/Fax/Copier	Standard
Electronics	Electric	Printer/Fax/Copier	Energy Star
Electronics	Electric	Set-top Boxes/DVR	Standard
Electronics	Electric	Set-top Boxes/DVR	Energy Star (2009)
Electronics	Electric	Set-top Boxes/DVR	Energy Star (2011)
Electronics	Electric	Devices and Gadgets	Standard
Miscellaneous	Electric	Pool Pump	Standard
Miscellaneous	Electric	Pool Pump	High Efficiency
Miscellaneous	Electric	Pool Pump	Two-Speed
Miscellaneous	Electric	Pool Heater	Electric Resistance
Miscellaneous	Electric	Pool Heater	Heat Pump (COP = 5.0)
Miscellaneous	Electric	Hot Tub / Spa	Standard
Miscellaneous	Electric	Hot Tub / Spa	Efficient Pumps

Table 5-1 Summary of Residential Equipment Measures (cont.)

End Use	Fuel	Technology	Efficiency Option
Miscellaneous	Electric	Hot Tub / Spa	Improved Controls and Pumps
Miscellaneous	Electric	Well Pump	Baseline (40% EF)
Miscellaneous	Electric	Well Pump	High Efficiency (60% EF)
Miscellaneous	Electric	Furnace Fan	Standard
Miscellaneous	Electric	Furnace Fan	ECM
Miscellaneous	Electric	Miscellaneous	Standard
Heating	Natural Gas	Furnace	AFUE 80%
Heating	Natural Gas	Furnace	AFUE 83%
Heating	Natural Gas	Furnace	AFUE 90%
Heating	Natural Gas	Furnace	AFUE 96%
Heating	Natural Gas	Boiler	EF 0.81
Heating	Natural Gas	Boiler	EF 0.82
Heating	Natural Gas	Boiler	EF 0.85
Heating	Natural Gas	Boiler	EF 0.95
Heating	Natural Gas	Other Heating	Gas Fireplace
Water Heating	Natural Gas	Water Heater <=55 gal	EF 0.59
Water Heating	Natural Gas	Water Heater <=55 gal	EF 0.63
Water Heating	Natural Gas	Water Heater <=55 gal	EF 0.74
Water Heating	Natural Gas	Water Heater <=55 gal	EF 0.76
Water Heating	Natural Gas	Water Heater <=55 gal	EF 0.86 (Condensing)
Water Heating	Natural Gas	Water Heater > 55 gal	EF 0.59
Water Heating	Natural Gas	Water Heater > 55 gal	EF 0.63
Water Heating	Natural Gas	Water Heater > 55 gal	EF 0.74
Water Heating	Natural Gas	Water Heater > 55 gal	EF 0.76
Water Heating	Natural Gas	Water Heater > 55 gal	EF 0.86 (Condensing)
Appliances	Natural Gas	Clothes Dryer	Standard
Appliances	Natural Gas	Clothes Dryer	Standard (AHAM)
Appliances	Natural Gas	Clothes Dryer	Efficient
Appliances	Natural Gas	Stove	Standard (EF .399)
Appliances	Natural Gas	Stove	Efficient (EF .42)
Miscellaneous	Natural Gas	Pool Heater	EF .78
Miscellaneous	Natural Gas	Pool Heater	EF .82
Miscellaneous	Natural Gas	Pool Heater	EF .90
Miscellaneous	Natural Gas	Pool Heater	EF .95
Miscellaneous	Natural Gas	Hot Tub / Spa	EF .78
Miscellaneous	Natural Gas	Hot Tub / Spa	EF .82
Miscellaneous	Natural Gas	Hot Tub / Spa	EF .90
Miscellaneous	Natural Gas	Hot Tub / Spa	EF .95
Miscellaneous	Natural Gas	Miscellaneous	Standard
Heating	Fuel Oil	Furnace	AFUE 81%
Heating	Fuel Oil	Furnace	AFUE 83%
Heating	Fuel Oil	Furnace	AFUE 85%
Heating	Fuel Oil	Furnace	AFUE 95%
Heating	Fuel Oil	Boiler	EF 0.81
Heating	Fuel Oil	Boiler	EF 0.84
Heating	Fuel Oil	Boiler	EF 0.85
Heating	Fuel Oil	Boiler	EF 0.95
Water Heating	Fuel Oil	Water Heater <=55 gal	EF 0.55
Water Heating	Fuel Oil	Water Heater <=55 gal	EF 0.62
Water Heating	Fuel Oil	Water Heater <=55 gal	EF 0.64
Water Heating	Fuel Oil	Water Heater <=55 gal	EF 0.68
Water Heating	Fuel Oil	Water Heater > 55 gal	EF 0.55
Water Heating	Fuel Oil	Water Heater > 55 gal	EF 0.62
Water Heating	Fuel Oil	Water Heater > 55 gal	EF 0.64
Water Heating	Fuel Oil	Water Heater > 55 gal	EF 0.68

Table 5-2 Summary of Residential Non-Equipment Measures

Measure	Existing	New
Insulation - Ceiling	X	X
Insulation - Ducting	X	X
Insulation - Foundation		X
Insulation - Infiltration Control	X	X
Insulation - Radiant Barrier	X	X
Insulation - Wall Cavity	X	X
Insulation - Wall Sheathing	X	X
Ducting - Repair and Sealing	X	X
Windows - High Efficiency/ENERGY STAR	X	X
Windows - Install Reflective Film	X	X
Doors - Storm and Thermal	X	X
Roofs - High Reflectivity	X	X
Attic Fan - Installation	X	X
Attic Fan - Photovoltaic - Installation	X	X
Whole-House Fan - Installation	X	X
Ceiling Fan - Installation	X	X
Thermostat - Clock/Programmable	X	X
Home Energy Management System	X	X
Central AC - Early Replacement	X	X
Central AC - Maintenance and Tune-Up	X	X
Central Heat Pump - Maintenance	X	X
Room AC - Removal of Second Unit	X	X
Boiler - Hot Water Reset	X	X
Boiler - Pipe Insulation	X	X
Boiler - Maintenance	X	X
Furnace - Maintenance	X	X
Water Heater - Drainwater Heat Recovery	X	X
Water Heater - Faucet Aerators	X	X
Water Heater - Low-Flow Showerheads	X	X
Water Heater - Pipe Insulation	X	X
Water Heater - Timer	X	X
Water Heater - Desuperheater	X	X
Water Heater - Solar System	X	X
Water Heater - Tank Blanket/Insulation	X	X
Interior Lighting - Occupancy Sensors	X	X
Exterior Lighting - Photosensor Control	X	X
Exterior Lighting - Photovoltaic Installation	X	X
Exterior Lighting - Timeclock Installation	X	X
Refrigerator - Early Replacement	X	X
Refrigerator - Maintenance	X	X
Refrigerator - Remove Second Unit	X	X
Freezer - Remove Second Unit	X	X
Freezer - Early Replacement	X	X
Freezer - Maintenance	X	X
Electronics - Smart Power Strips	X	X
Pool Pump - Timer	X	X
Pool Heater - Solar System	X	X
ENERGY STAR Home Design		X
Behavioral Feedback Tools	X	X

Table 5-3 Summary of Commercial Equipment Measures

End Use	Fuel	Technology	Label
Cooling	Electric	Air-Cooled Chiller	1.5 kw/ton, COP 2.3
Cooling	Electric	Air-Cooled Chiller	1.3 kw/ton, COP 2.7
Cooling	Electric	Air-Cooled Chiller	1.26 kw/ton, COP 2.8
Cooling	Electric	Air-Cooled Chiller	1.0 kw/ton, COP 3.5
Cooling	Electric	Air-Cooled Chiller	0.97 kw/ton, COP 3.6
Cooling	Electric	Water-Cooled Chiller	0.75 kw/ton, COP 4.7
Cooling	Electric	Water-Cooled Chiller	0.60 kw/ton, COP 5.9
Cooling	Electric	Water-Cooled Chiller	0.58 kw/ton, COP 6.1
Cooling	Electric	Water-Cooled Chiller	0.55 kw/Ton, COP 6.4
Cooling	Electric	Water-Cooled Chiller	0.51 kw/ton, COP 6.9
Cooling	Electric	Water-Cooled Chiller	0.50 kw/Ton, COP 7.0
Cooling	Electric	Water-Cooled Chiller	0.48 kw/ton, COP 7.3
Cooling	Electric	Roof top AC	EER 9.2
Cooling	Electric	Roof top AC	EER 10.1
Cooling	Electric	Roof top AC	EER 11.2
Cooling	Electric	Roof top AC	EER 12.0
Cooling	Electric	Roof top AC	Ductless Minisplit
Cooling	Electric	Air-Source Heat Pump	EER 9.3
Cooling	Electric	Air-Source Heat Pump	EER 10.3
Cooling	Electric	Air-Source Heat Pump	EER 11.0
Cooling	Electric	Air-Source Heat Pump	EER 11.7
Cooling	Electric	Air-Source Heat Pump	EER 12.0
Cooling	Electric	Air-Source Heat Pump	Ductless Minisplit
Cooling	Electric	Geothermal Heat Pump	EER 14.1
Cooling	Electric	Geothermal Heat Pump	EER 16
Cooling	Electric	Geothermal Heat Pump	EER 18
Cooling	Electric	Geothermal Heat Pump	EER 30
Cooling	Electric	Other Cooling	EER 9.8
Cooling	Electric	Other Cooling	EER 10.2
Cooling	Electric	Other Cooling	EER 10.8
Cooling	Electric	Other Cooling	EER 11
Cooling	Electric	Other Cooling	EER 11.5
Heating	Electric	Air-Source Heat Pump	EER 9.3
Heating	Electric	Air-Source Heat Pump	EER 10.3
Heating	Electric	Air-Source Heat Pump	EER 11.0
Heating	Electric	Air-Source Heat Pump	EER 11.7
Heating	Electric	Air-Source Heat Pump	EER 12.0
Heating	Electric	Air-Source Heat Pump	Ductless Minisplit
Heating	Electric	Geothermal Heat Pump	EER 14.1
Heating	Electric	Geothermal Heat Pump	EER 16
Heating	Electric	Geothermal Heat Pump	EER 18
Heating	Electric	Geothermal Heat Pump	EER 30
Heating	Electric	Electric Room Heat	Standard
Heating	Electric	Electric Furnace	Standard
Ventilation	Electric	Ventilation	Constant Volume

Table 5-3 Summary of Commercial Equipment Measures (continued)

End Use	Fuel	Technology	Label
Ventilation	Electric	Ventilation	Variable Air Volume
Water Heating	Electric	Water Heater	EF .97
Water Heating	Electric	Water Heater	EF .98
Water Heating	Electric	Water Heater	EF 2.0
Water Heating	Electric	Water Heater	EF 2.3
Water Heating	Electric	Water Heater	EF 2.4
Interior Lighting	Electric	Screw-in	Incandescent
Interior Lighting	Electric	Screw-in	90W Halogen PAR-38
Interior Lighting	Electric	Screw-in	70W HIR PAR-38
Interior Lighting	Electric	Screw-in	CFL
Interior Lighting	Electric	Screw-in	LED (2010)
Interior Lighting	Electric	Screw-in	LED (2020)
Interior Lighting	Electric	High-Bay Fixtures	Metal Halides
Interior Lighting	Electric	High-Bay Fixtures	LED (2010)
Interior Lighting	Electric	High-Bay Fixtures	T8
Interior Lighting	Electric	High-Bay Fixtures	High Pressure Sodium
Interior Lighting	Electric	High-Bay Fixtures	T5
Interior Lighting	Electric	High-Bay Fixtures	Light Emitting Plasma
Interior Lighting	Electric	High-Bay Fixtures	LED (2020)
Interior Lighting	Electric	Linear Fluorescent	T12
Interior Lighting	Electric	Linear Fluorescent	LED (2010)
Interior Lighting	Electric	Linear Fluorescent	T8
Interior Lighting	Electric	Linear Fluorescent	Super T8
Interior Lighting	Electric	Linear Fluorescent	T5
Interior Lighting	Electric	Linear Fluorescent	LED (2020)
Exterior Lighting	Electric	Screw-in	Incandescent
Exterior Lighting	Electric	Screw-in	90W Halogen PAR-38
Exterior Lighting	Electric	Screw-in	70W HIR PAR-38
Exterior Lighting	Electric	Screw-in	CFL
Exterior Lighting	Electric	Screw-in	LED (2010)
Exterior Lighting	Electric	Screw-in	LED (2020)
Exterior Lighting	Electric	HID	Metal Halides
Exterior Lighting	Electric	HID	LED (2010)
Exterior Lighting	Electric	HID	T8
Exterior Lighting	Electric	HID	High Pressure Sodium
Exterior Lighting	Electric	HID	T5
Exterior Lighting	Electric	HID	Light Emitting Plasma
Exterior Lighting	Electric	HID	LED (2020)
Exterior Lighting	Electric	Linear Fluorescent	T12
Exterior Lighting	Electric	Linear Fluorescent	LED (2010)
Exterior Lighting	Electric	Linear Fluorescent	T8
Exterior Lighting	Electric	Linear Fluorescent	Super T8
Exterior Lighting	Electric	Linear Fluorescent	T5
Exterior Lighting	Electric	Linear Fluorescent	LED (2020)
Refrigeration	Electric	Walk-in Refrigerator	14600 kWh/yr

Table 5-3 Summary of Commercial Equipment Measures (continued)

End Use	Fuel	Technology	Label
Refrigeration	Electric	Walk-in Refrigerator	10800 kWh/yr
Refrigeration	Electric	Walk-in Refrigerator	10000 kWh/yr
Refrigeration	Electric	Walk-in Refrigerator	9000 kWh/yr
Refrigeration	Electric	Reach-in Refrigerator	3800 kWh/yr
Refrigeration	Electric	Reach-in Refrigerator	3100 kWh/yr
Refrigeration	Electric	Reach-in Refrigerator	2500 kWh/yr
Refrigeration	Electric	Reach-in Refrigerator	2400 kWh/yr
Refrigeration	Electric	Reach-in Refrigerator	1500 kWh/yr
Refrigeration	Electric	Glass Door Display	14480 kWh/yr
Refrigeration	Electric	Glass Door Display	11700 kWh/yr
Refrigeration	Electric	Glass Door Display	8400 kWh/yr
Refrigeration	Electric	Glass Door Display	6800 kWh/yr
Refrigeration	Electric	Open Display Case	6500 kWh/yr
Refrigeration	Electric	Open Display Case	5350 kWh/yr
Refrigeration	Electric	Open Display Case	5300 kWh/yr
Refrigeration	Electric	Open Display Case	4330 kWh/yr
Refrigeration	Electric	Icemaker	7.0 kWh/100 lbs
Refrigeration	Electric	Icemaker	6.3 kWh/100 lbs
Refrigeration	Electric	Icemaker	6.0 kWh/100 lbs
Refrigeration	Electric	Icemaker	5.5 kWh/100 lbs
Refrigeration	Electric	Vending Machine	3400 kWh/year
Refrigeration	Electric	Vending Machine	3000 kWh/year
Refrigeration	Electric	Vending Machine	2400 kWh/year
Refrigeration	Electric	Vending Machine	1700 kWh/year
Food Preparation	Electric	Oven	Standard
Food Preparation	Electric	Oven	Energy Star
Food Preparation	Electric	Fryer	Standard
Food Preparation	Electric	Fryer	Energy Star
Food Preparation	Electric	Dishwasher	Standard
Food Preparation	Electric	Dishwasher	Energy Star
Food Preparation	Electric	Hot Food Container	Standard
Food Preparation	Electric	Hot Food Container	Energy Star
Office Equipment	Electric	Desktop Computer	Standard
Office Equipment	Electric	Desktop Computer	Energy Star
Office Equipment	Electric	Laptop	Standard
Office Equipment	Electric	Laptop	Energy Star
Office Equipment	Electric	Server	Standard
Office Equipment	Electric	Server	Energy Star
Office Equipment	Electric	Monitor	Standard
Office Equipment	Electric	Monitor	Energy Star
Office Equipment	Electric	Printer/Copier/Fax	Standard
Office Equipment	Electric	Printer/Copier/Fax	Energy Star
Office Equipment	Electric	POS Terminal	Standard
Office Equipment	Electric	POS Terminal	Energy Star
Miscellaneous	Electric	Non-HVAC Motors	Standard (EPAct)

Table 5-3 Summary of Commercial Equipment Measures (continued)

End Use	Fuel	Technology	Label
Miscellaneous	Electric	Non-HVAC Motors	Standard (EPAct 2015)
Miscellaneous	Electric	Non-HVAC Motors	High Efficiency
Miscellaneous	Electric	Non-HVAC Motors	High Efficiency (2015)
Miscellaneous	Electric	Non-HVAC Motors	Premium (NEMA)
Miscellaneous	Electric	Non-HVAC Motors	Premium (NEMA 2015)
Miscellaneous	Electric	Pool Pump	Standard
Miscellaneous	Electric	Pool Pump	High Efficiency
Miscellaneous	Electric	Pool Pump	High Efficiency, Multi-Speed
Miscellaneous	Electric	Pool Heater	Standard
Miscellaneous	Electric	Pool Heater	Heat Pump
Miscellaneous	Electric	Miscellaneous	Standard
Heating	Natural Gas	Furnace	EF .76
Heating	Natural Gas	Furnace	EF .80
Heating	Natural Gas	Furnace	EF .83
Heating	Natural Gas	Furnace	EF .90
Heating	Natural Gas	Boiler	EF .76
Heating	Natural Gas	Boiler	EF .80
Heating	Natural Gas	Boiler	EF .82
Heating	Natural Gas	Boiler	EF .85
Heating	Natural Gas	Boiler	EF .96
Heating	Natural Gas	Other Heating	AFUE .74
Heating	Natural Gas	Other Heating	AFUE .75
Heating	Natural Gas	Other Heating	AFUE .76
Heating	Natural Gas	Other Heating	AFUE .77
Heating	Natural Gas	Other Heating	AFUE .80
Water Heating	Natural Gas	Water Heater	EF 0.77
Water Heating	Natural Gas	Water Heater	EF 0.80
Water Heating	Natural Gas	Water Heater	EF 0.94
Food Preparation	Natural Gas	Oven	Standard
Food Preparation	Natural Gas	Oven	Energy Star
Food Preparation	Natural Gas	Fryer	Standard
Food Preparation	Natural Gas	Fryer	Energy Star
Food Preparation	Natural Gas	Broiler	Standard
Food Preparation	Natural Gas	Griddle	Standard
Food Preparation	Natural Gas	Griddle	Energy Star
Food Preparation	Natural Gas	Range	Standard
Food Preparation	Natural Gas	Range	High Efficiency
Food Preparation	Natural Gas	Steamer	Standard
Food Preparation	Natural Gas	Steamer	Energy Star
Miscellaneous	Natural Gas	Pool Heater	EF .78
Miscellaneous	Natural Gas	Pool Heater	EF .82
Miscellaneous	Natural Gas	Pool Heater	EF .90
Miscellaneous	Natural Gas	Pool Heater	EF .95
Miscellaneous	Natural Gas	Miscellaneous	Standard

Table 5-4 Summary of Commercial Non-Equipment Measures

Measure	Existing	New
Insulation - Ceiling	X	X
Insulation - Ducting	X	X
Insulation - Radiant Barrier	X	X
Insulation - Wall Cavity	X	X
HVAC - Duct Repair and Sealing	X	X
Doors - High Efficiency	X	X
Windows - High Efficiency	X	X
Windows - Install Reflective Film	X	X
Roof - High Reflectivity	X	X
Air-Cooled Chiller - Condenser Water Temperature Reset	X	X
Air-Cooled Chiller - Economizer	X	X
Air-Cooled Chiller - Thermal Energy Storage	X	X
Air-Cooled Chiller - VSD on Fans	X	X
Air-Cooled Chiller - Chilled Water Reset	X	X
Air-Cooled Chiller - Chilled Water Variable-Flow System	X	X
Air-Cooled Chiller - High Efficiency Cooling Tower Fans	X	X
Air-Cooled Chiller - Maintenance	X	X
Air-Cooled Chiller - Chiller Heat Recovery	X	X
Water-Cooled Chiller - Condenser Water Temperature Reset	X	X
Water-Cooled Chiller - Economizer	X	X
Water-Cooled Chiller - Thermal Energy Storage	X	X
Water-Cooled Chiller - VSD on Fans	X	X
Water-Cooled Chiller - Chilled Water Reset	X	X
Water-Cooled Chiller - Chilled Water Variable-Flow System	X	X
Water-Cooled Chiller - High Efficiency Cooling Tower Fans	X	X
Water-Cooled Chiller - Maintenance	X	X
Water-Cooled Chiller - Chiller Heat Recovery	X	X
RTU - Evaporative Precooler	X	X
RTU - Maintenance	X	X
Gas Boiler - High Efficiency Hot Water Circulation	X	X
Gas Boiler - Hot Water Reset	X	X
Gas Boiler - Combustion Controls (O2 Trim)	X	X
Gas Boiler - Condensate Return Lines	X	X
Gas Boiler - Condensing Economizer	X	X
Gas Boiler - Pipe Insulation	X	X
Gas Boiler - Steam Trap Maintenance	X	X
Gas Boiler - Maintenance	X	X
Gas Furnace - Maintenance	X	X
Space Heating - Heat Recovery Ventilator	X	X
Heat Pump - Maintenance	X	X
Ventilation - ECM on VAV Boxes	X	X
Ventilation - Variable Speed Control	X	X
Water Heater - Drainwater Heat Recovery	X	X
Water Heater - Faucet Aerators/Low Flow Nozzles	X	X
Water Heater - High Efficiency Circulation Pump	X	X
Water Heater - Desuperheater	X	X
Water Heater - Solar System	X	X
Water Heater - Install Timer	X	X
Water Heater - Pipe Insulation	X	X
Water Heater - Tank Blanket/Insulation	X	X
Water Heating - Booster Water Heater	X	X

Table 5-4 Summary of Commercial Non-Equipment Measures (continued)

Measure	Existing	New
Interior Lighting - Daylighting Controls	X	X
Interior Lighting - LED Exit Lighting	X	X
Interior Lighting - Occupancy Sensors	X	X
Interior Lighting - Timeclocks and Timers	X	X
Interior Lighting - Task Lighting	X	X
Interior Fluorescent - Bi-Level Fixture	X	X
Interior Fluorescent - Delamp and Install Reflectors	X	X
Exterior Lighting - Bi-Level Fixture	X	X
Exterior Lighting - Daylighting Controls	X	X
Exterior Lighting - Photovoltaic Installation	X	X
Refrigerator - Anti-Sweat Heater	X	X
Refrigerator - Decommissioning	X	X
Refrigerator - Demand Defrost	X	X
Refrigerator - Door Gasket Replacement	X	X
Refrigerator - Evaporator Fan Controls	X	X
Refrigerator - Floating Head Pressure	X	X
Refrigerator - Strip Curtain	X	X
Refrigerator - High Efficiency Compressor	X	X
Refrigerator - Variable Speed Compressor	X	X
Refrigerator - eCube	X	X
Vending Machine - Controller	X	X
Office Equipment - ENERGY STAR Power Supplies	X	X
Office Equipment - Plug Load Occupancy Sensors	X	X
Pool Heater - Solar	X	X
Pool Pump - Timer	X	X
Destratification Fans (HVLS)	X	X
Ventilation - CO2 Controlled	X	X
Non-HVAC Motors - Variable Speed Control	X	X
Energy Management System	X	X
Thermostat - Clock/Programmable	X	X
HVAC - Occupancy Sensors	X	X
Retrocommissioning - HVAC	X	
Retrocommissioning - Lighting	X	
Custom Measures	X	X
Commissioning - HVAC		X
Commissioning - Lighting		X
Advanced New Construction Designs	X	X
Data Center - Server Virtualization	X	X
Grocery - Display Case - LED Lighting	X	X
Grocery - Display Case Motion Sensors	X	X
Grocery - ECMs for Display Cases	X	X
Grocery - Open Display Case - Night Covers	X	X
Lodging - Guest Room Controls	X	X

Table 5-5 Summary of Industrial Equipment Measures

End Use	Fuel	Technology	Label
Cooling	Electric	Air-Cooled Chiller	1.5 kw/ton, COP 2.3
Cooling	Electric	Air-Cooled Chiller	1.3 kw/ton, COP 2.7
Cooling	Electric	Air-Cooled Chiller	1.26 kw/ton, COP 2.8
Cooling	Electric	Air-Cooled Chiller	1.0 kw/ton, COP 3.5
Cooling	Electric	Air-Cooled Chiller	0.97 kw/ton, COP 3.6
Cooling	Electric	Water-Cooled Chiller	0.75 kw/ton, COP 4.7
Cooling	Electric	Water-Cooled Chiller	0.60 kw/ton, COP 5.9
Cooling	Electric	Water-Cooled Chiller	0.58 kw/ton, COP 6.1
Cooling	Electric	Water-Cooled Chiller	0.55 kw/Ton, COP 6.4
Cooling	Electric	Water-Cooled Chiller	0.51 kw/ton, COP 6.9
Cooling	Electric	Water-Cooled Chiller	0.50 kw/Ton, COP 7.0
Cooling	Electric	Water-Cooled Chiller	0.48 kw/ton, COP 7.3
Cooling	Electric	Roof top AC	EER 9.2
Cooling	Electric	Roof top AC	EER 10.1
Cooling	Electric	Roof top AC	EER 11.2
Cooling	Electric	Roof top AC	EER 12.0
Cooling	Electric	Roof top AC	Ductless Minisplit
Cooling	Electric	Air-Source Heat Pump	EER 9.3
Cooling	Electric	Air-Source Heat Pump	EER 10.3
Cooling	Electric	Air-Source Heat Pump	EER 11.0
Cooling	Electric	Air-Source Heat Pump	EER 11.7
Cooling	Electric	Air-Source Heat Pump	EER 12.0
Cooling	Electric	Air-Source Heat Pump	Ductless Minisplit
Cooling	Electric	Geothermal Heat Pump	EER 14.1
Cooling	Electric	Geothermal Heat Pump	EER 16
Cooling	Electric	Geothermal Heat Pump	EER 18
Cooling	Electric	Geothermal Heat Pump	EER 30
Cooling	Electric	Other Cooling	EER 9.8
Cooling	Electric	Other Cooling	EER 10.2
Cooling	Electric	Other Cooling	EER 10.8
Cooling	Electric	Other Cooling	EER 11
Cooling	Electric	Other Cooling	EER 11.5
Heating	Electric	Air-Source Heat Pump	EER 9.3
Heating	Electric	Air-Source Heat Pump	EER 10.3
Heating	Electric	Air-Source Heat Pump	EER 11.0
Heating	Electric	Air-Source Heat Pump	EER 11.7
Heating	Electric	Air-Source Heat Pump	EER 12.0
Heating	Electric	Air-Source Heat Pump	Ductless Minisplit
Heating	Electric	Geothermal Heat Pump	EER 14.1
Heating	Electric	Geothermal Heat Pump	EER 16
Heating	Electric	Geothermal Heat Pump	EER 18
Heating	Electric	Geothermal Heat Pump	EER 30
Heating	Electric	Electric Room Heat	Standard
Heating	Electric	Electric Furnace	Standard
Ventilation	Electric	Ventilation	Constant Volume
Ventilation	Electric	Ventilation	Variable Air Volume
Interior Lighting	Electric	Screw-in	Incandescent
Interior Lighting	Electric	Screw-in	90W Halogen PAR-38
Interior Lighting	Electric	Screw-in	70W HIR PAR-38
Interior Lighting	Electric	Screw-in	CFL

Table 5-5 Summary of Industrial Equipment Measures (continued)

End Use	Fuel	Technology	Label
Interior Lighting	Electric	Screw-in	LED (2010)
Interior Lighting	Electric	Screw-in	LED (2020)
Interior Lighting	Electric	High-Bay Fixtures	Metal Halides
Interior Lighting	Electric	High-Bay Fixtures	LED (2010)
Interior Lighting	Electric	High-Bay Fixtures	T8
Interior Lighting	Electric	High-Bay Fixtures	High Pressure Sodium
Interior Lighting	Electric	High-Bay Fixtures	Induction
Interior Lighting	Electric	High-Bay Fixtures	Light Emitting Plasma
Interior Lighting	Electric	High-Bay Fixtures	T5
Interior Lighting	Electric	High-Bay Fixtures	LED (2020)
Interior Lighting	Electric	Linear Fluorescent	T12
Interior Lighting	Electric	Linear Fluorescent	LED (2010)
Interior Lighting	Electric	Linear Fluorescent	T8
Interior Lighting	Electric	Linear Fluorescent	Super T8
Interior Lighting	Electric	Linear Fluorescent	T5
Interior Lighting	Electric	Linear Fluorescent	LED (2020)
Exterior Lighting	Electric	Screw-in	Incandescent
Exterior Lighting	Electric	Screw-in	90W Halogen PAR-38
Exterior Lighting	Electric	Screw-in	70W HIR PAR-38
Exterior Lighting	Electric	Screw-in	CFL
Exterior Lighting	Electric	Screw-in	LED (2010)
Exterior Lighting	Electric	Screw-in	LED (2020)
Exterior Lighting	Electric	HID	Metal Halides
Exterior Lighting	Electric	HID	LED (2010)
Exterior Lighting	Electric	HID	T8
Exterior Lighting	Electric	HID	Light Emitting Plasma
Exterior Lighting	Electric	HID	High Pressure Sodium
Exterior Lighting	Electric	HID	T5
Exterior Lighting	Electric	HID	LED (2020)
Exterior Lighting	Electric	Linear Fluorescent	T12
Exterior Lighting	Electric	Linear Fluorescent	LED (2010)
Exterior Lighting	Electric	Linear Fluorescent	T8
Exterior Lighting	Electric	Linear Fluorescent	Super T8
Exterior Lighting	Electric	Linear Fluorescent	T5
Exterior Lighting	Electric	Linear Fluorescent	LED (2020)
Motors	Electric	Pumps	Standard
Motors	Electric	Pumps	High Efficiency
Motors	Electric	Fans & Blowers	Standard
Motors	Electric	Fans & Blowers	High Efficiency
Motors	Electric	Compressed Air	Standard
Motors	Electric	Compressed Air	High Efficiency
Motors	Electric	Matl Handling	Standard
Motors	Electric	Matl Handling	High Efficiency
Motors	Electric	Matl Processing	Standard
Motors	Electric	Matl Processing	High Efficiency
Motors	Electric	Other Motors	Standard
Motors	Electric	Other Motors	High Efficiency
Process	Electric	Process Heating	Standard
Process	Electric	Process Cooling and Refrig	Standard
Process	Electric	Electro-Chemical Processes	Standard

Table 5-5 Summary of Industrial Equipment Measures (continued)

End Use	Fuel	Technology	Label
Process	Electric	Other Process	Standard
Miscellaneous	Electric	Miscellaneous	Standard
Heating	Natural Gas	Furnace	EF .76
Heating	Natural Gas	Furnace	EF .80
Heating	Natural Gas	Furnace	EF .83
Heating	Natural Gas	Furnace	EF .90
Heating	Natural Gas	Boiler	EF .76
Heating	Natural Gas	Boiler	EF .80
Heating	Natural Gas	Boiler	EF .82
Heating	Natural Gas	Boiler	EF .85
Heating	Natural Gas	Boiler	EF .96
Heating	Natural Gas	Other Heating	AFUE .74
Heating	Natural Gas	Other Heating	AFUE .75
Heating	Natural Gas	Other Heating	AFUE .76
Heating	Natural Gas	Other Heating	AFUE .77
Heating	Natural Gas	Other Heating	AFUE .80
Process	Natural Gas	Process Heating	Standard
Process	Natural Gas	Process Boiler	EF .76
Process	Natural Gas	Process Boiler	EF .80
Process	Natural Gas	Process Boiler	EF .82
Process	Natural Gas	Process Boiler	EF .85
Process	Natural Gas	Process Boiler	EF .96
Process	Natural Gas	Process Cooling	Standard
Process	Natural Gas	Other Process	Standard
Miscellaneous	Natural Gas	Miscellaneous	Standard

Table 5-6 Summary of Industrial Non-Equipment Measures

Measure	Existing	New
Insulation - Ceiling	X	X
Insulation - Ducting	X	X
Insulation - Wall Cavity	X	X
HVAC - Duct Repair and Sealing	X	X
Air-Cooled Chiller - Economizer	X	X
Air-Cooled Chiller - Efficient Mechanical Layout	X	X
Air-Cooled Chiller - Maintenance	X	X
Air-Cooled Chiller - Chilled Water Reset	X	X
Air-Cooled Chiller - Chilled Water Variable-Flow System	X	X
Air-Cooled Chiller - Condenser Water Temperature Reset	X	X
Air-Cooled Chiller - High Efficiency Cooling Tower Fans	X	X
Air-Cooled Chiller - VSD on Fans	X	X
Water-Cooled Chiller - Economizer	X	X
Water-Cooled Chiller - Efficient Mechanical Layout	X	X
Water-Cooled Chiller - Maintenance	X	X
Water-Cooled Chiller - Chilled Water Reset	X	X
Water-Cooled Chiller - Chilled Water Variable-Flow System	X	X
Water-Cooled Chiller - Condenser Water Temperature Reset	X	X
Water-Cooled Chiller - High Efficiency Cooling Tower Fans	X	X
Water-Cooled Chiller - VSD on Fans	X	X
RTU - Maintenance	X	X
Heat Pump - Maintenance	X	X
Roofs - High Reflectivity	X	X
Energy Management System	X	X
Thermostat - Clock/Programmable	X	X
Interior Lighting - Occupancy Sensors	X	X
Interior Lighting - Skylights	X	X
Interior Lighting - Time Clocks and Timers	X	X
Interior Lighting - LED Exit Lighting	X	X
Interior Lighting - Daylighting Controls	X	X
Interior Screw-in - Task Lighting	X	X
Interior Fluorescent - Bi-Level Fixture	X	X
Interior Fluorescent - Delamp and Install Reflectors	X	X
Exterior Lighting - Bi-Level Fixture	X	X
Exterior Lighting - Daylighting Controls	X	X
Exterior Lighting - Photovoltaic Installation	X	X
Process - Conductivity Controls	X	X
Process - Controls on Fume Hoods	X	X
Process - Timers and Controls	X	X
Refrigeration - Floating Head Pressure	X	X
Refrigeration - System Controls	X	X
Refrigeration - System Maintenance	X	X
Refrigeration - System Optimization	X	X
Compressed Air - Air Usage Reduction	X	X

Table 5-6 Summary of Industrial Non-Equipment Measures (continued)

Measure	Existing	New
Compressed Air - Compressor Replacement	X	X
Compressed Air - System Controls	X	X
Compressed Air - System Maintenance	X	X
Compressed Air - System Optimization and Improvements	X	X
Pumping System - Controls	X	X
Pumping System - Maintenance	X	X
Pumping System - Optimization	X	X
Pumps - Variable Speed Control	X	X
Pump Equipment Upgrade	X	X
Fan Equipment Upgrade	X	X
Fan System - Controls	X	X
Fan System - Maintenance	X	X
Fan System - Optimization	X	X
Fans - Variable Speed Control	X	X
Motors - Magnetic Adjustable Speed Drives	X	X
Motors - Efficient Rewind	X	X
Motors - Synchronous Belts	X	X
Motors - Variable Frequency Drive	X	X
Retrocommissioning - HVAC	X	
Retrocommissioning - Lighting	X	
Destratification Fans (HVLS)	X	X
Ventilation - CO2 Controlled	X	X
Process Boiler - High Efficiency Hot Water Circulation	X	X
Process Boilers - Hot Water Reset	X	X
Process Boiler - Combustion Controls (O2 Trim)	X	X
Process Boiler - Condensate Return Lines	X	X
Process Boiler - Condensing Economizer	X	X
Process Boiler - Pipe Insulation	X	X
Process Boiler - Steam Trap Maintenance	X	X
Process Boiler - Maintenance	X	X
Gas Boiler - High Efficiency Hot Water Circulation	X	X
Gas Boiler - Hot Water Reset	X	X
Gas Boiler - Combustion Controls (O2 Trim)	X	X
Gas Boiler - Condensate Return Lines	X	X
Gas Boiler - Condensing Economizer	X	X
Gas Boiler - Pipe Insulation	X	X
Gas Boiler - Steam Trap Maintenance	X	X
Gas Boiler - Maintenance	X	X
Gas Furnace - Maintenance	X	X
Transformer - High Efficiency	X	X
Custom Measures	X	X
Commissioning - HVAC		X
Commissioning - Lighting		X

Results of the Economic Screen

Table 5-7 summarizes the number of equipment and non-equipment measures evaluated for each segment within each sector.

Table 5-7 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.

CHAPTER | 6

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 62,293 BTU, or 4.8% of the baseline energy forecast. By 2016, technical potential reaches 177,410 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. Table 9-1 in the fuel switching analysis chapter shows the conversion factors.

Because of the fuel switching analysis, we observe some interesting trends in the data. The technical potential case causes significant migration toward the electric technologies of geothermal heat pumps and heat pump water heaters. Due to their high capital costs and low natural gas prices, however, the economic potential case saw significant migration in the opposite direction- from electric space and water heating to high efficiency natural gas units. When viewed from the limited perspective of the residential electric analysis, for instance, this caused the technical potential case to use *more* energy than the economic case. When viewed from the total BTU content, however, this makes perfect sense. Because the geothermal heat pump is the most efficient heating technology in all cases, many units were switched and were added for technical potential, so the electric load actually grew while the total system was becoming more efficient. Meanwhile, the natural gas load dropped off considerably because of a corresponding loss of units. In the economic scenario, however, the tables were turned. The most efficient economic unit is the natural gas furnace; so many electric units were switching to natural gas. The number of consumers that actually adopted these measures, due to their complexity and added switching costs, is so minimal that effects to the achievable potential cases are virtually negligible at this time. Chapter 9 contains more details on fuel switching.

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	62,293	109,714	148,625	177,410
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

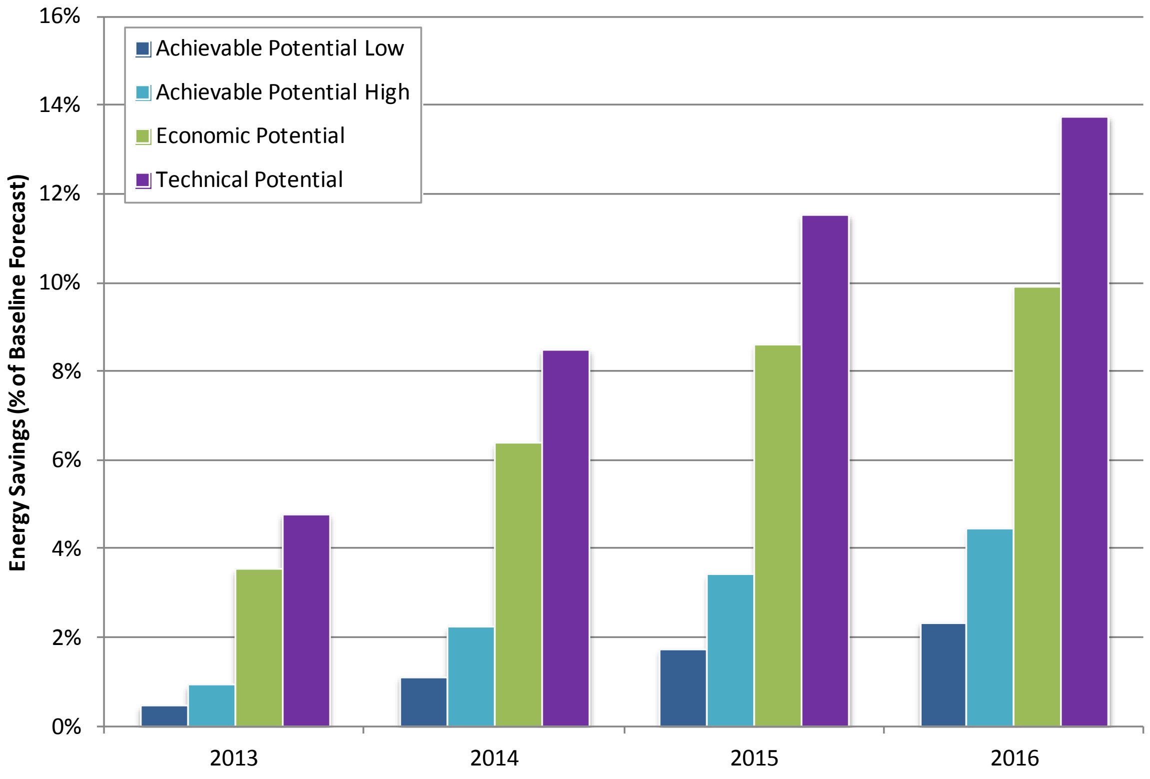
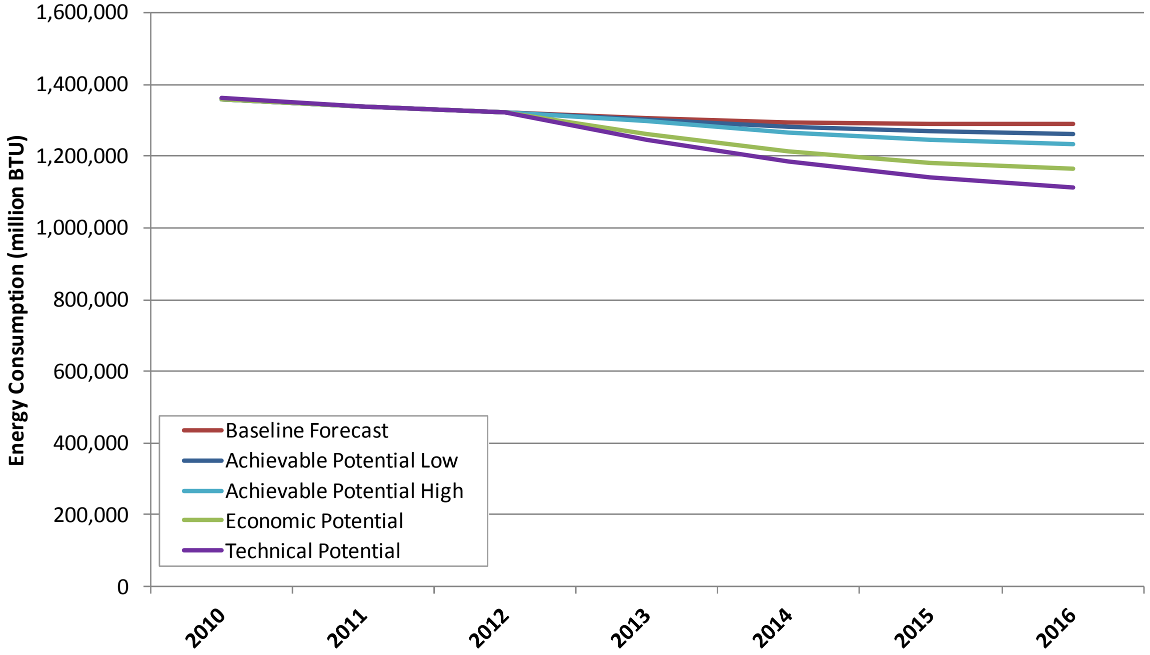


Figure 6-2 Combined Electric and Natural Gas Potential Forecasts (million BTU)



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. Figure 6-4 displays the electric energy-efficiency forecasts.

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	3,695	6,638	8,779	9,870
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	4.9%	9.0%	12.0%	13.5%

Figure 6-3 Summary of Electric Energy Savings

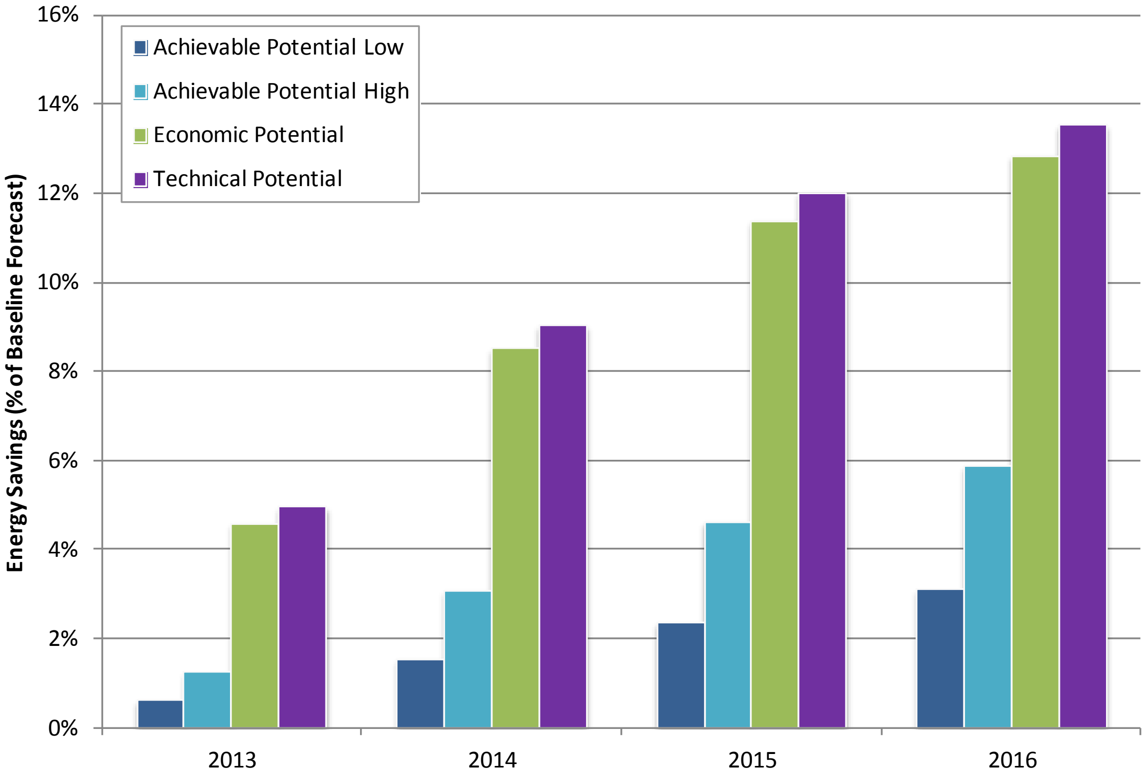
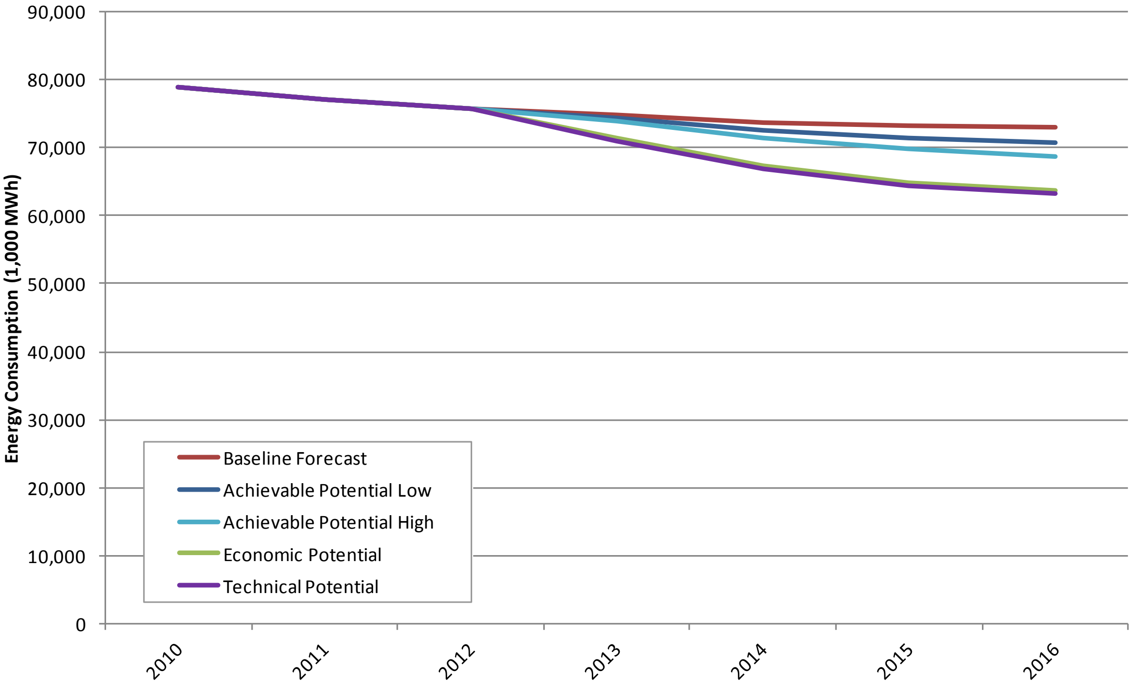


Figure 6-4 Electric Potentials Forecasts (GWh)



Natural Gas Energy Efficiency – Overall Results

Table 6-3 and Figure 6-5 summarize the natural gas energy-efficiency savings for the different levels of potential relative to the baseline forecast. Figure 6-6 displays the natural gas energy-efficiency forecasts.

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 6-5 Summary of Natural Gas Energy Savings

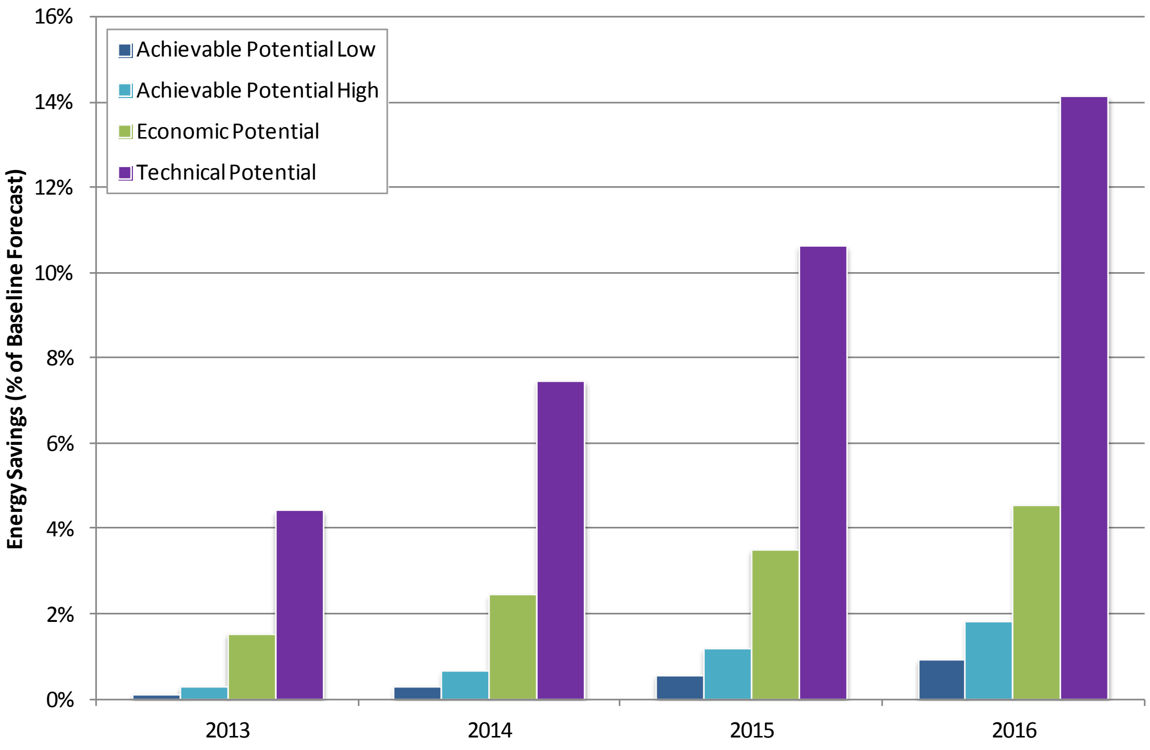
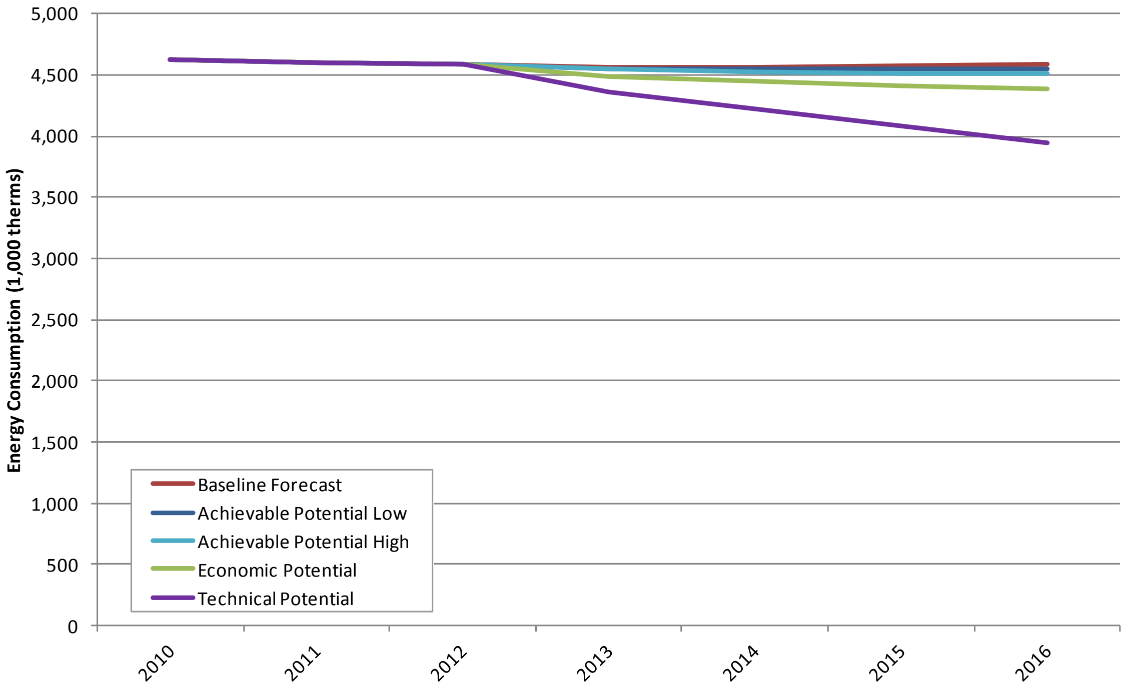


Figure 6-6 Natural Gas Potential Forecasts (1000 therms)



Overview of Energy Efficiency Potential by Sector and Fuel

Table 6-4, Figure 6-7, and Figure 6-8 summarize the range of electric achievable potential by sector. 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	173	493	751	926
Commercial	251	585	889	1,217
Industrial	22	47	78	113
Total	**446**	**1,125**	**1,718**	**2,255**
Achievable High Savings (GWh)				
Residential	352	994	1,488	1,769
Commercial	519	1,164	1,729	2,296
Industrial	46	93	150	212
Total	**918**	**2,251**	**3,368**	**4,277**

Figure 6-7 Achievable Low Electric Potential by Sector (GWh)

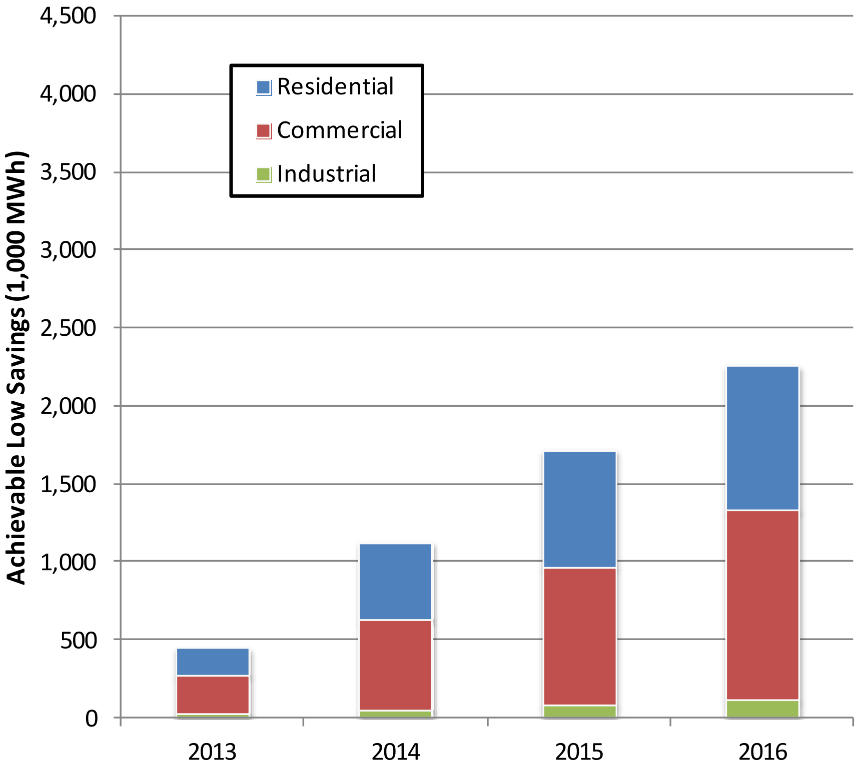


Figure 6-8 Achievable High Electric Potential by Sector (GWh)

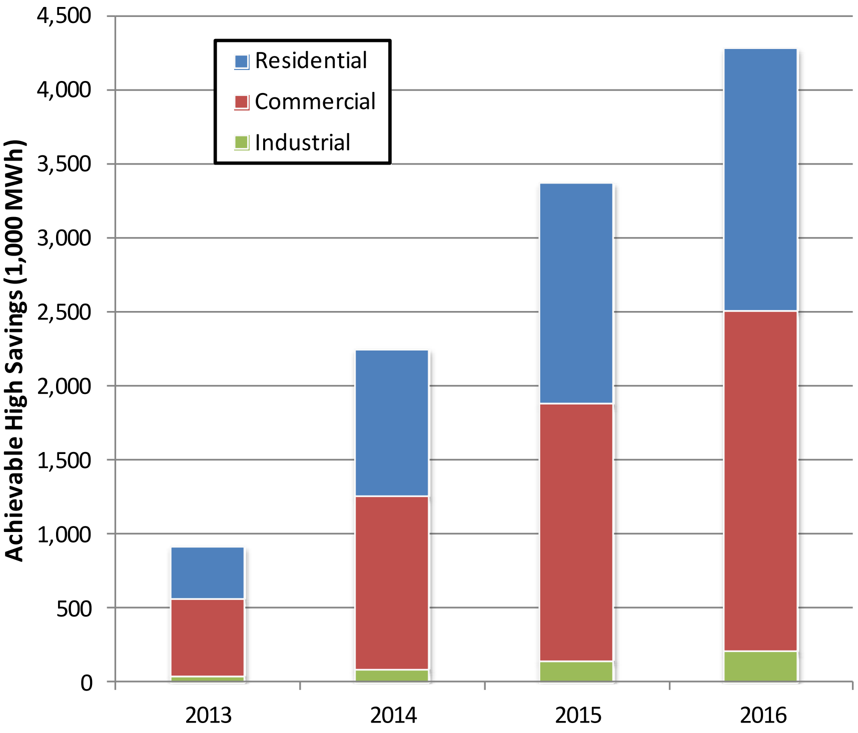


Table 6-5, Figure 6-9 and Figure 6-10 present the range of natural gas achievable potential by sector. Again, like the electric analysis, the commercial sector accounts for the largest portion of the savings, followed by the residential and then the industrial sectors.

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**

Figure 6-9 Achievable Low Natural Gas Potential by Sector (mmTherms)

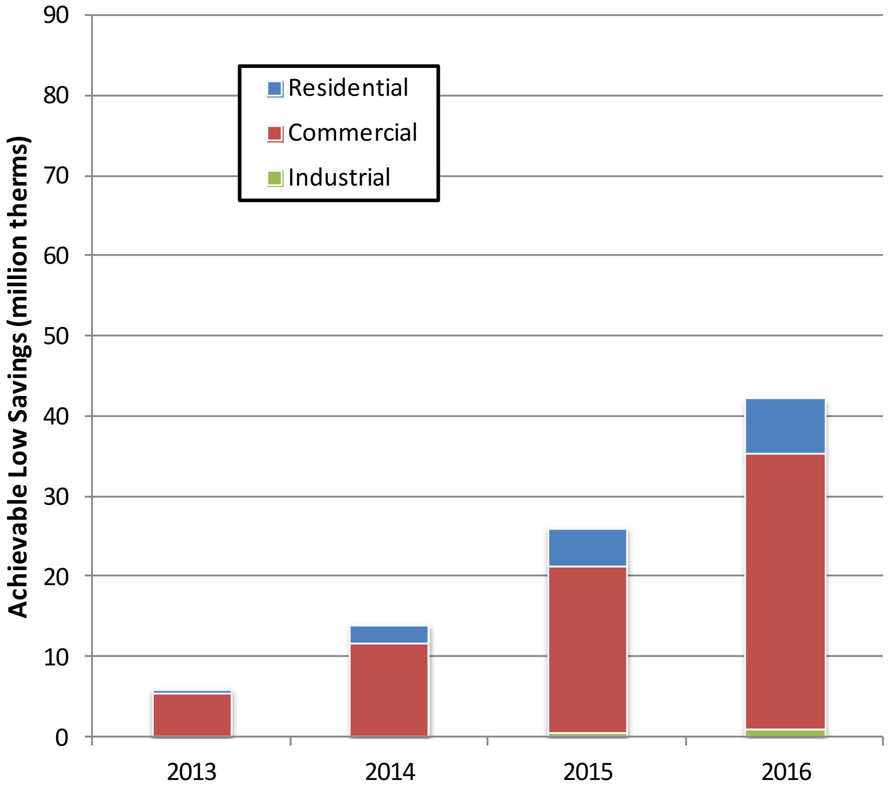
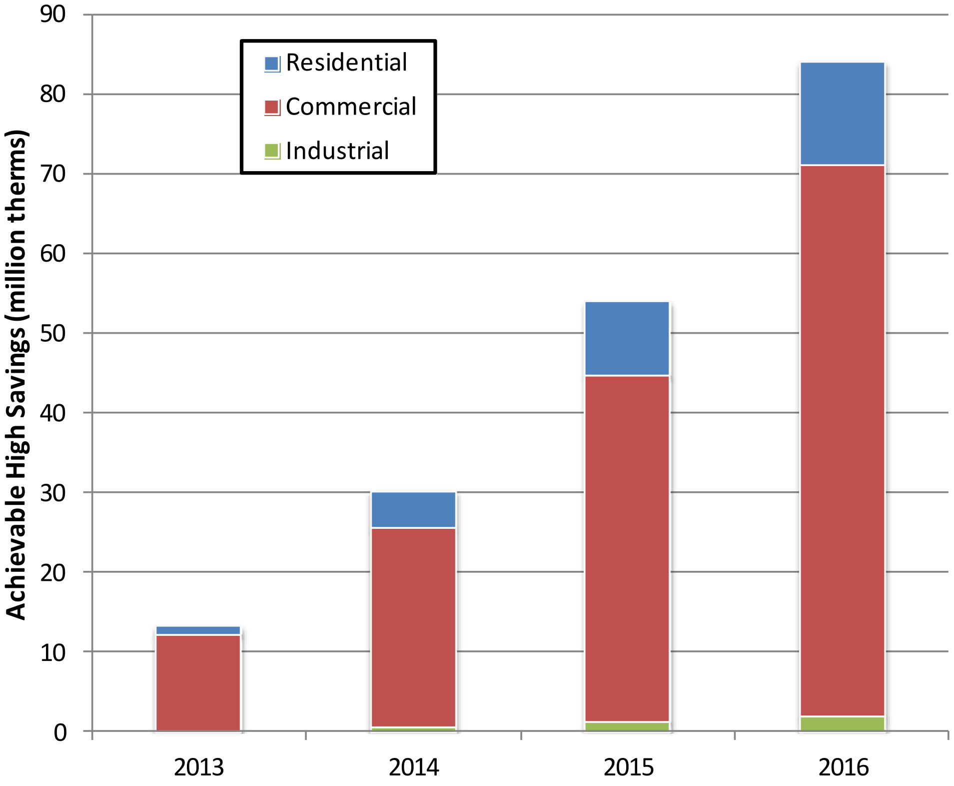


Figure 6-10 Achievable High Natural Gas Potential by Sector (mmTherms)



Year by year savings for electric energy, electric peak demand, and natural gas energy are available in Appendix F. Details for each sector are presented in Chapter 7.

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.

Residential Electricity Potential

Table 7-1 presents estimates for the four types of potential for the residential electricity sector. Figure 7-1 depicts these potential energy savings estimates graphically.

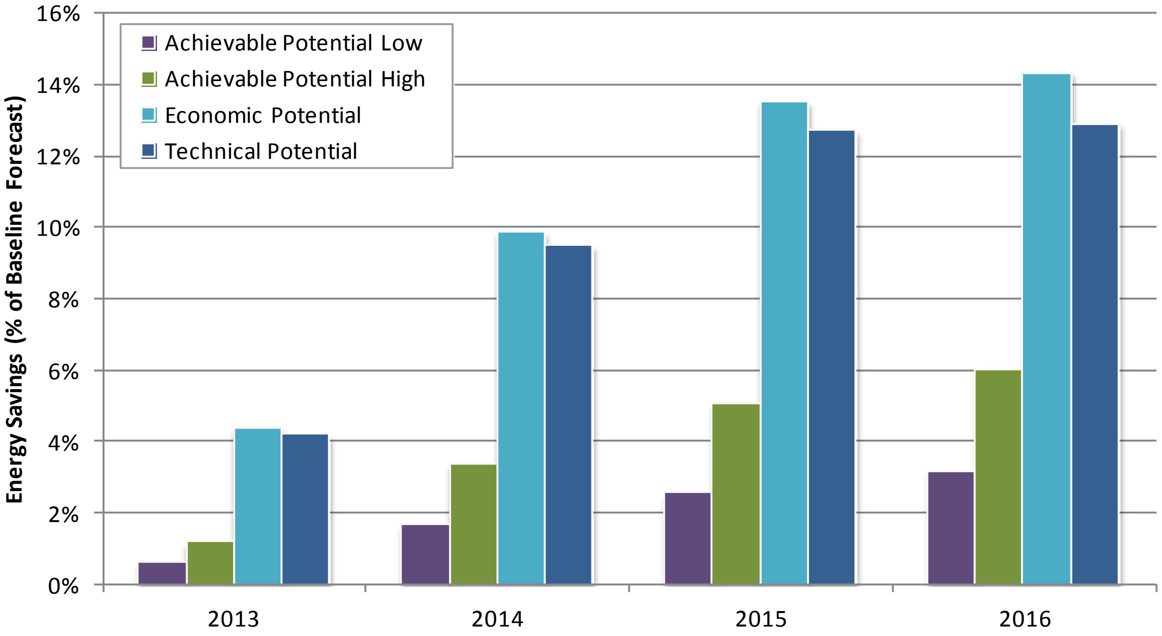
- **Achievable Low potential** projects 173 GWh of energy savings in 2013, 0.6% of the baseline forecast. This increases to 926 GWh, 3.1% of the baseline forecast, in 2016.
- **Achievable High potential** is 352 GWh in 2013, which represents 1.2% of the baseline forecast. By 2016, the cumulative energy savings are 1,769 GWh, 6.0% of the baseline forecast.
- **Economic potential,** which reflects a theoretical limit to savings when all cost-effective measures are taken, is 1,329 GWh in 2013. This represents 4.4% of the baseline energy forecast. By 2016, economic potential reaches 4,234 GWh, 14.4% of the baseline energy forecast.
- **Technical potential,** which reflects the adoption of all energy efficiency measures regardless of cost, is a theoretical upper bound on savings. In 2013, energy savings are 1,271 GWh, or 4.2% of the baseline energy forecast. By 2016, technical potential reaches 3,809 GWh, 12.9% of the baseline energy forecast.

The reason that electric technical potential savings are less than economic potential savings has to do with the fuel switching analysis that was applied to the residential sector. As discussed in the previous section, certain electric technologies were the most technically efficient option, while their corresponding natural gas technologies were the most economically efficient option. This caused customers to switch en masse to electric units in the technical potential case, while customers switched en mass to natural gas units in the economic potential case. When considering electric and natural gas on a total energy basis, the technical potential uses less energy than the economic potential, as one would expect. This is explained in more detail in Chapter 9. It should be noted that the effects of the fuel switching units are minimal in the achievable potential cases, as the adoption rates are so low that they put the number of statewide transactions in the hundreds and low thousands.

Table 7-1 Electricity Energy Efficiency Potential for the Residential Sector

	2013	2014	2015	2016
Baseline Forecast (GWh)	**30,442**	**29,793**	**29,515**	**29,502**
Energy Savings (GWh)				
Achievable Low Potential	173	493	751	926
Achievable High Potential	352	994	1,488	1,769
Economic Potential	1,329	2,935	3,987	4,234
Technical Potential	1,271	2,831	3,759	3,809
Energy Savings (% of Baseline)				
Achievable Low Potential	0.6%	1.7%	2.5%	3.1%
Achievable High Potential	1.2%	3.3%	5.0%	6.0%
Economic Potential	4.4%	9.9%	13.5%	14.4%
Technical Potential	4.2%	9.5%	12.7%	12.9%

Figure 7-1 Residential Electric Energy Efficiency Potential Savings



Residential Electric Potential by Market Segment

Single-family homes in New Jersey account for the majority of this sector's total sales in the base year and throughout the forecast. Similarly, single-family homes account for the largest share of potential savings by segment, as displayed in Table 7-2, which shows results for 2016.

Table 7-3 shows the Achievable Low savings by end use and market segment in 2016. The segments are similar in terms of the distribution of savings opportunities by end use, but there are a few notable differences. Single-family homes have more exterior lighting and so have more savings potential for this end use. Similarly, single-family homes are more likely to have swimming pools and therefore have more potential for savings in pool pumps (captured in the miscellaneous end use). Multi-family homes have a relatively larger opportunity in home electronics and air conditioning compared to single-family homes, reflecting an older appliance stock.

*Table 7-2 **Residential Electric Potential by Market Segment, 2016***

	Single Family	Single Family LI	Multi Family Rent	Multi Family Rent LI	Multi Family Own	Multi Family Own LI
Baseline Forecast (GWh)	**17,555**	**4,391**	**3,665**	**2,351**	**1,355**	**185**
Energy Savings (GWh)						
Achievable Low Potential	531	159	119	76	36	6
Achievable High Potential	1,013	304	227	147	68	11
Economic Potential	2,395	678	601	375	170	17
Technical Potential	2,187	598	552	305	152	16
Energy Savings as % of Baseline						
Achievable Low Potential	3.0%	3.6%	3.2%	3.3%	2.6%	3.0%
Achievable High Potential	5.8%	6.9%	6.2%	6.2%	5.0%	5.7%
Economic Potential	13.6%	15.4%	16.4%	15.9%	12.5%	9.0%
Technical Potential	12.5%	13.6%	15.1%	13.0%	11.2%	8.7%

*Table 7-3 **Residential Electric Achievable Low Potential by End Use and Market Segment, 2016 (GWh)***

End Use	Single Family	Single Family LI	Multi Family Rent	Multi Family Rent LI	Multi Family Own	Multi Family Own LI
Cooling	39.8	10.2	10.7	8.5	3.5	0.3
Heating	3.1	0.9	1.1	0.2	0.3	0.0
Water Heating	3.9	0.3	0.9	1.5	0.3	0.0
Interior Lighting	353.5	113.5	81.8	49.7	21.6	3.7
Exterior Lighting	41.9	13.9	10.3	8.6	3.8	0.6
Appliances	0.8	0.2	0.1	0.1	0.1	0.0
Electronics	84.5	19.7	13.7	8.0	6.0	0.8
Miscellaneous	3.3	0.3	0.0	-	0.0	-
Total	**530.9**	**159.0**	**118.7**	**76.5**	**35.5**	**5.5**

Residential Electric Potential by End Use

Table 7-4 provides estimates of savings for each end use and type of potential. The most significant savings opportunities come from the lighting end use. Negative savings in space heating and water heating for the technical potential case reflects the addition of geothermal heat pump and heat pump water heating units. This is due to the fuel switching analysis, as discussed in more detail in Chapter 9.

*Table 7-4 **Residential Electric Savings by End Use and Potential Type (GWh)***

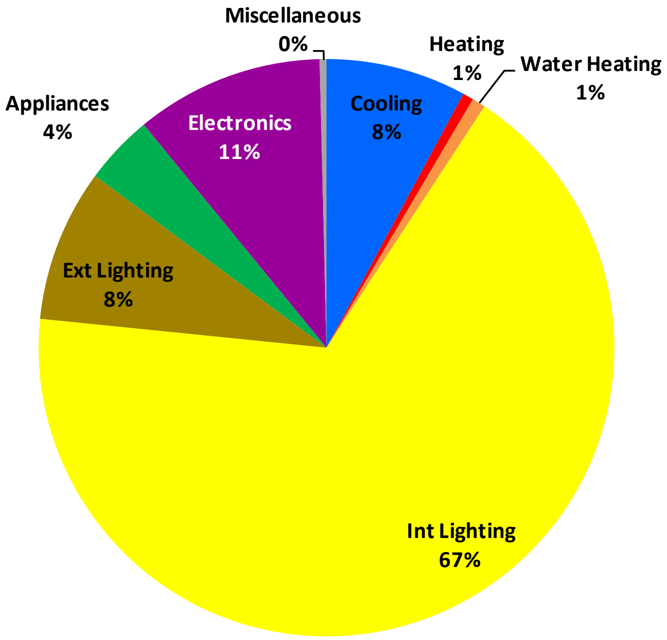
End Use	Case	2013	2014	2015	2016
Cooling	Achievable Low Potential	19.7	38.1	55.4	73.1

	Achievable High Potential	38.1	71.1	100.4	129.2
	Economic Potential	132.5	192.4	254.7	311.5
	Technical Potential	245.6	376.4	511.1	651.7
Heating	Achievable Low Potential	0.8	1.9	3.4	5.6
	Achievable High Potential	1.5	3.6	6.3	10.0
	Economic Potential	93.6	181.0	264.2	344.6
	Technical Potential	-315.6	-630.5	-940.5	-1,280.9
Water Heating	Achievable Low Potential	1.0	2.5	4.4	7.0
	Achievable High Potential	2.2	5.1	8.6	13.2
	Economic Potential	69.2	131.7	186.2	251.6
	Technical Potential	75.8	140.9	198.0	266.9
Interior Lighting	Achievable Low Potential	105.8	342.9	523.0	623.7
	Achievable High Potential	216.4	691.6	1,040.9	1,201.0
	Economic Potential	728.5	1,873.6	2,521.5	2,442.2
	Technical Potential	810.4	2,103.8	2,840.4	2,797.4
Exterior Lighting	Achievable Low Potential	13.8	46.1	69.6	79.1
	Achievable High Potential	32.8	106.2	157.2	170.0
	Economic Potential	84.5	210.1	276.0	253.4
	Technical Potential	105.9	264.4	347.5	330.2
Appliances	Achievable Low Potential	18.7	29.2	34.0	36.2
	Achievable High Potential	36.4	54.5	61.3	63.2
	Economic Potential	95.9	97.2	102.0	104.9
	Technical Potential	166.5	228.1	288.4	350.1
Electronics	Achievable Potential Low	12.6	32.0	59.3	97.8
	Achievable Potential High	24.2	60.2	108.9	175.3
	Economic Potential	120.8	241.1	363.0	496.4
	Technical Potential	124.1	245.5	368.9	504.4
Miscellaneous	Achievable Low Potential	0.2	0.6	1.9	3.5
	Achievable High Potential	0.6	1.4	4.3	7.6
	Economic Potential	4.4	8.5	19.2	29.4
	Technical Potential	46.9	89.1	128.8	169.2
Total	**Achievable Low Potential**	**172.6**	**493.2**	**751.0**	**926.1**
	Achievable High Potential	**352.1**	**993.6**	**1,487.9**	**1,769.5**
	Economic Potential	**1,329.4**	**2,935.5**	**3,986.9**	**4,234.0**
	Technical Potential	**1,259.5**	**2,817.7**	**3,742.6**	**3,789.0**

Figure 7-2 focuses on the residential achievable potential in 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. Electronics, cooling, and appliances also contribute significantly to the savings. Detailed measure information is available in 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
- Behavioral feedback tools

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



Residential Natural Gas Potential

Table 7-5 presents estimates for the four types of potential for natural gas usage in the residential sector. Figure 7-3 depicts these potential energy savings estimates graphically.

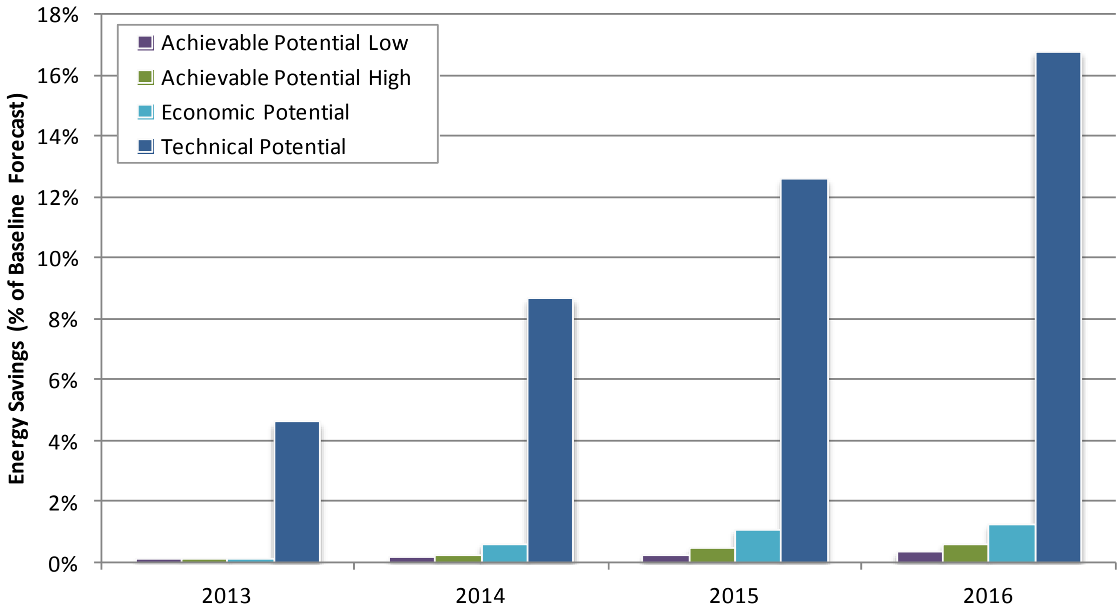
- **Achievable Low potential** projects 0.6 million therms (mmTherms) of energy savings in 2013, 0.0% of the baseline forecast. This increases to 6.9 mmTherms, 0.3% of the baseline forecast, in 2016.
- **Achievable High potential** is 1.1 mmTherms in 2013, which represents 0.0% of the baseline forecast. By 2016, the cumulative energy savings are 12.8 mmTherms, 0.5% of the baseline forecast.
- **Economic potential,** which reflects a theoretical limit to savings when all cost-effective measures are taken, is 1.7 mmTherms in 2013. This represents 0.1% of the baseline energy forecast. By 2016, economic potential reaches 28.2 mmTherms, 1.2% of the baseline energy forecast.
- **Technical potential,** which reflects the adoption of all energy efficiency measures regardless of cost, is a theoretical upper bound on savings. In 2013, energy savings are 105 mmTherms, or 4.6% of the baseline energy forecast. By 2016, technical potential reaches 394.1 mmTherms, 16.8% of the baseline energy forecast.

The reason that natural gas technical potential savings are so high relative to economic potential savings has to do with the fuel switching analysis that was applied to the residential sector. Certain electric technologies were the most technically efficient option, while their corresponding natural gas technologies were the most economically efficient option. This caused customers to switch en masse to electric units in the technical potential case, while customers switched en mass to natural gas units in the economic potential case. When considering electric and natural gas on a total energy basis, the technical potential uses less energy than the economic potential, as one would expect. This is explained in more detail in Chapter 9.

Table 7-5 Natural Gas Energy Efficiency Potential for the Residential Sector

	2013	2014	2015	2016
Energy Forecasts (million therms)	2,299.6	2,318.6	2,332.9	2,351.6
Cumulative Energy Savings (million therms)				
Achievable Low Potential	0.6	2.3	4.8	6.9
Achievable High Potential	1.1	4.6	9.3	12.8
Economic Potential	1.7	12.7	24.0	28.2
Technical Potential	105.3	200.2	293.3	394.1
Energy Savings (% of Baseline Forecast)				
Achievable Low Potential	0.0%	0.1%	0.2%	0.3%
Achievable High Potential	0.0%	0.2%	0.4%	0.5%
Economic Potential	0.1%	0.5%	1.0%	1.2%
Technical Potential	4.6%	8.6%	12.6%	16.8%

Figure 7-3 Residential Natural Gas Potential Savings



Residential Natural Gas Potential by Market Segment

Single-family homes in New Jersey account for the majority of this sector's total sales in the base year and throughout the forecast. Similarly, single-family homes account for the largest share of potential savings by segment, as displayed in Table 7-6, which shows results for 2016. The fuel switching analysis causes an influx of natural gas water heaters in the economic potential, which actually increases the load so much in the Single Family Low Income sector that it pushes the savings negative. It should be noted that the effects of the fuel switching units are minimal in the achievable potential cases, as the adoption rates are so low that they put the number of statewide transactions in the hundreds and low thousands.

Table 7-7 shows the savings by end use and market segment in 2016. Heating and water heating comprise the lion share of savings.

Table 7-6 Residential Natural Gas Potential by Market Segment, 2016 (thousand therms)

	Single Family	Single Family LI	Multi Family Rent	Multi Family Rent LI	Multi Family Own	Multi Family Own LI
Baseline Forecast (thousand therms)	**1,334,761**	**358,074**	**324,636**	**218,574**	**96,860**	**18,739**
Energy Savings (thousand therms)						
Achievable Low Potential	4,185	1,116	830	534	216	40
Achievable High Potential	7,756	2,073	1,543	991	392	73
Economic Potential	11,984	-1,522	9,628	3,379	3,218	1,499
Technical Potential	232,232	60,617	49,533	35,027	13,268	3,439
Energy Savings as % of Baseline						
Achievable Low Potential	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%
Achievable High Potential	0.6%	0.6%	0.5%	0.5%	0.4%	0.4%
Economic Potential	0.9%	-0.4%	3.0%	1.5%	3.3%	8.0%
Technical Potential	17.4%	16.9%	15.3%	16.0%	13.7%	18.4%

Table 7-7 Residential Achievable Potential Low by End Use and Market Segment, 2016 (thousand therms)

End Use	Single Family	Single Family LI	Multi Family Rent	Multi Family Rent LI	Multi Family Own	Multi Family Own LI
Heating	2,763	664	595	409	126	23
Appliances	1,368	447	236	126	90	16
Miscellaneous	0	0	0	0	0	0
Water Heating	54	5	0	0	0	0
Total	**4,185**	**1,116**	**830**	**534**	**216**	**40**

Residential Natural Gas Potential by End Use

Table 7-8 provides estimates of savings for each end use and type of potential. Negative savings in water heating for the economic potential case reflects the conversion of electric and fuel oil water heaters to high efficiency condensing natural gas fired units. This is due to the fuel switching analysis, as discussed in more detail in Chapter 9.

Table 7-8 Residential Natural Gas Savings by End Use and Potential Type (million therms)

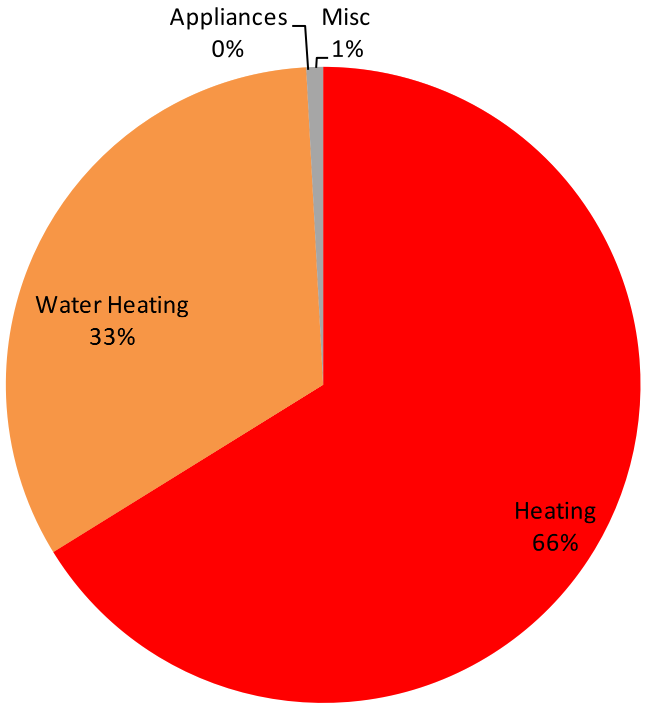
End Use	Case	2013	2014	2015	2016
Heating	Achievable Low Potential	0.4	1.4	2.9	4.6
	Achievable High Potential	0.8	2.6	5.4	8.3
	Economic Potential	5.5	15.1	25.8	33.4
	Technical Potential	97.0	186.0	274.2	369.2

Appliances	Achievable Low Potential	0.1	0.9	1.8	2.3
	Achievable High Potential	0.3	1.9	3.7	4.4
	Economic Potential	-3.8	-2.6	-2.1	-5.7
	Technical Potential	6.3	10.6	14.0	18.2
Miscellaneous	Achievable Low Potential	0.0	0.0	0.0	0.0
	Achievable High Potential	0.0	0.0	0.0	0.0
	Economic Potential	0.0	0.0	0.0	0.0
	Technical Potential	0.6	1.3	1.9	2.5
Water Heating	Achievable Low Potential	0.0	0.0	0.0	0.1
	Achievable High Potential	0.0	0.0	0.1	0.1
	Economic Potential	0.0	0.2	0.3	0.5
	Technical Potential	0.8	1.5	2.2	2.8
Total	Achievable Low Potential	**0.6**	**2.3**	**4.8**	**6.9**
	Achievable High Potential	**1.1**	**4.6**	**9.3**	**12.8**
	Economic Potential	**1.7**	**12.7**	**24.0**	**28.2**
	Technical Potential	**104.7**	**199.4**	**292.2**	**392.7**

Figure 7-4 focuses on the range of residential achievable potential in 2016. As expected, space heating and water heating savings are the largest opportunities. Detailed measure information is available in Appendix B. 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
- Behavioral feedback tools.

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



Commercial Electricity Potential

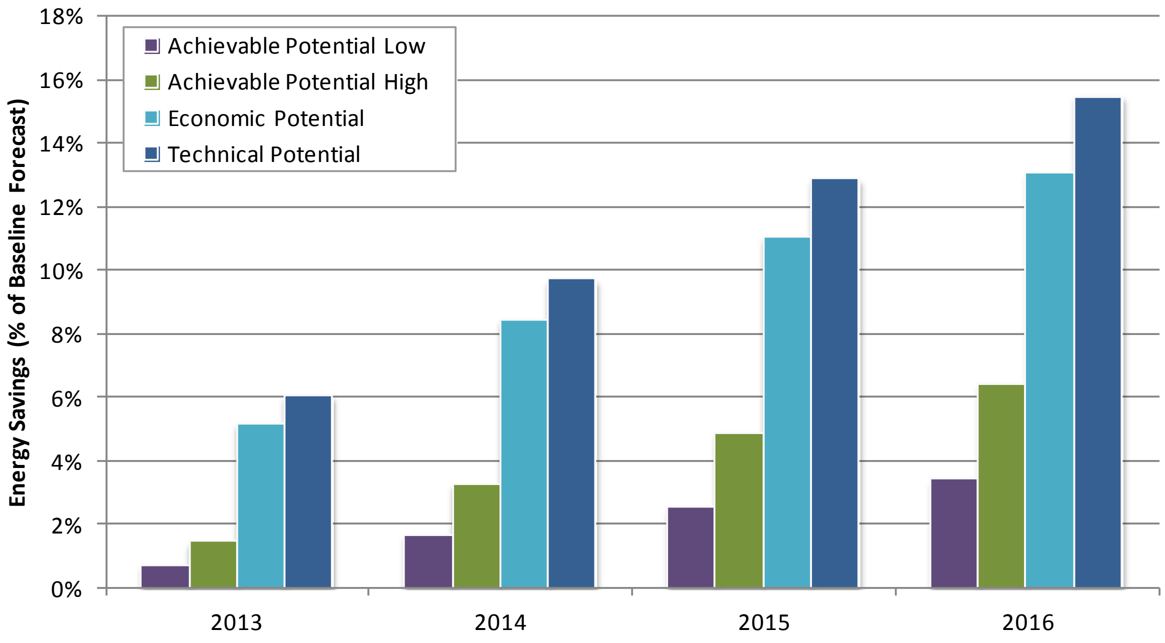
The baseline forecast for the commercial sector only grows slightly, which reflects the sluggish near-term economy and forthcoming codes and standards. Nevertheless, the opportunity for energy-efficiency savings is still significant for the commercial sector. Table 7-9 presents estimates for the four types of potential for the residential electricity sector. Figure 7-5 depicts these potential energy savings estimates graphically.

- **Achievable Low potential** projects 251 GWh of energy savings in 2013, 0.7% of the baseline forecast. This increases to 1,217 GWh, 3.4% of the baseline forecast, in 2016.
- **Achievable High potential** is 519 GWh in 2013, which represents 1.4% of the baseline forecast. By 2016, the cumulative energy savings are 2,296 GWh, 6.4% of the baseline forecast.
- **Economic potential,** which reflects a theoretical limit to savings when all cost-effective measures are taken, is 1,883 GWh in 2013. This represents 5.2% of the baseline energy forecast. By 2016, economic potential reaches 4,670 GWh, 13.0% of the baseline energy forecast.
- **Technical potential,** which reflects the adoption of all energy efficiency measures regardless of cost, is a theoretical upper bound on savings. In 2013, energy savings are 2,215 GWh, or 6.1% of the baseline energy forecast. By 2016, technical potential reaches 5,541 GWh, 15.5% of the baseline energy forecast.

Table 7-9 Electricity Efficiency Potential for the Commercial Sector

	2013	2014	2015	2016
Baseline Forecast (GWh)	36,511	35,964	35,699	35,797
Savings (GWh)				
Achievable Low Potential	251	585	889	1,217
Achievable High Potential	519	1,164	1,729	2,296
Economic Potential	1,883	3,030	3,943	4,670
Technical Potential	2,215	3,500	4,598	5,541
Savings (% of Baseline)				
Achievable Low Potential	0.7%	1.6%	2.5%	3.4%
Achievable High Potential	1.4%	3.2%	4.8%	6.4%
Economic Potential	5.2%	8.4%	11.0%	13.0%
Technical Potential	6.0%	9.7%	12.9%	15.5%

Figure 7-5 Commercial Energy Efficiency Potential Savings



Commercial Electric Potential by Market Segment

Table 7-10 shows potential estimates by building type segment in 2016. Retail has the largest achievable- low savings potential in 2016, followed by grocery, large office, and small office. Table 7-10. Table 7-11 summarizes achievable potential for each segment and end use.

Table 7-10 Commercial Electric Potential by Market Segment, 2016

	Small Office	Large Office	Restaurant	Retail	Grocery	College
Baseline Forecast	**4,094**	**5,581**	**1,616**	**6,811**	**3,683**	**2,082**
Energy Savings (1,000 MWh)						
Achievable Low Potential	130	149	48	263	151	67
Achievable High Potential	249	295	91	489	285	126
Economic Potential	493	612	191	1,026	544	260
Technical Potential	590	728	236	1,206	691	299
Energy Savings (% of Baseline)						
Achievable Low Potential	3.2%	2.7%	3.0%	3.9%	4.1%	3.2%
Achievable High Potential	6.1%	5.3%	5.6%	7.2%	7.7%	6.0%
Economic Potential	12.0%	11.0%	11.8%	15.1%	14.8%	12.5%
Technical Potential	14.4%	13.0%	14.6%	17.7%	18.8%	14.3%

	School	Health	Lodging	Warehouse	Misc.	Total
Baseline Forecast	**1,814**	**4,126**	**915**	**2,197**	**2,877**	**35,797**
Energy Savings (1,000 MWh)						
Achievable Low Potential	72	111	30	97	99	**1,217**
Achievable High Potential	131	211	56	179	184	**2,296**
Economic Potential	252	444	110	355	384	**4,670**
Technical Potential	304	510	135	389	456	**5,541**
Energy Savings (% of Baseline)						
Achievable Low Potential	3.9%	2.7%	3.3%	4.4%	3.5%	**3.4%**
Achievable High Potential	7.2%	5.1%	6.1%	8.2%	6.4%	**6.4%**
Economic Potential	13.9%	10.8%	12.1%	16.2%	13.3%	**13.0%**
Technical Potential	16.7%	12.4%	14.7%	17.7%	15.9%	**15.5%**

Table 7-11 Commercial Electric Achievable Low Potential by End Use and Market Segment, 2016 (GWh)

Segment	Cooling	Space Heating	Ventil ation	Water Heat	Int. Lighting	Ext. Lighting	Food Prep	Refriger ation	Office Equip	Misc	Total
Small Office	16.5	3.7	4.6	3.3	50.4	24.8	0.0	0.8	26.1	0.0	**130.3**
Large Office	16.9	4.0	22.4	3.6	49.2	15.2	0.0	1.9	36.1	0.0	**149.3**
Restaurant	4.3	0.5	4.3	4.5	11.0	9.4	0.6	11.9	1.3	0.0	**47.8**
Retail	23.2	9.7	25.4	9.7	132.7	41.1	1.3	10.7	9.0	0.0	**262.8**
Grocery	9.4	1.9	6.9	3.5	28.2	8.3	1.5	90.4	1.0	0.0	**150.9**
College	8.1	2.1	5.9	3.7	29.6	10.6	0.1	0.7	6.2	0.0	**67.0**
School	3.4	0.6	1.6	1.9	44.5	12.0	0.3	2.3	5.1	0.0	**71.6**
Health	7.0	1.1	2.5	2.5	29.4	6.6	0.1	2.4	4.8	0.0	**56.5**
Lodging	3.2	2.2	1.4	1.8	32.1	7.4	0.1	4.0	0.6	0.0	**52.9**
Warehouse	8.2	1.6	2.5	2.3	37.1	25.4	0.0	1.5	13.1	0.0	**91.9**
Miscellaneous	33.3	4.7	13.7	5.1	47.5	23.8	0.2	2.5	4.6	0.0	**135.5**
Total	**133.6**	**32.3**	**91.3**	**41.7**	**491.7**	**184.6**	**4.3**	**129.1**	**107.8**	**0.1**	**1217**

Commercial Electric Potential by End Use

Table 7-12 presents the commercial sector savings by end use and potential type. The end uses with the highest technical and economic potential are lighting, cooling, ventilation, and refrigeration.

Figure 7-6 focuses on 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. Regarding refrigeration, it is interesting to point out a relatively new control and sensing technology that vendors such as "eCube" are using to regulate the system energy. The technology consists of a solid, waxy food simulant that is fitted around a thermostat sensor that would otherwise measure air temperature. The refrigeration controls therefore attempt to regulate the temperature of food, which changes more slowly and gradually than air, thereby reducing the frequency of refrigeration on/off cycles. Refrigeration energy savings are then followed in descending order by cooling, ventilation, office equipment, and small amounts of the other end uses.

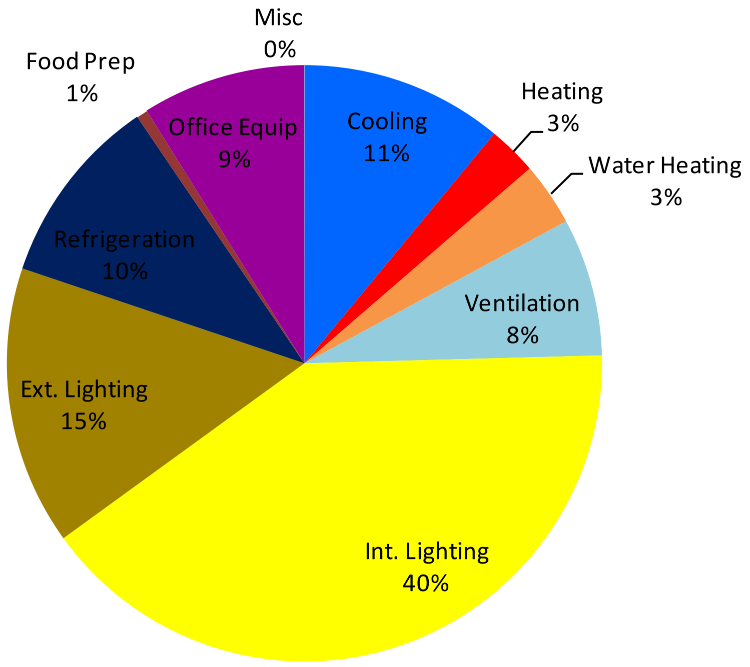
Detailed measure information is available in the Appendix C. The key measures comprising the potential are listed below:

- 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, decommissioning
- Efficient office equipment – computers, servers

Table 7-12 Commercial Potential by End Use and Potential Type (GWh)

End Use	Case	2013	2014	2015	2016
Cooling	Achievable Low Potential	23	46	82	134
	Achievable High Potential	51	100	168	262
	Economic Potential	257	342	449	585
	Technical Potential	320	444	611	810
Heating	Achievable Low Potential	6	11	20	32
	Achievable High Potential	14	25	42	66
	Economic Potential	76	97	125	161
	Technical Potential	91	118	156	204
Ventilation	Achievable Low Potential	12	28	53	91
	Achievable High Potential	29	65	117	192
	Economic Potential	211	354	505	668
	Technical Potential	239	392	555	733
Water Heating	Achievable Low Potential	5	14	26	42
	Achievable High Potential	12	30	55	87
	Economic Potential	65	120	176	234
	Technical Potential	80	140	201	266
Interior Lighting	Achievable Low Potential	126	295	399	492
	Achievable High Potential	244	553	732	875
	Economic Potential	752	1,278	1,565	1,700
	Technical Potential	839	1,396	1,725	1,919
Exterior Lighting	Achievable Low Potential	30	79	133	185
	Achievable High Potential	59	148	243	324
	Economic Potential	156	294	403	465
	Technical Potential	167	309	424	494
Refrigeration	Achievable Low Potential	32	60	90	126
	Achievable High Potential	70	123	176	237
	Economic Potential	260	307	360	422
	Technical Potential	343	424	513	611
Food Preparation	Achievable Low Potential	1	3	5	7
	Achievable High Potential	2	6	10	16
	Economic Potential	10	20	30	41
	Technical Potential	10	20	30	41
Office Equipment	Achievable Low Potential	16	49	82	108
	Achievable High Potential	38	113	185	236
	Economic Potential	96	219	329	393
	Technical Potential	125	258	382	461
Miscellaneous	Achievable Low Potential	0	0	0	0
	Achievable High Potential	0	0	0	0
	Economic Potential	0	1	1	1
	Technical Potential	0	1	1	1
Total	**Achievable Low Potential**	**251**	**585**	**889**	**1,217**
	Achievable High Potential	**519**	**1,164**	**1,729**	**2,296**
	Economic Potential	**1,883**	**3,030**	**3,943**	**4,670**
	Technical Potential	**2,215**	**3,500**	**4,598**	**5,541**

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



Commercial Natural Gas Potential

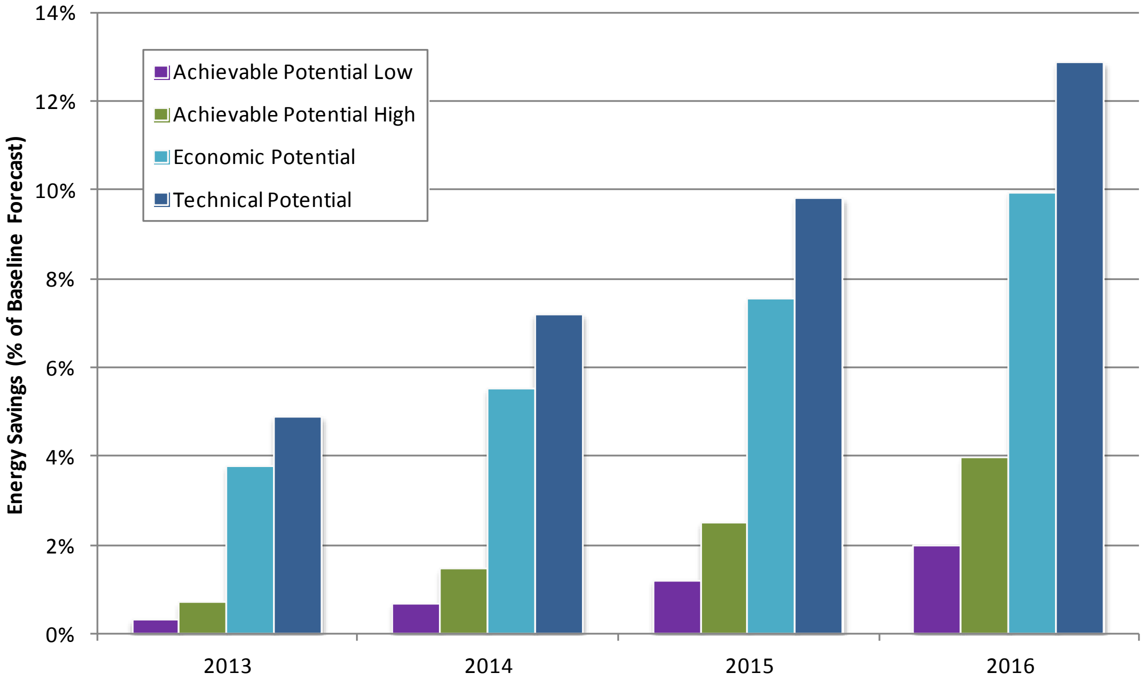
Table 7-13 and Figure 7-7 present the savings associated with each level of potential. The highlights from the potentials are described below.

- **Achievable Low potential** projects 5 million therms (mmTherms) of energy savings in 2013, 0.3% of the baseline forecast. This increases to 34 mmTherms, 2.0% of the baseline forecast, in 2016.
- **Achievable High potential** is 12 mmTherms in 2013, which represents 0.7% of the baseline forecast. By 2016, the cumulative energy savings are 69 mmTherms, 3.9% of the baseline forecast.
- **Economic potential,** which reflects a theoretical limit to savings when all cost-effective measures are taken, is 67 mmTherms in 2013. This represents 3.8% of the baseline energy forecast. By 2016, economic potential reaches 175 mmTherms, 9.9% of the baseline energy forecast.
- **Technical potential,** which reflects the adoption of all energy efficiency measures regardless of cost, is a theoretical upper bound on savings. In 2013, energy savings are 87 mmTherms, or 4.9% of the baseline energy forecast. By 2016, technical potential reaches 226 mmTherms, 12.9% of the baseline energy forecast.

Table 7-13 Natural Gas Efficiency Potential for the Commercial Sector

	2013	2014	2015	2016
Energy Forecasts (mmTherm)	1,771	1,753	1,748	1,756
Cumulative Energy Savings (mmTherm)				
Achievable Low Potential	5.2	11.4	20.6	34.3
Achievable High Potential	12.0	25.1	43.5	69.2
Economic Potential	66.6	96.3	131.5	174.6
Technical Potential	86.5	125.9	171.2	225.8
Energy Savings (% of Baseline Forecast)				
Achievable Low Potential	0.3%	0.7%	1.2%	2.0%
Achievable High Potential	0.7%	1.4%	2.5%	3.9%
Economic Potential	3.8%	5.5%	7.5%	9.9%
Technical Potential	4.9%	7.2%	9.8%	12.9%

Figure 7-7 Commercial Natural Gas Potential Savings



Commercial Natural Gas Potential by Market Segment

Table 7-14 below shows natural gas potential estimates by segment in 2016. Table 7-15 summarizes the achievable potential for each segment by end use.

Table 7-14 Commercial Natural Gas Potential by Market Segment, 2016

	Small Office	Large Office	Restaurant	Retail	Grocery	College	School	Health	Lodging	Warehouse	Misc.	Total
Baseline Forecast	**176,002**	**137,427**	**99,587**	**305,804**	**57,370**	**102,268**	**140,064**	**285,802**	**58,486**	**96,759**	**296,601**	**1,756,171**
Energy Savings (thousand therms)												
Achievable Low Potential	3,553	2,448	1,557	6,380	1,257	2,234	1,588	5,425	778	1,804	7,258	**34,281**
Achievable High Potential	7,225	4,981	3,259	12,967	2,565	4,443	3,256	10,847	1,569	3,674	14,379	**69,165**
Economic Potential	18,677	11,930	8,495	33,366	6,406	10,105	8,737	26,464	4,118	10,620	35,641	**174,559**
Technical Potential	26,360	18,767	9,216	39,950	7,251	13,481	16,001	32,263	5,963	13,160	43,427	**225,838**
Energy Savings (% of Baseline)												
Achievable Low Potential	2.0%	1.8%	1.6%	2.1%	2.2%	2.2%	1.1%	1.9%	1.3%	1.9%	2.4%	**2.0%**
Achievable High Potential	4.1%	3.6%	3.3%	4.2%	4.5%	4.3%	2.3%	3.8%	2.7%	3.8%	4.8%	**3.9%**
Economic Potential	10.6%	8.7%	8.5%	10.9%	11.2%	9.9%	6.2%	9.3%	7.0%	11.0%	12.0%	**9.9%**
Technical Potential	15.0%	13.7%	9.3%	13.1%	12.6%	13.2%	11.4%	11.3%	10.2%	13.6%	14.6%	**12.9%**

Table 7-15 Commercial Natural Gas Achievable High Potential by End Use and Market Segment, 2016 (million therms)

Segment	Space Heating	Water Heat	Food Prep	Misc.	Total
Small Office	6.4	0.8	0.0	6.2	13.4
Large Office	4.2	0.6	0.2	4.2	9.1
Restaurant	0.7	1.1	1.5	1.4	4.7
Retail	10.6	1.7	0.7	11.0	24.0
Grocery	1.9	0.5	0.1	2.3	4.8
College	3.6	0.8	0.1	3.9	8.3
School	1.9	0.9	0.4	2.2	5.4
Health	6.7	2.8	1.3	8.5	19.3
Lodging	0.4	1.0	0.2	1.1	2.6
Warehouse	3.6	0.1	0.0	3.3	7.0
Misc.	12.8	1.2	0.4	12.9	27.2
Total	**52.8**	**11.4**	**4.9**	**56.9**	**126.1**

Commercial Natural Gas Potential by End Use

Table 7-16 presents the commercial sector savings by end use and potential type. The end uses with the highest technical and economic potential are heating, water heating, and food preparation. This study shows no savings available in the miscellaneous end use due to its uncertain composition.

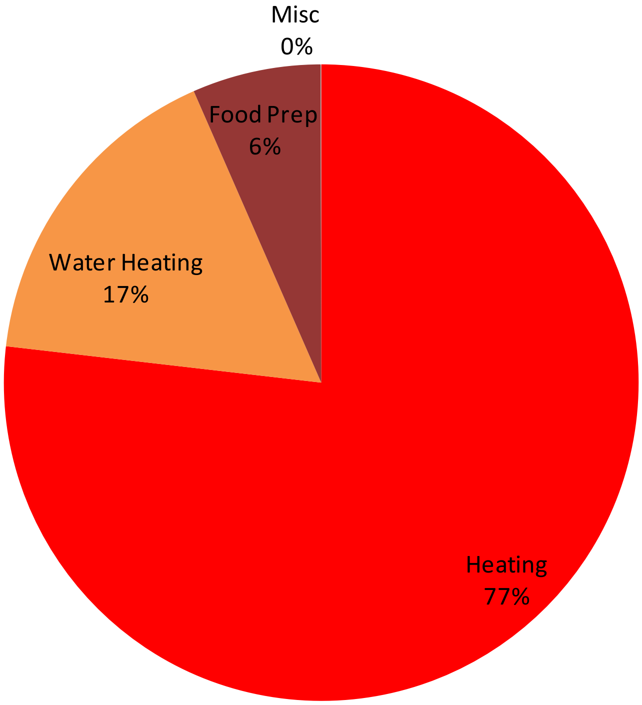
Table 7-16 Commercial Natural Gas Potential by End Use and Potential Type (million therms)

End Use	Case	2013	2014	2015	2016
Heating	Achievable Low Potential	4.0	8.8	15.8	26.3
	Achievable High Potential	9.3	19.2	33.1	52.8
	Economic Potential	50.7	71.7	97.3	129.5
	Technical Potential	68.0	97.6	131.7	173.8
Water Heating	Achievable Low Potential	0.9	1.9	3.5	5.7
	Achievable High Potential	1.9	4.1	7.3	11.4
	Economic Potential	12.3	17.7	23.9	31.1
	Technical Potential	15.0	21.4	29.1	38.1
Food Preparation	Achievable Low Potential	0.3	0.7	1.4	2.2
	Achievable High Potential	0.7	1.7	3.1	4.9
	Economic Potential	3.5	6.9	10.3	13.9
	Technical Potential	3.5	6.9	10.3	13.9
Miscellaneous	Achievable Low Potential	0.0	0.0	0.0	0.0
	Achievable High Potential	0.0	0.0	0.0	0.0
	Economic Potential	0.0	0.0	0.0	0.1
	Technical Potential	0.0	0.1	0.1	0.1
Total	**Achievable Low Potential**	**5.2**	**11.4**	**20.6**	**34.3**
	Achievable High Potential	**12.0**	**25.1**	**43.5**	**69.2**
	Economic Potential	**66.6**	**96.3**	**131.5**	**174.6**
	Technical Potential	**86.5**	**125.9**	**171.2**	**225.8**

Figure 7-8 below shows achievable potential savings by end use. As expected, heating provides the largest share of the savings, with water heating and food preparation each successively smaller. Detailed measure information is available in Appendix C. 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 7-8 Commercial Natural Gas Achievable Low Potential Savings by End Use in 2016



Industrial Electricity Potential

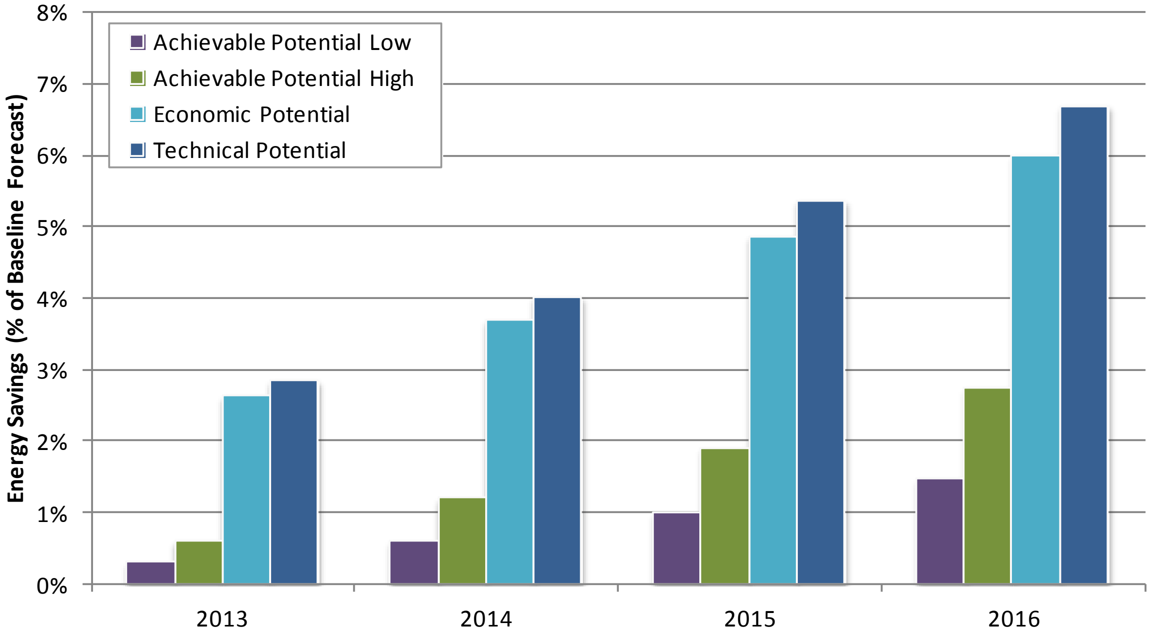
The industrial sector in New Jersey only accounts for 11% of total energy consumption, but there are prime efficiency opportunities nonetheless. Table 7-17 and Figure 7-9 present the savings for the various types of potential considered in this study.

- **Achievable Low potential** projects 22 GWh of energy savings in 2013 and 113 GWh in 2016. This corresponds to 0.3% of the baseline forecast in 2013 and 1.5% in 2016.
- **Achievable High potential** is 46 GWh in 2013, which represents 0.6% of the baseline forecast. By 2016, the cumulative energy savings are 212 GWh, 2.7% of the baseline forecast.
- **Economic potential**, which reflects the savings when all cost-effective measures are taken, is 205 GWh in 2013. This represents 2.6% of the baseline energy forecast. By 2016, economic potential reaches 464 GWh, 6.0% of the baseline energy forecast.
- **Technical potential,** which reflects the adoption of all energy efficiency measures regardless of cost, is a theoretical upper bound on savings. In 2013, energy savings are 222 GWh, or 2.8% of the baseline energy forecast. By 2016, technical potential reaches 518 GWh, 6.7% of the baseline energy forecast.

Table 7-17 Electric Efficiency Potential for the Industrial Sector

	2013	2014	2015	2016
Energy Forecasts (GWh)	7,822	7,858	7,937	7,732
Cumulative Energy Savings (GWh)				
Achievable Low Potential	22	47	78	113
Achievable High Potential	46	93	150	212
Economic Potential	205	290	386	464
Technical Potential	222	316	426	518
Energy Savings (% of Baseline Forecast)				
Achievable Low Potential	0.3%	0.6%	1.0%	1.5%
Achievable High Potential	0.6%	1.2%	1.9%	2.7%
Economic Potential	2.6%	3.7%	4.9%	6.0%
Technical Potential	2.8%	4.0%	5.4%	6.7%

Figure 7-9 Industrial Electric Potential Savings



Industrial Electric Potential by Market Segment

Table 7-18 shows electric energy efficiency potential for the four industrial segments in 2016. Table 7-19 shows the Achievable Low savings by end use and market segment in 2016.

Table 7-18 Industrial Electric Potential by Market Segment, 2016

	Chemical and Pharmaceutical	Paper	Food	Other Industrial	Total
Baseline Forecast (GWh)	**2,475**	**1,074**	**720**	**3,464**	**7,732**
Energy Savings (GWh)					
Achievable Low Potential	31.5	15.5	9.8	55.9	**112.8**
Achievable High Potential	58.8	28.7	18.2	106.0	**211.7**
Economic Potential	119.7	56.8	38.3	249.3	**464.1**
Technical Potential	128.1	58.7	43.3	287.6	**517.6**
Energy Savings as % of Baseline					
Achievable Low Potential	1.3%	1.4%	1.4%	1.6%	**1.5%**
Achievable High Potential	2.4%	2.7%	2.5%	3.1%	**2.7%**
Economic Potential	4.8%	5.3%	5.3%	7.2%	**6.0%**
Technical Potential	5.2%	5.5%	6.0%	8.3%	**6.7%**

Table 7-19 Industrial Electric Achievable Potential Low by End Use and Market Segment, 2016

End Use	Chemical and Pharmaceutical	Paper	Food	Other Industrial	Total
Cooling	2.09	0.66	0.79	11.58	15.12
Heating	0.57	0.18	0.21	3.09	4.05
Ventilation	0.74	0.23	0.28	3.84	5.09
Interior Lighting	2.46	1.14	1.25	13.95	18.79
Exterior Lighting	0.26	0.12	0.13	1.43	1.94
Motors	22.69	12.81	5.22	19.27	59.99
Process	2.71	0.39	1.93	2.76	7.79
Miscellaneous	-	-	-	-	-
Grand Total	**31.52**	**15.52**	**9.81**	**55.92**	**112.78**

Industrial Electric Potential by End Use

Table 7-20 provides estimates of savings for each end use and type of potential. Not surprisingly, the largest savings opportunities are found in motors and drives.

Table 7-20 Industrial Electric Potential by End Use and Potential Type (GWh)

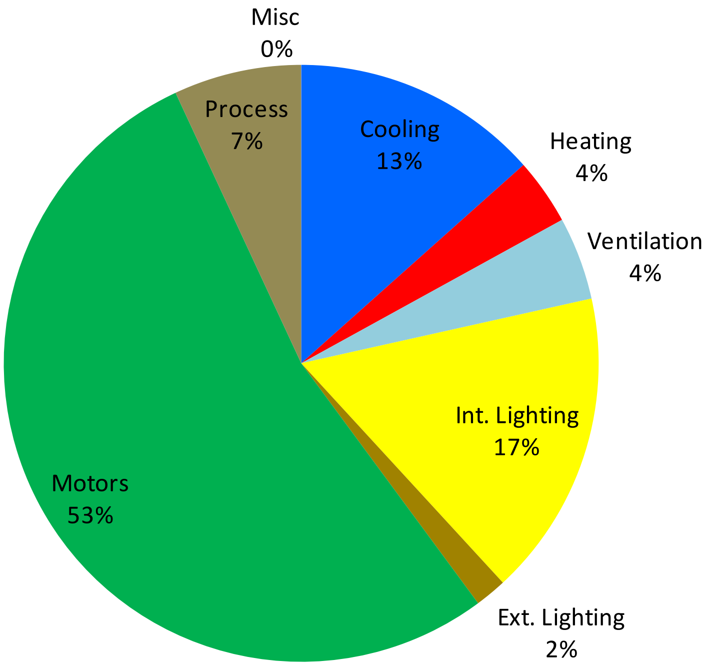
End Use	Potential	2013	2014	2015	2016
Cooling	Achievable Low Potential	2.5	5.4	9.7	15.1
	Achievable High Potential	5.7	11.4	19.8	29.6
	Economic Potential	29.8	39.9	54.0	67.3
	Technical Potential	38.1	53.2	74.0	92.4
Heating	Achievable Low Potential	0.7	1.4	2.5	4.1
	Achievable High Potential	1.7	3.2	5.5	8.4
	Economic Potential	9.2	11.8	15.2	18.8
	Technical Potential	12.2	16.4	22.7	28.8
Ventilation	Achievable Low Potential	0.7	1.8	3.4	5.1
	Achievable High Potential	1.7	4.1	7.6	11.1
	Economic Potential	16.9	32.8	49.8	63.2
	Technical Potential	18.2	34.3	51.4	65.1
Interior Lighting	Achievable Low Potential	3.8	8.5	14.1	18.8
	Achievable High Potential	7.6	16.4	26.3	33.8
	Economic Potential	34.8	55.0	71.8	74.5
	Technical Potential	37.9	59.0	77.1	81.6
Exterior Lighting	Achievable Low Potential	0.5	1.1	1.7	1.9
	Achievable High Potential	1.0	2.1	3.1	3.5
	Economic Potential	2.8	4.4	5.6	5.4
	Technical Potential	2.9	4.6	5.8	5.7
Motors	Achievable Low Potential	13.1	26.3	41.8	60.0
	Achievable High Potential	26.9	51.9	79.9	111.2
	Economic Potential	101.9	131.8	168.9	206.4
	Technical Potential	97.7	125.9	160.6	197.4
Process	Achievable Low Potential	0.9	2.2	4.4	7.8
	Achievable High Potential	1.9	4.2	8.2	14.0
	Economic Potential	9.7	14.3	20.7	28.2
	Technical Potential	12.4	18.3	26.7	36.4
Miscellaneous	Achievable Low Potential	-	-	-	-
	Achievable High Potential	-	-	-	-
	Economic Potential	-	-	-	-
	Technical Potential	-	-	-	-
Total	**Achievable Low Potential**	**22.3**	**46.7**	**77.6**	**112.8**
	Achievable High Potential	**46.5**	**93.3**	**150.4**	**211.7**
	Economic Potential	**205.1**	**290.0**	**385.9**	**464.0**
	Technical Potential	**219.5**	**311.8**	**418.3**	**507.4**

Figure 7-10 illustrates the 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, potential savings are incrementally small to upgrade to even more efficient levels. 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 large opportunities for savings in cooling, lighting, process, ventilation, and finally space heating. Detailed measure information is available in Appendix D. The key measures comprising the potential are listed below:

- Motors – 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 & programmable thermostats

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



Industrial Natural Gas Potential

Table 7-21 and Figure 7-11 present the savings for the various types of potential considered in this study for the industrial sector.

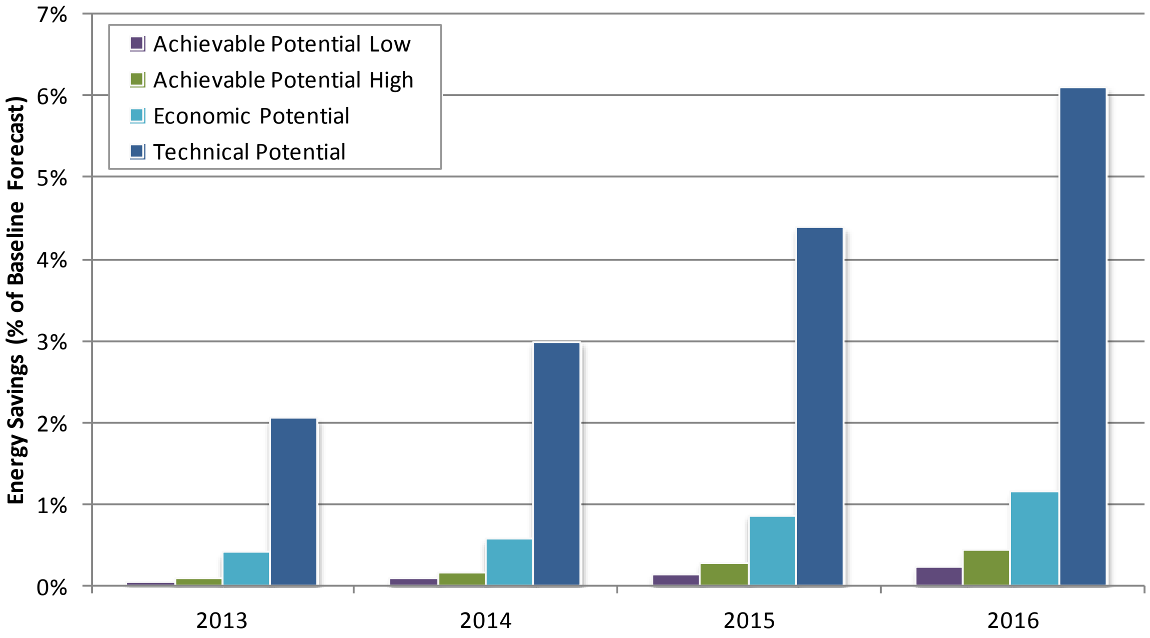
- **Achievable Low potential** projects 0.1 million therms (mmTherms) of energy savings in 2013, 0.0% of the baseline forecast. This increases to 1.0 mmTherms, 0.2% of the baseline forecast, in 2016.
- **Achievable High potential** is 0.3 mmTherms in 2013, which represents 0.1% of the baseline forecast. By 2016, the cumulative energy savings are 2.0 mmTherms, 0.4% of the baseline forecast.

- **Economic potential,** which reflects a theoretical limit to savings when all cost-effective measures are taken, is 1.9 mmTherms in 2013. This represents 0.4% of the baseline energy forecast. By 2016, economic potential reaches 5.4 mmTherms, 1.1% of the baseline energy forecast.
- **Technical potential,** which reflects the adoption of all energy efficiency measures regardless of cost, is a theoretical upper bound on savings. In 2013, energy savings are 10.0 mmTherms, or 2.0% of the baseline energy forecast. By 2016, technical potential reaches 29.3 mmTherms, 6.1% of the baseline energy forecast.

Table 7-21 Natural Gas Efficiency Potential for the Industrial Sector

	2013	2014	2015	2016
Energy Forecasts (million therms)	489	487	487	481
Cumulative Energy Savings (million therms)				
Achievable Low Potential	0.1	0.3	0.6	1.0
Achievable High Potential	0.3	0.7	1.3	2.0
Economic Potential	1.9	2.7	4.1	5.4
Technical Potential	10.0	14.5	21.3	29.3
Energy Savings (% of Baseline Forecast)				
Achievable Low Potential	0.0%	0.1%	0.1%	0.2%
Achievable High Potential	0.1%	0.1%	0.3%	0.4%
Economic Potential	0.4%	0.5%	0.8%	1.1%
Technical Potential	2.0%	3.0%	4.4%	6.1%

Figure 7-11 Industrial Natural Gas Potential Savings



Industrial Natural Gas Potential by Market Segment

Table 7-22 shows electric energy efficiency potential for the four industrial segments in 2016. Table 7-23 shows the Achievable Low savings by end use and market segment in 2016. A large portion of the savings comes from space heating improvements in the Other Industrial category. The largest industrial segments typically dedicate very little of their energy to space conditioning, so the smaller businesses that are grouped into the Other Industrial category will have more by comparison.

Table 7-22 Industrial Natural Gas Potential by Market Segment, 2016

	Chemical and Pharmaceutical	Paper	Food	Other Industrial	Total
Baseline Forecast (thousand therms)	**165,316**	**73,008**	**66,053**	**176,521**	**480,898**
Energy Savings (thousand therms)					
Achievable Low Potential	88.4	51.7	50.0	815.5	**1,005.5**
Achievable High Potential	163.0	96.6	94.5	1,632.7	**1,986.8**
Economic Potential	494.7	311.7	279.5	4,361.4	**5,447.2**
Technical Potential	9,926.5	4,413.5	3,865.6	11,132.8	**29,338.5**
Energy Savings as % of Baseline					
Achievable Low Potential	0.1%	0.1%	0.1%	0.5%	**0.2%**
Achievable High Potential	0.1%	0.1%	0.1%	0.9%	**0.4%**
Economic Potential	0.3%	0.4%	0.4%	2.5%	**1.1%**
Technical Potential	6.0%	6.0%	5.9%	6.3%	**6.1%**

Table 7-23 Industrial Natural Gas Achievable Potential Low by End Use and Market Segment, 2016 (million therms)

End Use	Chemical and Pharmaceutical	Paper	Food	Other Industrial	Total
Heating	32	22	27	795	876
Process	56	30	23	20	130
Miscellaneous	25	16	21	609	671
Total	**114**	**68**	**71**	**1,425**	**1,677**

Industrial Natural Gas Potential by End Use

Table 7-24 provides estimates of savings for each end use and type of potential. Since natural gas is chiefly used for heating, the number of end uses is more limited than the electricity analysis.

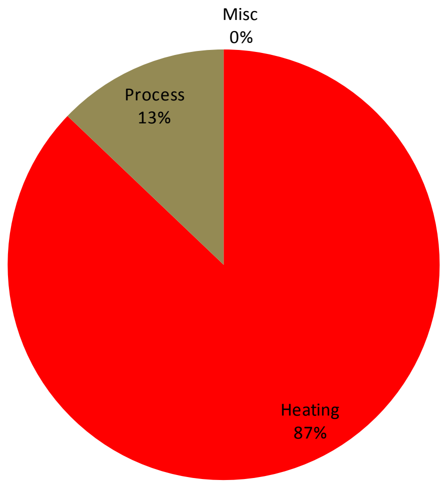
Table 7-24 Industrial Natural Gas Potential by End Use and Potential Type (thousand therms)

End Use	Potential	2013	2014	2015	2016
Heating	Achievable Low Potential	140.4	291.7	558.9	875.9
	Achievable High Potential	324.3	640.4	1,164.9	1,759.3
	Economic Potential	1,887.1	2,613.3	3,722.7	4,670.3
	Technical Potential	3,340.6	4,733.3	6,780.9	8,793.7
Process	Achievable Low Potential	-	6.8	58.6	129.6
	Achievable High Potential	-	12.6	105.1	227.5
	Economic Potential	-	63.0	409.7	777.0
	Technical Potential	6,486.8	9,539.7	14,068.8	19,827.2
Miscellaneous	Achievable Low Potential	-	-	-	-
	Achievable High Potential	-	-	-	-
	Economic Potential	-	-	-	-
	Technical Potential	-	-	-	-
Total	**Achievable Low Potential**	**140.4**	**298.5**	**617.5**	**1,005.5**
	Achievable High Potential	**324.3**	**653.0**	**1,269.9**	**1,986.8**
	Economic Potential	**1,887.1**	**2,676.4**	**4,132.4**	**5,447.2**
	Technical Potential	**9,827.5**	**14,273.0**	**20,849.7**	**28,621.0**

Figure 7-12 illustrates the 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. Detailed measure information is available in Appendix D. The key measures comprising the potential are listed below:

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

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



ALTERNATE AVOIDED COST SCENARIO

To observe the sensitivity of study results to changes in forecast market prices of electricity and natural gas, we ran a scenario in which the avoided costs for each fuel in each year of the study were increased by 20%. The models were then re-run with all other variables held constant.

The total number of measures passing the economic screen (with TRC benefit-to-cost ratio greater or equal to 1.0) increased from 6,343 to 6,578.[21] This is an increase of only 3.7%, because only a fraction of measures are close to the marginal value of 1.0. Details can be seen below in Table 8-1.

Table 8-1 Alternate Avoided Cost Scenario, Count of Measures Passing Economic Screen

Sector	Count of All Measures with B/C ratio > 1.0, All Fuels		
	Reference Case: Avoided Costs from New Jersey Rate Counsel	**Alternate Case:** 20% Higher Avoided Costs	**Delta**
Residential	995	1,064	6.9%
Commercial	3,842	3,975	3.5%
Industrial	1,506	1,539	2.2%
Total	**6,343**	**6,578**	**3.7%**

With the newly passing measures migrating from technical potential into economic and achievable potential, the savings are increased by a small amount. The electric achievable low potential in 2016, for instance, only increased from 3.1% of the baseline forecast to 3.2%. This is a change of 66 GWh or 2.9% of total savings, as shown in Table 8-2

Table 8-2 Alternate Avoided Cost Scenario, 2016 Achievable Low Potential (GWh savings)

Sector	**Reference Case:** Avoided Costs from New Jersey Rate Counsel	**Alternate Case:**20% Higher Avoided Costs	**Delta**
Residential	936	944	0.9%
Commercial	1,214	1,265	4.2%
Industrial	112	119	6.3%
Total	**2,262**	**2,328**	**2.9%**

The effects of the change are more pronounced for natural gas measures, as the savings potential in the reference case is already quite low. The natural gas achievable low potential in 2016 increased from 1.0% to 1.2%. This is a change of 2.6 million therms or 12.3% of total savings in the reference case, as shown in Table 8-3.

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[21] The number of measures cited here includes all permutations of technologies and measures, as well as their inclusion in the various building segments. It should be noted that this is distinct from the measure count given in Chapter 5, which for simplicity of reporting does not consider the dimension of building segment.

Table 8-3 Alternate Avoided Cost Scenario, 2016 Achievable Low Potential (million therm savings)

Sector	**Reference Case:** Avoided Costs from New Jersey Rate Counsel	**Alternate Case:**20% Higher Avoided Costs	**Delta**
Residential	8.4	9.2	8.6%
Commercial	38.9	41.6	7.0%
Industrial	1.3	3.9	194.1%
Total	**48.6**	**54.6**	**12.3%**

FUEL SWITCHING ANALYSIS

Energy efficiency potential studies have not traditionally explored the effects of switching technologies between system types and fuel types. In this context, where both electricity and natural gas are being studied on a statewide basis, one may wish to investigate the economic potential of switching from room air conditioning to central air conditioning technology. Or an example that is very relevant in the New Jersey market; will consumers switch from fuel oil furnaces to natural gas furnaces, and if so, how many?

The equipment stock accounting inside the LoadMAP modeling tool has the ability to support such a switching analysis, and has been activated and incorporated for the residential sector in all the results given above. The switching forecast is integrated with the traditional potential analysis, and operates on the same principles to calculate technical, economic, and achievable cases in turn. There are several important distinctions to the switching case, however, that should be discussed.

Technical Potential and Fuel Switching

First, the technical potential must compare all eligible technologies on an apples-to-apples basis. Therefore, kWh, therms, gallons of fuel oil, or any other fuel source must be converted to BTUs so the most efficient option can be selected on a same-fuel basis. The conversion factors used in the study are shown in Table 9-1 below. It is important to note our assumption in this study that electric energy is considered at the system level rather than at the meter. To convert directly from a kWh to kBTU, the factor is 3.414. This was factored up by 3.34 to account for the energy expended at the generator and lost during transmission.

Table 9-1 Converting to kBTU for Switching Comparison

Fuel	Value	Units
Electricity	11.4	kBTU per kWh
Natural Gas	100.0	kBTU per Therm
Fuel Oil	138.7	kBTU per Gallon

Economic Potential and Fuel Switching

The next consideration is that of economics. The lifetime benefits from energy saving are again compared to the incremental measure cost in the same way as the core potential analysis described above. The switching analysis, however, includes an additional switching cost between $280 and $462 depending on the technology, extra labor required, and additional parts or components required. If we revisit the example of switching from room AC to central AC, one would need to install ductwork, pour a concrete pad outside the home, and so on in order to enable the technology.

Achievable Potential and Fuel Switching

Finally, all economic decisions are decremented by the market adoption rates to arrive at achievable potential in the same manner as the core analysis. After this, the adoption is penalized by an additional factor to account for the fact that people very rarely choose fuel switching due to its inherently higher complexity. This factor, which we term "propensity," has been set at 5% in this analysis for all years and all measures.

The technologies made available for the switching analysis are shown below in Table 9-2, along with information regarding the directionality that they can be moved if the energy, economic, and adoption data align appropriately. For example, the analysis assumes that a customer may wish to switch away from a natural gas boiler to a geothermal heat pump, but never the opposite.

Table 9-2 Switching Options and Directionality

Fuel	Technology	Switchable	Directionality
Electric	Central AC	TRUE	Both Ways
Electric	Room AC	TRUE	From Only
Electric	Electric Room Heat	TRUE	From Only
Electric	Electric Furnace	TRUE	From Only
Electric	Air-Source Heat Pump	TRUE	To Only
Electric	Geothermal Heat Pump	TRUE	To Only
Electric	Water Heater <=55 gal	TRUE	Both Ways
Electric	Water Heater > 55 gal	TRUE	Both Ways
Natural Gas	Furnace	TRUE	Both Ways
Natural Gas	Boiler	TRUE	From Only
Natural Gas	Water Heater <=55 gal	TRUE	Both Ways
Natural Gas	Water Heater > 55 gal	TRUE	Both Ways
Fuel Oil	Furnace	TRUE	From Only
Fuel Oil	Boiler	TRUE	From Only
Fuel Oil	Water Heater <=55 gal	TRUE	From Only
Fuel Oil	Water Heater > 55 gal	TRUE	From Only

The fuel switching analysis results for the achievable potential cases show that the market will likely support the migration of 3,177 to 5,713 space heating systems between 2013 and 2016. These will virtually all occur in the form of converting natural gas boilers, electric furnaces, and fuel oil systems to natural gas furnaces.

During the same time period, the analysis also predicts that 1,118 to 2,434 water heaters will be switched, primarily from electric to gas water heaters, although some segments and niches have load profiles and economics that dictate switching in the opposite direction. The model does not predict any air conditioning or cooling technology switches.

These results can be viewed pictorially or in tables on the following pages. Figure 9-1and Figure 9-2 show the achievable low and high potential cases for space heating, with all data in the positive y-axis representing a unit that has switched *into* a category. Each graph is symmetrical, therefore, with a corresponding unit along the negative y-axis that has been switched *away* from a category. Figure 9-3 and Figure 9-4 show the same information for water heating technologies. The unit counts are available in Table 9-3 and Table 9-4.

Figure 9-1 Space Heating – Number of Fuel Switching Units, Achievable Low Case

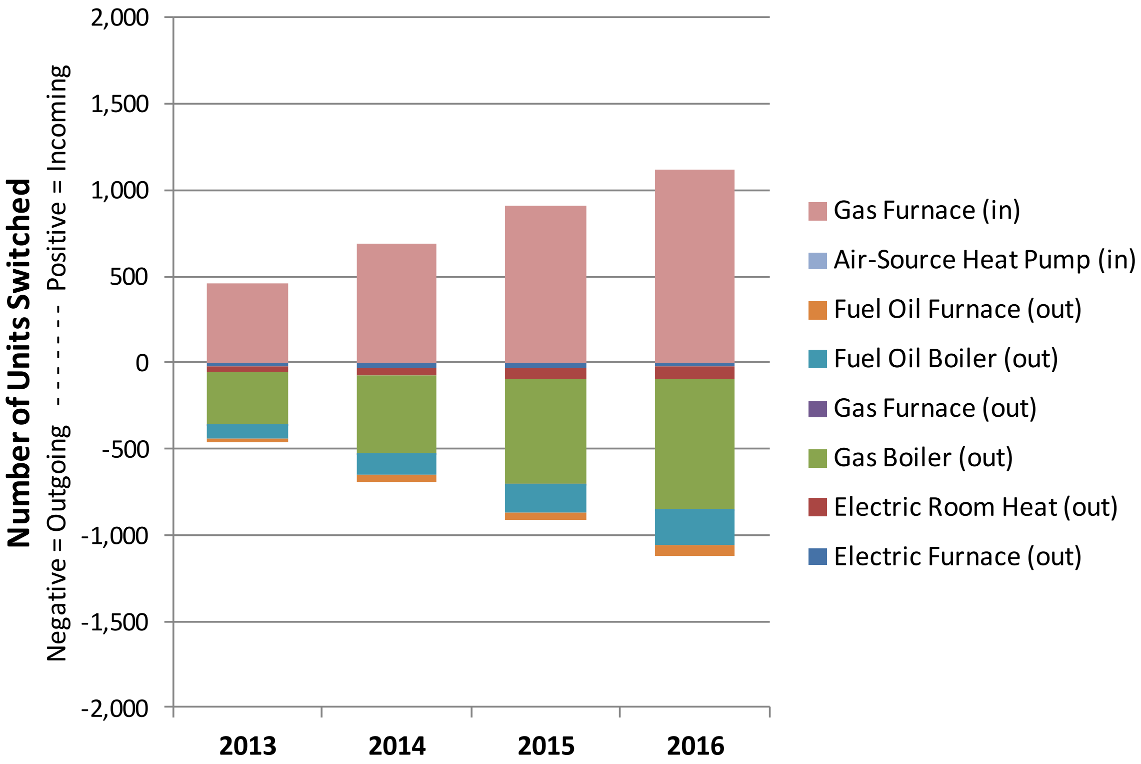

Figure 9-2 Space Heating – Number of Fuel Switching Units, Achievable High Case

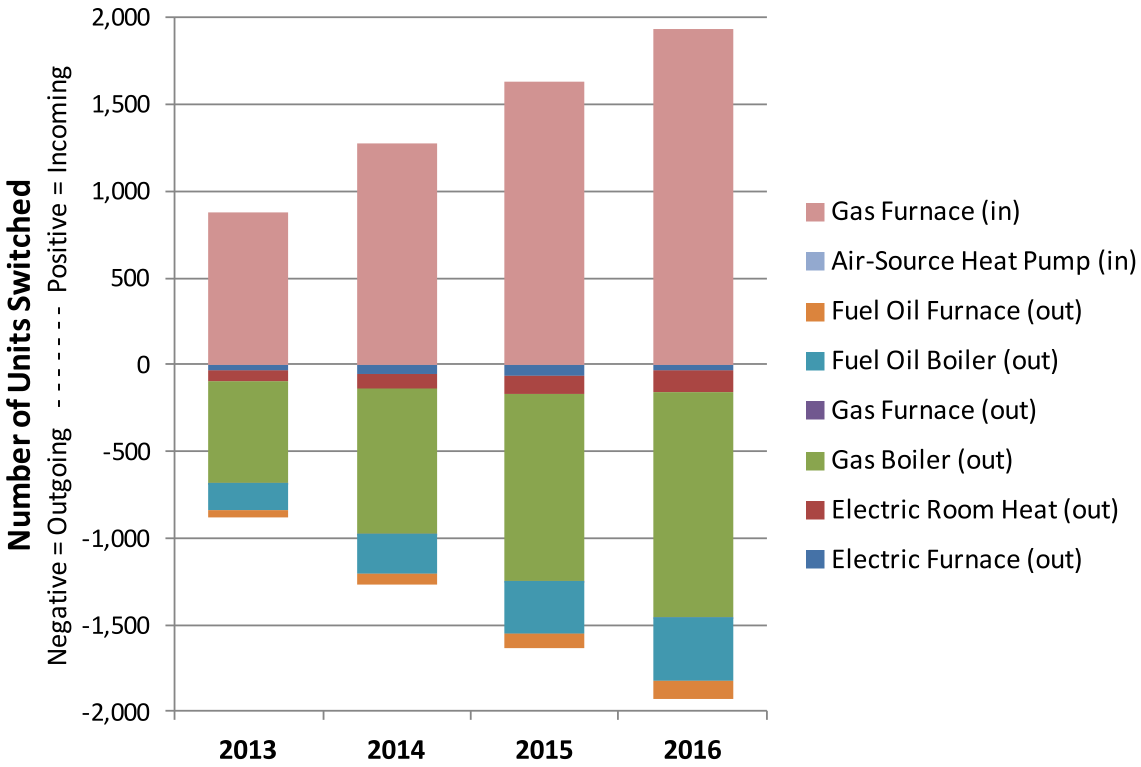

Table 9-3 Space Heating – Number of Fuel Switching Units

Switching Direction	Technology	Achievable Low				Achievable High			
		2013	2014	2015	2016	2013	2014	2015	2016
Outgoing	Electric Furnace (out)	-19	-28	-37	-20	-37	-52	-65	-34
	Electric Room Heat (out)	-32	-47	-60	-73	-62	-87	-108	-125
	Gas Boiler (out)	-301	-452	-603	-755	-579	-838	-1077	-1301
	Gas Furnace (out)	0	0	0	0	0	0	-1	-1
	Fuel Oil Boiler (out)	-82	-124	-166	-208	-158	-230	-296	-359
	Fuel Oil Furnace (out)	-23	-35	-47	-64	-44	-64	-84	-110
Incoming	Air-Source Heat Pump (in)	0	0	0	0	0	1	1	1
	Gas Furnace (in)	458	686	913	1,119	881	1,271	1,630	1,929

Figure 9-3 Water Heating – Number of Fuel Switching Units, Achievable Low Case

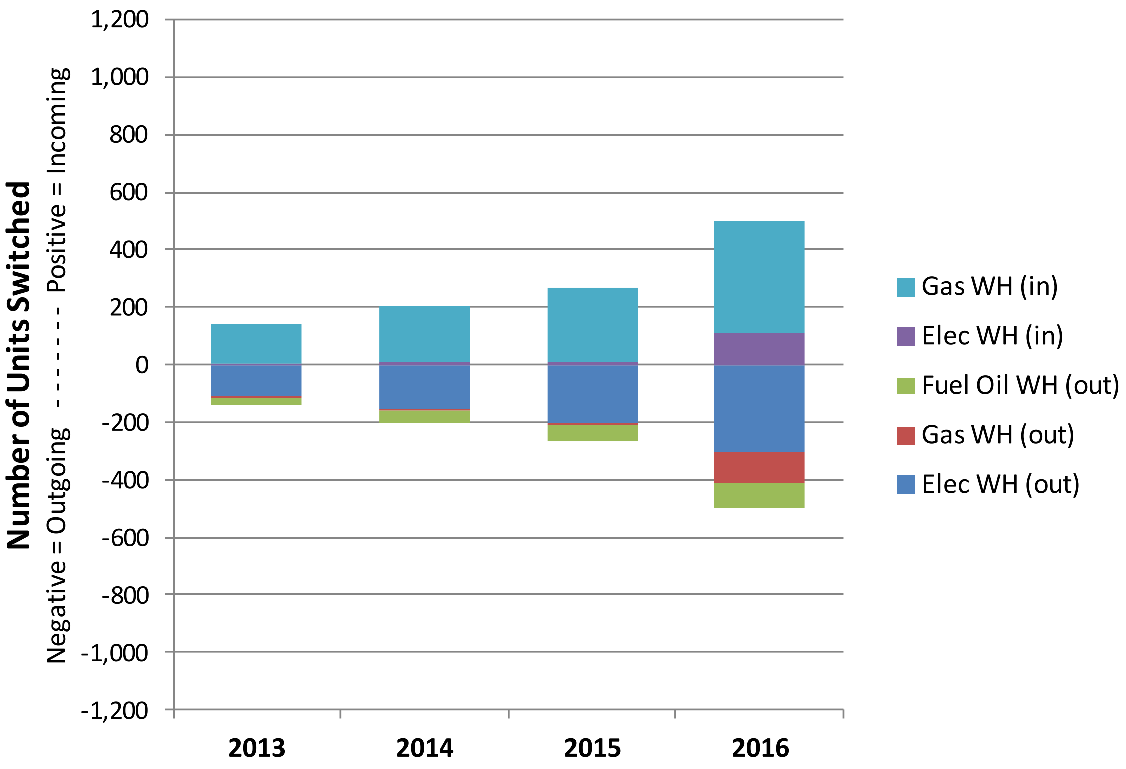

Figure 9-4 Water Heating – Number of Fuel Switching Units, Achievable High Case

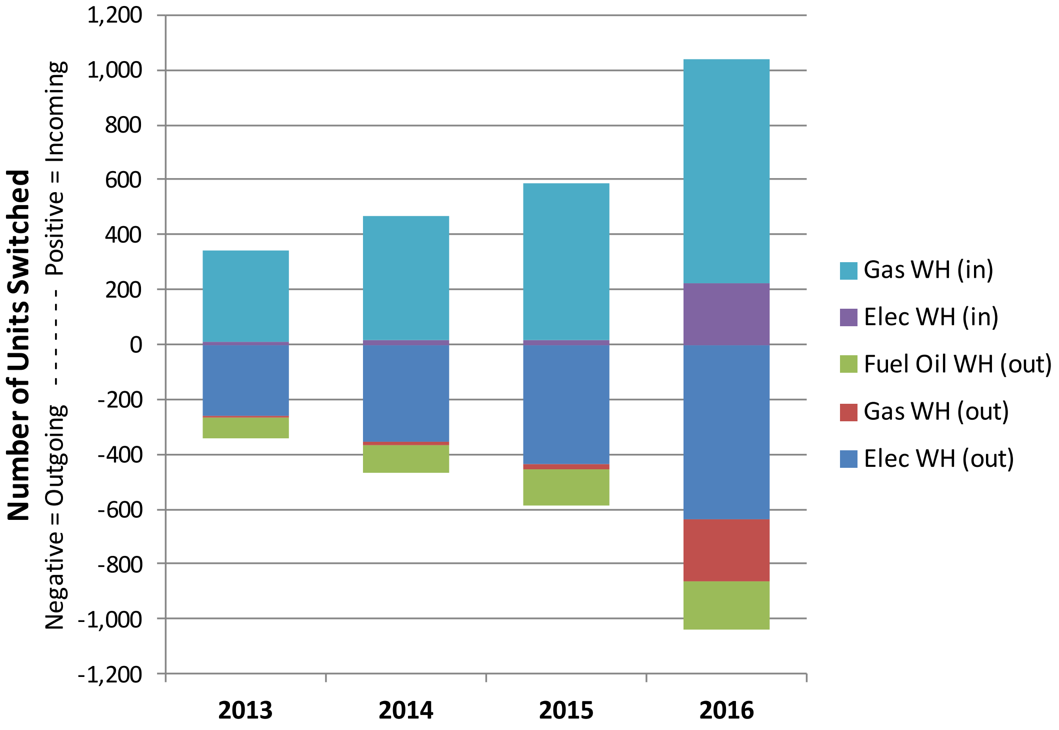

Table 9-4 Water Heating – Number of Fuel Switching Units

Switching Direction	Technology	Achievable Low				Achievable High			
		2013	2014	2015	2016	2013	2014	2015	2016
Outgoing	Electric WH (out)	-108	-155	-202	-306	-258	-353	-439	-638
	Natural Gas WH (out)	-5	-7	-8	-108	-12	-15	-18	-226
	Fuel Oil WH (out)	-30	-44	-59	-85	-71	-101	-129	-176
Incoming	Electric WH (in)	5	7	8	108	12	15	18	226
	Natural Gas WH (in)	138	200	261	391	329	454	568	814
	Fuel Oil WH (in)	0	0	0	0	0	0	0	0

CHAPTER | **10**

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 5.9% of the forecasted 2016 electric load, as well as 1.0% 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)[22] 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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[22] Sometimes called Continuous Energy Improvement (CEI).

CHAPTER | **11**

COMPARISON TO RECENT REGIONAL POTENTIAL STUDIES

We compared the average annual potential savings for all sectors from our study with two recent regional studies to see how they aligned. In general, the results that we produced are on a reasonable par with these studies. The two studies compared were:

- **Delaware's Energy Efficiency Potential and Program Scenarios to Meet Its Energy Efficiency Resource Standard.** A study by Center for Energy and Environmental Policy, University of Delaware, available at: http://www.ceep.udel.edu/energy/publications/2011_DNREC_EERS_CEEP_Report_May_2011.pdf

  Our Achievable High case most closely corresponds to the case in this study that assumes the most aggressive participation rates in the country (i.e. Vermont), and so is compared to it. We compare our Achievable Low case with their case that assumes the average participation rates from the "14 leading states" that have the highest participation rates in the nation. This study covers electricity and natural gas.

- **Electric Energy Efficiency Potential for Pennsylvania**. A study by GDS Associates and Nexant, May 10, 2012, available at: http://www.puc.state.pa.us/electric/pdf/Act129/Act129-PA_Market_Potential_Study051012.pdf

  Our Achievable High Case corresponds to their high case, in which they assume high adoption rates and an incentive amount that is 100% of the incremental cost of measures. We compare our Achievable Low Case to their case with incentives of 30% to 60% of incremental cost. This study only covers electricity.

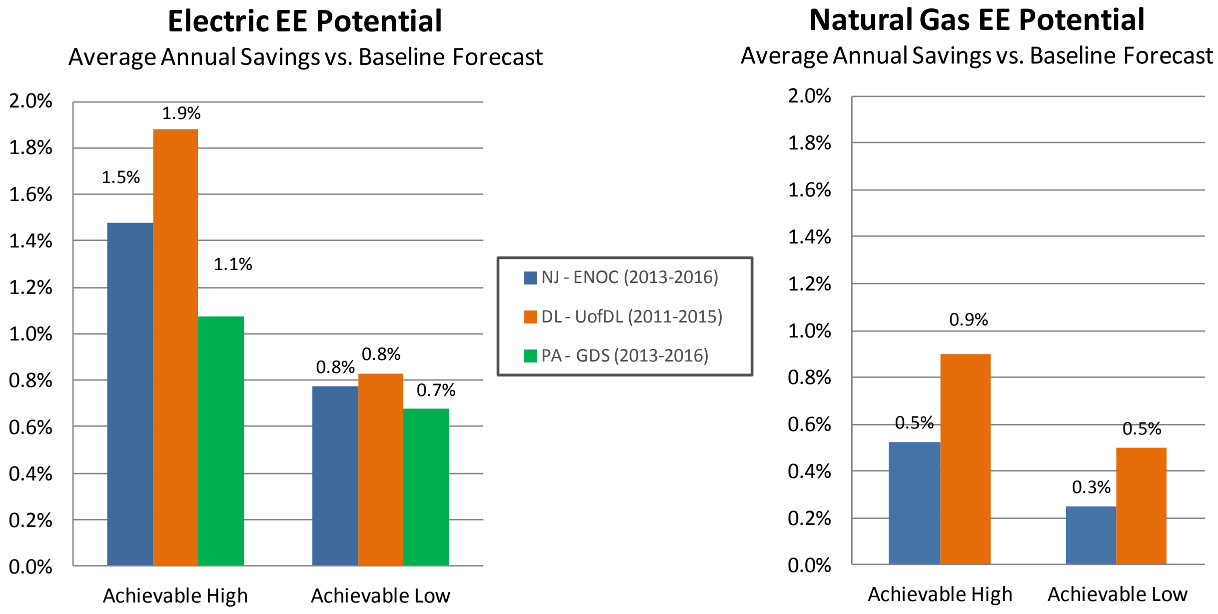
The three studies show an annual Achievable High potential for electric savings in the range of 1.1% to 1.9%, while the Achievable Low is in the range of 0.7% to 0.8% per year.

For natural gas, the two studies have an annual Achievable High potential between 0.5% and 0.9%, whereas the Achievable Low is in the range of 0.3% to 0.5% per year. Please see the Table 11-1 and Figure 11-1 for the data.

Table 11-1 Comparison to other studies (average annual savings vs. baseline forecast)

	Achievable High	Achievable Low
Electricity		
New Jersey – ENOC (2013-2016)	1.5%	0.8%
Delaware – U of DL (2011-2015)	1.9%	0.8%
Pennsylvania – GDS (2013-2016)	1.1%	0.7%
Natural Gas		
New Jersey – ENOC (2013-2016)	0.5%	0.3%
Delaware – U of DL (2011-2015)	0.9%	0.5%
Pennsylvania – GDS (2013-2016)	*N/A*	*N/A*

Figure 11-1 Comparison with recent regional potential studies



ENERGY EFFICIENCY POTENTIAL BEYOND 2016

New Jersey's next program planning cycle for the years 2013 to 2016 was the primary focus of this study and report. However, because there is a small incremental effort to include additional years in our modeling framework, we have extended the methodologies described above to produce estimates of energy efficiency potential through the year 2024. This will provide insight into longer term planning for the next two planning cycles: 2017 to 2020 and 2021 to 2024.

We present overall and sector-level 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 29,925 BTU in 2016 and increases to 160,552 BTU by 2024. This represents 2.3% of the baseline forecast in 2016 and 11.4% in 2024.
- **Achievable High potential** forms the upper bound on the range of achievable potential. It is 57,144 BTU in 2016, which represents 4.4% of the baseline forecast. By 2024, the cumulative savings are 225,579 BTU, 16.0% of the baseline forecast.
- **Economic potential**, which reflects the savings when all cost-effective measures are taken, is 127,588 BTU in 2016. This represents 9.9% of the baseline energy forecast. By 2024, economic potential reaches 326,006 BTU, 23.1% 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 2016, energy savings are 177,390 BTU, or 13.7% of the baseline energy forecast. By 2024, technical potential reaches 471,288 BTU, % of the baseline energy forecast.

Table 12-1 and Figure 12-1 summarize the energy-efficiency savings for the different levels of potential relative to the baseline forecast. Figure 12-2 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. Table 9-1 in the fuel switching analysis chapter shows the conversion factors.

Table 12-1 Summary of Combined Electric and Natural Gas Energy Efficiency Potential

	2013	2016	2020	2024
Baseline Forecast (million BTU)	1,308,205	1,291,174	1,344,903	1,412,982
Cumulative Savings (million BTU)				
Achievable Potential Low	5,678	29,925	87,381	160,552
Achievable Potential High	11,799	57,144	140,787	225,579
Economic Potential	45,966	127,588	224,560	326,006
Technical Potential	62,433	177,390	324,214	471,288
Energy Savings (% of Baseline)				
Achievable Potential Low	0.4%	2.3%	6.5%	11.4%
Achievable Potential High	0.9%	4.4%	10.5%	16.0%
Economic Potential	3.5%	9.9%	16.7%	23.1%
Technical Potential	4.8%	13.7%	24.1%	33.4%

Figure 12-1 Summary of Combined Electric and Natural Gas Energy Savings

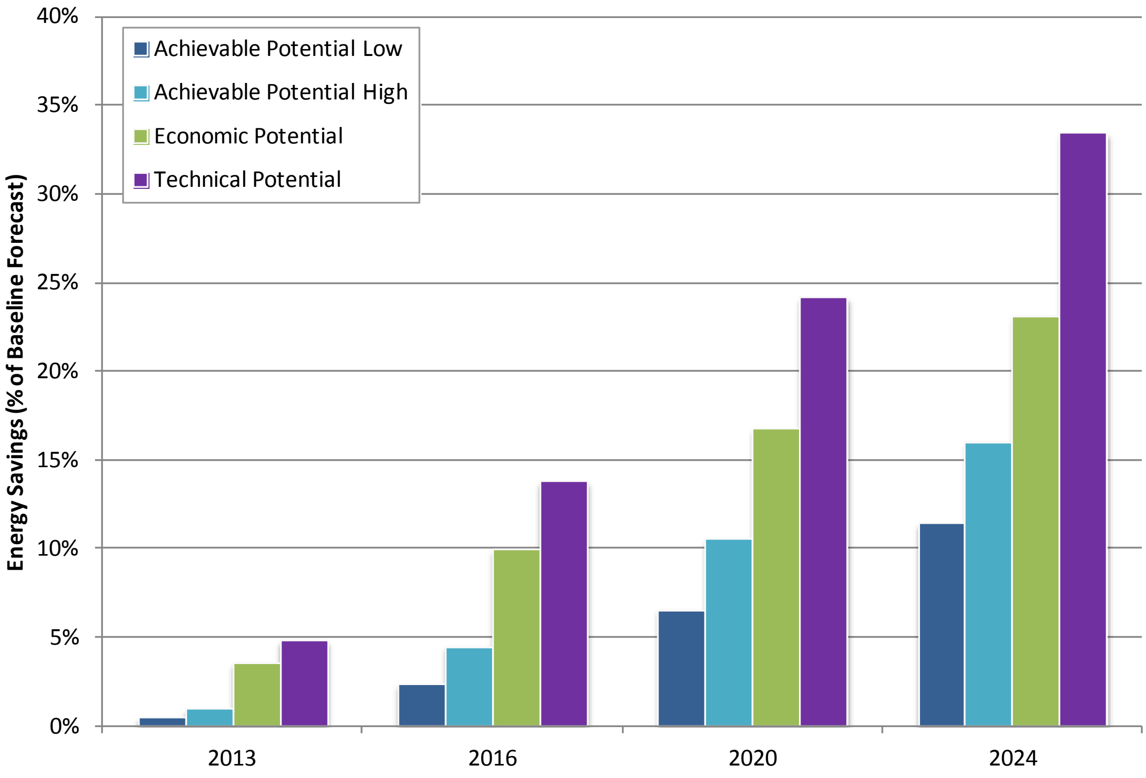
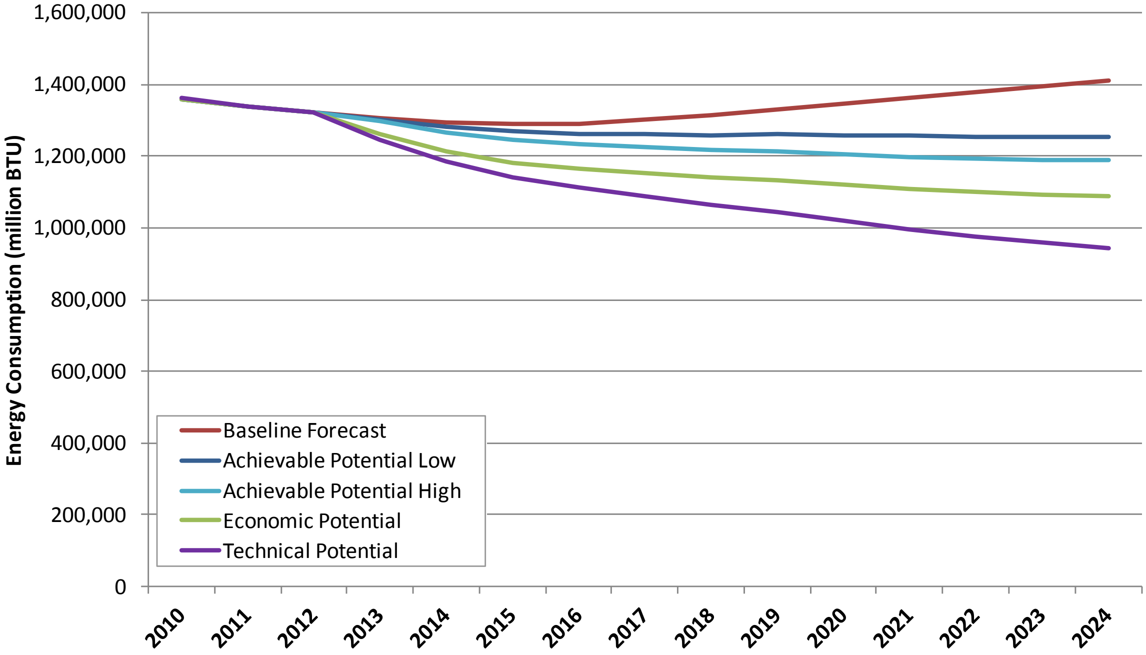


Figure 12-2 Combined Electric and Natural Gas Potential Forecasts (million BTU)



Electric Energy Efficiency – Overall Results

Table 12-2 and Figure 12-3 summarize the electric energy-efficiency savings for the different levels of potential relative to the baseline forecast. Figure 12-4 displays the electric energy-efficiency forecasts.

Table 12-2 Summary of Electric Energy Efficiency Potential

	2013	2016	2020	2024
Baseline Forecast (GWh)	74,776	73,031	76,603	81,041
Cumulative Savings (GWh)				
Achievable Potential Low	446	2,255	6,200	10,945
Achievable Potential High	918	4,277	9,891	15,219
Economic Potential	3,418	9,369	15,536	21,932
Technical Potential	3,708	9,868	16,276	23,126
Energy Savings (% of Baseline)				
Achievable Potential Low	0.6%	3.1%	8.1%	13.5%
Achievable Potential High	1.2%	5.9%	12.9%	18.8%
Economic Potential	4.6%	12.8%	20.3%	27.1%
Technical Potential	5.0%	13.5%	21.2%	28.5%

Figure 12-3 Summary of Electric Energy Savings

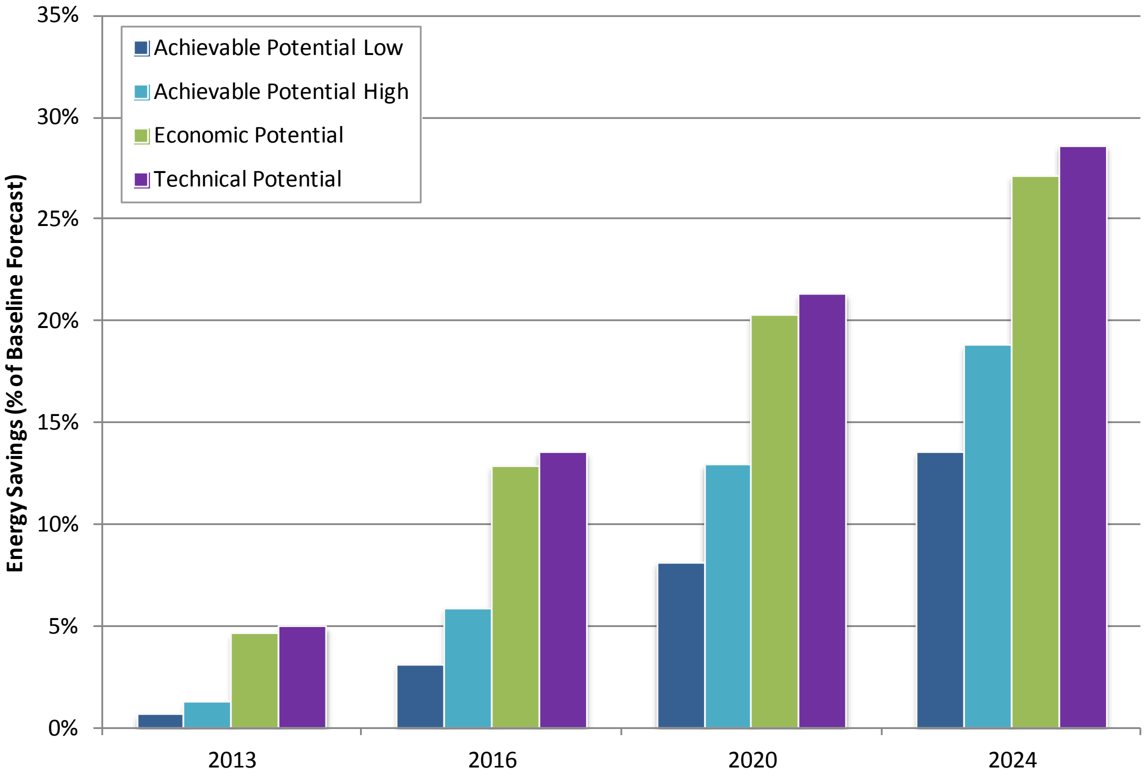
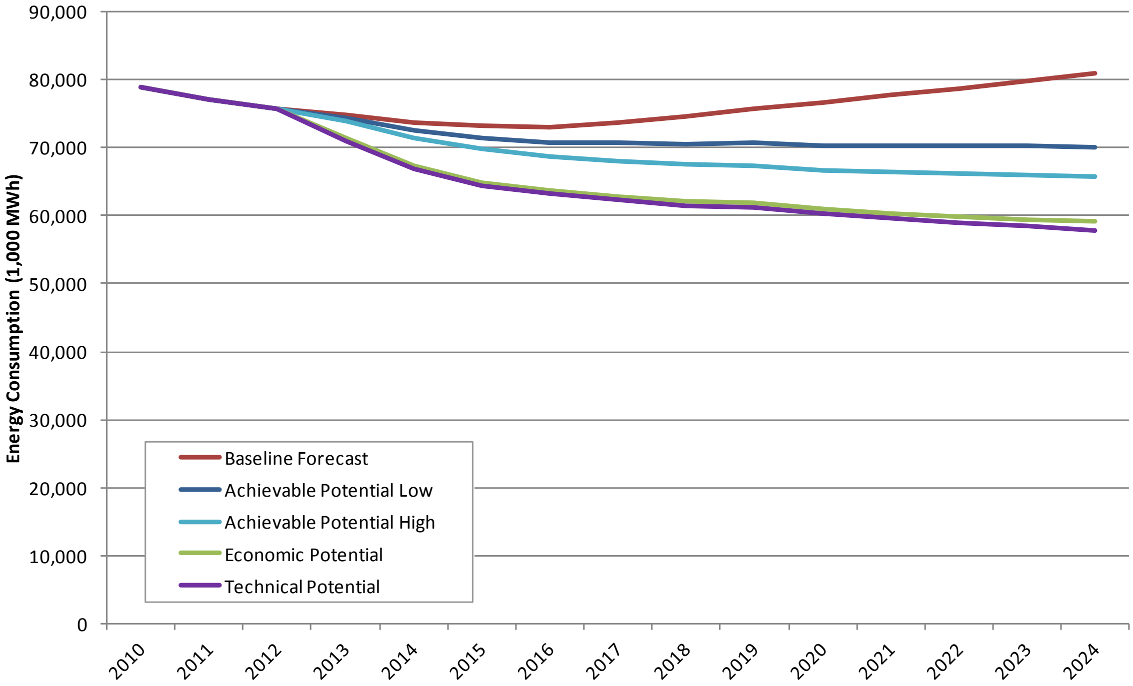


Figure 12-4 Electric Potentials Forecasts (GWh)



Natural Gas Energy Efficiency – Overall Results

Table 12-3 and Figure 12-5 summarize the natural gas energy-efficiency savings for the different levels of potential relative to the baseline forecast. Figure 12-6 displays the natural gas energy-efficiency forecasts.

Table 12-3 Summary of Natural Gas Energy Efficiency Potential

	2013	2016	2020	2024
Baseline Forecast (1,000 therms)	4,560,186	4,588,711	4,718,937	4,893,965
Cumulative Savings (1,000 therms)				
Achievable Potential Low	5,906	42,208	167,194	358,224
Achievable Potential High	13,420	83,980	280,684	521,336
Economic Potential	70,161	208,193	475,061	760,595
Technical Potential	201,774	649,293	1,387,187	2,077,276
Energy Savings (% of Baseline)				
Achievable Potential Low	0.1%	0.9%	3.5%	7.3%
Achievable Potential High	0.3%	1.8%	5.9%	10.7%
Economic Potential	1.5%	4.5%	10.1%	15.5%
Technical Potential	4.4%	14.1%	29.4%	42.4%

Figure 12-5 Summary of Natural Gas Energy Savings

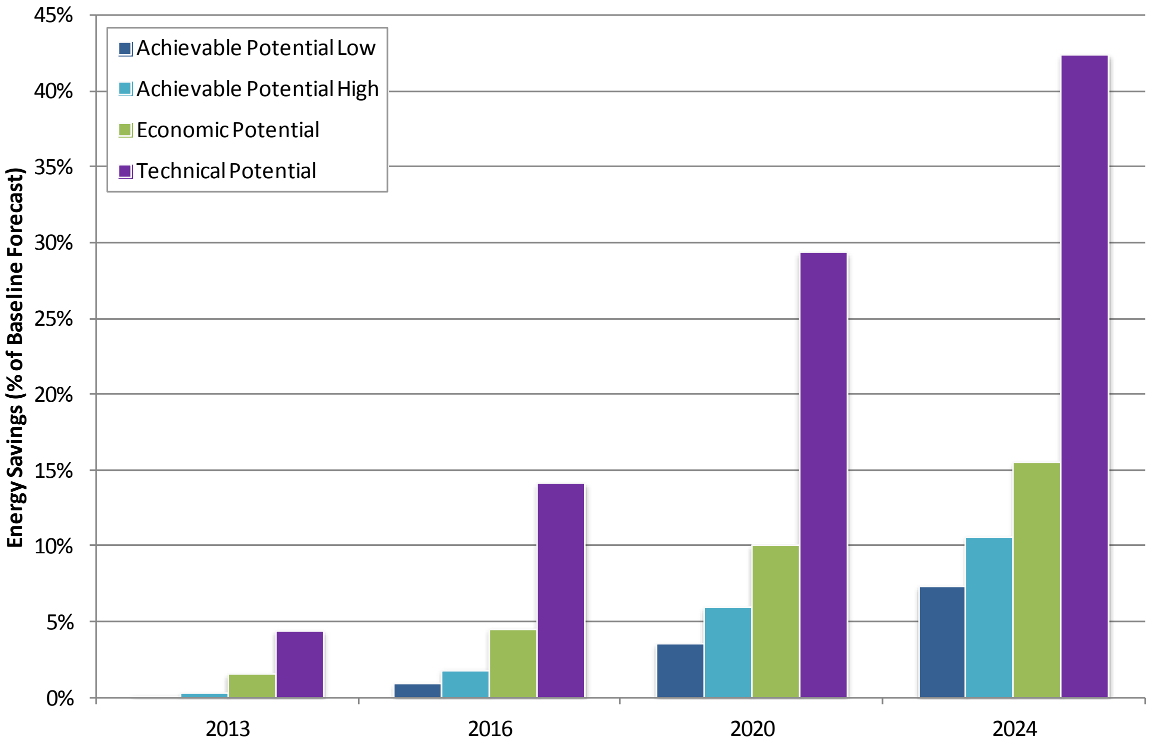
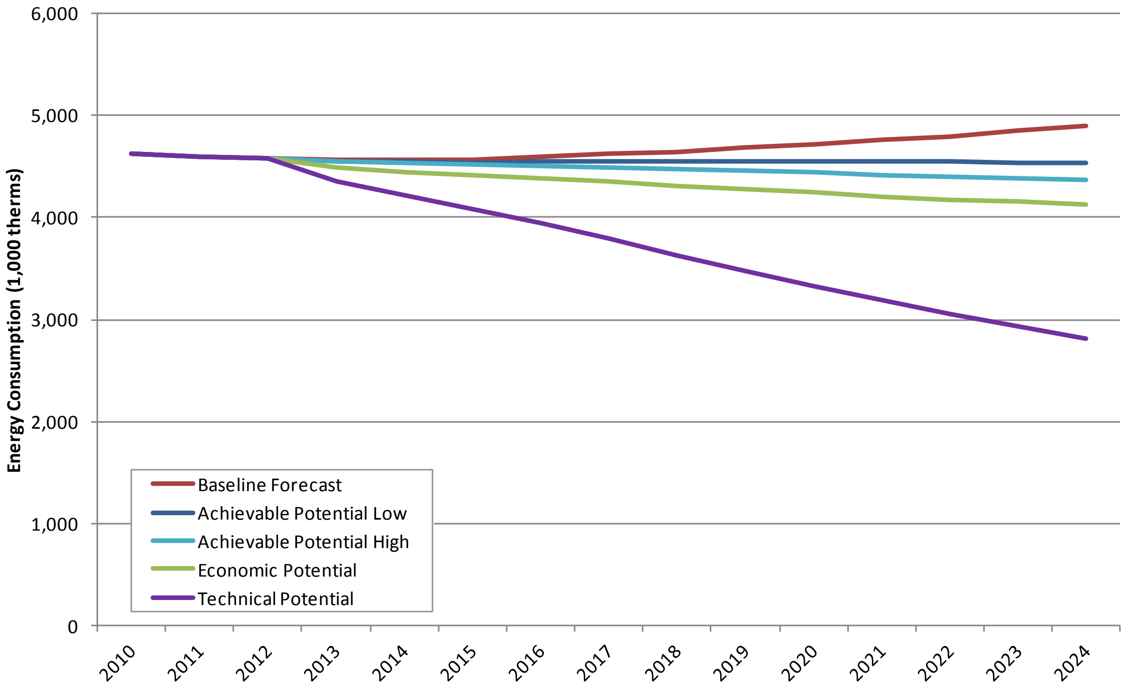


Figure 12-6 Natural Gas Potential Forecasts (1000 therms)



Overview of Energy Efficiency Potential by Sector and Fuel

Table 12-4, Figure 12-7, and Figure 12-8 summarize the range of electric achievable potential by sector. 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 12-4 Electric Achievable Potential by Sector (GWh)

	2013	2016	2020	2024
Achievable Low Savings (GWh)				
Residential	173	926	2,159	2,919
Commercial	251	1,217	3,676	7,309
Industrial	22	113	365	716
Total	**446**	**2,255**	**6,200**	**10,945**
Achievable High Savings (GWh)				
Residential	352	1,769	3,497	4,174
Commercial	519	2,296	5,802	10,034
Industrial	46	212	592	1,011
Total	**918**	**4,277**	**9,891**	**15,219**

Figure 12-7 Achievable Low Electric Potential by Sector (GWh)

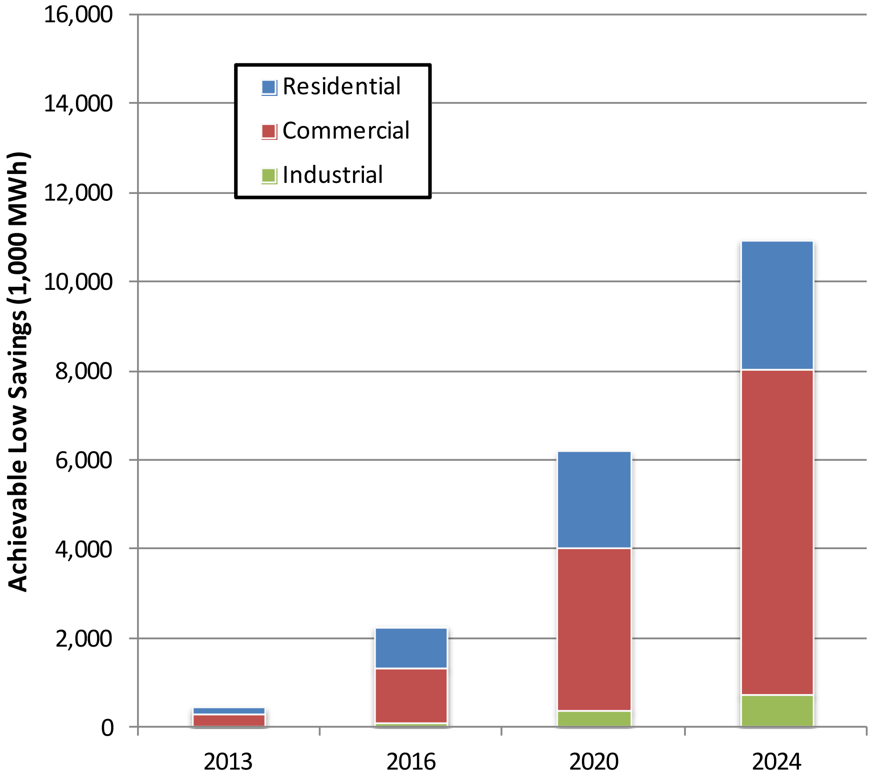


Figure 12-8 Achievable High Electric Potential by Sector (GWh)

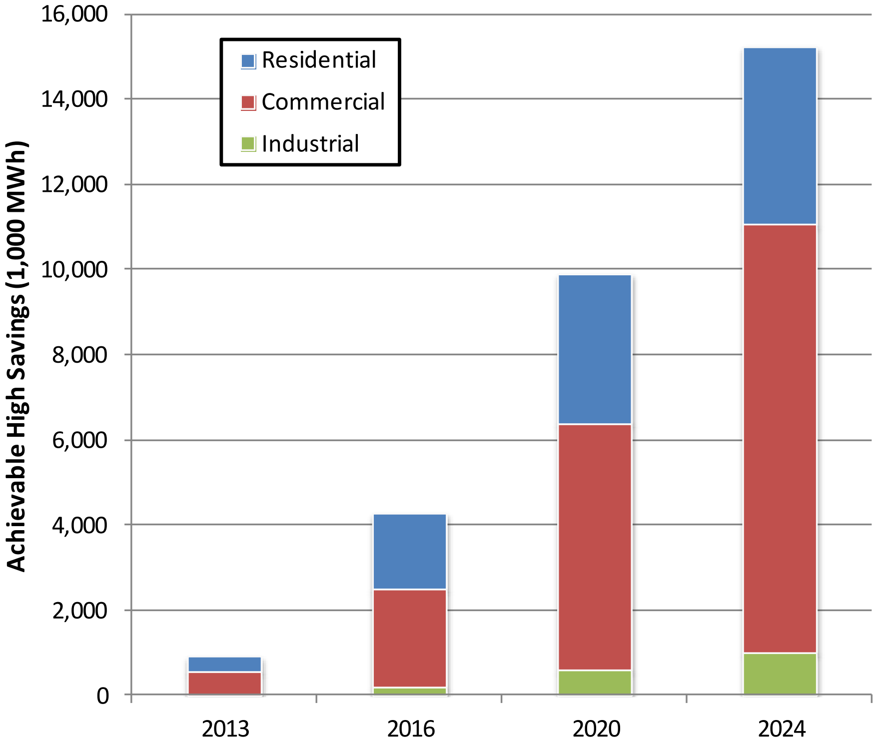


Table 12-5, Figure 12-9, and Figure 12-10 present the range of natural gas achievable potential by sector. Again, like the electric analysis, the commercial sector accounts for the largest portion of the savings, followed by the residential and then the industrial sectors.

Table 12-5 Natural Gas Achievable Potential by Sector (million therms)

	2013	2016	2020	2024
Achievable Low Savings (million therms)				
Residential	0.6	6.9	32.0	83.2
Commercial	5.2	34.3	131.2	266.8
Industrial	0.1	1.0	4.0	8.2
Total	**5.9**	**42.2**	**167.2**	**358.2**
Achievable High Savings (million therms)				
Residential	1.1	12.8	50.6	115.9
Commercial	12.0	69.2	223.3	392.9
Industrial	0.3	2.0	6.8	12.5
Total	**13.4**	**84.0**	**280.7**	**521.3**

Figure 12-9 Achievable Low Natural Gas Potential by Sector (million Therms)

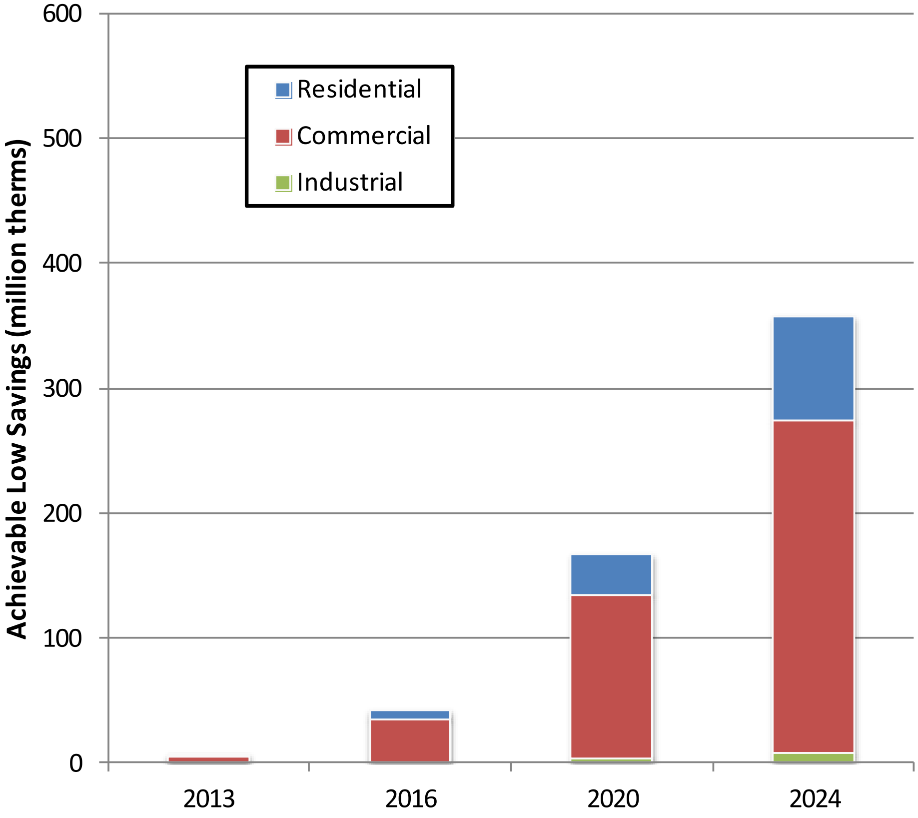
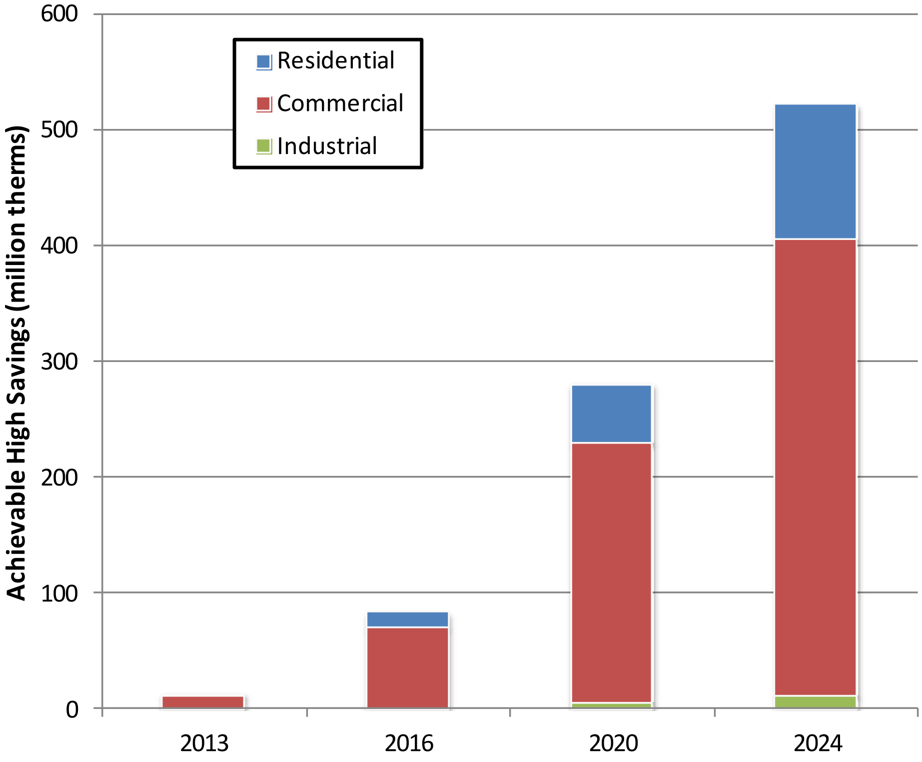


Figure 12-10 Achievable High Natural Gas Potential by Sector (million Therms)



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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