RECEIVED
November 1, 2016
INDIANA UTILITY
REGULATORY COMMISSION

Northern Indiana Public Service Company (NIPSCO)
Demand-side Management (DSM)
Market Potential Study for Electricity

Revised Report

Applied Energy Group, Inc.
500 Ygnacio Valley Road
Suite 450
Walnut Creek, CA 94596
510.982.3525
www.appliedenergygroup.com

Prepared for:
Northern Indiana Public Service Company

February 18, 2016,
Revised August 8, 2016

This report was prepared by

Applied Energy Group, Inc.
500 Ygnacio Valley Blvd., Suite 450
Walnut Creek, CA 94596

Project Director: I. Rohmund
Project Manager: B. Kester
D. Costenaro
F. Nguyen
K. Walter
S. Yoshida

In cooperation with
Morgan Marketing Partners

Contents

List of Figures

List of Tables

SECTION | 1

Introduction

In October 2015, Northern Indiana Public Service Company (NIPSCO) retained Applied Energy Group (AEG) to conduct a Demand Side Management (DSM) Market Potential Study for electricity and natural gas. NIPSCO also retained Morgan Marketing Partners (MMP) to develop the DSM Program Potential based on the market potential study and to complete the overall benefit cost results based on the program potential as determined by the market potential study. Part of this study included an accounting for the exclusion of the large industrial customers that elected to opt-out of participation in NIPSCO's electric energy efficiency programs as allowed by Indiana Code (IC 8-1-8.5-9).

This report uses the information from the 2014 Forecast, conducted by AEG and MMP, and provides estimates of the potential reductions in annual electricity use and summer peak demand for electricity customers in the NIPSCO service territory from energy efficiency (EE) efforts from 2016 to 2036. The natural gas analysis is described in a separate report, "NIPSCO Demand-Side Management (DSM) Potential Study and Action Plan for Natural Gas."

To produce a reliable and transparent estimate of the DSM resource potential, the AEG team performed the following tasks to meet NIPSCO's key objectives:

- Used updated information and data from NIPSCO, as well as secondary data sources, to describe how customers use energy by sector, segment, end use and technology.
- Removed the commercial and industrial customers who had already opted out or who NIPSCO forecasted to opt out of EE programs as of January 1, 2016 as allowed by IC 8-1-8.5-9.
- Developed a baseline projection of how customers are likely to use electricity in the absence of future programs. The baseline provides the metric against which future program savings are measured. This projection utilized updated technology data, modeling assumptions, and energy baselines that reflect both current and anticipated federal, state, and local energy efficiency legislation that will impact DSM potential.
- Estimated the technical, economic, and achievable potential at the measure level for energy efficiency and demand response within the NIPSCO service territory over the 2016-2036 planning horizon, including annual energy savings and summer peak demand savings.

Morgan Marketing Partners used the measure-level savings estimates to develop program potential. The program potential includes budget and impact estimates for the subset of measures that fit these criteria. The final budgets and impacts are then run through cost-effectiveness modeling using the DSMore tool to finalize the cost-effective program savings potential.

Abbreviations and Acronyms

Throughout the report several abbreviations and acronyms are used. 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 by EIA
AHAM	Association of Home Appliance Manufacturers
AMI	Advanced Metering Infrastructure
AMR	Automated Meter Reading
Auto-DR	Automated Demand Response
B/C Ratio	Benefit to Cost Ratio
BEST	AEG's Building Energy Simulation Tool
C&I	Commercial and Industrial
CAC	Central Air Conditioning
CFL	Compact Fluorescent Lamp
CPP	Critical Peak Pricing
DHW	Domestic Hot Water
DLC	Direct Load Control
DR	Demand Response
DSM	Demand Side Management
EE	Energy Efficiency
EIA	Energy Information Administration
EUL	Estimated Useful Life
EUI	Energy Usage Intensity
FERC	Federal Energy Regulatory Commission
HH	Household
HID	High Intensity Discharge Lamps
HVAC	Heating Ventilation and Air Conditioning
ICAP	Installed Capacity
IOU	Investor Owned Utility
LED	Light Emitting Diode lamp
LoadMAP	AEG's Load Management Analysis and Planning™ tool
MW	Megawatt
NPV	Net Present Value
O&M	Operations and Maintenance
PCT	Programmable Communicating Thermostat
RTU	Roof top Unit
TRC	Total Resource Cost test
UCT	Utility Cost Test
UEC	Unit Energy Consumption
WH	Water heater

SECTION | 2

Analysis Approach and Data Development

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

Overview of Analysis Approach

To perform the potential analysis, AEG used a bottom-up approach following the major steps listed below. These analysis steps are described in more detail throughout the remainder of this chapter.

1. Perform a market characterization to describe sector-level electricity use for the residential, commercial, and industrial sectors for the base year, 2014. This included using NIPSCO data and other secondary data sources such as the Energy Information Administration (EIA).
2. Develop a baseline projection of energy consumption and peak demand by sector, segment, and end use for 2014 through 2036.
3. Define and characterize several hundred DSM measures to be applied to all sectors, segments, and end uses.
4. Estimate technical, economic, and achievable potential at the measure level in terms of energy and peak demand impacts from DSM measures for 2016-2036.
5. Develop program designs to support the DSM program planning.

LoadMAP Model

For the measure-level DSM analysis, AEG used its Load Management Analysis and Planning tool (LoadMAP™) version 4.5 to develop both the baseline projection and the estimates of DSM potential. AEG 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 since. Built in Excel, the LoadMAP framework (see Figure 2-1) is both accessible and transparent and has the following key features:

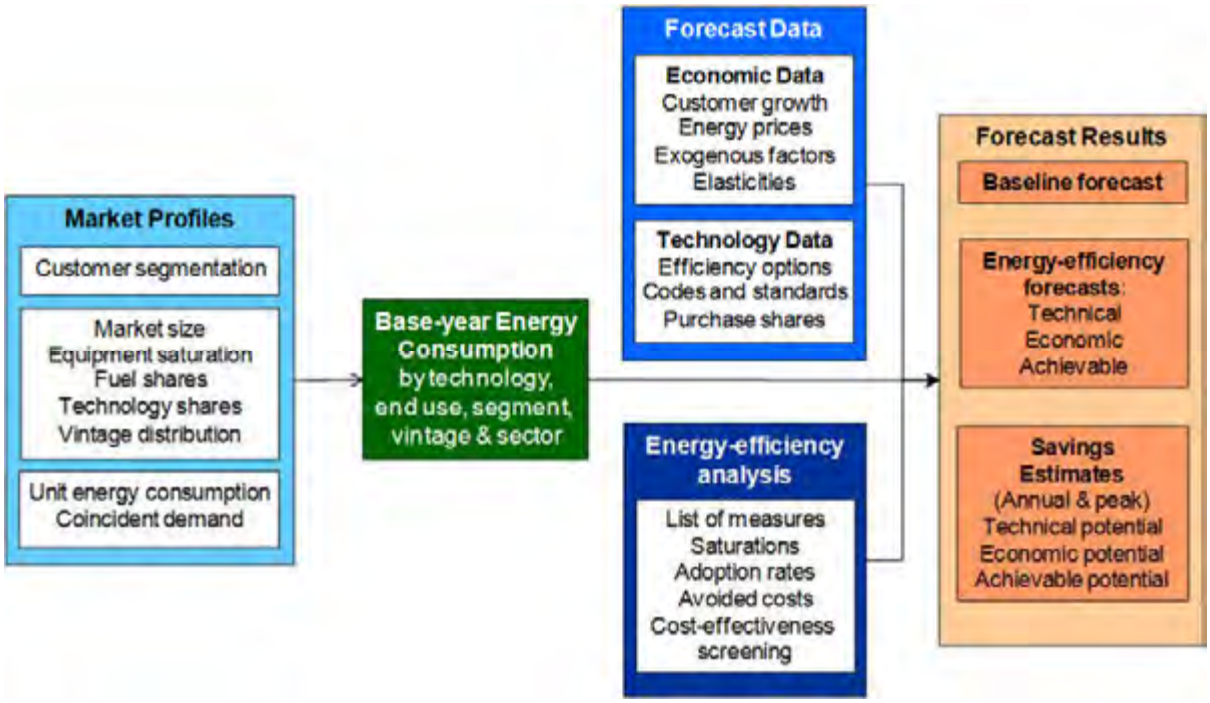
- Embodies the basic principles of rigorous end-use models (such as EPRI's REEPS and COMMEND) but in a more simplified, accessible form.
- Includes stock-accounting algorithms that treat older, less efficient appliance/equipment stock separately from newer, more efficient equipment. Equipment is replaced 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).
- Incorporates energy-efficiency measures, demand-response options, combined heat and power (CHP) and distributed generation options and fuel switching.

Consistent with the segmentation scheme and the market profiles described 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 various types of potential.[1]

Figure 2-1 LoadMAP Analysis Framework



Definitions of Potential

Before delving into the details of the analysis approach, it is important to define the meaning of DSM potential. In this study, the savings estimates represent gross savings[2] developed for four types of potential: technical potential, economic potential, achievable potential and program potential. The first three levels are developed at the measure level. Technical and economic potential are both theoretical limits to efficiency savings. Achievable potential embodies a set of assumptions about the decisions consumers are likely to make regarding the efficiency of the equipment they purchase, the maintenance activities they undertake, the controls they use for

[1] 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 projection and the value in the potential forecast (e.g., the technical potential forecast).

[2] Savings in "gross" terms instead of "net" terms mean that the baseline projection does not include naturally occurring efficiency beyond the base year. In other words, the baseline assumes that energy efficiency levels reflect that some customers are already purchasing the more efficient option in the base year and are held steady throughout the baseline projection.

energy-consuming equipment, and the elements of building construction. Finally, program potential estimates what is likely to occur through utility programs. The various levels are described below.

- **Technical Potential** is defined as the theoretical upper limit of DSM 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.

  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 to align with the stock turnover of related equipment units, rather than modeled as immediately available all at once.
- **Economic Potential** represents the adoption of all ***cost-effective*** DSM 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 costs of the delivering the measure through a utility program, with incentives not included since they are a transfer payment. If the benefits outweigh the costs (that is, if the TRC ratio is greater than 1.0), a given measure is included in the economic potential. Customers are then assumed to purchase the most efficient cost-effective option applicable to them at any decision juncture.
- **Achievable Potential** refines economic potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of DSM measures.
- **Program Potential** creates utility programs from the measure-level, achievable potential results. This includes the subset of measures that can realistically be implemented considering alignment with near-term implementation accomplishments and budgetary constraints, as well as long-term strategic goals and planning constraints.

Market Characterization

The first step in the analysis approach is 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 NIPSCO's electricity footprint to quantify energy use by sector, segment, end-use application, and the current set of technologies used. AEG rely primarily on information from NIPSCO and secondary sources as necessary.

Segmentation for Modeling Purposes

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

Table 2-1 Overview of NIPSCO Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, commercial, industrial
2	Segment	Residential: single family, multi family, mobile homes and low income Commercial: small (<1M kWh/year) and large (>1M kWh/year) Industrial: small (<1M kWh/year) and large (>1M kWh/year)
3	Vintage	Existing and new construction
4	End uses	Cooling, lighting, water heat, motors, etc. (as appropriate by sector)
5	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, motors by application, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

With the segmentation scheme defined, AEG then performed a high-level market characterization of electricity sales in the base year to allocate sales to each customer segment. AEG used NIPSCO data and secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count, energy consumption, and peak demand matched the NIPSCO system totals from 2014 billing data. Data sources used in this study are explained later in the data sources section. 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). Equipment with a saturation greater than 100% indicates more than one unit is present in the average home or facility.
- **UEC (unit energy consumption) or EUI (energy-use index)** describes the amount of electricity consumed in 2014 by a specific technology in buildings that have the technology. 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.
- **Annual Energy Intensity** for the residential sector represents the average electricity use for the technology across all NIPSCO customers' homes in 2014. 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 2014 for NIPSCO's customers.
- **Annual Usage** is the annual energy use by an end use technology in the segment. It is the product of the market size and intensity and is quantified in GWh.

- **Peak Demand** for each technology for summer peak and winter peak are calculated using peak fractions of annual energy use from AEG's EnergyShape library and NIPSCO system peak data.

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

Baseline Projection

The next step was to develop the baseline projection of annual electricity use and summer peak demand for 2014 through 2036 by customer segment and end use without new utility programs. The end-use projection includes the relatively certain impacts of known and adopted legislation, as well as codes and standards that will unfold over the study timeframe. All such legislation and mandates that were defined as of June 2015 are included in the baseline. Note that the status of the Clean Power Plan was still in flux at the time of this analysis and therefore was not specifically considered. The baseline projection 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 projection include:

- Current economic growth forecasts (i.e., customer growth, income growth)
- Electricity price forecasts
- Trends in fuel shares and equipment saturations
- Existing and approved changes to building codes and equipment standards
- Known and adopted legislation
- Naturally occurring efficiency improvements, which include purchases of high-efficiency equipment options by early adopters.

AEG also developed a baseline projection for summer and winter peak by applying the peak fractions from the energy market profiles to the annual energy forecast in each year. The baseline-projection results for the system as a whole and for each sector are presented in Chapter 4.

DSM Measure Analysis

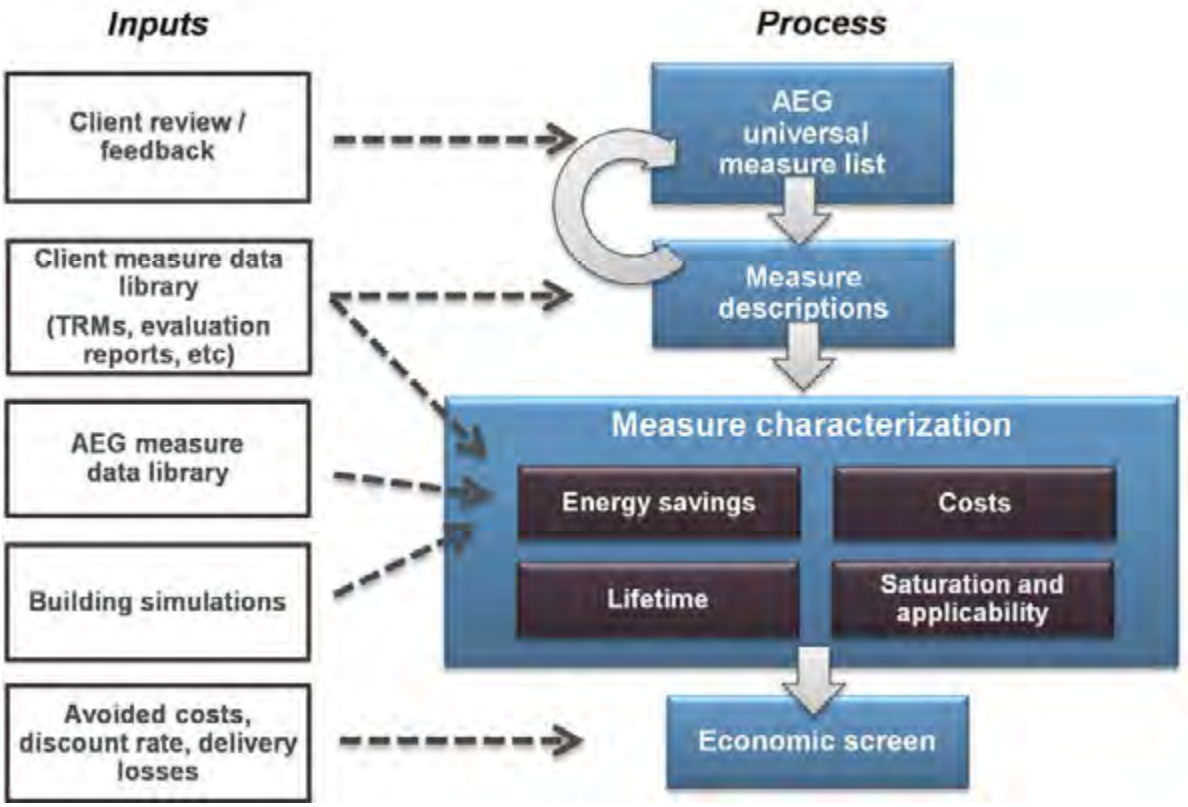
This section describes the framework used to assess the savings, costs, and other attributes of DSM measures. These characteristics form the basis for measure-level cost-effectiveness analyses as well as for determining measure-level savings. For all measures, AEG assembled information to reflect equipment performance, incremental costs, and equipment lifetimes. AEG used this information, along with NIPSCO's most recent avoided costs data, in the economic screen to determine economically feasible measures.

Energy-Efficiency Measures

Figure 2-2 outlines the framework for energy-efficiency measure analysis. 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.

As part of this step, AEG compiled a robust list of energy efficiency measures for each customer sector, drawing upon NIPSCO program experience, AEG's own measure databases and building simulation models, and secondary sources, as explained in the data sources section. 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.

Figure 2-2 Approach for Energy-Efficiency Measure Assessment



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 24 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 retro commissioning (initial or ongoing monitoring of building energy systems to optimize energy use)

Once the list of EE measures was assembled, the project team assessed their energy-saving characteristics, as well as the measure's incremental cost, service life, and other performance factors. Following the characterization, the measures were screened for economic viability, which serves as the basis for developing the economic and achievable potential.

Representative EE Measure Data Inputs

To provide an example of the energy-efficiency measure data, Table 2-2 and Table 2-3 present examples of the detailed data inputs behind both equipment and non-equipment measures, respectively, for the case of residential central air conditioning (A/C) in single-family homes. Table 2-2 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 2-2 Example Equipment Measures for Central AC – Single-Family Home

Efficiency Level	Useful Life	Equipment Cost	Energy Usage (kWh/yr)	On Market	Off Market
SEER 13.7	18	$2,898	1,749	2014	n/a
SEER 14 (Energy Star)	18	$3,236	1,604	2014	n/a
SEER 15 (CEE Tier 2)	18	$3,573	1,538	2014	n/a
SEER 16 (CEE Tier 3)	18	$3,910	1,482	2014	n/a
SEER 18	18	$4,588	1,394	2014	n/a
SEER 21	18	$5,472	1,299	2014	n/a

Table 2-3 lists some of the non-equipment measures applicable to A/C 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[3] of the measure, and the savings as a percentage of the relevant energy end uses.

Table 2-3 Example Non-Equipment Measures – Single Family Home, Existing

End Use	Measure	Saturation in 2014[4]	Applica-bility	Lifetime (yrs)	Measure Installed Cost	Energy Savings (%)
Cooling	Insulation - Ceiling	43%	75%	25	$978	3%
Cooling	Ducting - Repair and Sealing	30%	75%	20	$442	4%
Cooling	Windows - High Eff/ENERGY STAR	33%	75%	25	$412	24%
Cooling	Attic Fan - Installation	15%	40%	19	$597	.25%

Screening EE 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

[3] 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.
[4] Note that saturation levels reflected for the base year change over time as more measures are adopted.

the TRC test that compares the lifetime energy and peak demand benefits of each applicable measure with its cost. 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. Lifetime costs represent incremental measure cost and annual O&M costs. 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.
- The economic screen at the measure level does not include any assumption about program delivery costs. Those are considered in the assessment of program potential.

Table 2-4 summarizes the number of measures evaluated for each segment within each sector.

Table 2-4 Number of Measures Evaluated

Sector	Total Measures	Measure Permutations w/ 2 Vintages	Measure Permutations w/ Segments
Residential	80	160	640
Commercial	97	194	388
Industrial	72	144	288
Total Measures Evaluated	**249**	**498**	**1,316**

The appendix to this volume presents results for the economic screening process by segment, vintage, end use and measure for all sectors.

EE Potential

The approach AEG used for this study to calculate the EE potential adheres to the approaches and conventions outlined in the National Action Plan for Energy-Efficiency (NAPEE) Guide for Conducting Potential Studies (November 2007).[5] The NAPEE Guide represents the most credible and comprehensive industry practice for specifying DSM potential. As described in Chapter 1, four types of potential were developed as part of this effort: technical potential, economic potential, achievable potential, and program potential.

The calculation of **technical potential** and **economic potential** is a straightforward algorithm as described in Section 1. To develop estimates for **achievable potential**, AEG develops market adoption rates for each measure that specify the percentage of customers that will select the

[5] 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.

highest–efficiency, cost-effective option. These adoption rates are based on a variety of secondary sources, as well as past program history from NIPSCO.

Achievable potential is at the measure-level and includes every possible cost-effective opportunity for EE savings regardless of the type of intervention (i.e., utility program, government program, equipment promotion by manufacturers, etc.). The measure-level potential results are presented in Chapter 5.

AEG and MMP then developed **program potential** by selecting the subset of measures in the achievable potential amount that can realistically be implemented considering alignment with near-term implementation accomplishments and budgetary constraints as well as long-term strategic goals and planning constraints. The program potential is what is recorded in the DSM Action Plan and is presented in Chapter 6.

Data Development

This section describes 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:

- NIPSCO data
- AEG's databases and analysis tools
- Other secondary data and reports

NIPSCO Data

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

- **NIPSCO customer data:** NIPSCO provided billing data for development of customer counts and energy use for each sector.
- **Load forecasts:** NIPSCO provided an economic growth forecast by sector; electric load forecast; peak-demand forecasts at the sector level; and retail electricity price history and forecasts.
- **Economic information:** NIPSCO provided avoided cost forecasts, a discount rate, and line loss factor.
- **NIPSCO program data**: NIPSCO provided information about past and current programs, including program descriptions, goals, and achievements to date.
- **NIPSCO's 2010 EE Potential Study**: NIPSCO provided the KEMA 2010 Electricity and Natural Gas Potential studies, which included results from a saturation survey[6].

AEG Data

AEG maintains several databases and modeling tools that are used for forecasting and potential studies. Relevant data from these tools has been incorporated into the analysis and deliverables for this study.

- **AEG Energy Market Profiles**: For more than 10 years, AEG staff has 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

[6] Cause No. 44001, Petitioner's Exhibit No. EGH-3, NIPSCO Gas Efficiency Market Potential Study, KEMA Inc., March 30, 2011, page G-69

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)**. AEG'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.
- **AEG's EnergyShape™:** This database of load shapes includes the following:
  - Residential – electric load shapes for ten regions, three housing types, 13 end uses
  - Commercial – electric load shapes for nine regions, 54 building types, ten 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
- **AEG's Database of Energy Efficiency Measures (DEEM):** AEG maintains an extensive database of measure data for our studies. Our database draws upon reliable sources including:
  - Technical resource manuals (TRMs) from across the U.S., including the Indiana TRM from 2013. The TRM 2.2 was not used since it has not been filed or approved by the Commission.
  - Northwest Power and Conservation Council Plan workbooks and Regional Technical Forum (RTF). To develop its Power Plan, the Council maintains workbooks with detailed information about measures. The RTF updates the measures on an ongoing basis.
  - 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. AEG uses the DEER database to cross check the measure savings developed using BEST and other sources in the DEEM database.
  - The EIA Technology Forecast Updates – Residential and Commercial Building Technologies – Reference Case
  - Other sources of cost data including RS Means cost data and Grainger Catalog Cost data.
- **Recent studies**. AEG has conducted numerous studies of EE potential in the last five years. Input assumptions and analysis results from NIPSCO were checked against the results from these other studies, which include Ameren Illinois, Ameren Missouri, Vectren Energy, and Indianapolis Power & Light. In addition, AEG used the information about impacts of building codes and appliance standards from recent reports for the Edison Electric Institute[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.

- **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, data from the 2015 AEO was used.

[7] AEG staff has prepared three white papers on the topic of factors that affect U.S. electricity consumption, including appliance standards and building codes. Links to all three white papers are provided:
http://www.edisonfoundation.net/IEE/Documents/IEE_RohmundApplianceStandardsEfficiencyCodes1209.pdf
http://www.edisonfoundation.net/iee/Documents/IEE_CodesandStandardsAssessment_2010-2025_UPDATE.pdf.
http://www.edisonfoundation.net/iee/Documents/IEE_FactorsAffectingUSElecConsumption_Final.pdf

- **American Community Survey:** The US Census American Community Survey is an ongoing survey that provides data every year on household characteristics. Data for NIPSCO were available for this study. http://www.census.gov/acs/www/
- **Local Weather Data:** Weather from NOAA's National Climatic Data Center for South Bend, Indiana was used as the basis for building simulations.
- **EPRI End-Use Models (REEPS and COMMEND)**. These models provide the elasticities applied to electricity prices, household income, home size and heating and cooling.
- **Other relevant regional sources:** These include reports from the Consortium for Energy Efficiency, the EPA, and the American Council for an Energy-Efficient Economy.

Application of Data to the Analysis

This section describes how the data sources listed above were used at each step of the study.

Data Application for Market Characterization

NIPSCO billing data was used to construct the high-level market characterization of electricity use and households/floor space for the residential, commercial, and industrial sectors. The American Community Survey and the customer surveys from 2010 were used to allocate energy sales and customers to housing type and income level in the residential sector.

Data Application for Market Profiles

The specific data elements for the market profiles, together with the key data sources, are shown in Table 2-5. To develop the market profiles for each segment, AEG 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 NIPSCO's 2010 Potential Study, the American Community Survey and AEG's Energy Market Profiles database to develop existing appliance saturations, appliance and equipment characteristics, and building characteristics.
3. Ensured calibration to control totals for annual electricity sales in each sector and segment.
4. Compared and cross-checked with other recent AEG studies.
5. Worked with NIPSCO staff to vet the data against their knowledge and experience.

Data Application for Baseline Projection

Table 2-6 summarizes the LoadMAP model inputs required for the baseline projection. These inputs are required for each segment within each sector, as well as for new construction and existing dwellings/buildings.

Table 2-5 Data Applied for the Market Profiles

Model Inputs	Description	Key Sources
Market size	Base-year residential dwellings, commercial floor space, and industrial employment	NIPSCO billing data NIPSCO Load Forecast AEO 2015
Annual intensity	Residential: Annual use per household Commercial: Annual use per square foot Industrial: Annual use per employee	NIPSCO billing data AEG's Energy Market Profiles AEO 2015 Other recent studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology Percentage of C&I floor space/employment with equipment/technology	NIPSCO 2010 Residential Saturation Survey American Community Survey AEG's Energy Market Profiles NIPSCO Load Forecast
UEC/EUI for each end-use technology	UEC: Annual electricity use in homes and buildings that have the technology EUI: Annual electricity use per square foot/employee for a technology in floor space that has the technology	Recent Midwest potential studies HVAC uses: BEST simulations using prototypes developed for NIPSCO Engineering analysis
Appliance/equipment age distribution	Age distribution for each technology	Recent AEG studies, EIA Data (CBECS, RECS)
Efficiency options for each technology	List of available efficiency options and annual energy use for each technology	AEG DEEM AEO 2015 Previous studies
Peak factors	Share of technology energy use that occurs during the peak hour	NIPSCO system peak data EnergyShape database

Table 2-6 Data Needs for the Baseline Projection and Potentials Estimation in LoadMAP

Model Inputs	Description	Key Sources
Customer growth forecasts	Forecasts of new construction in residential and C&I sectors	NIPSCO load forecast AEO 2015 economic growth forecast
Equipment purchase shares for baseline projection	For each equipment/technology, purchase shares for each efficiency level; specified separately for existing equipment replacement and new construction	Shipments data from AEO AEO 2015 regional forecast assumptions[8] Appliance/efficiency standards analysis NIPSCO program results and evaluation reports
Electricity prices	Forecast of average energy and capacity avoided costs and retail prices	NIPSCO forecast
Utilization model parameters	Price elasticities, elasticities for other variables (income, weather)	EPRI's REEPS and COMMEND models AEO 2015

[8] AEG developed baseline purchase decisions using the Energy Information Agency's *Annual Energy Outlook* report (2015), which utilizes the National Energy Modeling System (NEMS) to produce a self-consistent supply and demand economic model. AEG 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 future increases in naturally occurring conservation or effects of future DSM programs that may be embedded in the AEO forecasts.

In addition, AEG implemented assumptions for known future equipment standards as of December 2013, as shown in Table 2-7, Table 2-8 and Table 2-9. The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

Table 2-7 Residential Electric Equipment Standards[9]

2013's Efficiency or Standard Assumption
1st Standard (relative to 2013's standard)
2nd Standard (relative to 2013's standard)

End Use	Technology	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 8.2										
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 (20 lumens/watt)						Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T8 (89 lumens/watt)						T8 (92.5 lumens/watt)						
Appliances	Refrigerator/2nd Refrigerator	NAECA Standard	25% more efficient											
	Freezer	NAECA Standard	25% more efficient											
	Dishwasher	14% more efficient than 2010 standard (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)		EF 3.73										
	Microwave Ovens	Conventional			1.0 Watts (maximum standby power)									
Miscellaneous	Furnace Fans	Conventional						40% more efficient						

[9] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

Table 2-8 Commercial Electric Equipment Standards[10]

2013's Efficiency or Standard Assumption
1st Standard (relative to 2013's standard)
2nd Standard (relative to 2013's standard)

End Use	Technology	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Chillers	2007 ASHRAE 90.1												
	Roof Top Units	EER 11.0/11.2												
	Packaged Terminal AC/HP	EER 11.0/11.2												
Cooling/Heating	Heat Pump	EER 11.0/COP 3.3												
Ventilation	Ventilation	Constant Air Volume/Variable Air Volume												
Lighting	Screw-in/Pin Lamps	Incandescent	Advanced Incandescent - tier 1 (20 lumens/watt)						Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T8 (89 lumens/watt)					T8 (92.5 lumens/watt)							
	High Intensity Discharge	EPACT 2005 (Mercury Vapor Fixture Phase-out)				Metal Halide Ballast Improvement								
Water Heating	Water Heater	EF 0.97												
Refrigeration	Walk-in Refrigerator/Freezer	EISA 2007 Standard				10-38% more efficient								
	Reach-in Refrigerator	EPACT 2005 Standard				40% more efficient								
	Glass Door Display	EPACT 2005 Standard				12-28% more efficient								
	Open Display Case	EPACT 2005 Standard				10-20% more efficient								
	Vending Machines	33% more efficient than EPAC 2005 Standard												
	Ice maker	2010 Standard					15% more efficient							
Miscellaneous	Non-HVAC Motors	EISA 2007 Standards				Expanded EISA 2007 Standards								

Table 2-9 Industrial Electric Equipment Standards[11]

2013's Efficiency or Standard Assumption
1st Standard (relative to 2013's standard)
2nd Standard (relative to 2013's standard)

End Use	Technology	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Chillers	2007 ASHRAE 90.1												
	Roof Top Units	EER 11.0/11.2												
	Packaged Terminal AC/HP	EER 11.0												
Cooling/Heating	Heat Pump	EER 11.0/COP 3.3												
Ventilation	Ventilation	Constant Air Volume/Variable Air Volume												
Lighting	Screw-in/Pin Lamps	Incandescent	Advanced Incandescent - tier 1 (20 lumens/watt)						Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T8 (89 lumens/watt)					T8 (92.5 lumens/watt)							
	High Intensity Discharge	EPACT 2005 (Mercury Vapor Fixture Phase-out)				Metal Halide Ballast Improvement								
Motors	Pumps, Fans & Blowers, Compressed Air, Material Handling and Processing	EISA 2007 Standards			Expanded EISA 2007 Standards									

[10] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.
[11] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

DSM Measure Data Application

Table 2-10 details the energy-efficiency data inputs to the LoadMAP model. It describes each input and identifies the key sources used in the NIPSCO analysis.

Table 2-10 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.	AEG DEEM AEG BEST (HVAC only)
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.	AEG DEEM AEG BEST (HVAC only) 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.	AEG DEEM
Measure Lifetimes	Estimates derived from the technical data and secondary data sources that support the measure demand and energy savings analysis.	AEG DEEM
Applicability	Estimate of the percentage of dwellings in the residential sector, square feet in the commercial sector, or employees in the industrial sector where the measure is applicable and where it is technically feasible to implement.	AEG DEEM
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.	AEG 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 2014 dollars. AEG applied a discount rate of 6.53% in real dollars. All impacts in this report are presented at the customer meter, but electric energy delivery losses of 2.97% for residential, 2.65% for commercial and 1.65% for industrial customers were provided by NIPSCO in order to gross up impacts to the generator for economic analysis.

Achievable Potential Estimation

To estimate achievable potential, two sets of parameters are needed to represent customer decision making behavior with respect to energy-efficiency choices.

- **Technical diffusion 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 projection (instantaneous potential), they are phased in according to adoption schedules that generally align with the diffusion of similar equipment measures. These adoption rates are used within LoadMAP to generate the Technical and Economic potentials for non-equipment measures.

- **Achievable adoption rates**. Customer adoption rates or take rates are applied to Economic potential to estimate Achievable Potential. These rates represent customer adoption of economic measures when delivered through a best-practice portfolio of well-operated efficiency programs under a reasonable policy or regulatory framework. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with trade allies and delivery partners. The primary barrier to adoption reflected in this case is customer preferences. The initial adoption rates were developed from other potential studies from the region. The initial rates were then compared with recent NIPSCO program results and adjustments were made, if necessary, to bring the adoption rates into alignment. For example, if the program achieved a higher adoption rate than suggested by the initial adoption assumption and customer participation is expected to continue at this pace, then the market adoption rates for that measure were adjusted upward.

Achievable adoption rates are presented in Appendix B.

SECTION | 3

Market Characterization and Market Profiles

This section describes how customers in the NIPSCO service territory use electricity in the base year of the study, 2014. It begins with a high-level summary of energy use across all sectors and then delves into each sector in more detail. Note that the totals may not always add up due to rounding.

Energy Use Summary

Total electricity use for the residential, commercial and industrial sectors for NIPSCO in 2014 was 9,120 GWh, once opt-out customers were removed from consideration[12]. As shown in Figure 3-1 and Table 3-1, the industrial sector is 22% of the total energy used for the study. The remaining use is split almost evenly between the residential and commercial sectors. In terms of summer peak demand, the total system peak in 2014 was 1,938 MW. The residential sector has the lowest load factor at 43% and, therefore, a proportionally higher contribution to peak. This is due to the high saturation of air conditioning equipment. Street lighting was not a part of the scope of this potential study.

Figure 3-1 Sector-Level Electricity Use in Base Year 2014

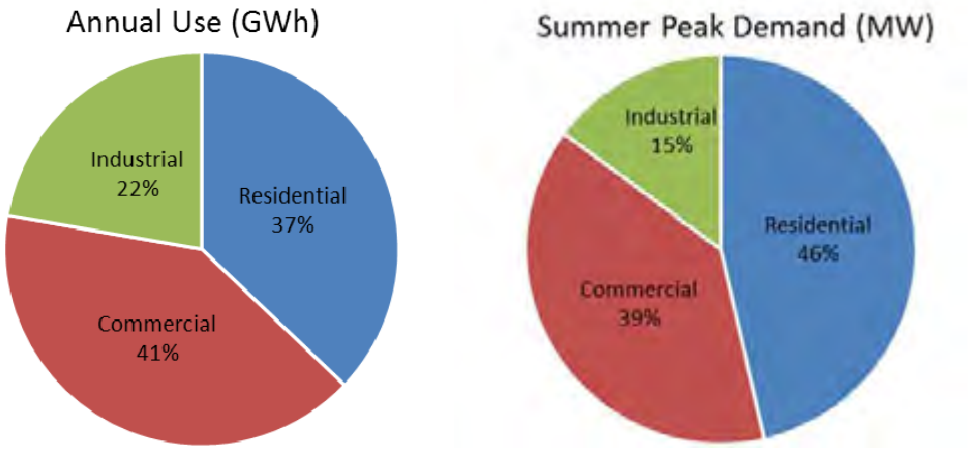


Table 3-1 NIPSCO Sector Control Totals (2014)

Sector	Annual Electricity Use (GWh)	% of Annual Use	Summer Peak Demand (MW)	% of Summer Peak	Implied Summer Load Factor (%)
Residential	3,384	37%	900	46%	43%
Commercial	3,705	41%	750	39%	56%
Industrial	2,031	22%	288	15%	80%
Total	**9,120**	**100%**	**1,938**	**100%**	**54%**

[12] Information about the number of opt-out customers and their energy use is presented in the industrial-sector discussion below.

Residential Sector

The total number of households and residential electricity sales for the service territory were obtained from NIPSCO's customer database. In 2014, there were just over 400,000 households in the NIPSCO territory that used a total of 3,384 GWh with peak demand of 900 MW. The average use per customer (or household) of 8,411 kWh is relatively low compared to other regions of the country. AEG allocated these totals into four residential segments and the values are shown in Table 3-2.

Table 3-2 Residential Sector Control Totals (2014)

Segment	Number of Customers	Electricity Use (GWh)	% of Annual Use	Annual Use/Customer (kWh/HH)	Summer Peak (MW)
Single Family	205,468	2,003	59%	9,747	581
Multi Family	60,685	338	10%	5,573	93
Mobile Home	6,896	46	1%	6,662	10
Low Income	129,290	997	29%	7,713	216
Total	**402,339**	**3,384**	**100%**	**8,411**	**900**

Energy Market Profile

As described in the previous chapter, the market profiles provide the foundation for development of the baseline projection and the potential estimates. The average market profile for the residential sector is presented in Figure 3-3. Segment-specific market profiles are presented in Appendix A. Figure 3-2 shows the distribution of annual electricity use by end use for all customers. In this MPS, AEG incorporated NIPSCO-specific saturations from the 2010 KEMA Potential Study.

Three main electricity end uses —appliances, space heating, and space cooling — account for 51% of total use. Appliances include refrigerators, freezers, stoves, clothes washers, clothes dryers, dishwashers, and microwaves. The remainder of the energy falls into the electronics, lighting, water heating and the miscellaneous category – which is comprised of furnace fans, pool pumps, and other "plug" loads (all other usage not covered by those listed in

Table 3-3, such as hair dryers, power tools, coffee makers, etc.). Figure 3-2 also shows estimates of summer peak demand by end use. As expected, A/C is the largest contributor to summer peak demand, followed by appliances. Lighting has low coincidence and makes a small contribution. Figure 3-3 presents the electricity intensities by end use and housing type. Single-family homes have the highest use per customer at 9,747 kWh/year, which reflects a higher saturation of air conditioning and larger home size.

Figure 3-2 Residential Electricity Use and Summer Peak Demand by End Use (2014)

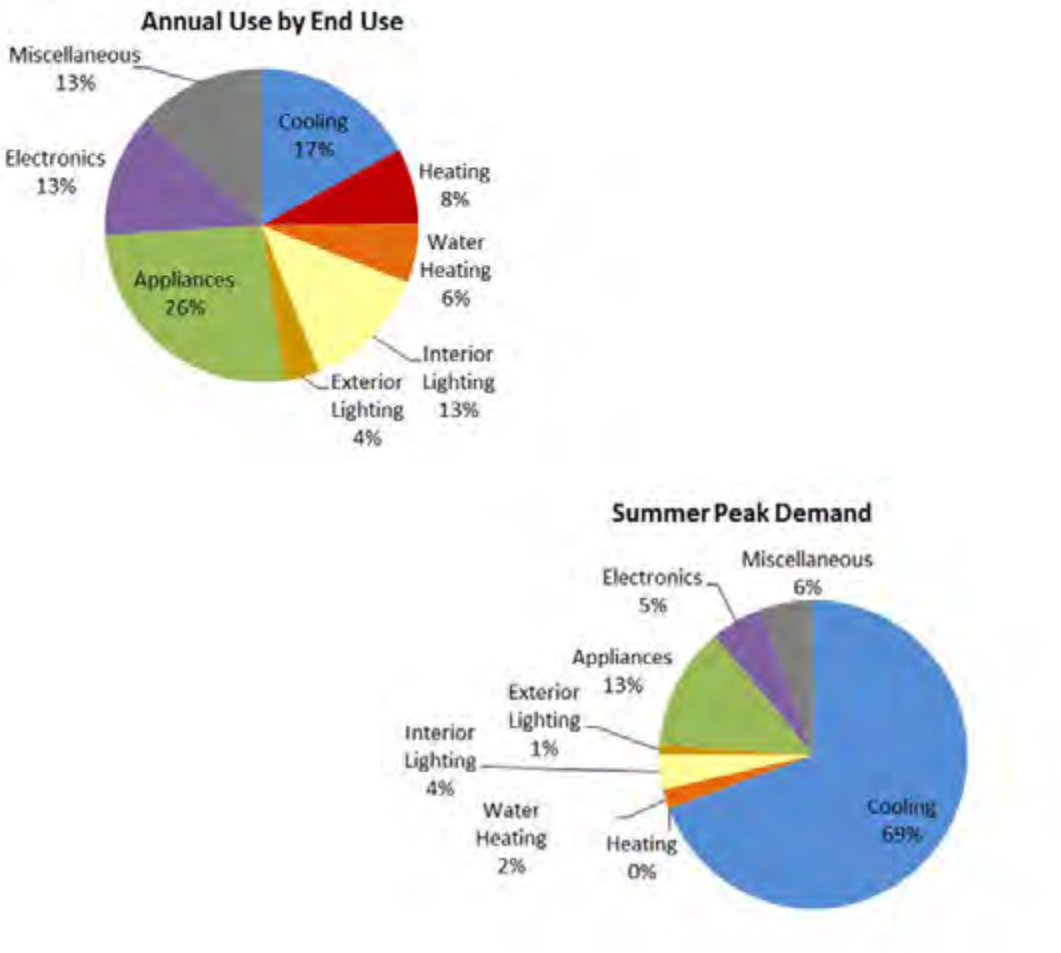


Figure 3-3 Residential Energy Intensity by End Use and Segment (kWh/HH, 2014)

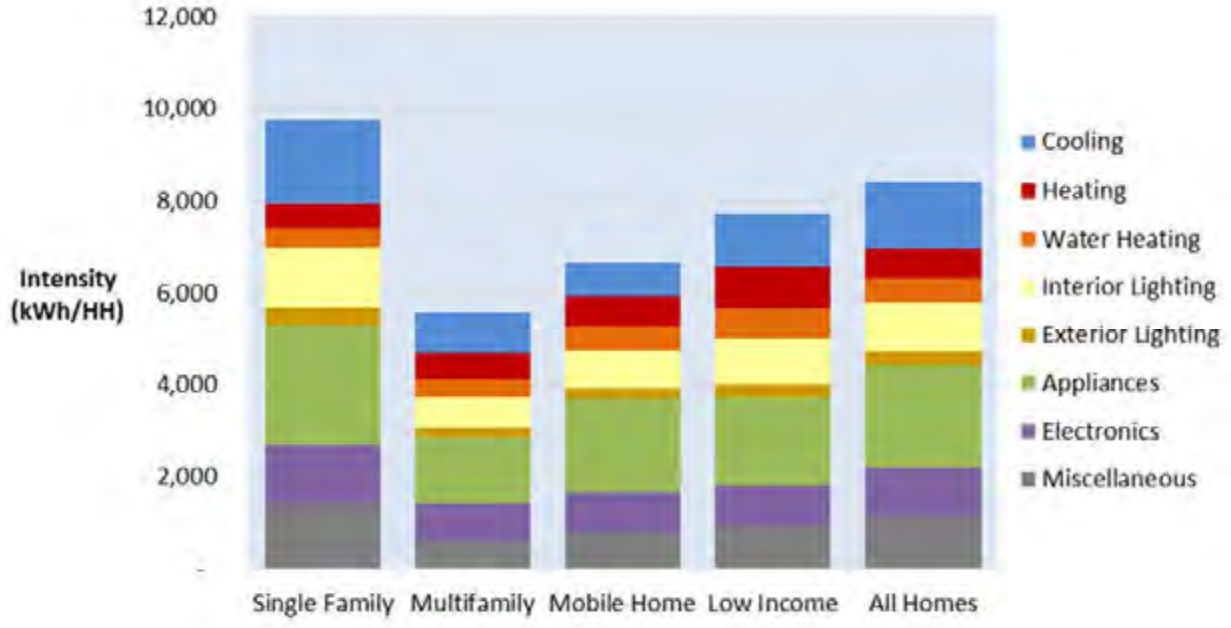


Table 3-3 Average Market Profile for the Residential Sector, 2014

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)	Summer Peak (MW)
Cooling	Central AC	47.3%	2,207	1,043	420	507
Cooling	Room AC	43.1%	806	347	140	90
Cooling	Air-Source Heat Pump	1.5%	2,152	33	13	16
Cooling	Geothermal Heat Pump	0.2%	2,329	4	2	2
Space Heating	Electric Zonal Room Heat	3.0%	6,120	186	75	0
Space Heating	Electric Furnace	3.4%	10,513	360	145	0
Space Heating	Air-Source Heat Pump	1.5%	6,879	106	43	0
Space Heating	Geothermal Heat Pump	0.2%	6,516	11	4	0
Water Heating	Water Heater <= 55 Gal	11.4%	2,973	338	136	13
Water Heating	Water Heater > 55 Gal	5.5%	3,116	172	69	7
Interior Lighting	Screw-in	100.0%	741	741	298	23
Interior Lighting	Linear Fluorescent	100.0%	125	125	50	4
Interior Lighting	Specialty	100.0%	233	233	94	7
Exterior Lighting	Screw-in	100.0%	307	307	124	9
Appliances	Clothes Washer	73.7%	88	65	26	3
Appliances	Clothes Dryer	48.2%	772	372	150	18
Appliances	Dishwasher	49.4%	395	195	78	9
Appliances	Refrigerator	100.0%	745	745	300	35
Appliances	Freezer	35.8%	589	211	85	11
Appliances	Second Refrigerator	26.7%	1,045	279	112	13
Appliances	Stove	52.8%	426	225	91	18
Appliances	Microwave	99.8%	129	129	52	11
Electronics	Personal Computers	54.5%	184	100	40	5
Electronics	Monitor	65.5%	78	51	20	2
Electronics	Laptops	128.0%	49	62	25	3
Electronics	TVs	249.1%	165	412	166	20
Electronics	Printer/Fax/Copier	75.2%	60	45	18	2
Electronics	Set-top Boxes/DVR	258.5%	112	291	117	14
Electronics	Devices and Gadgets	100.0%	108	108	44	5
Miscellaneous	Pool Pump	1.2%	1,363	16	6	1
Miscellaneous	Pool Heater	0.2%	1,370	2	1	0
Miscellaneous	Hot Tub / Spa	3.5%	2,053	72	29	3
Miscellaneous	Furnace Fan	72.7%	658	478	192	23
Miscellaneous	Well pump	8.0%	564	45	18	2
Miscellaneous	Dehumidifiers	23.6%	626	148	59	7
Miscellaneous	Miscellaneous	100.0%	354	354	143	17
	Total			**8,411**	**3,384**	**900**

Commercial Sector

The total electric energy consumed by commercial customers in NIPSCO's service area in 2014 was 3,705 GWh. The average intensity of use was 11.7 kWh/square foot. A key difference from the 2014 forecast is that these control totals now exclude customers who opted-out of participation in EE programs. AEG received a list from NIPSCO of customers who had already opted out or who NIPSCO forecasted to opt out of EE programs as of January 1, 2016, as allowed by IC-8-1-8.5-9. The opt-out customers were then removed after the initial market segmentation. Although the opt-out customers are typically large industrial customers, approximately 160 GWh was also removed from the commercial sector.

Energy Market Profile

Figure 3-4 shows the distribution of annual electricity consumption and summer peak demand by end use across all commercial buildings. Electric usage is dominated by cooling and lighting, which comprise 50% of annual electricity usage. Summer peak demand is dominated by cooling.

Figure 3-4 Commercial Sector Electricity Consumption by End Use (2014)

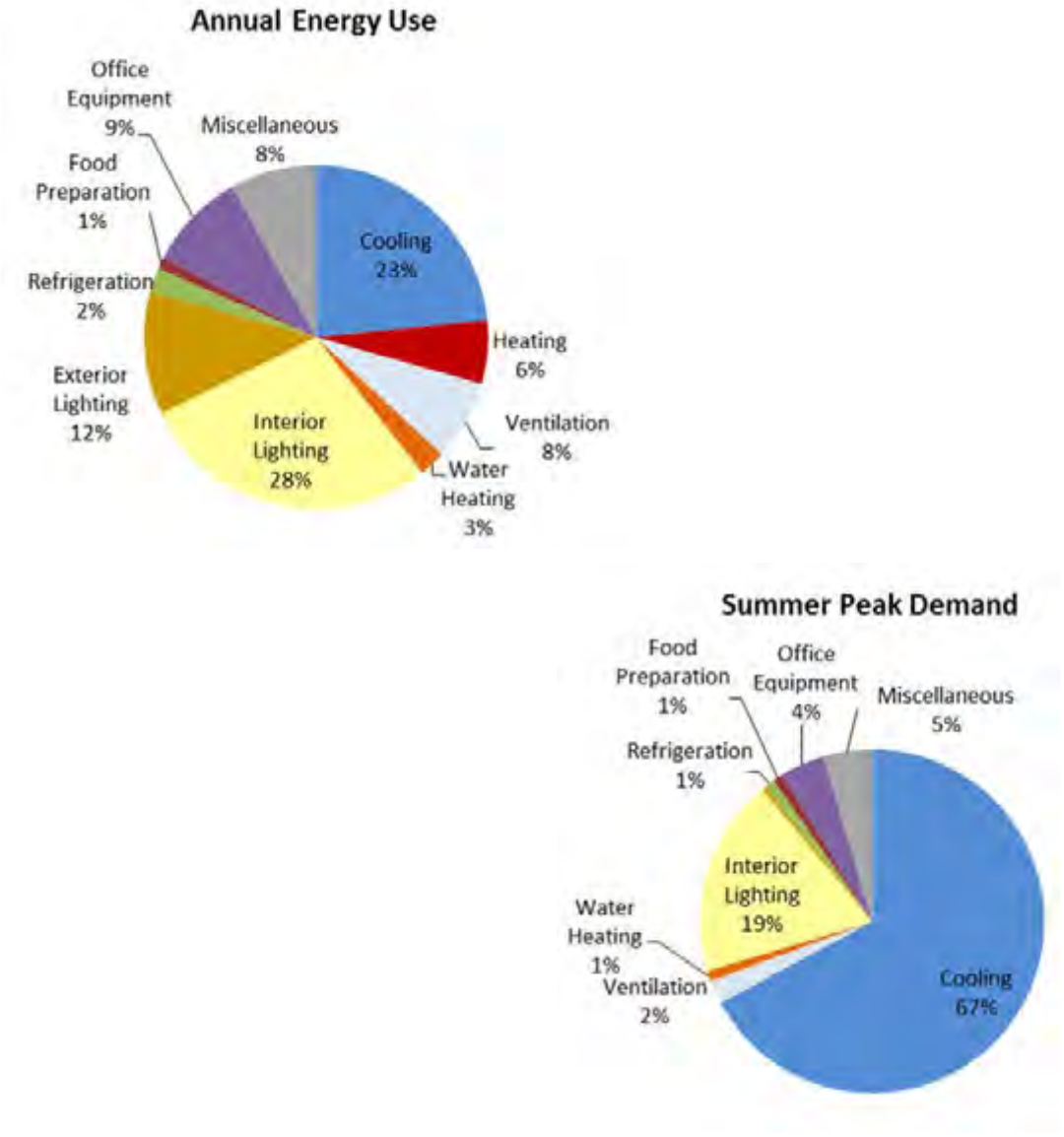


Table 3-4 shows the average market profile for electricity of the commercial sector as a whole, representing a composite of all segments and buildings. Market profiles for each segment are presented in the appendix to this volume.

Table 3-4 Average Electric Market Profile for the Commercial Sector, 2014

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)
Cooling	Air-Cooled Chiller	4.5%	3.22	0.14	45.6
Cooling	Water-Cooled Chiller	6.0%	3.51	0.21	66.3
Cooling	RTU	54.9%	3.97	2.18	691.5
Cooling	Room AC	3.7%	4.06	0.15	47.6
Cooling	Air-Source Heat Pump	0.9%	3.97	0.04	11.7
Cooling	Geothermal Heat Pump	0.8%	2.42	0.02	6.2
Heating	Electric Furnace	10.3%	4.70	0.48	153.6
Heating	Electric Room Heat	3.5%	4.47	0.16	49.3
Heating	Air-Source Heat Pump	0.9%	3.83	0.04	11.4
Heating	Geothermal Heat Pump	0.8%	2.43	0.02	6.2
Ventilation	Ventilation	100.0%	0.88	0.88	280.0
Water Heating	Water Heating	42.3%	0.69	0.29	92.1
Interior Lighting	Screw-in	100.0%	0.51	0.51	160.4
Interior Lighting	High-Bay Fixtures	100.0%	0.86	0.86	271.7
Interior Lighting	Linear Fluorescent	100.0%	1.93	1.93	614.0
Exterior Lighting	Screw-in	100.0%	0.18	0.18	56.5
Exterior Lighting	HID	100.0%	1.06	1.06	334.9
Exterior Lighting	Linear Fluorescent	100.0%	0.12	0.12	36.7
Refrigeration	Walk-in Refrigerator	11.6%	0.28	0.03	10.2
Refrigeration	Reach-in Refrigerator	45.0%	0.06	0.03	8.9
Refrigeration	Glass Door Display	35.6%	0.06	0.02	7.2
Refrigeration	Open Display Case	35.6%	0.38	0.14	42.9
Refrigeration	Icemaker	35.5%	0.11	0.04	11.8
Refrigeration	Vending Machine	35.5%	0.05	0.02	5.6
Food Preparation	Oven	38.0%	0.06	0.02	7.4
Food Preparation	Fryer	44.0%	0.09	0.04	12.4
Food Preparation	Griddle	39.1%	0.08	0.03	10.0
Food Preparation	Dishwasher	14.6%	0.12	0.02	5.7
Food Preparation	Steamer	14.6%	0.09	0.01	4.2
Food Preparation	Hot Food Container	14.6%	0.02	0.00	0.8
Office Equipment	Desktop Computer	100.0%	0.59	0.59	187.8
Office Equipment	Laptop	100.0%	0.09	0.09	29.0
Office Equipment	Server	100.0%	0.17	0.17	55.1
Office Equipment	Monitor	100.0%	0.10	0.10	33.1
Office Equipment	Printer/Copier/Fax	100.0%	0.08	0.08	25.7
Office Equipment	POS Terminal	81.8%	0.05	0.04	12.0
Miscellaneous	Non-HVAC Motors	22.1%	0.15	0.03	10.6
Miscellaneous	Pool Pump	3.8%	0.02	0.00	0.3
Miscellaneous	Pool Heater	1.7%	0.03	0.00	0.2
Miscellaneous	Other	100.0%	0.91	0.91	288.9
	Total			**11.68**	**3,705**

Industrial Sector

NIPSCO provided a list of customers who had already opted out or who NIPSCO forecasted to opt-out of EE programs as of January 1, 2016, as allowed by IC-8-1-8.5-9. AEG then removed those customers from the overall sector control totals. Table 3-5 shows the amount of electricity removed from the control totals, broken down by the segments used in LoadMAP. As expected the largest segment affected by the removal of opt-out customers is the Large Industrial segment, which represented approximately 75% of the total sector sales. As a result, the DSM programs will need to focus on the smaller customers and will likely change the mix of measures in the programs.

Table 3-5 C&I Opt-Out Customers (2014)

Segment	2014 GWh All Customers	2014 GWh from Opt Out Customers	% of Total Sector Sales from Opt Out Customers
Commercial	3,872	166	4.3%
Small Industrial	839	527	5.2%
Large Industrial	9,230	7,511	74.6%
C&I Total	**13,941**	**8,205**	**58.9%**

The total electricity used in 2014 by NIPSCO's industrial customers, after removing the opt-out customers, was 2,031 GWh, while peak demand was 288 MW. NIPSCO billing data, load forecast and secondary sources were used to allocate usage to large and small segments and to develop estimates of energy intensity (annual kWh/employee). Using the electricity use and intensity estimates, AEG inferred the number of employees which is the unit of analysis in LoadMAP for the industrial sector. These are shown in Table 3-6.

Table 3-6 Industrial Sector Control Totals (2014)

Segment	Electricity Sales (GWh)	Intensity (Annual kWh/employee)	Number of Employees	Summer peak Demand (MW)
Small Industrial (<1M kWh/year)	1,779	26,377	67,453	262
Large Industrial (>1M kWh/year)	251	247,963	1,014	27
Total	**2,031**	**29,658**	**68,467**	**288**

Energy Market Profile

Figure 3-5 shows the distribution of annual electricity consumption and summer peak demand by end use for all industrial customers. Motors are the largest overall end use for the industrial sector, accounting for 38% 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 21% of annual energy use, which includes heating, cooling, refrigeration, and electro-chemical processes. Cooling contributes the most to summer peak demand with 43%. Exterior lighting and space heating are not coincident with the system peak and therefore do not appear in the pie chart.

Figure 3-5 Industrial Electricity Use by End Use (2014), All Segments

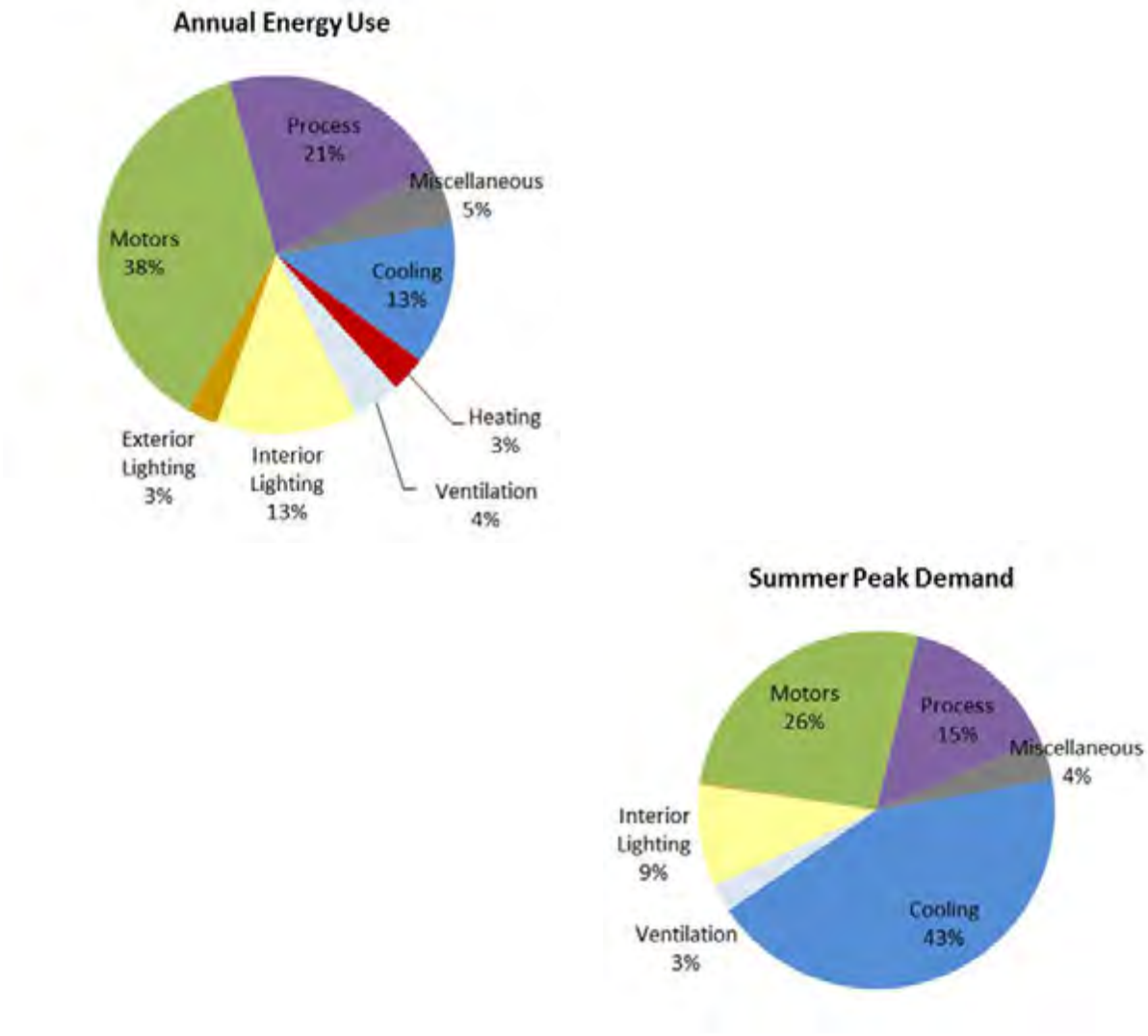


Table 3-7 shows the composite market profile for the industrial sector.

Table 3-7 Average Electric Market Profile for the Industrial Sector, 2014

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/ Employee)	Usage (GWh)	Summer Peak (MW)
Cooling	Air-Cooled Chiller	5.0%	4,056	204	13.9	7
Cooling	Water-Cooled Chiller	11.1%	2,936	327	22.4	1
Cooling	RTU	51.1%	5,877	3,003	205.6	7
Cooling	Room AC	3.3%	6,316	205	14.1	11
Cooling	Air-Source Heat Pump	1.2%	4,381	54	3.7	98
Cooling	Geothermal Heat Pump	0.7%	3,767	27	1.8	2
Heating	Electric Furnace	9.4%	7,044	665	45.5	0
Heating	Electric Room Heat	3.9%	5,651	218	14.9	0
Heating	Air-Source Heat Pump	1.2%	4,215	52	3.5	0
Heating	Geothermal Heat Pump	0.7%	3,779	27	1.8	0
Ventilation	Ventilation	100.0%	1,258	1,258	86.1	7
Interior Lighting	Screw-in	100.0%	175	175	12.0	1
Interior Lighting	High-Bay Fixtures	100.0%	3,128	3,128	214.2	4
Interior Lighting	Linear Fluorescent	100.0%	510	510	34.9	22
Exterior Lighting	Screw-in	100.0%	35	35	2.4	0
Exterior Lighting	HID	100.0%	660	660	45.2	0
Exterior Lighting	Linear Fluorescent	100.0%	135	135	9.3	0
Process	Process Heating	100.0%	3,906	3,906	267.5	27
Process	Process Cooling	100.0%	807	807	55.2	5
Process	Process Refrigeration	100.0%	807	807	55.2	5
Process	Process Electro-Chemical	100.0%	568	568	38.9	4
Process	Process Other	100.0%	222	222	15.2	2
Motors	Pumps	100.0%	1,919	1,919	131.4	13
Motors	Fans & Blowers	100.0%	2,336	2,336	159.9	16
Motors	Compressed Air	100.0%	1,894	1,894	129.7	13
Motors	Conveyors	100.0%	4,830	4,830	330.7	33
Motors	Other Motors	100.0%	154	154	10.6	1
Miscellaneous	Miscellaneous	100.0%	1,534	1,534	105.0	10
	Total			**29,658**	**2,030.6**	**288**

SECTION | 4

Baseline Projection

Prior to developing estimates of energy-efficiency potential, AEG developed a baseline end-use projection to quantify what the consumption is likely going to be in the future absent any efficiency programs. The savings from past programs are embedded in the forecast, but the baseline projection assumes that those past programs cease to exist in the future. Possible savings from future programs are captured by the potential estimates.

The baseline projection incorporates assumptions about:

- Customer and economic growth
- Appliance/equipment standards and building codes already mandated (see Section 2)
- Forecasts of future electricity prices and other drivers of consumption
- Trends in fuel shares and appliance saturations and assumptions about miscellaneous electricity growth
- Naturally occurring energy efficiency, which reflects the manufacture of more efficient options in response to new appliance standards and purchases of high-efficiency appliances and equipment by early adopters outside of utility programs.

Although it aligns closely, the baseline projection is not NIPSCO's official load forecast. Rather it was developed to serve as the metric against which DSM potentials are measured. This chapter presents the baseline projections AEG developed for this study. Below, AEG presents the baseline projections for each sector, which include projections of annual use in GWh and summer peak demand in MW as well as a summary across all sectors.

Residential Sector

Annual Use

Table 4-1 and Figure 4-1 present the baseline projection for electricity at the end-use level for the residential sector as a whole. Overall, residential use increases from 3,384 GWh in 2014 to 3,720 GWh in 2036, an increase of 9.9%. This reflects a modest customer growth forecast. This table also shows the estimate of naturally occurring energy efficiency, which has the greatest impact in the lighting end uses due to early adoption of light emitting diode (LED) lamps. Figure 4-2 presents the baseline projection of annual electricity use per household. Most noticeable is that lighting use decreases throughout the time period as the lighting standards from the Energy Independence and Security Act of 2007 (EISA) come into effect.

Table 4-2 shows the end-use forecast at the technology level for select years. This projection is in general alignment with NIPSCO's residential load forecast. Specific observations include:

1. Lighting use declines as a result of the EISA lighting standards in 2020.
2. Appliance energy use experiences significant efficiency gains from new standards, but this is offset by customer growth.
3. Growth in use in electronics is substantial and reflects an increase in the saturation of electronics and the trend toward higher-powered computers. Growth in other miscellaneous use is also substantial. This end use has grown consistently in the past and AEG incorporates future growth assumptions that are consistent with the Annual Energy Outlook.

Table 4-1 Residential Baseline Projection by End Use (GWh)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	574	583	580	582	587	612	6.6%
Heating	267	238	240	244	251	265	-0.6%
Water Heating	205	205	204	203	198	198	-3.8%
Interior Lighting	442	451	443	358	279	266	-40.0%
Exterior Lighting	124	109	100	72	48	44	-64.7%
Appliances	894	902	914	936	970	1,039	16.2%
Electronics	430	460	465	478	516	659	53.2%
Miscellaneous	449	461	475	497	538	638	42.3%
Total	**3,384**	**3,408**	**3,421**	**3,371**	**3,388**	**3,720**	**9.9%**

Figure 4-1 Residential Baseline Projection by End Use (GWh)

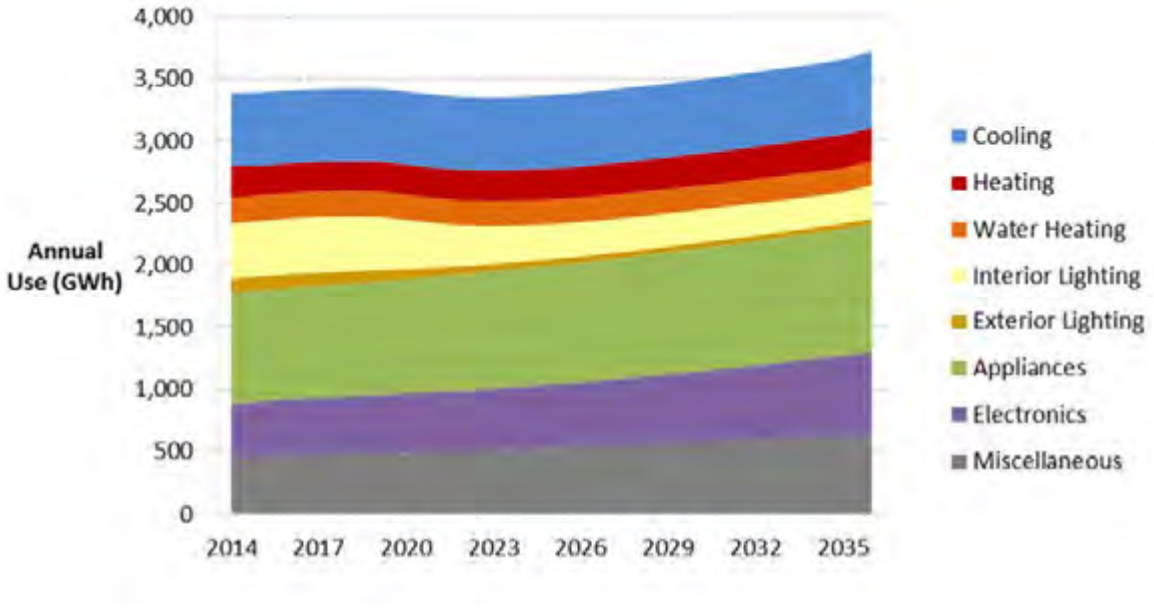


Figure 4-2 Residential Baseline Projection by End Use – Annual Use per Household

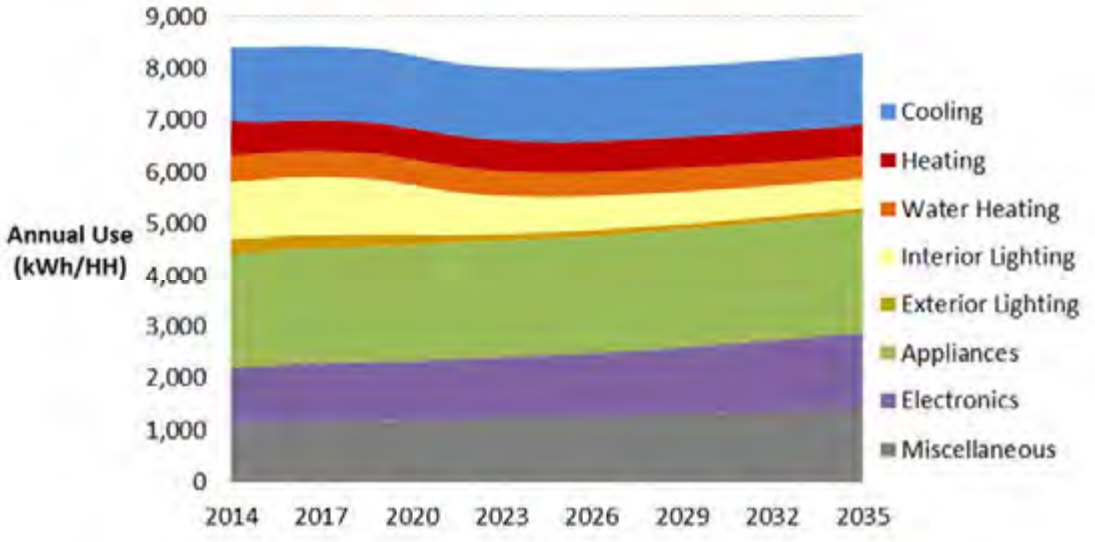


Table 4-2 Residential Baseline Projection by End Use and Technology (GWh)

End Use	Technology	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	Central AC	420	427	428	431	441	468	11.6%
	Room AC	140	140	137	134	129	123	-11.9%
	Air-Source Heat Pump	13	14	14	15	16	18	35.4%
	Geothermal Heat Pump	2	2	2	2	2	3	72.8%
Heating	Electric Furnace	145	129	129	131	133	136	-5.9%
	Electric Zonal Room Heat	43	39	39	41	44	51	19.7%
	Air-Source Heat Pump	4	4	4	5	5	7	56.5%
	Geothermal Heat Pump	75	66	67	68	69	71	-5.2%
Water Heating	Water Heater <= 55 gal	136	137	138	141	145	159	16.7%
	Water Heater > 55 gal	69	68	66	62	52	39	-44.0%
Interior Lighting	Screw-in	298	300	295	223	152	138	-53.8%
	Linear Fluorescent	50	51	51	52	53	55	9.0%
	Specialty	94	100	97	83	74	73	-22.2%
Ext. Lighting	Screw-in	124	109	100	72	48	44	-64.7%
Appliances	Refrigerator	300	303	307	315	327	346	15.6%
	Second Refrigerator	112	114	117	121	128	141	25.9%
	Freezer	85	87	89	93	98	105	23.6%
	Clothes Washer	26	26	25	24	21	19	-26.0%
	Clothes Dryer	150	152	154	158	163	173	15.2%
	Dishwasher	78	77	76	76	77	85	8.3%
	Stove	52	53	53	54	56	60	15.4%
	Microwave	91	92	93	96	100	109	20.5%
Electronics	Personal Computers	40	42	44	48	55	74	82.4%
	Monitor	20	21	21	21	22	24	15.7%
	Laptops	25	26	28	30	34	46	82.9%
	Printer/Fax/Copier	18	19	19	21	24	33	81.2%
	TVs	166	172	179	190	211	256	54.6%
	Set-top Boxes/DVR	117	133	124	112	102	127	9.0%
	Devices and Gadgets	44	47	50	57	69	99	128.3%
Miscellaneous	Well Pump	6	6	7	7	7	7	16.7%
	Dehumidifier	1	1	1	1	1	1	10.0%
	Pool Pump	29	29	29	30	31	33	15.1%
	Pool Heater	192	194	196	197	197	196	1.8%
	Hot Tub / Spa	18	18	18	19	20	21	15.1%
	Furnace Fan	59	59	60	61	62	66	10.2%
	Other	143	153	164	183	220	315	120.6%
Total		**3,384**	**3,408**	**3,421**	**3,371**	**3,388**	**3,720**	**9.9%**

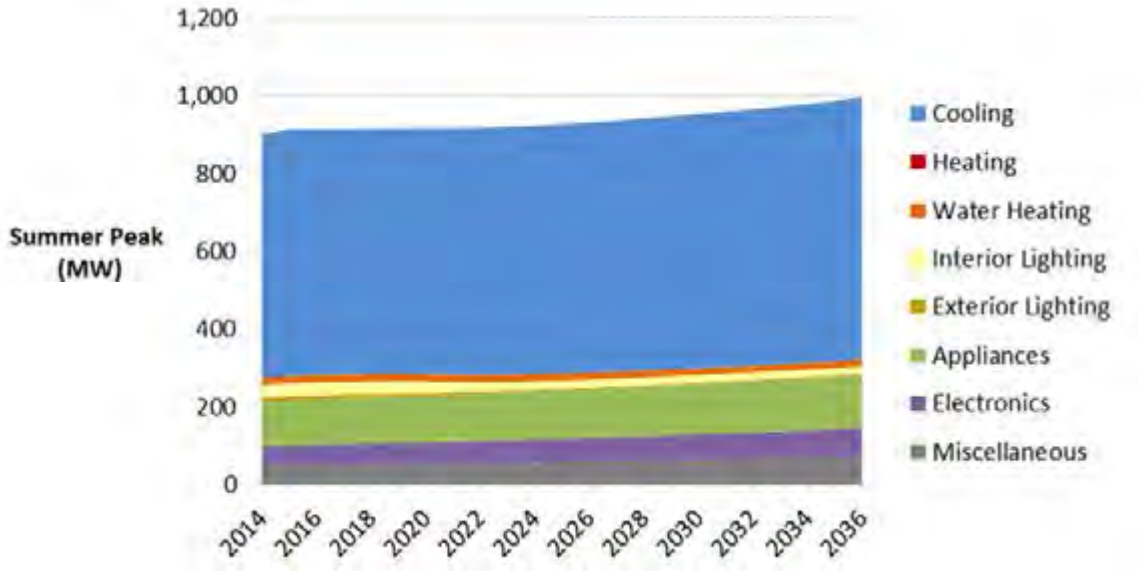
Residential Summer Peak Demand Projection

Table 4-3 and Figure 4-3 present the residential baseline projection for summer peak demand at the end-use level. Overall, residential summer peak increases from 900 MW in 2014 to 999 MW in 2036, an increase of 11.0%. Cooling and appliances show a modest increase while water heating decreases slightly and lighting declines significantly. The summer peak associated with electronics and miscellaneous uses increases substantially, in correspondence with growth in annual energy use.

Table 4-3 Residential Summer Peak Baseline Projection by End Use (MW)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	624	634	632	635	644	676	8.3%
Heating	0	0	0	0	0	0	0.0%
Water Heating	19	19	19	18	18	18	-3.6%
Interior Lighting	33	33	33	27	21	20	-40.0%
Exterior Lighting	9	8	7	5	4	3	-64.7%
Appliances	116	117	119	122	126	135	16.6%
Electronics	48	52	52	54	58	74	53.1%
Miscellaneous	51	52	54	57	61	72	42.1%
Total	**900**	**915**	**916**	**918**	**932**	**999**	**11.0%**

Figure 4-3 Residential Summer Peak Baseline Projection by End Use (MW)



Commercial Sector Baseline Projections

Annual Use

Annual electricity use in the commercial sector grows during the overall forecast horizon, starting at 3,705 GWh in 2014, and increasing to 4,127 in 2036 representing 11.4% growth. Table 4-4 and Figure 4-4 present the baseline projection at the end-use level for the commercial sector as a whole. Usage in lighting is declining slightly throughout the forecast, due largely to the phasing in of codes and standards such as the EISA 2007 lighting standards.

Table 4-4 Commercial Baseline Projection by End Use (GWh)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	869	890	893	900	913	939	8.1%
Heating	220	196	197	198	200	199	-9.8%
Ventilation	280	278	275	271	264	265	-5.5%
Water Heating	92	91	92	92	93	88	-4.9%
Interior Lighting	1,046	1,044	1,042	1,030	1,020	1,008	-3.6%
Ext. Lighting	428	434	436	434	430	422	-1.4%
Refrigeration	87	88	89	92	96	101	16.5%
Food Prep	40	40	40	41	42	44	9.4%
Office Equip	343	348	353	368	405	480	40.2%
Miscellaneous	300	324	349	388	454	581	93.7%
Total	**3,705**	**3,734**	**3,766**	**3,814**	**3,917**	**4,127**	**11.4%**

Figure 4-4 Commercial Baseline Projection by End Use

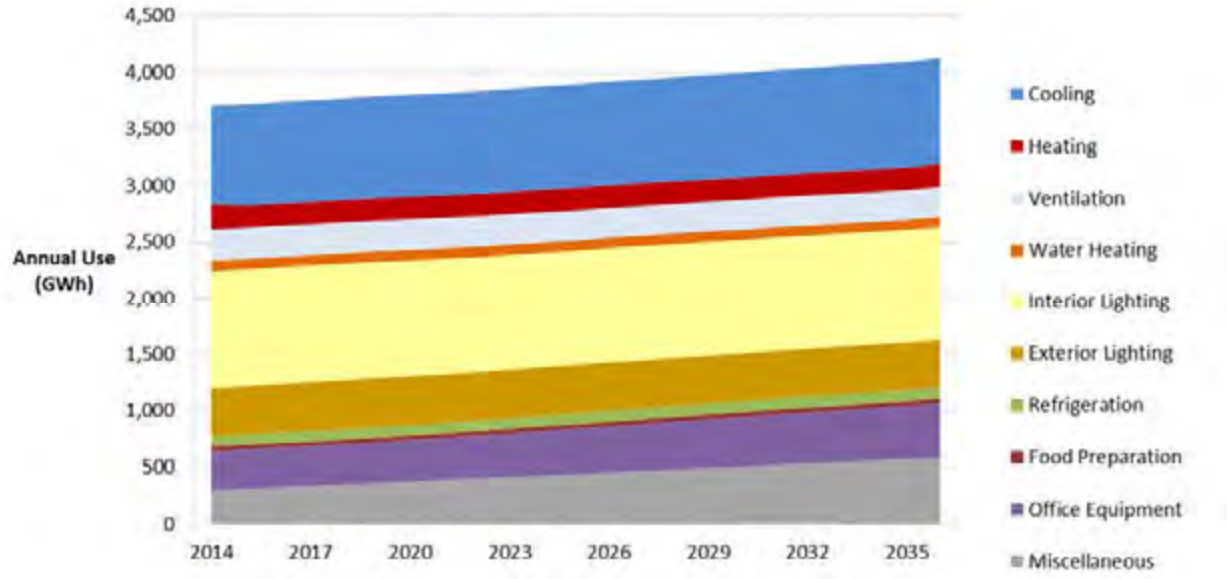


Table 4-5 presents the commercial sector annual forecast by technology for select years. Screw-in lighting technologies decrease significantly over the forecast period as a result of efficiency standards.

Table 4-5 Commercial Baseline Projection by End Use and Technology (GWh)

End Use	Technology	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	Air-Cooled Chiller	46	51	55	61	71	91	99.8%
	Water-Cooled Chiller	66	72	76	82	93	112	69.4%
	RTU	691	699	691	681	664	633	-8.5%
	Room AC	48	51	54	59	68	88	84.0%
	Air Source Heat Pump	12	12	12	11	11	10	-10.8%
	Geo. Heat Pump	6	6	6	6	6	5	-15.7%
Heating	Electric Furnace	154	137	137	139	141	140	-8.6%
	Electric Zonal Heat	49	44	45	45	46	47	-4.7%
	Air Source Heat Pump	11	10	10	9	9	8	-30.7%
	Geo. Heat Pump	6	5	5	5	4	4	-41.6%
	Ventilation	280	278	275	271	264	265	-5.5%
	Water Heater	92	91	92	92	93	88	-4.9%
Int. Lighting	Screw-in	160	146	135	112	91	85	-46.9%
	High-Bay Fixtures	272	283	291	303	318	325	19.6%
	Linear Fluorescent	614	615	615	614	611	598	-2.6%
Ext. Lighting	Screw-in	56	53	51	44	36	34	-39.6%
	HID	335	343	349	354	357	352	5.1%
	Linear Fluorescent	37	37	37	37	37	36	-2.3%
Refrigeration	Walk-in Refrigerator	10	10	11	11	11	12	17.9%
	Reach-in Refrigerator	9	9	9	9	9	10	8.8%
	Glass Door Display	7	7	8	8	8	9	18.2%
	Open Display Case	43	45	47	50	53	56	30.1%
	Icemaker	12	10	9	8	8	8	-29.7%
	Vending Machine	6	6	6	6	6	7	18.2%
Food Prep.	Dishwasher	6	6	5	5	5	5	-10.8%
	Oven	7	7	7	7	8	8	11.6%
	Fryer	12	13	13	13	14	15	21.4%
	Griddle	10	10	10	10	10	11	7.3%
	Steamer	4	4	4	4	4	4	0.2%
	Hot Food Container	1	1	1	1	1	1	22.7%
Office Equip.	Desktop Computer	188	191	195	204	224	266	41.6%
	Laptop	29	28	27	26	28	32	11.8%
	Monitor	33	33	33	34	37	43	30.5%
	Server	55	58	60	64	72	86	55.6%
	Printer/Copier/Fax	26	25	25	25	27	32	23.5%
	POS Terminal	12	13	14	15	17	22	79.4%
Miscellaneous	Pool Heater	0	0	0	0	0	0	2.2%
	Pool Pump	0	0	0	0	0	0	5.0%
	Non-HVAC Motors	11	11	11	11	12	13	20.6%
	Other	289	313	337	376	442	568	96.5%
Total		**3,705**	**3,734**	**3,766**	**3,814**	**3,917**	**4,127**	**11.4%**

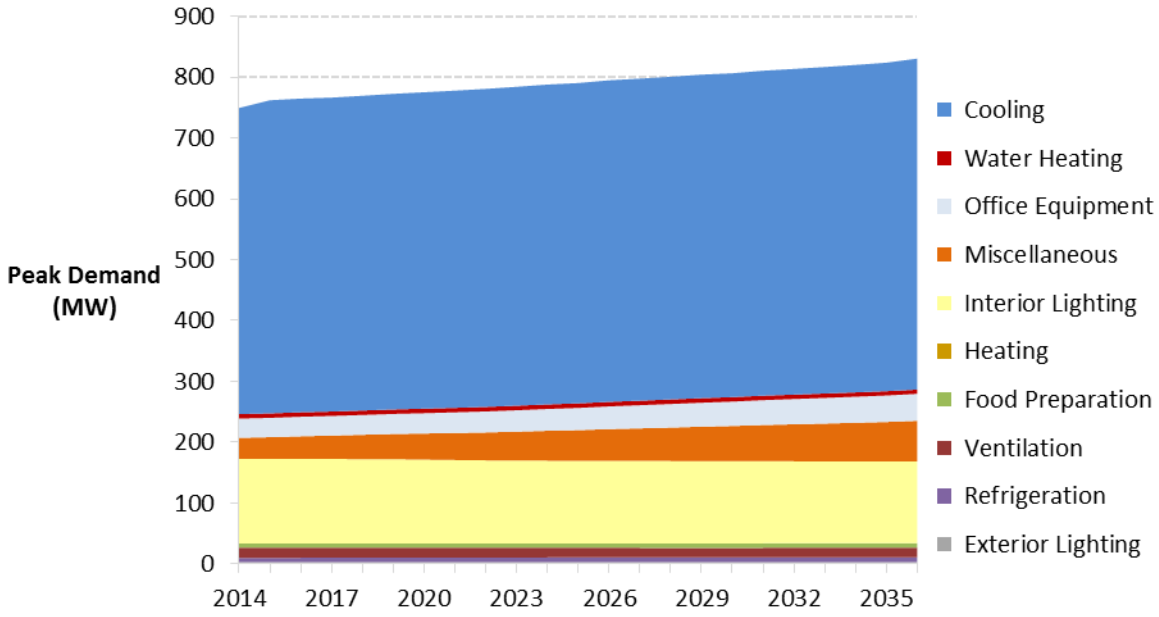
Commercial Summer Peak Demand Projection

Table 4-6 and Figure 4-5 present the summer peak baseline projection at the end-use level for the commercial sector as a whole. Summer peak demand stays relatively flat during the overall forecast horizon, starting at 750 MW in 2014 and increasing to 831 in 2036.

Table 4-6 Commercial Summer Peak Baseline Projection by End Use (MW)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	503	516	516	517	529	544	8.1%
Heating	0	0	0	0	0	0	0.0%
Ventilation	17	16	16	16	16	16	-5.5%
Water Heating	7	7	7	7	7	7	-4.9%
Interior Lighting	139	139	139	139	136	134	-3.6%
Ext. Lighting	3	3	3	3	3	3	-1.4%
Refrigeration	7	7	7	7	8	8	16.5%
Food Prep	7	7	7	7	7	8	9.4%
Office Equip	32	32	32	33	37	44	40.2%
Miscellaneous	34	37	38	40	52	67	93.7%
Total	**750**	**765**	**767**	**770**	**795**	**831**	**10.8%**

Figure 4-5 Commercial Summer Peak Baseline Projection by End Use (MW)



Industrial Sector Baseline Projections

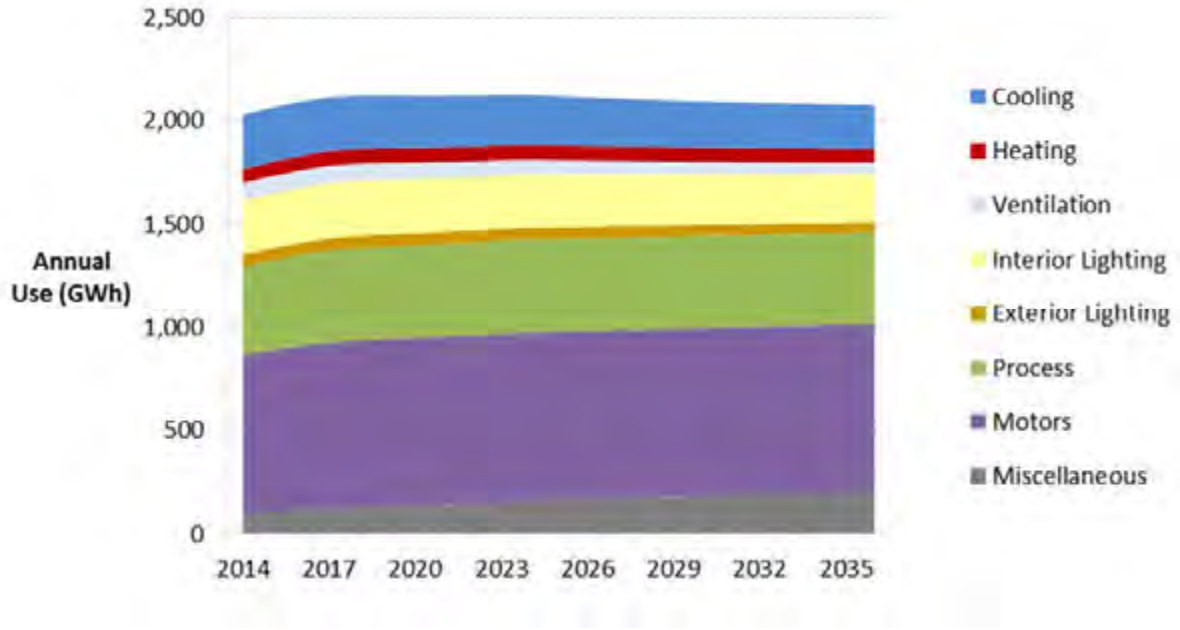
Annual Use

Annual industrial use remains relatively flat throughout the forecast horizon. Table 4-7 and Figure 4-6 present the projection at the end-use level. Overall, industrial annual electricity use (not including opt-out customers) increases from 2,031 GWh in 2014 to 2,076 GWh in 2036. This comprises an overall increase of 2.2% over the 32-year period.

Table 4-7 Industrial Baseline Projection by End Use (GWh)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	261	262	259	251	237	212	-19%
Heating	66	68	69	69	68	65	-1%
Ventilation	86	84	81	76	66	52	-40%
Interior Lighting	261	267	268	261	251	235	-10%
Exterior Lighting	57	58	59	58	56	52	-8%
Motors	432	447	454	455	455	445	3%
Process	762	790	804	808	813	805	6%
Miscellaneous	105	118	129	144	168	210	100%
Total	**2,031**	**2,094**	**2,123**	**2,122**	**2,114**	**2,076**	**2.2%**

Figure 4-6 Industrial Baseline Projection by End Use (GWh)



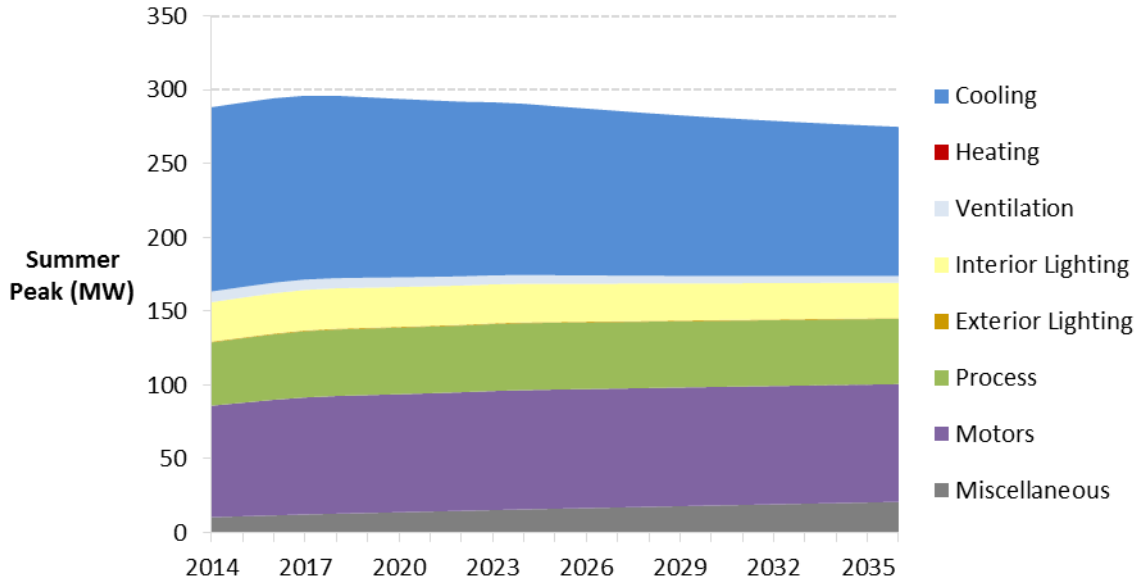
Industrial Summer Peak Demand Projection

Table 4-8 and Figure 4-7 present the projection of summer peak demand for the industrial sector. Once the opt-out customers are removed, the peak forecast decreases by 4.6% between 2014 and 2036.

Table 4-8 Industrial Summer Peak Baseline Projection by End Use (MW)

End Use	2014	2016	2018	2021	2026	2036	% Change (14-36)
Cooling	125	125	124	120	113	101	-19%
Heating	0	0	0	0	0	0	0%
Ventilation	7	7	7	6	6	4	-40%
Interior Lighting	27	27	27	27	26	24	-10%
Exterior Lighting	1	1	1	1	1	0	-8%
Process	43	44	45	45	45	44	3%
Motors	76	78	80	80	81	80	6%
Miscellaneous	10	12	13	14	17	21	100%
Total	**288**	**294**	**296**	**293**	**287**	**275**	**-4.6%**

Figure 4-7 Industrial Summer Peak Baseline Projection by End Use (MW)



Summary of Baseline Projections across Sectors

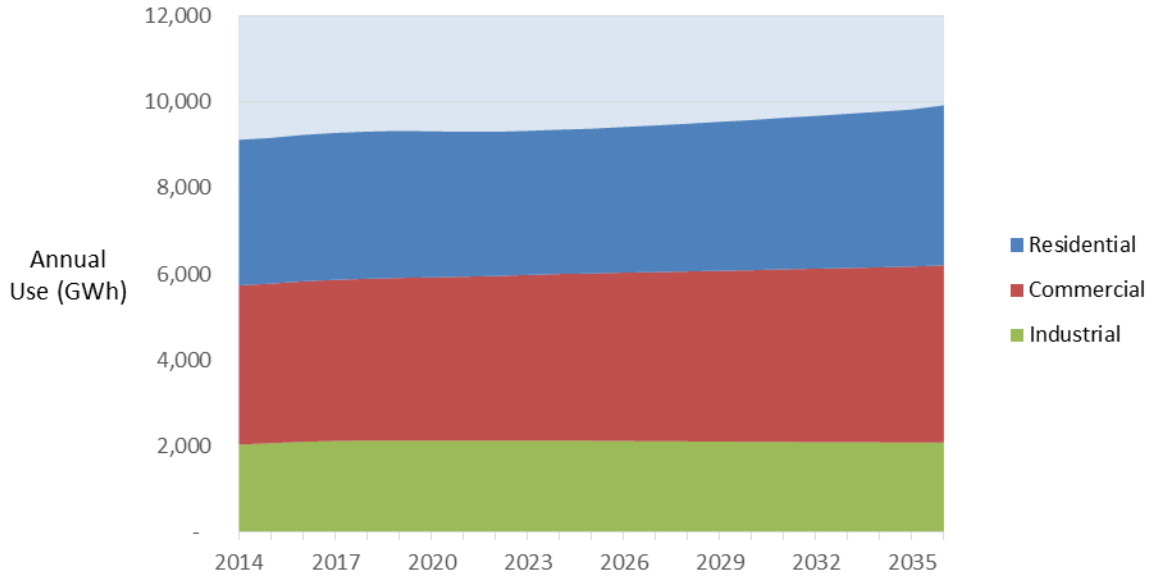
Annual Use

Table 4-9 and Figure 4-8 provide a summary of the baseline projection for annual use by sector for the entire NIPSCO service territory. Overall, the forecast shows relatively modest growth in electricity use, driven primarily by customer growth forecasts.

Table 4-9 Baseline Projection Summary (GWh)

Sector	2014	2016	2018	2021	2026	2036	% Change (14-36)
Residential	3,384	3,408	3,421	3,371	3,388	3,720	9.9%
Commercial	3,705	3,734	3,766	3,814	3,917	4,127	11.4%
Industrial	2,031	2,094	2,123	2,122	2,114	2,076	2.2%
Total	**9,120**	**9,235**	**9,310**	**9,307**	**9,419**	**9,923**	**8.8%**

Figure 4-8 Baseline Projection Summary (GWh)



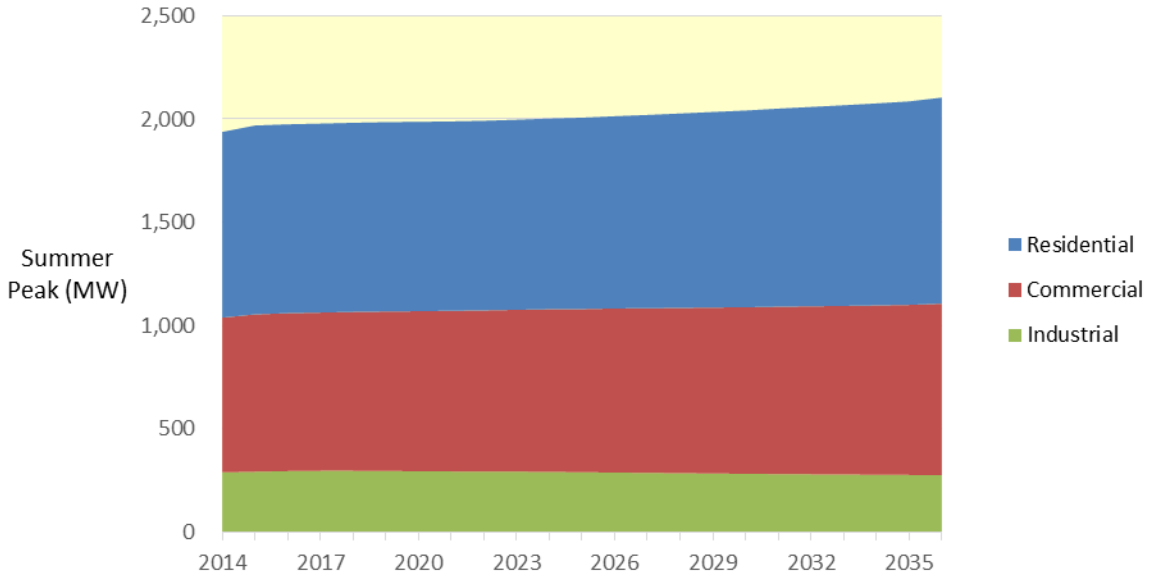
Summer Peak Demand Projection

Table 4-10 and Figure 4-9 provide a summary of the baseline projection for summer peak demand. Overall, the forecast shows modest growth of 8.6%, aligning with the energy forecast.

Table 4-10 Baseline Summer Peak Projection Summary (MW)

Sector	2014	2016	2018	2021	2026	2036	% Change (14-36)
Residential	900	915	916	918	932	999	11.0%
Commercial	750	765	770	778	795	831	10.8%
Industrial	288	294	296	293	287	275	-4.6%
Total	**1,938**	**1,975**	**1,982**	**1,989**	**2,014**	**2,104**	**8.6%**

Figure 4-9 Baseline Summer Peak Projection Summary (MW)



SECTION | 5

Measure-Level DSM Potential

This chapter presents the measure-level DSM potential for NIPSCO. This includes every possible measure that is considered in the measure list, regardless of program implementation concerns.

The annual energy savings are in GWh and the summer peak demand savings in MW from energy-efficiency measures. Year-by-year savings for annual energy and peak demand are available in the LoadMAP model, which was provided to NIPSCO at the conclusion of the study.

A summary of annual energy and summer peak demand savings across all three sectors is shown first, followed by details for each sector.

Overall Summary of DSM Potential

This section presents the annual energy and peak demand savings from energy-efficiency measures for eligible customers. Compared to the 2014 Forecast, the savings are dramatically lower for two reasons:

- Opt-out customers are excluded from this study, which affects primarily the industrial sector savings
- Estimates of Achievable Potential represent a realistic level of potential that can be achieved

Summary of Annual Energy Savings

Table 5-1 and Figure 5-1 summarize the EE savings in terms of annual energy use for all measures for three levels of potential relative to the baseline projection. Figure 5-2 displays the EE forecasts.

- **Technical potential** reflects the adoption of all EE measures regardless of cost-effectiveness. First-year savings are 284 GWh, or 3.1% of the baseline projection. Cumulative gross savings in 2021 are 1,171 GWh, or 12.6% of the baseline. By 2036 cumulative savings reach 2,984 GWh, or 30.1% of the baseline.
- **Economic potential** reflects the savings when the most efficient cost-effective measures are taken by all customers. The first-year savings in 2016 are 214 GWh, or 2.3% of the baseline projection. By 2021, cumulative savings reach 881 GWh, or 9.5% of the baseline. By 2036, cumulative savings reach 2,367 GWh, or 23.9% of the baseline projection.
- **Achievable potential** refines the economic potential by taking into account expected participation, customer preferences, and budget constraints. It shows 82 GWh savings in the first year, or 0.9% of the baseline and by 2021 cumulative savings reach 328 GWh, or 3.5% of the baseline projection. By 2036, cumulative savings reach 1,027 GWh, or 10.4% of the baseline projection. This results in average annual savings of 0.5% of the baseline each year. Achievable potential reflects 36%-44% of economic potential throughout the forecast horizon.

Table 5-1 Summary of DSM Potential (Annual Energy, GWh)

	2016	2018	2021	2026	2036
Baseline projection (GWh)	9,236	9,310	9,307	9,419	9,906
Cumulative Savings (GWh)					
Achievable Potential	82	199	328	558	1,027
Economic Potential	214	548	881	1,403	2,367
Technical Potential	283	717	1,171	1,848	2,984
Cumulative Savings as a % of Baseline					
Achievable Potential	0.9%	2.1%	3.5%	5.9%	10.4%
Economic Potential	2.3%	5.9%	9.5%	14.9%	23.9%
Technical Potential	3.1%	7.7%	12.6%	19.6%	30.1%

Figure 5-1 Summary of DSM Potential as % of Baseline Projection (Annual Energy)

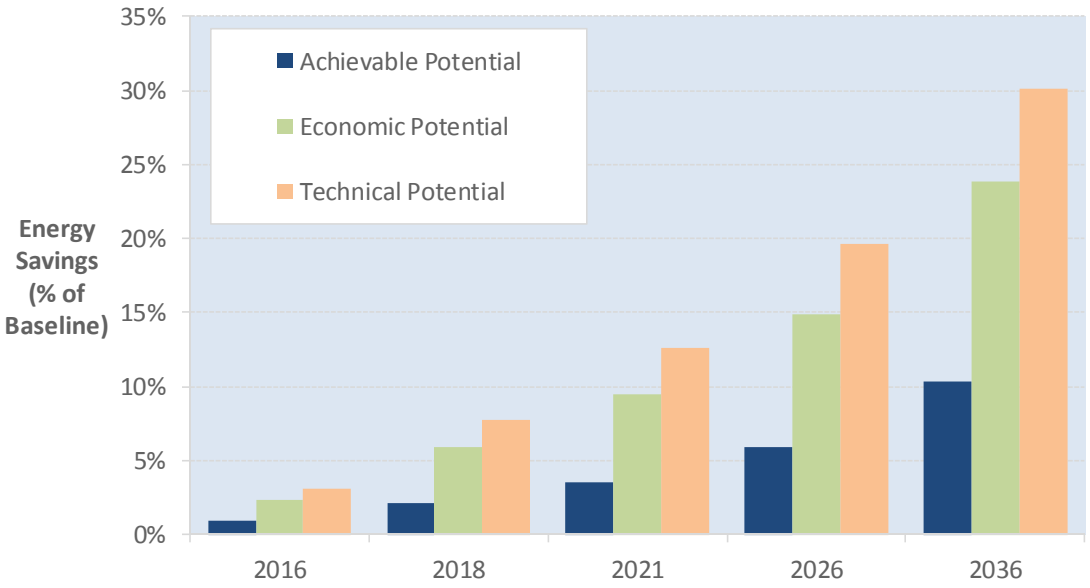
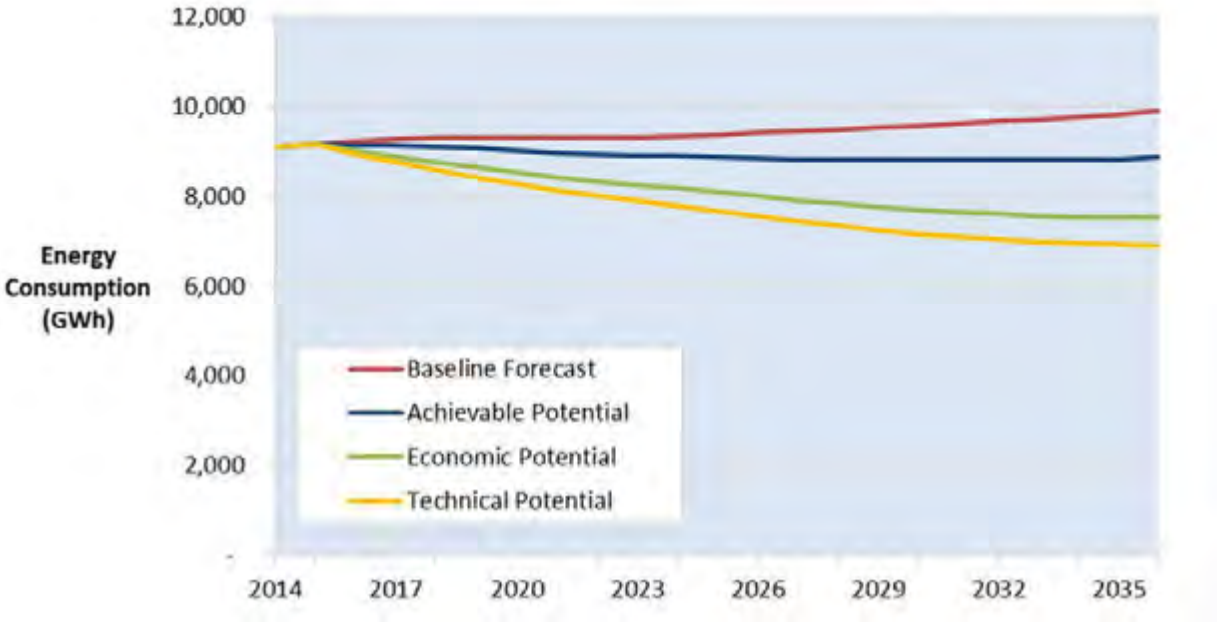


Figure 5-2 Baseline Projection and DSM Forecast Summary (Annual Energy, GWh)



Summary of Summer Peak Demand Savings from EE

Table 5-2 and Figure 5-3 summarize the summer peak demand savings from all EE measures for three levels of potential relative to the baseline projection[13]. Figure 5-4 displays the EE forecasts of summer peak demand.

- **Technical potential** for summer peak demand savings is 226 MW in 2021, or 11.3% of the baseline projection. This increases to 671 MW by 2036, or 31.9% of the summer peak baseline projection.
- **Economic potential** is estimated to be 163 MW or 8.2% reduction in the 2021 summer peak demand baseline projection. In 2036, savings are 525 MW or 24.9% of the summer peak baseline projection.
- **Achievable potential** is 62 MW by 2021, or 3.1% of the baseline projection. By 2036, cumulative savings reach 230 MW, or 10.9% of the baseline projection.

Table 5-2 Summary of DSM Potential (Summer Peak, MW)

	2016	2018	2021	2026	2036
Baseline projection (MW)	**1,975**	**1,982**	**1,989**	**2,014**	**2,104**
Cumulative Savings (MW)					
Achievable Potential	15	35	62	113	230
Economic Potential	37	92	163	284	525
Technical Potential	50	126	226	388	671
Cumulative Savings as a % of Baseline					
Achievable Potential	0.8%	1.7%	3.1%	5.6%	10.9%
Economic Potential	1.9%	4.6%	8.2%	14.1%	24.9%
Technical Potential	2.5%	6.3%	11.3%	19.3%	31.9%

[13] The savings from Demand Response programs are shown in Chapter 7. The demand response analysis was done separately from the Energy Efficiency analysis.

Figure 5-3 Summary of DSM Potential as % of Summer Peak Baseline Projection

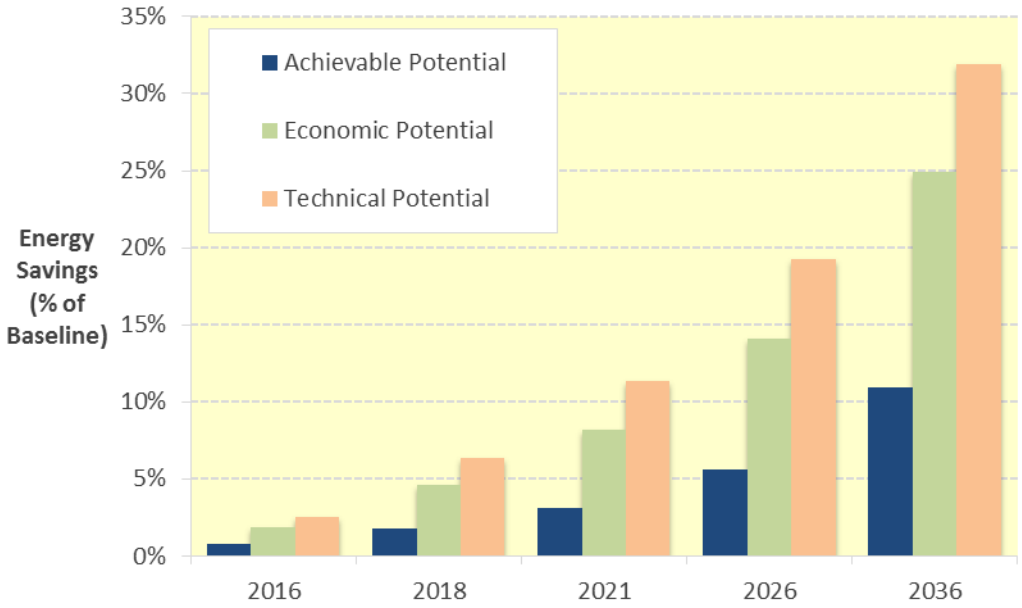
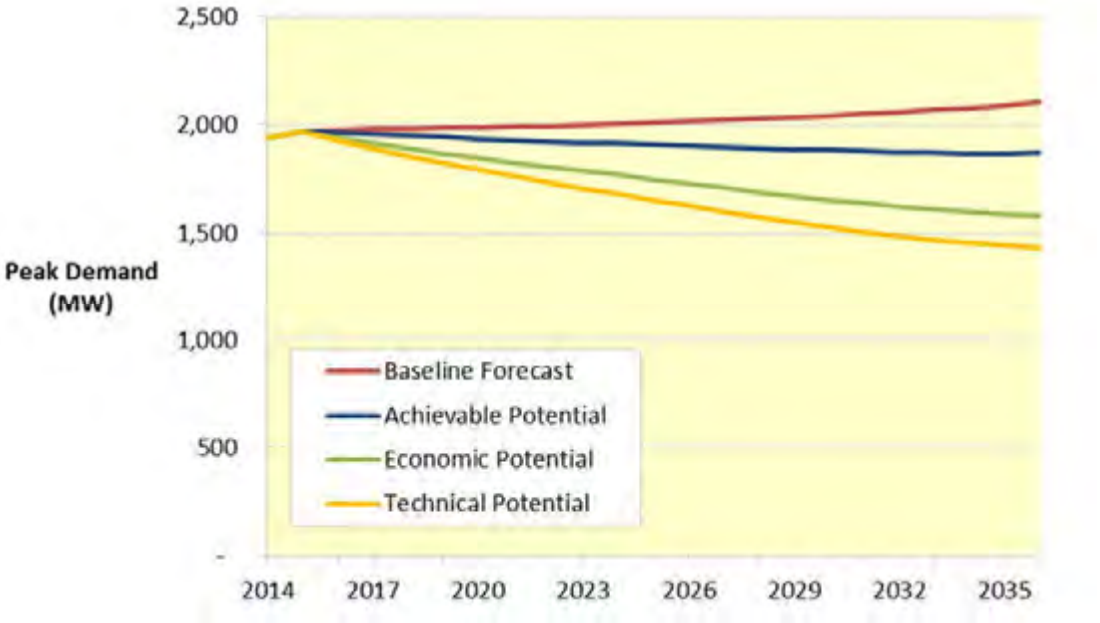


Figure 5-4 Summary of the Summer Peak Baseline Projection and DSM Forecasts (MW)



Summary of DSM Potential by Sector

Table 5-3, Figure 5-5, and Figure 5-6 summarize the range of electric achievable potential by sector. Residential provides the most early energy potential, but Commercial surpasses it after 2021, and has nearly doubled the 20 year potential of Residential. Because the Industrial customers who opt out from DSM programs are typically large consumers of energy, the focus of savings is on smaller industrial customers. For peak demand, Residential provides the most potential reduction throughout the study.

Table 5-3 Achievable DSM Potential by Sector (Annual Use and Summer Peak)

	2016	2018	2021	2026	2036
Cumulative Annual Energy Savings (GWh)					
Residential	51	109	144	203	362
Commercial	26	77	157	300	560
Industrial	5	13	27	55	106
Total	**82**	**199**	**328**	**558**	**1,027**
Cumulative Summer Peak Demand Savings (MW)					
Residential	11	21	34	59	122
Commercial	4	12	25	48	96
Industrial	1	1	3	6	12
Total	**15**	**35**	**62**	**113**	**230**

Figure 5-5 Achievable DSM Potential by Sector (Annual Energy, GWh)

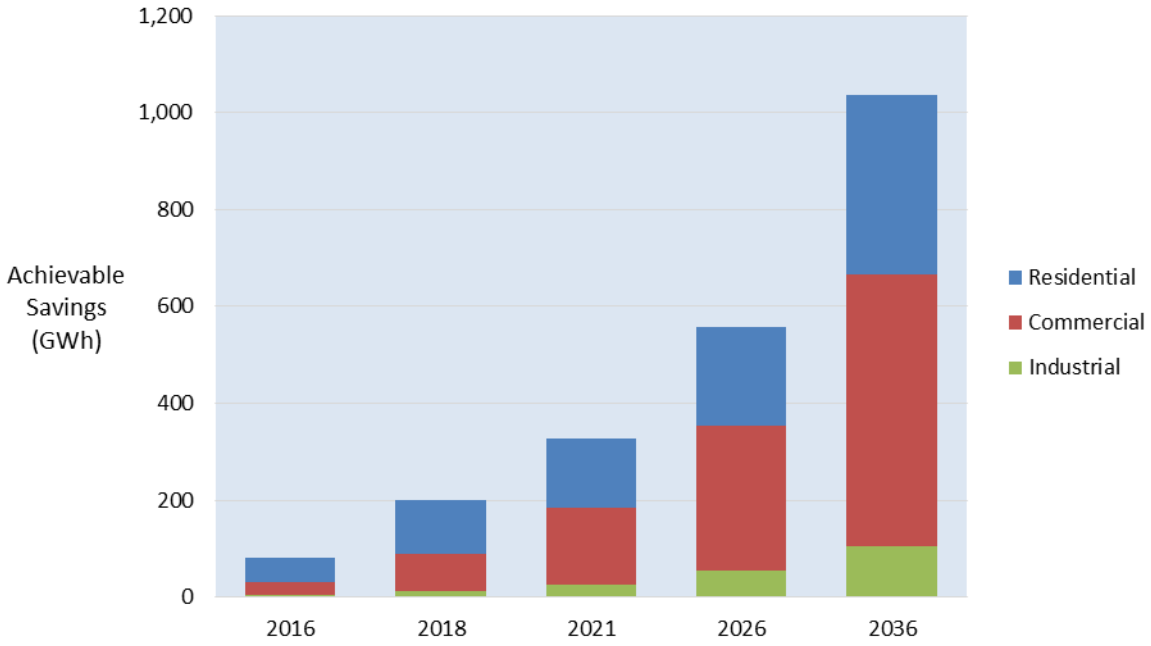
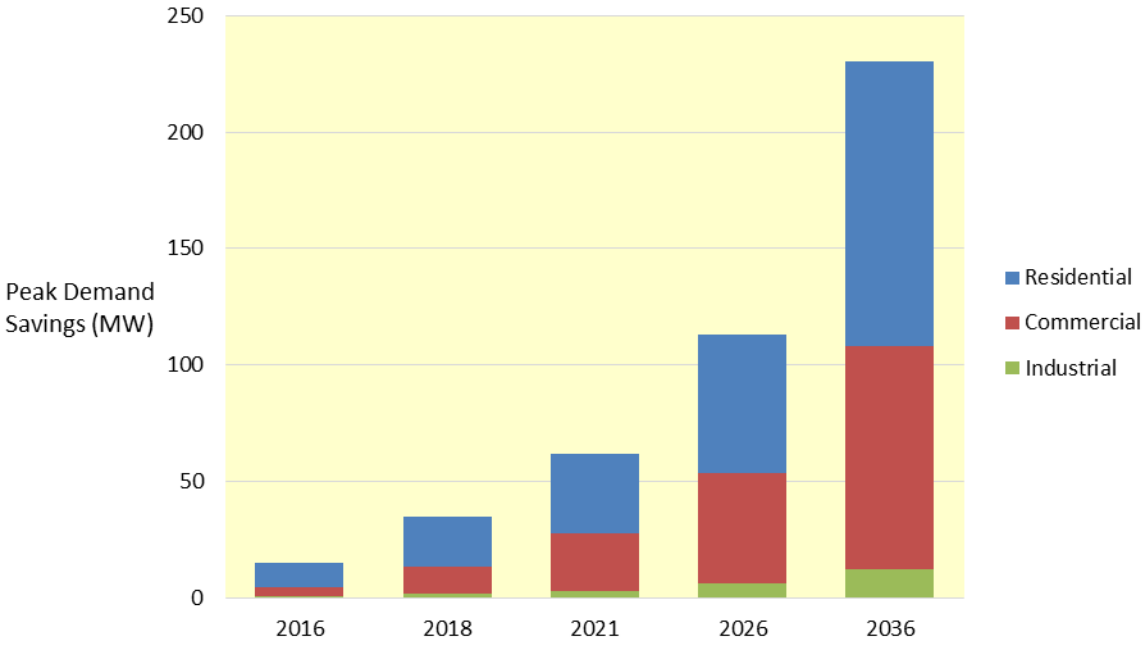


Figure 5-6 Achievable DSM Potential by Sector (Summer Peak Demand, MW)



Residential DSM Potential

Table 5-4 and Figure 5-7 present estimates for measure-level EE potential for the residential sector in terms of annual energy savings. Achievable potential in the first year, 2016 is 51 GWh, or 1.5% of the baseline projection. By 2021, cumulative savings are 144 GWh, or 4.3% of the baseline projection. Achievable potential represents roughly 44% of economic potential.

Table 5-4 Residential DSM Potential (Annual Energy, GWh)

	2016	2018	2021	2026	2036
Baseline projection (GWh)	**3,408**	**3,421**	**3,371**	**3,388**	**3,702**
Cumulative Savings (GWh)					
Achievable Potential	51	109	144	203	362
Economic Potential	119	278	354	461	814
Technical Potential	160	364	491	659	1,074
Cumulative Savings as a % of Baseline					
Achievable Potential	1.5%	3.2%	4.3%	6.0%	9.8%
Economic Potential	3.5%	8.1%	10.5%	13.6%	22.0%
Technical Potential	4.7%	10.6%	14.6%	19.5%	29.0%

Figure 5-7 Residential DSM Savings as a % of the Baseline Projection (Annual Energy)

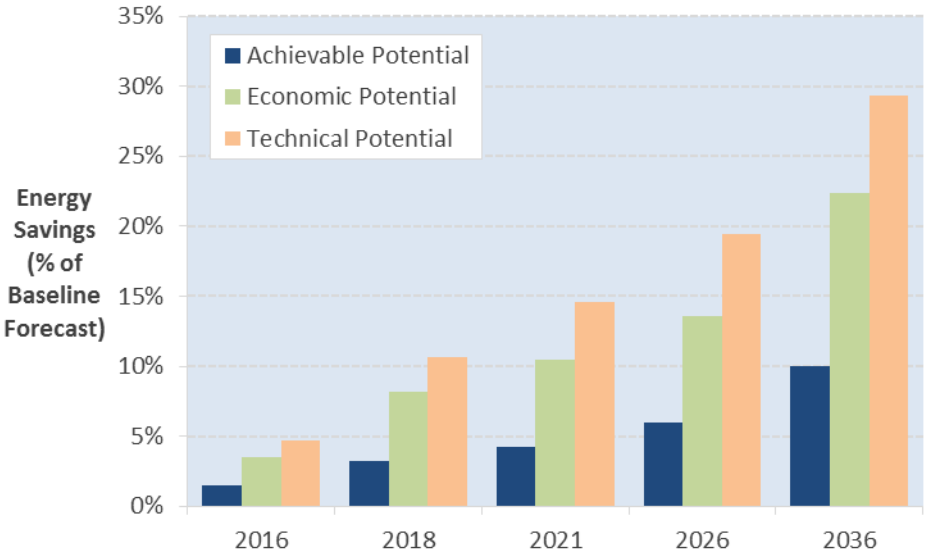
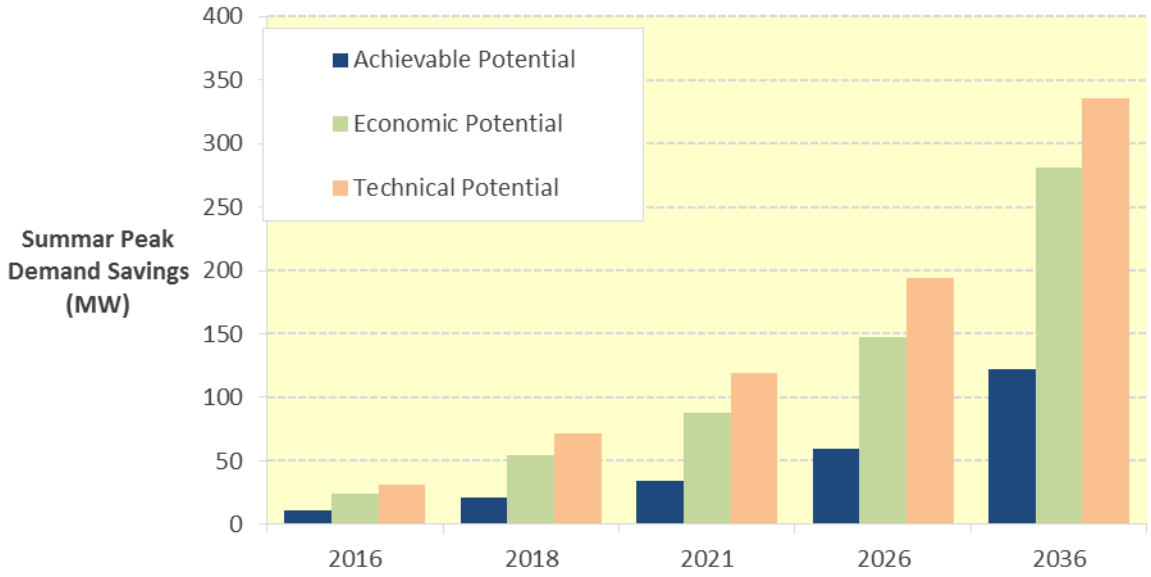


Table 5-5 and Figure 5-8 show residential DSM potential in terms of summer peak savings. In the first year, 2016, summer peak savings are 11 MW, or 1.2% of the baseline summer peak projection. By 2021, cumulative savings are 34 MW, or 3.7% of the baseline summer peak projection.

Table 5-5 Residential DSM Potential (Summer Peak Demand, MW)

	2016	2018	2021	2026	2036
Baseline projection (MW)	**915**	**916**	**918**	**932**	**999**
Cumulative Savings (MW)					
Achievable Potential	11	34	34	59	122
Economic Potential	24	55	88	147	281
Technical Potential	31	71	119	194	335
Cumulative Savings as a % of Baseline					
Achievable Potential	1.2%	2.3%	3.7%	6.3%	12.2%
Economic Potential	2.6%	5.9%	9.6%	15.8%	28.1%
Technical Potential	3.4%	7.8%	12.9%	20.8%	33.6%

Figure 5-8 Residential DSM Savings as a % of Summer Peak Baseline Projection



Below are the top residential measures from the perspective of annual energy use and summer peak demand.

Table 5-6 identifies the top 20 residential measures from the perspective of annual energy savings in 2021. The top measure is interior screw in lighting as a result of purchases of LED lamps, which are cost effective throughout the forecast horizon. NIPSCO's currently running behavioral program is the second highest-achieving measure by 2021.

Table 5-6 Residential Top Measures in 2021 (Annual Energy, GWh)

Rank	Residential Measure	2021 Cumulative Energy Savings (GWh)	% of Total
1	Interior Lighting - Screw-in LEDs	36.5	25.3%
2	Behavioral Programs	22.3	15.5%
3	Interior Lighting – Specialty LEDs	18.1	12.6%
4	Exterior Lighting - Screw-in LEDs	11.5	8.0%
5	Windows - High Efficiency/ENERGY STAR	7.2	5.0%
6	Cooling - Central AC	6.0	4.2%
7	Water Heating – HP Water Heater <= 55 gal	5.8	4.0%
8	Refrigerator - Remove Second Unit	5.4	3.8%
9	Ducting - Repair and Sealing	4.0	2.8%
10	Ceiling Fan - Installation	3.7	2.5%
11	Appliances - Refrigerator	3.6	2.5%
12	Thermostat - Smart / Interactive	3.6	2.5%
13	Appliances - Freezer	2.7	1.8%
14	Heating - Air-Source Heat Pump	1.5	1.0%
15	Room AC - Removal of Second Unit	1.5	1.0%
16	Whole-House Fan - Installation	1.3	0.9%
17	Electronics - Personal Computers	1.2	0.8%
18	Miscellaneous - Dehumidifier	1.0	0.7%
19	Miscellaneous - Furnace Fan	1.0	0.7%
20	Electronics - Laptops	0.8	0.5%
Total	**Total Top 20 Measures**	**138.5**	**96.2%**
	Total All Measures	**144.0**	**100%**

Figure 5-9 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Lighting savings account for a substantial portion of the savings throughout the forecast horizon, but the share declines over time as the market is transformed. The same is true for exterior lighting. Water heater savings increase after 2021 as a result of heat pump water heaters becoming cost effective at that time. Savings from cooling measures and appliances are steadily increasing throughout the forecast horizon.

Figure 5-9 Residential Achievable Savings Forecast (Annual Energy, GWh)

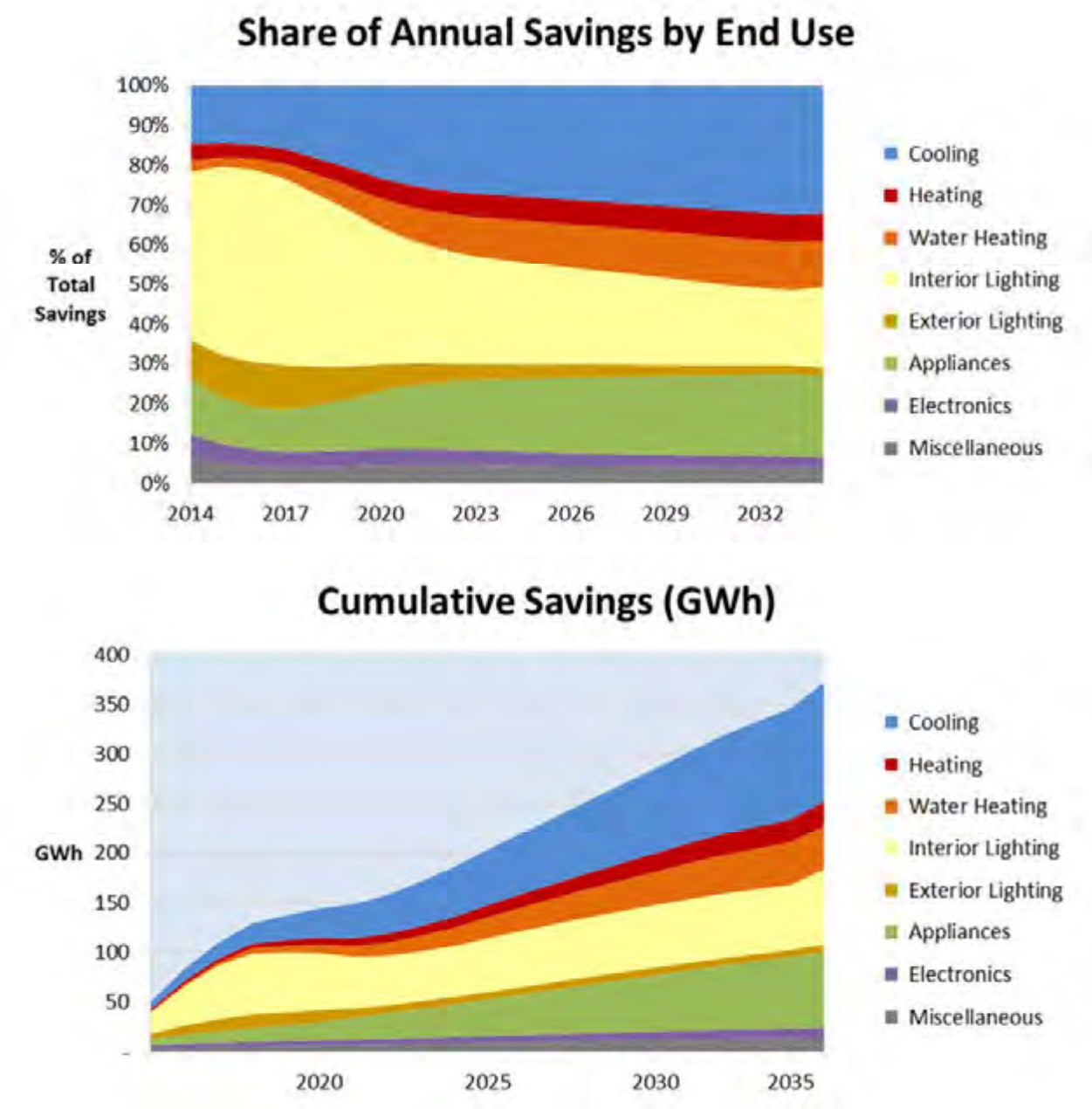
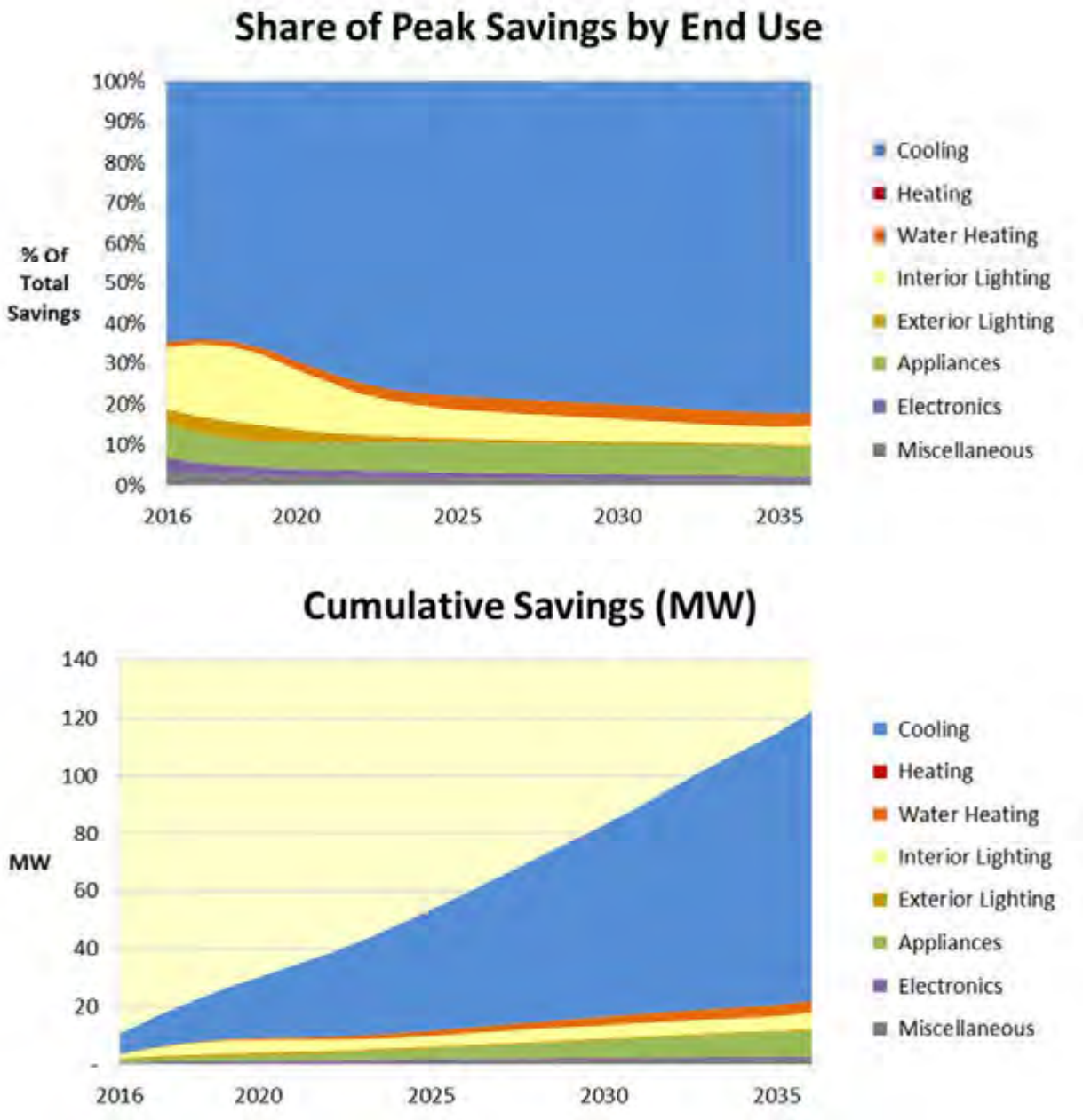


Table 5-7 identifies the top 20 residential measures from the perspective of summer peak savings in 2021. The top measure is central AC replacement, at 21.1% of the savings in 2021. The top 20 measures account for 97.4% of total savings in 2021. Figure 5-10 presents the forecasts of summer peak savings by end use as a percent of total annual savings and cumulative savings. Savings from cooling-related measures dominate throughout the forecast horizon because it is the most peak-coincident end use.

Table 5-7 Residential Top Measures in 2021 (Summer Peak Demand, MW)

Rank	Residential Measure	2021 Cumulative Summer Peak Savings (MW)	% of Total
1	Cooling - Central AC	7.2	21.0%
2	Behavioral Programs	6.1	17.9%
3	Thermostat - Smart / Interactive	5.2	15.3%
4	Ducting - Repair and Sealing	3.5	10.3%
5	Interior Lighting - Screw-in LEDs	2.7	7.9%
6	Whole-House Fan - Installation	1.5	4.4%
7	Interior Lighting – Specialty LEDs	1.3	3.9%
8	Room AC - Removal of Second Unit	1.1	3.3%
9	Exterior Lighting - Screw-in LEDs	0.9	2.5%
10	Refrigerator - Remove Second Unit	0.6	1.8%
11	Cooling - Room AC	0.6	1.8%
12	Water Heating - HP Water Heater <= 55 gal	0.5	1.6%
13	Appliances - Refrigerator	0.4	1.2%
14	Appliances - Freezer	0.3	1.0%
15	Windows - High Efficiency/ENERGY STAR	0.3	0.9%
16	Cooling - Air-Source Heat Pump	0.3	0.9%
17	Insulation - Ducting	0.2	0.5%
18	Insulation - Ceiling	0.1	0.4%
19	Electronics - Personal Computers	0.1	0.4%
20	Miscellaneous - Dehumidifier	0.1	0.3%
Total	**Total Top 20 Measures**	**33.2**	**97.4%**
	Total All Measures	**34.1**	**100%**

Figure 5-10 Residential Achievable Savings Forecast (Summer Peak, MW)



Commercial Sector DSM Potential

Table 5-8 and Figure 5-11 present estimates for the three levels of EE potential for the commercial sector from the perspective of annual energy savings. In 2016, the first year of the projection, achievable potential is 26 GWh, or 0.7% of the baseline projection. By 2021, savings are 157 GWh, or 4.1% of the baseline projection. Throughout the forecast horizon, achievable potential represents about 32%-43% of economic potential.

Table 5-8 DSM Potential for the Commercial Sector (Energy Savings)

	2016	2018	2021	2026	2036
Baseline projection (GWh)	**3,734**	**3,766**	**3,814**	**3,917**	**4,127**
Cumulative Savings (GWh)					
Achievable Potential	26	77	157	300	560
Economic Potential	80	229	446	791	1,290
Technical Potential	99	286	552	961	1,534
Cumulative Savings as a % of Baseline					
Achievable Potential	0.7%	2.0%	4.1%	7.7%	13.6%
Economic Potential	2.1%	6.1%	11.7%	20.2%	31.3%
Technical Potential	2.7%	7.6%	14.5%	24.5%	37.2%

Figure 5-11 Commercial Energy Efficiency Savings (Energy)

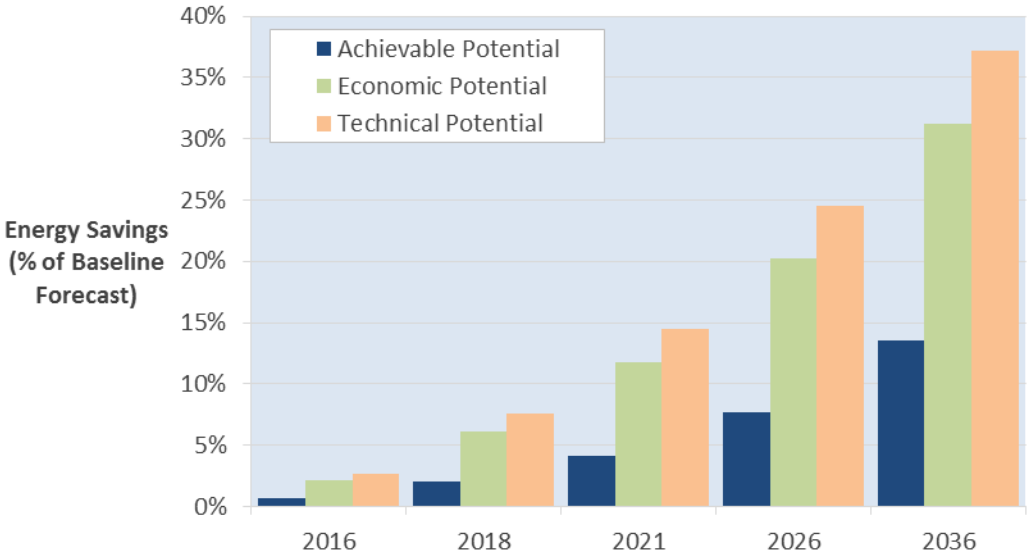
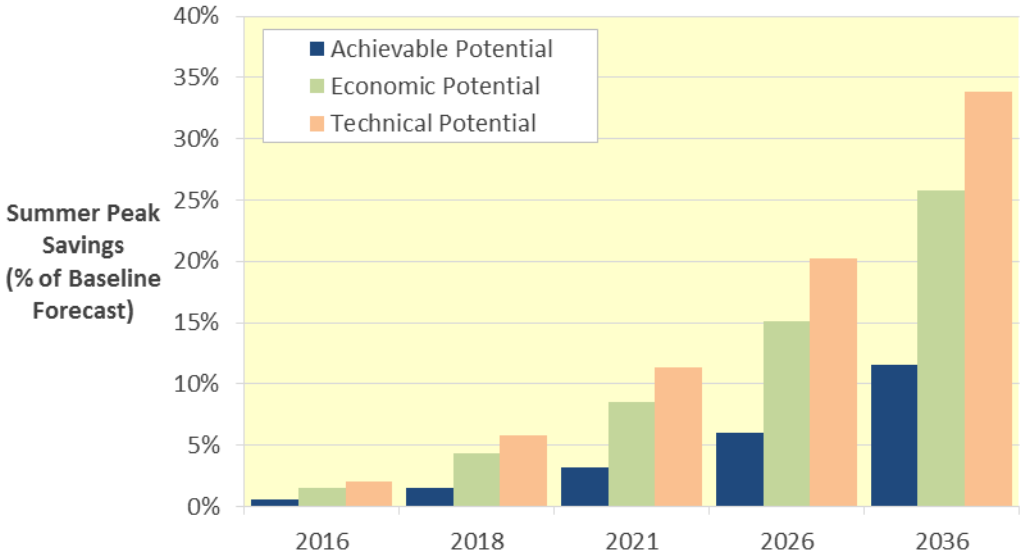


Table 5-9 and Figure 5-12 present savings estimates from the perspective of summer peak demand. These savings reflect energy-efficiency measures and demand-response programs. In 2016, the first year of the projection, achievable potential is 4 MW, or 0.5% of the baseline summer peak projection. By 2021, savings are 25 MW, or 8.5% of the baseline projection.

Table 5-9 DSM Potential for the Commercial Sector (Summer Peak Demand)

	2016	2018	2021	2026	2036
Baseline projection (MW)	**765**	**770**	**778**	**795**	**831**
Cumulative Savings (MW)					
Achievable Potential	4	12	25	48	96
Economic Potential	11	33	66	120	215
Technical Potential	15	44	88	161	281
Cumulative Savings as a % of Baseline					
Achievable Potential	0.5%	1.5%	3.2%	6.0%	11.6%
Economic Potential	1.5%	4.3%	8.5%	15.1%	25.8%
Technical Potential	2.0%	5.8%	11.3%	20.2%	33.8%

Figure 5-12 Commercial DSM Potential (Summer Peak)



Below are the top commercial measures from the perspective of annual energy use and summer peak demand.

Table 5-10 identifies the top 20 commercial-sector measures from the perspective of annual energy savings in 2021. The top measure is interior LED replacements for exterior high-intensity displays, with other lighting measures following close behind.

Figure 5-13 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Lighting savings from interior and exterior applications account for a substantial portion of the savings throughout the forecast horizon. Cooling savings are also substantial throughout the forecast.

Table 5-10 Commercial Sector Top Measures in 2021 (Annual Energy, GWh)

Rank	Commercial Measure	2021 Cumulative Energy Savings (GWh)	% of Total
1	Exterior Lighting – HID LEDs	20.29	12.9%
2	Interior Lighting - Linear LEDs	19.54	12.5%
3	Interior Lighting - Occupancy Sensors	15.09	9.6%
4	Interior Lighting - High-Bay Fixtures LEDs	12.82	8.2%
5	Office Equipment - Desktop Computer	12.74	8.1%
6	Retrocommissioning	10.99	7.0%
7	Interior Lighting - Daylighting Controls	9.15	5.8%
8	Water Heating - Water Heater	8.21	5.2%
9	Interior Lighting - Screw-in LEDs	7.47	4.8%
10	HVAC - Economizer	4.60	2.9%
11	Office Equipment - Server	3.96	2.5%
12	Cooling - Water-Cooled Chiller	3.39	2.2%
13	Cooling - RTU	3.00	1.9%
14	Exterior Lighting - Screw-in LEDs	3.00	1.9%
15	Cooling - Air-Cooled Chiller	1.95	1.2%
16	Office Equipment - Printer/Copier/Fax	1.85	1.2%
17	RTU - Maintenance	1.82	1.2%
18	Ventilation - Ventilation	1.50	1.0%
19	Cooling - Room AC	1.47	0.9%
20	Advanced New Construction Designs	1.41	0.9%
Total	**Total Top 20 Measures**	**144.24**	**92.0%**
	Total All Measures	**156.8**	**100%**

Figure 5-13 Commercial Achievable Savings Forecast (Annual Energy, GWh)

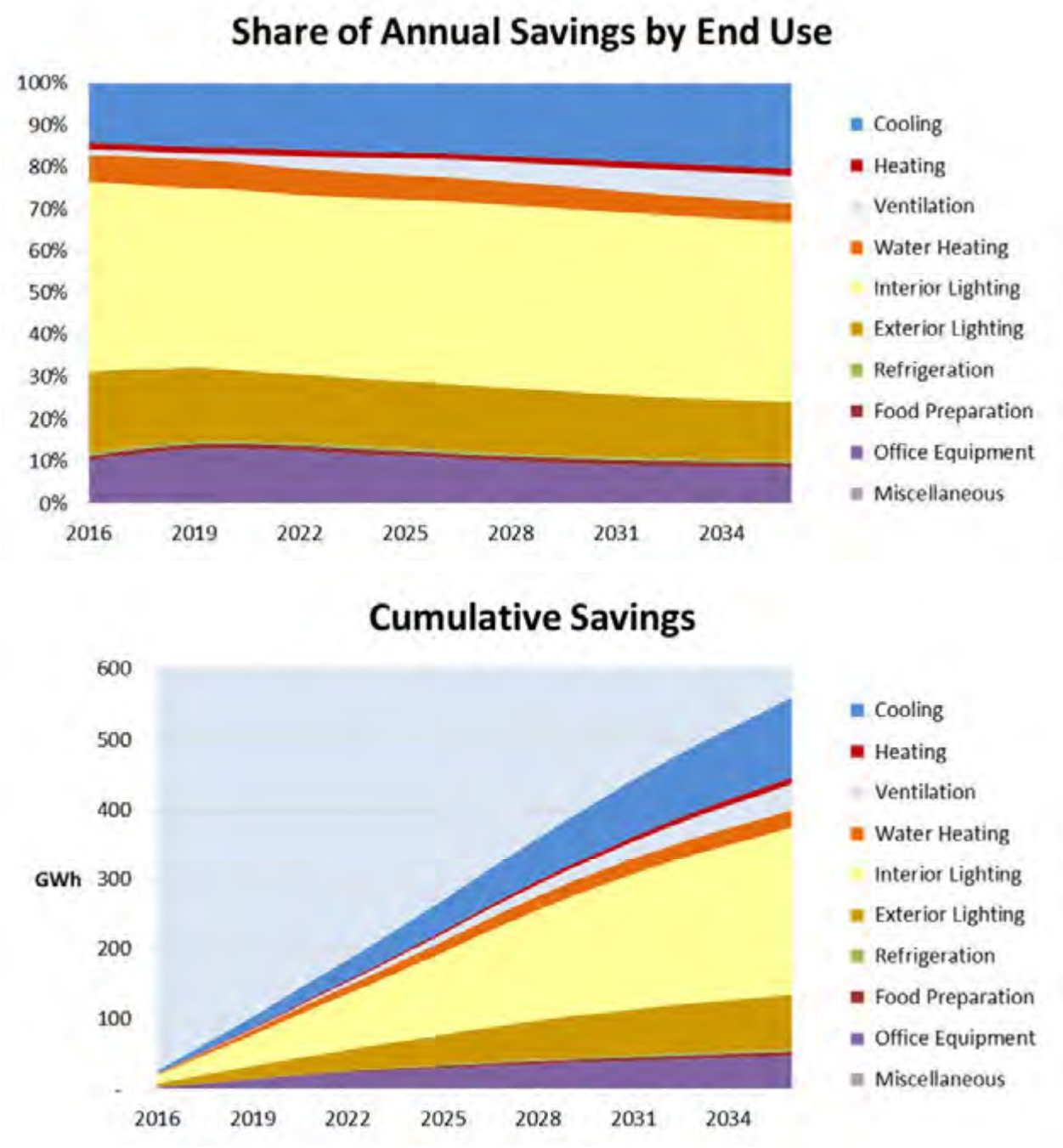


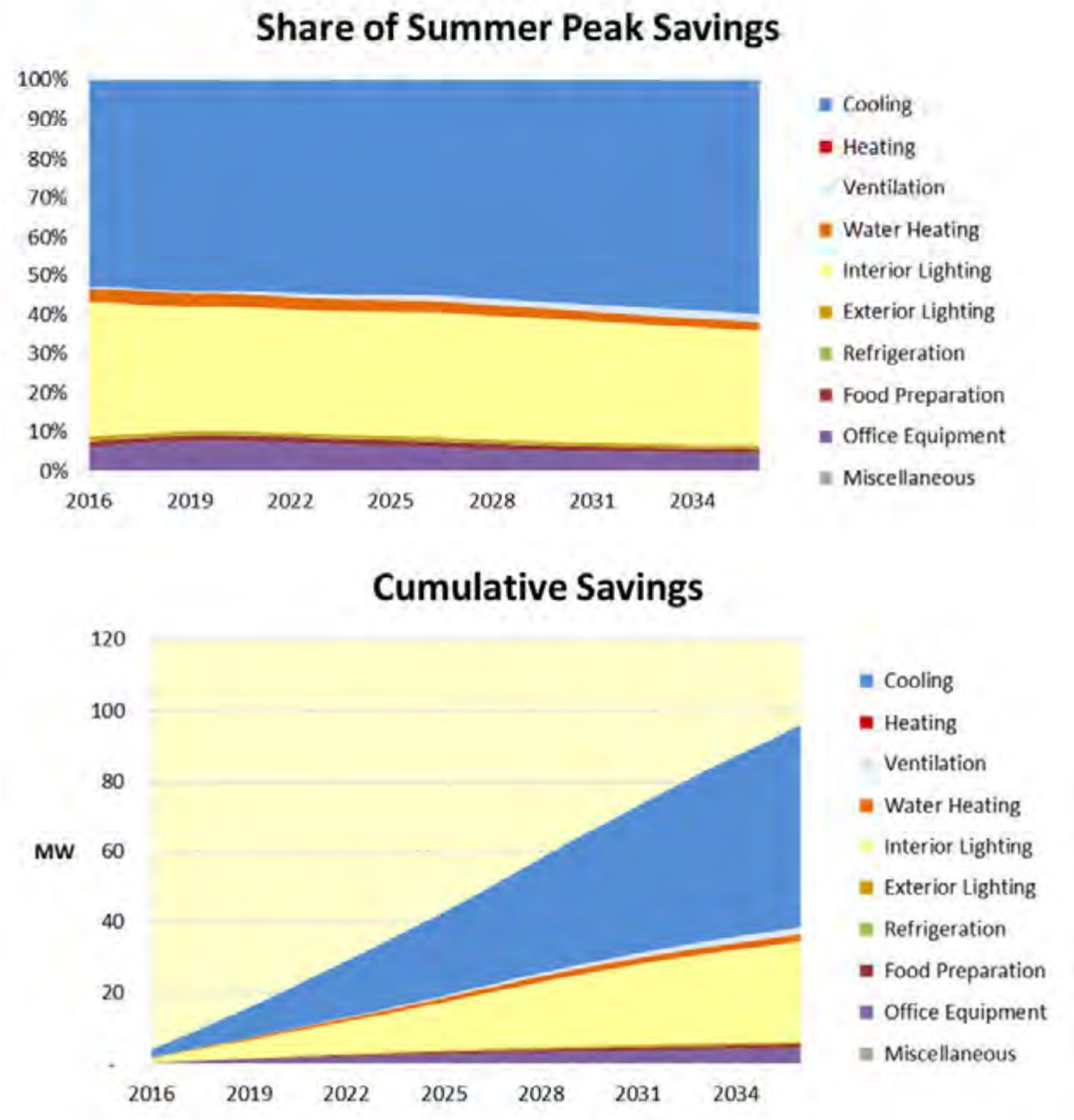
Table 5-11 identifies the top 20 commercial-sector measures from the perspective of summer peak savings in 2021. In 2021, the top peak savings come from optimization of the cooling system through Retrocommissioning and HVAC economizers, with the majority of the rest coming from lighting measures, as lighting use is coincident with the peak hour.

Table 5-11 Commercial Sector Top Measures in 2021 (Summer Peak, MW)

Rank	Commercial Measure	2021 Cumulative Summer Peak Savings (MW)	% of Total
1	Retrocommissioning	3.1	12.6%
2	HVAC - Economizer	2.7	10.9%
3	Interior Lighting - Linear LEDs	2.6	10.6%
4	Cooling - Water-Cooled Chiller	2.0	8.0%
5	Cooling - RTU	1.7	7.1%
6	Interior Lighting - High-Bay LEDs	1.7	7.0%
7	Interior Lighting - Daylighting Controls	1.2	5.0%
8	Office Equipment - Desktop Computer	1.2	4.8%
9	Cooling - Air-Cooled Chiller	1.1	4.6%
10	RTU - Maintenance	1.1	4.3%
11	Interior Lighting - Screw-in LEDs	1.0	4.1%
12	Cooling - Room AC	0.9	3.5%
13	Interior Lighting - Occupancy Sensors	0.8	3.3%
14	Water Heating - Water Heater	0.7	2.7%
15	Office Equipment - Server	0.4	1.5%
16	Insulation - Ceiling	0.3	1.3%
17	Chiller - Chilled Water Reset	0.3	1.1%
18	Insulation - Ducting	0.3	1.1%
19	Office Equipment - Printer/Copier/Fax	0.2	0.7%
20	Food Preparation - Griddle	0.2	0.7%
Total	**Total Top 20 Measures**	**23.2**	**94.7%**
	Total All Measures	**24.5**	**100%**

Figure 5-14 presents forecasts of summer peak savings by end use as a percent of total summer peak savings and cumulative savings. Savings from cooling-related measures dominate throughout the forecast horizon.

Figure 5-14 Commercial Sector Achievable Savings Forecast (Summer Peak, MW)



Industrial Potential

Table 5-12 and Figure 5-15 present potential estimates at the measure level for the industrial sector, from the perspective of annual energy savings. With the opt-out customers removed, the savings for the industrial customers are closely aligned with the commercial sector. As a percent of the baseline projection, industrial savings are the lowest as a result of stringent motor standards and the challenges of identifying additional opportunities to reduce process energy use.

Savings in the first year, 2016 are 5 GWh, or 0.2% of the baseline projection. In 2021, savings reach 27 GWh, or 1.3% of the baseline projection.

Table 5-12 DSM Potential for the Industrial Sector (Annual Energy, GWh)

	2016	2018	2021	2026	2036
Baseline projection (GWh)	**2,094**	**2,123**	**2,122**	**2,114**	**2,076**
Cumulative Savings (GWh)					
Achievable Potential	5	13	27	55	106
Economic Potential	15	41	81	151	262
Technical Potential	24	67	128	228	376
Cumulative Savings as a % of Baseline					
Achievable Potential	0.2%	0.6%	1.3%	2.6%	5.1%
Economic Potential	0.7%	1.9%	3.8%	7.2%	12.6%
Technical Potential	1.1%	3.2%	6.0%	10.8%	18.1%

Figure 5-15 Industrial DSM Potential as a % of the Baseline Projection (Annual Energy)

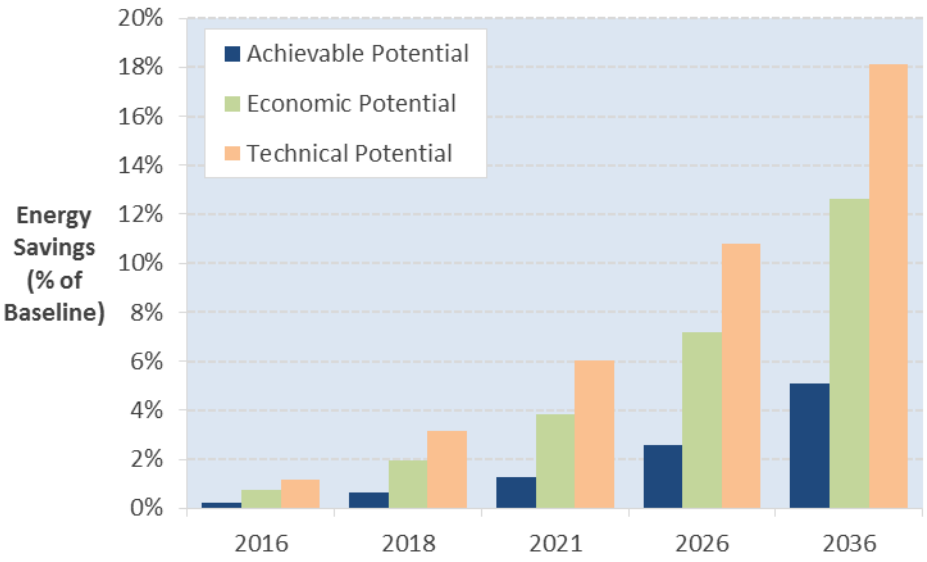
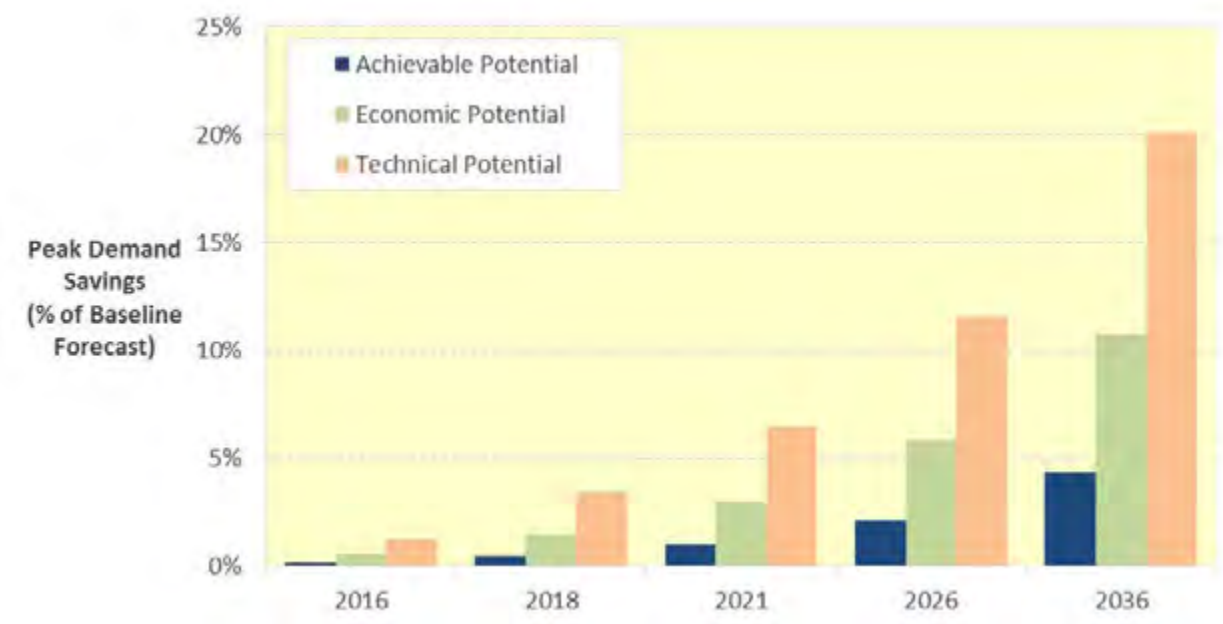


Table 5-13 and Figure 5-16 present potential estimates from the perspective of summer peak savings. In 2016, the first year of the potential forecast, achievable savings are 0.5 MW, or 0.2% of the baseline projection. By 2021, savings have increased to 3 MW, or 1.0% of the baseline summer peak projection.

Table 5-13 DSM Potential for the Industrial Sector (Summer Peak, MW)

	2016	2018	2021	2026	2036
Baseline projection (MW)	**294**	**296**	**293**	**287**	**275**
Cumulative Savings (MW)					
Achievable Potential	0.5	1	3	6	12
Economic Potential	2	4	9	17	30
Technical Potential	4	10	19	33	55
Cumulative Savings as a % of Baseline					
Achievable Potential	0.2%	0.5%	1.0%	2.1%	4.3%
Economic Potential	0.6%	1.5%	3.0%	5.8%	10.8%
Technical Potential	1.2%	3.4%	6.5%	11.6%	20.1%

Figure 5-16 Industrial Energy Efficiency Savings (Peak Demand)



Below are the top industrial measures from the perspective of annual energy use and summer peak demand.

Table 5-14 identifies the top 20 industrial measures from the perspective of annual energy savings in 2021. The top measure is interior LED replacements for high-bay fixtures. The next two measures in ranking are optimization measures focused on pumping and fan systems.

Table 5-14 Industrial Sector Top Measures in 2021 (Annual Energy, GWh)

Rank	Industrial Measure	2021 Cumulative Energy Savings (GWh)	% of Total
1	Interior Lighting - High-Bay LEDs	7.9	29.2%
2	Pumping System - Optimization	3.3	12.3%
3	Fan System - Optimization	3.2	11.7%
4	Exterior Lighting – HID LEDs	2.3	8.6%
5	Compressed Air - Air Usage Reduction	1.4	5.2%
6	Motors - Variable Frequency Drive (Pumps)	1.3	4.9%
7	Interior Lighting - Linear LEDs	1.1	3.9%
8	Compressed Air - Compressor Replacement	1.0	3.6%
9	Interior Lighting - Screw-in LEDs	1.0	3.6%
10	Retrocommissioning	0.7	2.5%
11	Cooling - RTU	0.5	1.9%
12	Cooling - Water-Cooled Chiller	0.5	1.9%
13	Cooling - Air-Cooled Chiller	0.3	1.2%
14	Transformer - High Efficiency	0.3	1.1%
15	Exterior Lighting - Linear LEDs	0.3	1.1%
16	Cooling - Room AC	0.3	1.1%
17	Insulation - Ceiling	0.2	0.9%
18	Interior Lighting - Occupancy Sensors	0.2	0.7%
19	Fan System - Maintenance	0.2	0.6%
20	Pumping System - Maintenance	0.2	0.6%
Total	**Total Top 20 Measures**	**26.0**	**96.6%**
	Total All Measures	**27.0**	**100%**

Figure 5-17 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Motor-related measures account for a substantial portion of the savings throughout the forecast horizon. Savings associated with lighting measures are also substantial throughout the forecast.

Figure 5-17 Industrial Achievable Savings Forecast (Annual Energy, GWh)

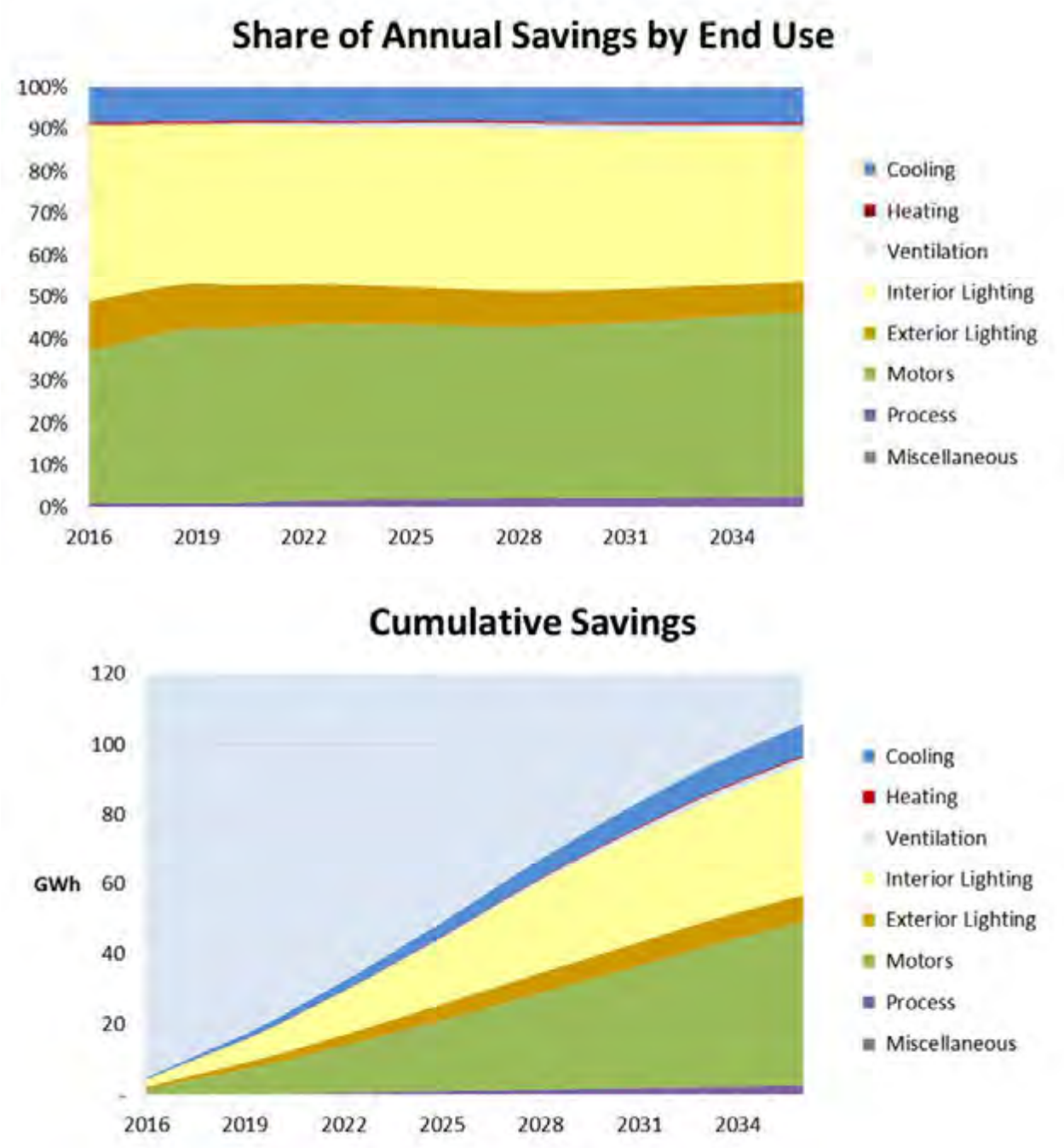


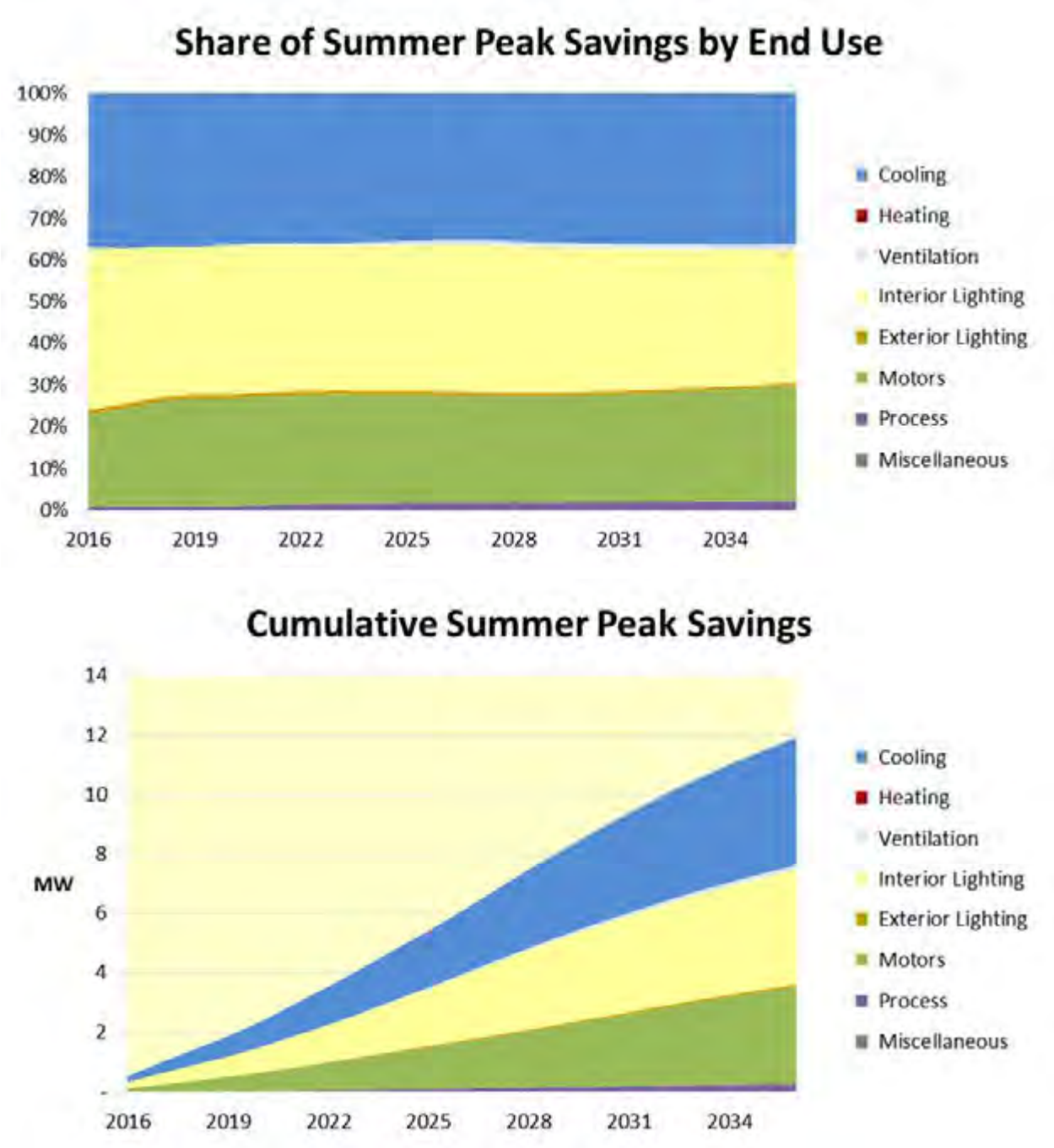
Table 5-15 identifies the top 20 industrial measures from the perspective of summer peak savings in 2021. The top measure, 27% of the summer peak savings, is the same as the highest energy saving measure - LED replacement of high-bay lighting, since use is coincident with the system peak hour.

Table 5-15 Industrial Top Measures in 2021 (Summer Peak Demand, MW)

Rank	Industrial Measure	2021 Cumulative Summer Peak Savings (MW)	% of Total
1	Interior Lighting - High-Bay LEDs	0.81	27.4%
2	Pumping System - Optimization	0.25	8.4%
3	Cooling - RTU	0.25	8.4%
4	Cooling - Water-Cooled Chiller	0.24	8.2%
5	Fan System - Optimization	0.24	8.0%
6	Cooling - Air-Cooled Chiller	0.15	5.2%
7	Compressed Air - Air Usage Reduction	0.14	4.7%
8	Cooling - Room AC	0.14	4.7%
9	Insulation - Ceiling	0.12	4.1%
10	Interior Lighting - Linear LEDs	0.11	3.7%
11	Interior Lighting - Screw-in LEDs	0.10	3.3%
12	Retrocommissioning	0.07	2.3%
13	Chiller - VSD on Fans	0.05	1.9%
14	Transformer - High Efficiency	0.04	1.5%
15	Compressed Air - Compressor Replacement	0.03	1.1%
16	Chiller - Chilled Water Reset	0.03	1.0%
17	Cooling - Geothermal Heat Pump	0.03	1.0%
18	Motors - Variable Frequency Drive (Pumps)	0.03	0.9%
19	Exterior Lighting – HID LEDs	0.02	0.7%
20	Interior Lighting - Occupancy Sensors	0.02	0.6%
Total	**Total Top 20 Measures**	**2.86**	**97.1%**
	Total All Measures	**2.95**	**100%**

Figure 5-18 presents forecasts of summer peak savings by end use as a percent of total summer peak savings and cumulative savings. Cooling, lighting, motors and process all contribute to the savings throughout the forecast horizon.

Figure 5-18 Industrial Achievable Savings Forecast (Summer Peak, MW)



SECTION | 6

Program Potential

Program potential is defined as the portion of the achievable potential that might be reasonably attained given constraints of resources. It consists of the subset of the measure-level potential that is aligned with near-term implementation accomplishments and the available budget. To develop program potential, MMP used program design, incentive structures, net-to-gross factors, marketing approaches, budgets, historic field experience, and staff resources to refine the key assumptions in achievable potential and participation rates to a final level that can be accomplished given the realities of the utility operations and program delivery and to reflect the ramp-up time for new initiatives. MMP made these adjustments based on actual historic program experience and budgets.

Using refined, projected costs for incentives and program delivery, net-to-gross factors, plus the adjusted participation rates of the program potential, cost-benefit analysis was completed to determine if the program was cost effective from a Total Resource Cost Test perspective for NIPSCO. To complete this analysis, the cost effectiveness model DSMore was utilized.

The DSMore tool is an award-winning modeling software that is nationally recognized and used in many states across the country to determine cost-effectiveness. Developed and licensed by Integral Analytics, based in Cincinnati Ohio, the DSMore cost-effectiveness modeling tool takes hourly prices and hourly energy savings from the specific measures/technologies being considered for the DSM program, and then correlates both to weather. This tool looks at over 30 years of historic weather variability to get the full weather variances appropriately modeled. In turn, this allows the model to capture the low probability, but high consequence weather events and apply appropriate value to them. Thus, a more accurate view of the value of the DSM measure can be captured in comparison to other alternative supply options. Inputs into the model include participation rates, incentives paid, energy and demand savings of the measure, life of the measure, net-to-gross factors, implementation costs, administrative costs, and incremental measure costs to the participant.

To be consistent with other NIPSCO planning efforts, DSMore utilizes NIPSCO provided utility rates; escalation rates; discount rates for the utility, society and the participant; and avoided costs. The model also produces specific measure energy savings by hour. These hourly savings are then provided to NIPSCO for use within its Integrated Resource Plan models.

Table 6-1 below lists the distinct program groupings that emerged from this exercise to deliver an effective and balanced portfolio of energy and peak demand savings opportunities across all customer segments.

Table 6-1 Portfolio of DSM Program Groupings Included in Program Potential

Residential Program Groupings	Commercial Program Groupings	Industrial Program Groupings
Res Appliances	Com Cooling	Ind Cooling
Res Cooling	Com Exterior Lighting	Ind Exterior Lighting
Res Electric Heating	Com Electric Food Prep	Ind Interior Lighting
Res Electric Miscellaneous	Com Electric Heating	Ind Motors
Res Electric Water Heat	Com Interior Lighting	Ind Heating
Res Exterior Lighting	Com Elec Miscellaneous	
Res Interior Lighting	Com Office Equipment	
	Com Refrigeration	
	Com Ventilation	
	Com Electric Water Heat	

Portfolio Budgets and Impacts

Figure 6-1 and Figure 6-2 show the annual portfolio budget allocations by program grouping and by budget category, respectively. The portfolio begins in the near term at about $20 million per year in annual spending and increases to $62 million in 2036. Costs and participation/savings drop in 2020 due to changes in the Federal standards for lighting.

Table 6-2 details the budgets for each program grouping for every year of the study. Approximately 53% of the total budget is for "Incentives", however, another 16% is in the "Other" category. The "Other" category includes items such as the low income measures which are paid by the utility but not classified as an incentive according to the California Standard Practice Manual formulas for the TRC test. "Other" also includes some additional implementation costs for some measures with very low incremental costs to cover the cost of including them in the portfolio. Administrative costs include NIPSCO staffing costs, planning and consulting costs and evaluation, measurement and verification costs, which represents 8% of the total costs. Implementation costs equal 23% of the total cost. These figures are in line with historic program costs.

Figure 6-1 Utility Costs by Program ($ million)

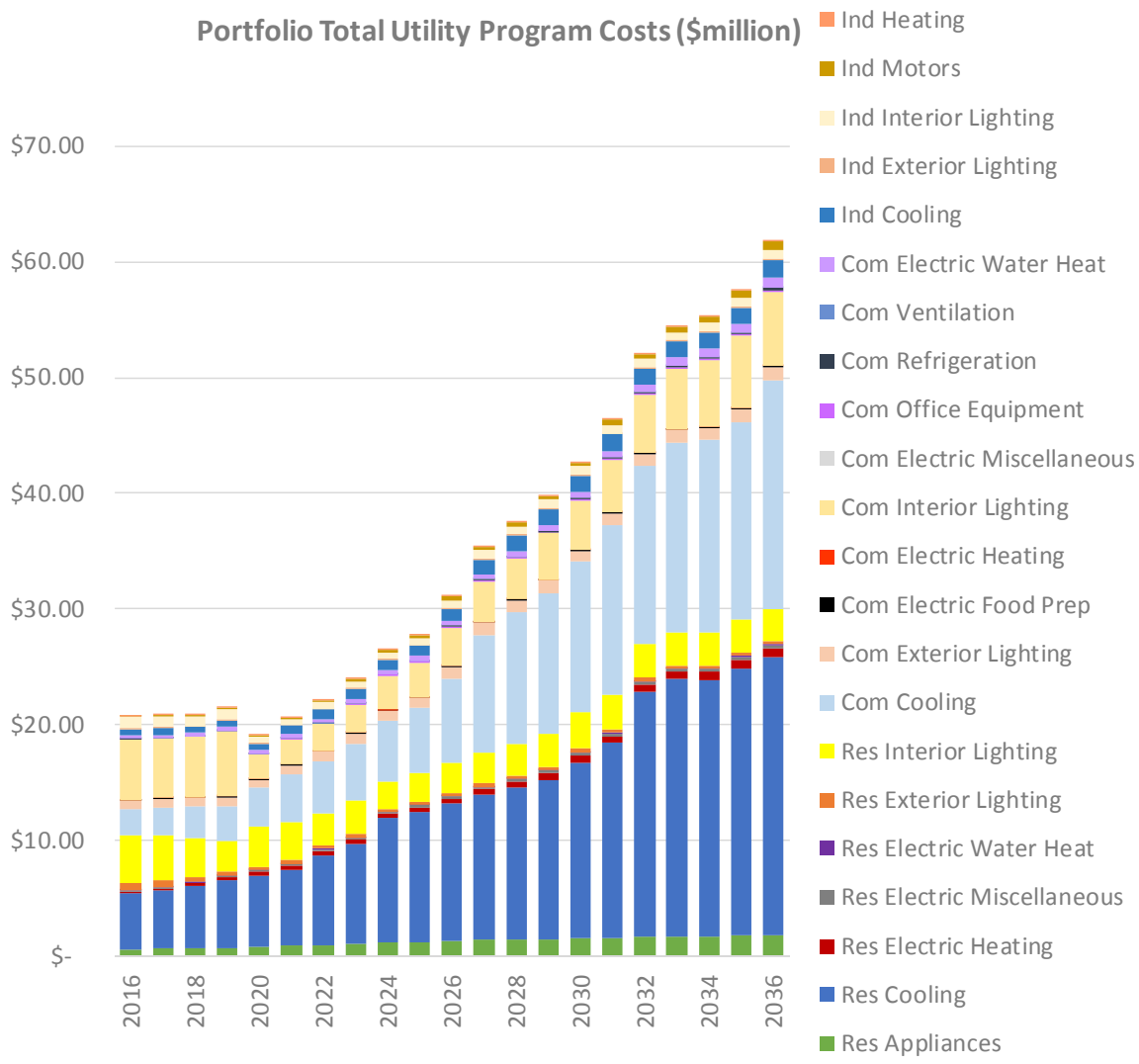


Figure 6-2 Utility Costs by Budget Category

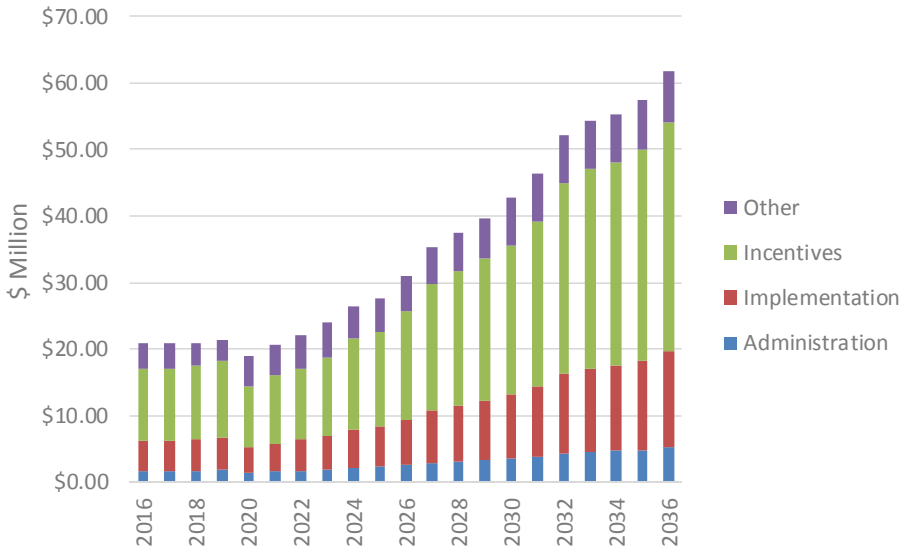
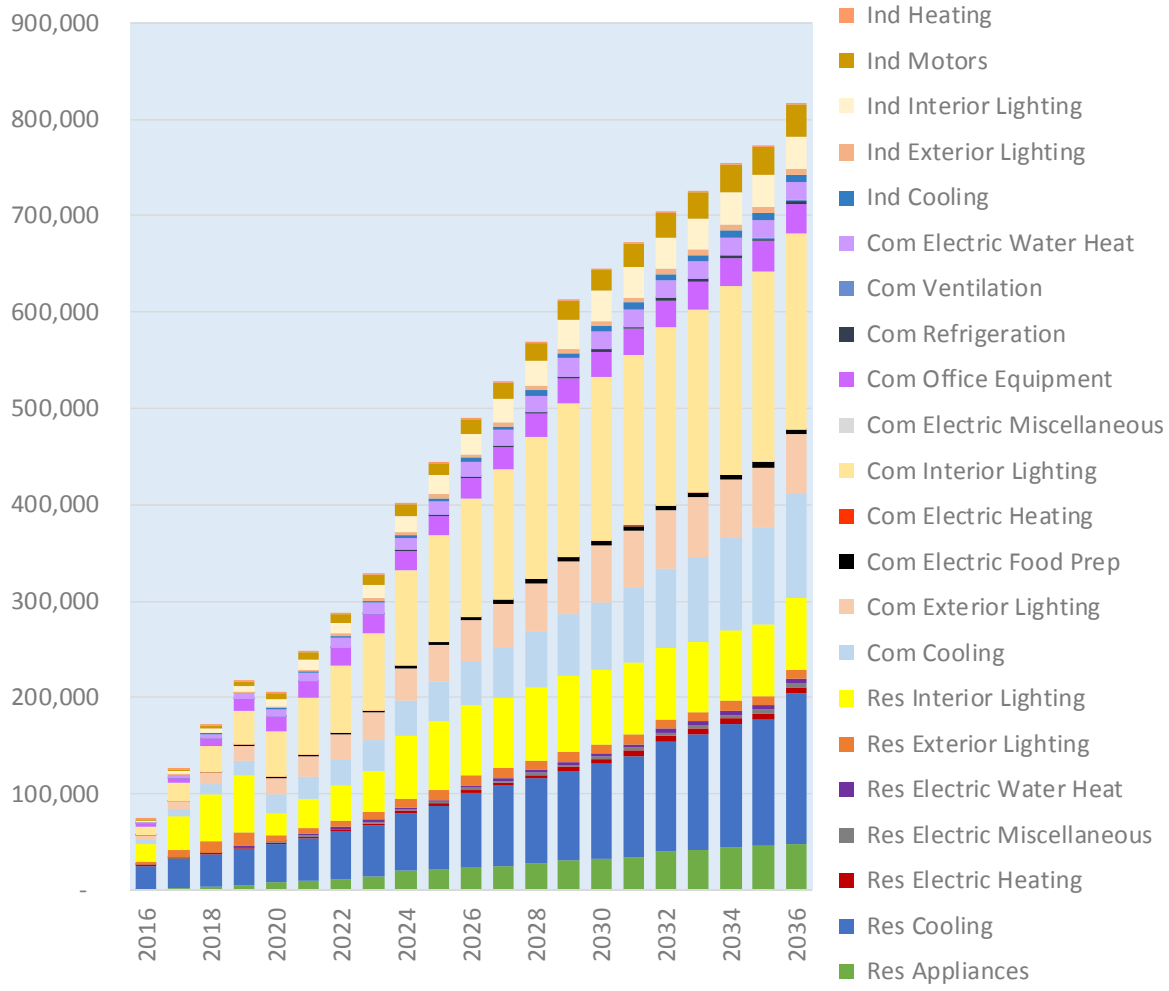


Figure 6-3 shows the net cumulative energy savings in each year of the Program Potential by program.

Figure 6-3 Net Cumulative Energy Savings by Program (MWh)



Error! Not a valid bookmark self-reference. presents the net cumulative peak demand savings in each year. Please note that all savings are provided at the power plant, which include line losses and given in terms of net savings.

Figure 6-4 Net Cumulative Summer Peak Demand Savings by Program (MW)

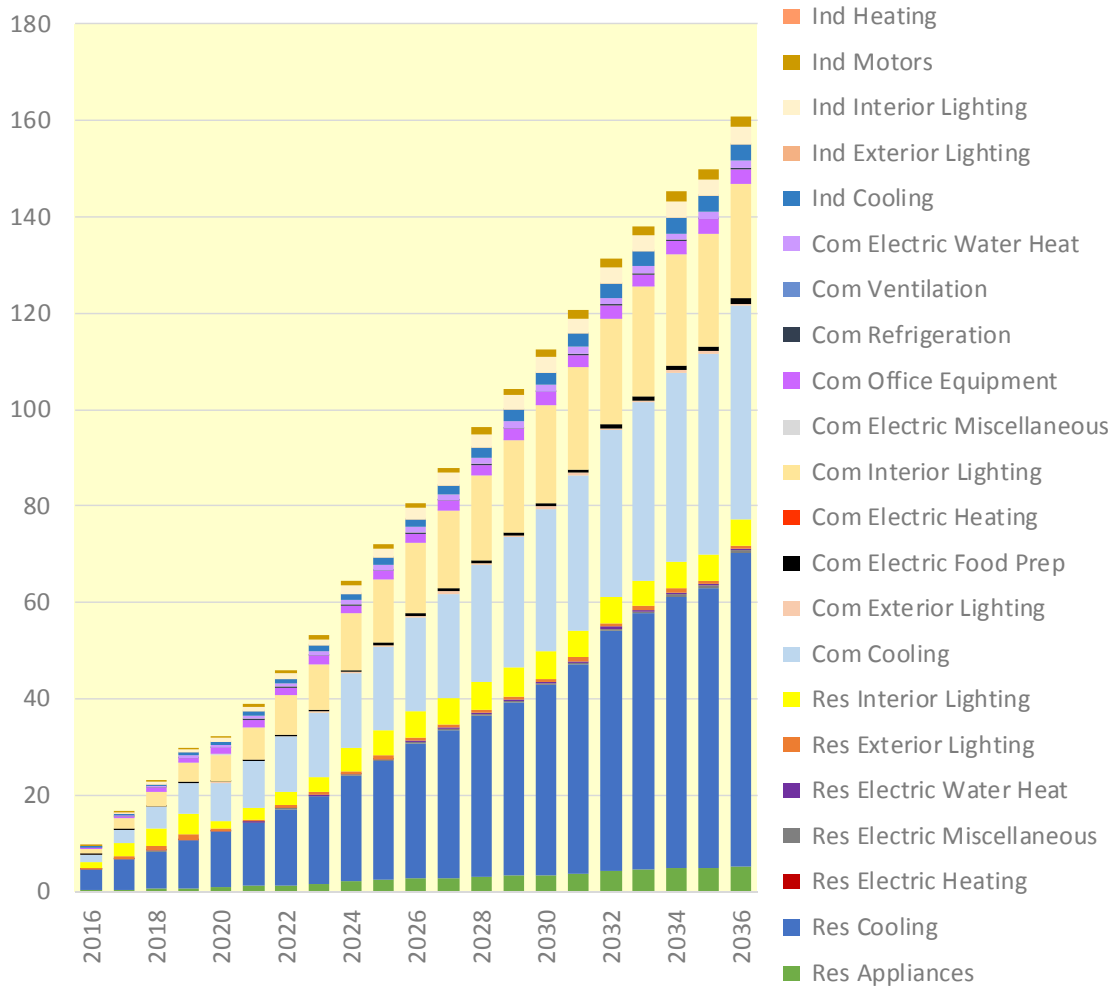


Table 6-2 shows the program costs by year for the study period. Table 6-3 and 6-4 shows the energy savings and demand savings by program by year for the study period.

Table 6-2 Utility Costs by Program ($ million)

Program	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Res Appliances	$0.7	$0.7	$0.7	$0.8	$0.8	$1.0	$1.1	$1.1	$1.2	$1.3	$1.4	$1.4	$1.5	$1.5	$1.6	$1.6	$1.8	$1.8	$1.8	$1.8	$1.9
Res Cooling	$4.8	$5.0	$5.3	$5.8	$6.2	$6.6	$7.7	$8.6	$10.7	$11.2	$11.9	$12.5	$13.1	$13.8	$15.2	$16.8	$21.1	$22.1	$22.1	$23.1	$24.0
Res Electric Heating	$0.2	$0.2	$0.2	$0.3	$0.3	$0.3	$0.3	$0.4	$0.4	$0.4	$0.5	$0.5	$0.5	$0.6	$0.6	$0.6	$0.6	$0.6	$0.7	$0.7	$0.7
Res Electric Miscellaneous	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.3	$0.3	$0.3	$0.3
Res Electric Water Heat	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1	$0.0	$0.0	$0.0
Res Exterior Lighting	$0.6	$0.6	$0.5	$0.4	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Res Interior Lighting	$4.2	$3.9	$3.3	$2.7	$3.4	$3.3	$2.8	$3.0	$2.3	$2.5	$2.6	$2.6	$2.7	$2.8	$3.2	$3.1	$2.9	$2.8	$2.8	$2.8	$2.8
Com Cooling	$2.2	$2.3	$2.8	$3.0	$3.4	$4.1	$4.5	$4.9	$5.3	$5.6	$7.3	$10.2	$11.4	$12.2	$12.9	$14.6	$15.4	$16.4	$16.6	$17.1	$19.7
Com Exterior Lighting	$0.7	$0.8	$0.7	$0.8	$0.7	$0.7	$0.8	$0.8	$0.8	$0.8	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0	$1.1	$1.1	$1.1
Com Electric Food Prep	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Com Electric Heating	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Com Interior Lighting	$5.3	$5.1	$5.2	$5.6	$2.1	$2.2	$2.3	$2.4	$2.9	$3.0	$3.3	$3.5	$3.5	$4.0	$4.3	$4.5	$5.0	$5.2	$5.7	$6.2	$6.4
Com Electric Miscellaneous	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Com Office Equipment	$0.0	$0.0	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Com Refrigeration	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Com Ventilation	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Com Electric Water Heat	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.4	$0.4	$0.4	$0.5	$0.5	$0.5	$0.5	$0.5	$0.6	$0.6	$0.7	$0.7	$0.7	$0.9
Ind Cooling	$0.6	$0.6	$0.5	$0.6	$0.6	$0.7	$0.8	$0.9	$0.9	$0.9	$1.0	$1.2	$1.4	$1.4	$1.4	$1.4	$1.4	$1.4	$1.4	$1.4	$1.6
Ind Exterior Lighting	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Ind Interior Lighting	$1.0	$0.9	$0.9	$0.9	$0.5	$0.5	$0.5	$0.6	$0.6	$0.6	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.7	$0.8
Ind Motors	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.2	$0.2	$0.2	$0.2	$0.3	$0.3	$0.3	$0.3	$0.3	$0.5	$0.5	$0.5	$0.6	$0.6	$0.8
Ind Heating	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Residential Total	$10.5	$10.5	$10.2	$10.0	$11.2	$11.6	$12.4	$13.5	$15.1	$15.9	$16.8	$17.6	$18.3	$19.2	$21.1	$22.7	$27.0	$28.0	$28.0	$29.1	$30.1
Commercial Total	$8.6	$8.6	$9.1	$9.8	$6.6	$7.6	$8.1	$8.7	$9.7	$10.0	$12.3	$15.5	$16.7	$18.1	$19.0	$21.0	$22.4	$23.7	$24.5	$25.5	$28.5
Industrial Total	$1.7	$1.7	$1.5	$1.6	$1.2	$1.5	$1.6	$1.7	$1.7	$1.7	$2.0	$2.3	$2.5	$2.5	$2.5	$2.7	$2.7	$2.7	$2.8	$2.9	$3.2
PORTFOLIO TOTAL	$20.8	$20.8	$20.9	$21.4	$19.1	$20.7	$22.1	$24.0	$26.5	$27.7	$31.1	$35.3	$37.5	$39.8	$42.7	$46.4	$52.1	$54.4	$55.3	$57.5	$61.8

Table 6-3 Net Cumulative Energy Savings by Program (MWh)

Program	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Res Appliances	1,396	2,836	4,335	5,892	7,604	9,608	11,700	13,880	20,187	22,058	23,996	25,675	28,030	31,062	32,549	34,000	40,390	41,736	45,220	46,287	48,233
Res Cooling	24,364	29,988	33,046	37,313	40,764	44,295	49,117	53,823	59,740	65,355	77,417	82,219	87,751	92,768	98,702	105,751	114,237	120,221	127,318	131,408	156,084
Res Electric Heating	176	376	597	835	1,089	1,353	1,627	1,911	2,204	2,505	2,830	3,177	3,545	3,933	4,306	4,680	5,058	5,440	5,654	5,853	6,039
Res Electric Miscellaneous	157	325	504	694	893	1,099	1,307	1,520	1,741	1,971	2,344	2,576	2,695	2,814	2,942	3,068	3,191	3,363	3,567	3,734	4,035
Res Electric Water Heat	201	407	617	828	1,041	1,657	1,774	1,886	1,993	2,095	2,683	2,778	2,882	2,990	3,098	4,199	4,278	4,378	4,920	4,940	5,458
Res Exterior Lighting	3,989	7,950	11,231	13,799	4,922	6,019	6,941	7,890	9,436	10,352	10,091	9,819	9,731	9,904	9,802	9,611	9,539	9,375	9,334	9,260	9,139
Res Interior Lighting	18,260	35,314	49,413	60,569	23,990	30,719	36,471	42,387	64,668	71,660	72,197	73,247	75,421	78,818	76,988	75,314	74,534	73,129	73,826	73,870	73,641
Com Cooling	3,554	7,141	10,970	14,844	18,858	23,336	27,665	32,152	36,761	41,170	46,400	51,790	57,880	64,171	69,936	77,315	82,728	88,813	94,903	101,434	108,184
Com Exterior Lighting	4,125	7,574	11,072	14,791	17,017	20,877	24,815	28,888	33,465	37,580	41,986	46,550	50,963	55,277	59,069	59,825	60,218	60,933	61,510	62,009	62,404
Com Electric Food Prep	255	511	789	1,076	1,372	1,676	1,994	2,325	2,672	3,019	3,298	3,564	3,825	4,104	4,362	4,607	4,850	5,106	5,211	5,325	5,423
Com Electric Heating	2	3	5	7	8	10	12	15	17	19	21	23	26	29	31	32	33	35	37	39	40
Com Interior Lighting	9,783	18,682	26,939	36,028	47,901	58,579	69,300	80,239	99,094	110,674	123,155	135,317	147,377	159,747	170,688	176,702	184,671	189,855	195,043	198,491	202,333
Com Elec Miscellaneous	7	13	20	28	35	43	51	58	66	74	75	76	77	80	82	84	86	88	89	91	92
Com Office Equipment	2,151	4,756	7,681	10,832	13,864	16,938	17,990	18,762	19,402	20,322	21,634	22,974	24,290	25,531	26,600	27,412	28,055	28,807	29,623	30,570	31,616
Com Refrigeration	129	257	385	521	663	810	961	1,117	1,439	1,405	1,531	1,640	1,759	1,878	1,984	2,186	2,469	2,443	2,578	2,676	2,773
Com Ventilation	2	7	15	26	39	53	70	88	109	128	158	178	206	237	258	296	322	363	424	461	501
Com Electric Water Heat	1,335	2,830	4,340	5,830	7,093	8,362	9,635	10,914	12,176	13,418	14,700	15,872	17,059	18,327	18,293	18,234	18,041	18,138	18,476	18,704	18,971
Ind Cooling	322	627	897	1,203	1,504	1,869	2,235	2,636	3,021	3,394	3,791	4,253	4,760	5,259	5,744	6,112	6,473	6,840	7,149	7,402	7,765
Ind Exterior Lighting	440	766	1,101	1,434	1,729	2,081	2,443	2,827	3,202	3,563	3,961	4,395	4,815	5,222	5,604	5,608	5,609	5,651	5,696	5,740	5,766
Ind Interior Lighting	1,696	2,897	4,125	5,386	7,895	9,696	11,543	13,506	17,320	19,493	21,801	24,311	26,744	29,104	31,271	31,622	32,026	32,579	33,133	33,496	33,754
Ind Motors	1,123	2,307	3,499	4,691	5,925	7,436	8,947	10,548	11,959	13,334	15,218	16,811	18,372	19,924	21,503	24,015	25,715	27,407	28,808	30,143	32,400
Ind Heating	1	1	2	3	3	4	6	7	8	10	11	12	14	16	18	19	21	22	23	24	26
Residential Total	48,543	77,198	99,744	119,930	80,304	94,750	108,937	123,296	159,970	175,997	191,559	199,490	210,055	222,290	228,387	236,622	251,227	257,643	269,839	275,351	302,630
Commercial Total	21,343	41,774	62,216	83,981	106,849	130,683	152,494	174,560	205,202	227,808	252,956	277,984	303,464	329,380	351,303	366,694	381,474	394,581	407,895	419,800	432,338
Industrial Total	3,581	6,599	9,624	12,717	17,056	21,086	25,174	29,524	35,510	39,793	44,783	49,782	54,706	59,525	64,140	67,376	69,844	72,499	74,809	76,806	79,711
PORTFOLIO TOTAL	73,467	125,571	171,583	216,628	204,209	246,519	286,605	327,380	400,682	443,598	489,297	527,256	568,224	611,195	643,830	670,693	702,545	724,723	752,543	771,957	814,679

Table 6-4 Net Cumulative Coincident Summer Peak Demand Savings by Program (MW)

Program	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Res Appliances	0.2	0.5	1.0	1.7	2.6	3.7	5.0	6.6	8.9	11.3	14.0	16.9	19.9	23.2	26.6	30.2	34.6	39.0	43.9	48.9	54.0
Res Cooling	4.4	10.7	18.5	28.4	39.9	53.0	68.8	86.9	108.7	133.2	161.3	191.8	225.2	261.2	300.6	344.1	394.0	447.1	503.5	561.6	626.7
Res Electric Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Res Electric Miscellaneous	0.0	0.1	0.1	0.2	0.3	0.4	0.6	0.7	0.9	1.2	1.4	1.7	2.1	2.4	2.7	3.1	3.4	3.8	4.2	4.7	5.1
Res Electric Water Heat	0.0	0.1	0.1	0.2	0.3	0.4	0.6	0.8	0.9	1.1	1.4	1.6	1.9	2.1	2.4	2.8	3.2	3.6	4.0	4.5	5.0
Res Exterior Lighting	0.3	0.9	1.7	2.7	3.1	3.5	4.1	4.6	5.3	6.1	6.9	7.6	8.3	9.0	9.8	10.5	11.2	11.9	12.6	13.3	13.9
Res Interior Lighting	1.4	4.0	7.6	12.1	13.9	16.2	18.9	22.0	26.8	32.1	37.4	42.9	48.4	54.3	60.0	65.6	71.1	76.5	82.0	87.4	92.9
Com Cooling	1.5	4.4	9.0	15.1	23.0	32.7	44.2	57.6	73.0	90.2	109.7	131.5	155.8	182.9	212.4	244.7	279.3	316.2	355.7	397.3	441.6
Com Exterior Lighting	0.0	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.7	2.0	2.4	2.8	3.2	3.6	4.1	4.5	4.9	5.4	5.8
Com Electric Food Prep	0.0	0.1	0.3	0.5	0.7	1.0	1.3	1.7	2.2	2.7	3.3	3.9	4.5	5.2	6.0	6.8	7.6	8.5	9.4	10.3	11.2
Com Electric Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Com Interior Lighting	1.1	3.2	6.3	10.4	15.9	22.7	30.8	40.2	51.8	64.9	79.5	95.7	113.3	132.4	152.9	174.1	196.1	218.7	241.9	265.4	289.4
Com Electric Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Com Office Equipment	0.2	0.6	1.3	2.3	3.6	5.2	6.8	8.6	10.4	12.2	14.2	16.3	18.6	20.9	23.4	25.9	28.5	31.1	33.9	36.7	39.6
Com Refrigeration	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.7	1.9	2.1	2.3	2.5
Com Ventilation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Com Electric Water Heat	0.1	0.3	0.7	1.2	1.7	2.4	3.2	4.0	5.0	6.1	7.3	8.6	9.9	11.4	12.9	14.4	15.8	17.3	18.8	20.3	21.8
Ind Cooling	0.1	0.4	0.8	1.3	1.9	2.8	3.7	4.8	6.2	7.6	9.3	11.1	13.2	15.5	18.0	20.7	23.5	26.5	29.6	32.8	36.2
Ind Exterior Lighting	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7
Ind Interior Lighting	0.2	0.5	0.9	1.4	2.3	3.2	4.4	5.8	7.6	9.6	11.8	14.3	17.1	20.0	23.2	26.5	29.8	33.1	36.5	39.9	43.4
Ind Motors	0.1	0.2	0.5	0.8	1.2	1.7	2.3	3.0	3.8	4.7	5.8	7.0	8.3	9.7	11.2	12.8	14.6	16.5	18.6	20.7	22.9
Ind Heating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential Total	**6.2**	**9.9**	**12.9**	**16.2**	**14.7**	**17.3**	**20.6**	**23.8**	**29.9**	**33.5**	**37.4**	**40.1**	**43.3**	**46.4**	**49.9**	**54.2**	**61.2**	**64.6**	**68.3**	**70.0**	**77.3**
Commercial Total	**3.0**	**5.9**	**8.9**	**12.1**	**15.6**	**19.2**	**22.6**	**26.1**	**30.6**	**34.2**	**38.2**	**42.4**	**46.8**	**51.3**	**55.3**	**58.9**	**62.1**	**65.2**	**68.4**	**71.1**	**74.3**
Industrial Total	**0.4**	**0.7**	**1.0**	**1.4**	**1.9**	**2.3**	**2.8**	**3.3**	**3.9**	**4.4**	**5.0**	**5.6**	**6.1**	**6.7**	**7.3**	**7.6**	**8.0**	**8.3**	**8.6**	**8.8**	**9.2**
PORTFOLIO TOTAL	**9.6**	**16.5**	**22.9**	**29.7**	**32.2**	**38.8**	**46.0**	**53.2**	**64.5**	**72.2**	**80.6**	**88.0**	**96.2**	**104.4**	**112.4**	**120.7**	**131.2**	**138.0**	**145.2**	**150.0**	**160.8**

Cost Effectiveness

With the program budgets and impacts presented above, the industry standard cost-effectiveness tests were performed with the DSMore software tool, as described above, to gauge the economic merits of the portfolio. Each test compares the benefits of the DSM programs to their costs – using its own unique perspectives and definitions – all defined in terms of net present value of future cash flows. The definitions for the four standard tests most commonly used in DSM program design are described below.

- **Total Resource Cost test (TRC).** The benefits in this test are the lifetime avoided energy costs and avoided capacity costs. The costs in this test are the incremental measure costs plus all administrative costs spent by the program administrator.
- **Utility Cost Test (UCT).** The benefits in this test are the lifetime avoided energy costs and avoided capacity costs, the same as the TRC benefits. The costs in this test are the program administrator's incentive costs and administrative costs.
- **Participant Cost Test (PCT).** The benefits in this test are the lifetime value of retail rate savings (which is another way of saying "lost utility revenues"). The costs in this test are those seen by the participant; in other words: the incremental measure costs minus the value of incentives paid out.
- **Rate Impact Measure test (RIM).** The benefits of the RIM test are the same as the TRC benefits. The RIM costs are the same as the UCT, except for the addition of lost revenue. This test attempts to show the effects that EE programs will have on rates, which is almost always to raise them on a per unit basis. Thus, costs typically outweigh benefits from the point of view of this test, but the assumption is that absolute energy use decreases to a greater extent than per-unit rates are increased — resulting in lower average utility bills.

The cost-effectiveness results for the NIPSCO program-potential portfolio are shown in Table 6-5 below. Lifetime TRC benefits are $847 million dollars and costs of $479 million dollars result in a robust TRC benefit-to-cost ratio of 1.77. The portfolio passes the cost-effectiveness screen with a B/C ratio at 1.0 or higher for all of the standard tests, except RIM.

Table 6-5 DSM Action Plan Cost Effectiveness Summary

Program	NPV TRC Benefits ($million)	NPV TRC Costs ($ million)	TRC Ratio	UCT Ratio	PCT Ratio	RIM Ratio
Res Appliances	$32.48	$19.42	1.67	2.35	6.09	0.36
Res Cooling	$239.81	$173.48	1.38	1.91	2.80	0.58
Res Electric Heating	$2.91	$7.22	0.40	0.61	2.62	0.17
Res Electric Miscellaneous	$4.58	$2.64	1.73	2.37	4.67	0.46
Res Electric Water Heat	$3.37	$0.53	6.34	9.44	22.67	0.37
Res Exterior Lighting	$10.81	$5.17	2.09	2.56	14.79	0.25
Res Interior Lighting	$86.14	$46.81	1.84	2.33	9.33	0.30
Com Cooling	$142.46	$109.18	1.30	1.67	3.24	0.44
Com Exterior Lighting	$36.82	$12.94	2.85	3.58	15.42	0.19
Com Electric Food Prep	$5.22	$1.33	3.92	4.98	11.84	0.34
Com Electric Heating	$0.02	$0.03	0.73	0.93	4.40	0.16
Com Interior Lighting	$171.55	$62.12	2.76	3.53	8.36	0.30
Com Electric Miscellaneous	$0.11	$0.01	10.08	11.48	53.37	0.39
Com Office Equipment	$24.46	$1.10	22.33	26.23	146.10	0.30
Com Refrigeration	$2.05	$0.81	2.53	3.37	11.64	0.28
Com Ventilation	$0.23	$0.19	1.18	1.50	5.71	0.23
Com Electric Water Heat	$17.19	$6.23	2.76	3.51	11.52	0.28
Ind Cooling	$12.17	$13.92	0.87	1.11	1.61	0.50
Ind Exterior Lighting	$4.61	$1.29	3.57	4.53	10.69	0.35
Ind Interior Lighting	$28.46	$10.74	2.65	3.30	6.28	0.40
Ind Motors	$21.57	$3.43	6.29	8.00	17.72	0.43
Ind Heating	$0.01	$0.05	0.27	0.34	1.47	0.16
Residential Total	$380.11	$255.28	1.49	2.02	4.34	0.44
Commercial Total	$400.11	$193.93	2.06	2.63	6.98	0.32
Industrial Total	$66.82	$29.44	2.27	2.87	5.42	0.42
PORTFOLIO TOTAL	$847.05	$478.64	1.77	2.33	5.61	0.37

Supply Curves

The purpose of supply curves is to better understand the relationship between DSM impacts and the costs required to reach those savings levels. Energy efficiency programs and their associated impacts are rank-ordered according to their cost per unit of savings. The two data points (unit cost and savings impacts) are plotted on a line chart. The upward slope of the line indicates that it becomes increasingly expensive to achieve additional savings.

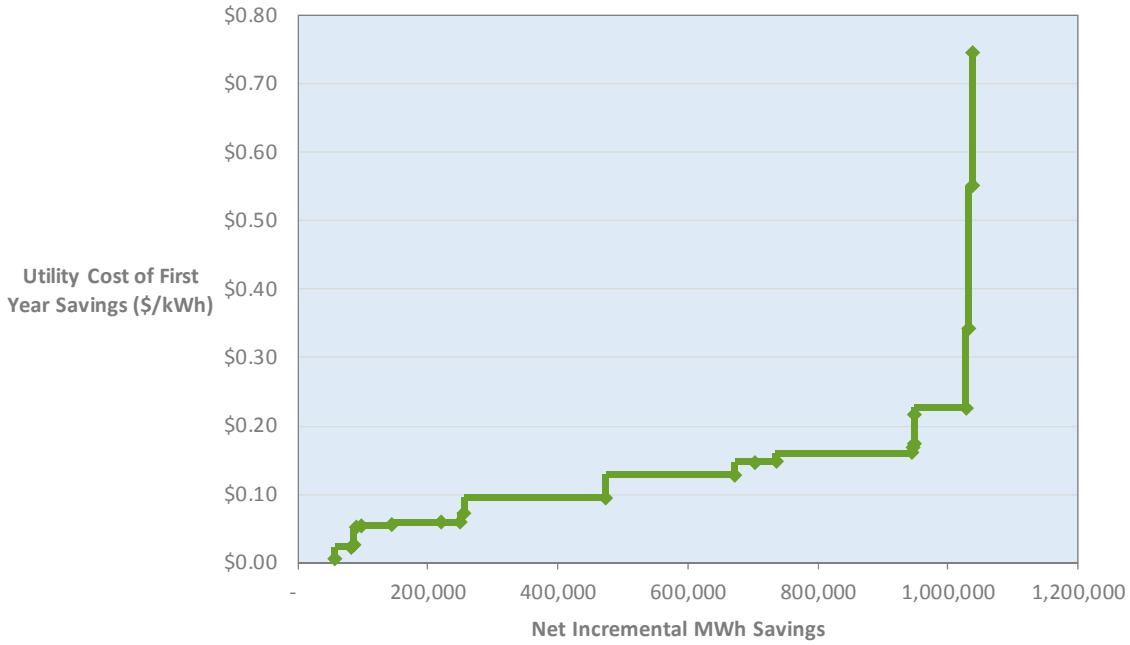
Supply Curves based on Annual Energy Savings

Table 6-6 and Figure 6-5 provide a supply curve of cumulative energy impacts for 2016 through 2021 plotted against the first-year costs of those savings. All energy efficiency programs, except Industrial cooling and heating, come in at a price point lower than $0.50/first-year kWh.

Table 6-6 Supply Curve 2016-2021 (MWh Savings vs. $/kWh)

Program	Net Incremental MWh Savings 2016-2021	Utility Cost of First-Year Savings ($/kWh)
Com Office Equipment	56,222	$0.01
Ind Motors	24,980	$0.02
Res Electric Water Heat	4,752	$0.03
Com Electric Miscellaneous	146	$0.03
Com Refrigeration	2,764	$0.05
Ind Exterior Lighting	7,550	$0.05
Res Exterior Lighting	47,910	$0.06
Com Exterior Lighting	75,456	$0.06
Com Electric Water Heat	29,789	$0.06
Com Electric Food Prep	5,678	$0.07
Res Interior Lighting	218,266	$0.10
Com Interior Lighting	197,912	$0.13
Res Appliances	31,672	$0.15
Ind Interior Lighting	31,695	$0.15
Res Cooling	209,770	$0.16
Com Ventilation	143	$0.17
Res Electric Miscellaneous	3,672	$0.17
Com Electric Heating	36	$0.22
Com Cooling	78,703	$0.23
Res Electric Heating	4,427	$0.34
Ind Cooling	6,422	$0.55
Ind Heating	14	$0.75

Figure 6-5 Supply Curve 2016-2021 (MWh Savings vs. $/kWh)



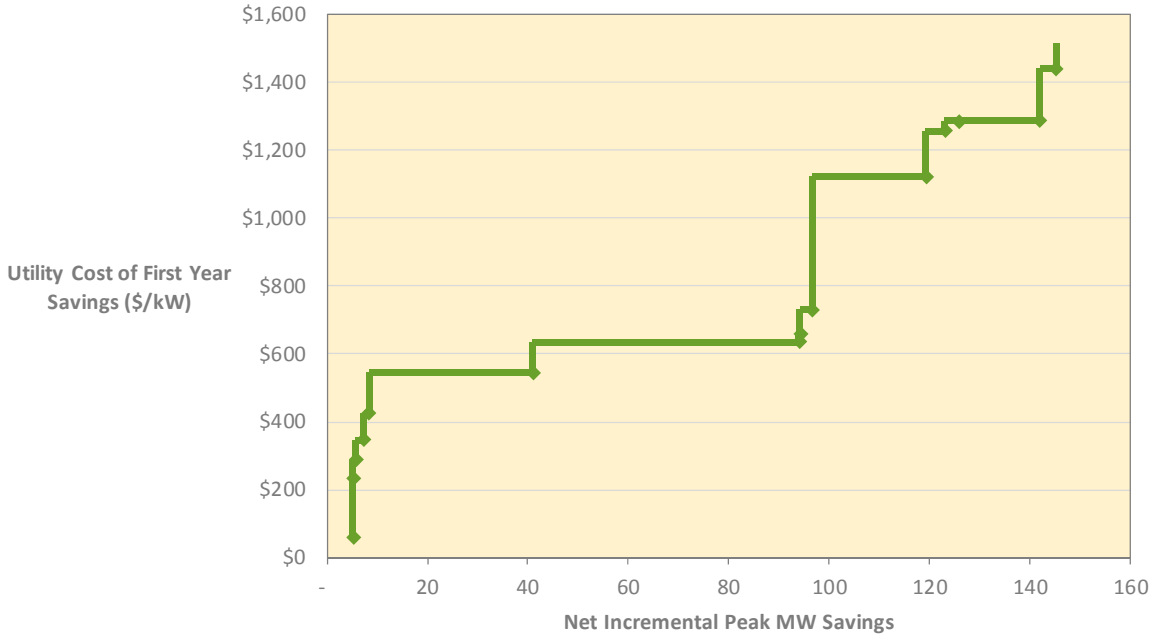
Supply Curves based on Annual Peak Demand Savings

Table 6-7 and Figure 6-6 provide a supply curve of cumulative peak savings for 2016 through 2021 plotted against the first-year costs of those savings. About half of the energy efficiency programs, provide capacity resources to the system at a competitive price lower than $1,000/kW. Lighting does not have significant impacts that are coincident with the system peak and therefore have a much higher utility cost of first year savings. Heating is not coincident with the peak and therefore is not shown in the list for any of the sectors.

Table 6-7 Supply Curve 2016-2021 (Peak MW Savings vs. $/kW)

Program	Net Incremental Peak MW Savings 2016-2021	Utility Cost of First Year Savings ($/kW)
Com Office Equipment	5.2	$61
Com Electric Miscellaneous	0.0	$233
Res Electric Water Heat	0.4	$287
Ind Motors	1.7	$348
Com Electric Food Prep	1.0	$425
Com Cooling	32.7	$545
Res Cooling	53.0	$636
Com Refrigeration	0.2	$658
Com Electric Water Heat	2.4	$730
Com Interior Lighting	22.7	$1,122
Res Appliances	3.7	$1,257
Ind Cooling	2.8	$1,285
Res Interior Lighting	16.2	$1,287
Ind Interior Lighting	3.2	$1,440
Res Electric Miscellaneous	0.4	$1,513
Ind Exterior Lighting	0.1	$5,769
Com Exterior Lighting	0.5	$8,257

Figure 6-6 Supply Curve 2016-2021 (Peak MW Savings vs. $/kW)



SECTION | 7

Demand Response Potential

NIPSCO currently offers direct load control and interruptible demand response programs. As part this analysis, all types of demand response programs were considered, but ultimately the analysis focuses only on programs that can be implemented using NIPSCO's existing tariff structures. The DR analysis does not include the analysis of demand-side rates and dynamic pricing programs, since NIPSCO does not currently, nor do they plan on adding, two-way communicating technology or AMI in the near term.

Analysis Approach

The major steps used to perform the demand response (DR) potential assessment are listed below. The major steps are described in detail throughout the analysis.

1. Market Characterization
2. Define the relevant DR options by customer class
3. Outline participation hierarchy for DR options to prevent double-counting of impacts
4. Develop DR program assumptions which include participation rates, unit savings, and program costs
5. Estimate DR potential and develop program budgets and supply curves
6. Assess cost-effectiveness of DR options

These steps are described below.

Market Characterization

The analysis begins with segmentation of the NIPSCO customer base and a description of how customers use energy in the peak hour.

Segmentation of Customers for DR Analysis

The market segmentation scheme for the DR analysis is presented in Table 7-1. The first dimension of customer segmentation is by sector and the second dimension is by customer size. The residential sector is considered a single group -- designated by NIPSCO's residential rate codes of 611, 612, and 613. The C&I segmentation corresponds with NIPSCO's small, medium, large and industrial rate codes. Net metered, off peak tariff, municipal and street lighting customers were excluded from the analysis. Street lighting load typically occurs at night and therefore has no potential to impact loads at the system peak hour. Unlike the EE portion of the analysis, opt-out customers were included in the analysis, as they offer a large opportunity for demand load reduction and are not restricted by regulations.

Table 7-1 Overall DR Market Segmentation Scheme

Dimension	Segmentation Variable	Description	
Dimension 1	Sector	Residential and Nonresidential	
Dimension 2	Customer Size Classes	Residential (Rate Codes 611, 612, 613)	
		Nonresidential (by Rate Code)	
		Small C&I	620, 621, 622
		Medium C&I	623
		Large C&I	624, 625
		Extra Large C&I	625, 632, 633, 634

Baseline Customer and Coincident Peak Projection

The next step was to define the baseline projection for the number of customers and peak demand for each customer segment. Consistent with the EE potential analysis, the base year is 2014 and is characterized by using NIPSCO's 2014 billing data. The baseline projection incorporates NIPSCO's forecasts of summer peak demand and customer counts from 2015 through 2037. NIPSCO's total customer count projections were adjusted to correspond to the segmentation scheme defined above. Table 7-2 presents customer projections for each segment.

Since C&I opt-out customers are eligible to participate in DR programs, the eligible customer base is much larger than that used in the EE potential analysis.

Table 7-2 DR Baseline Projection of Customer by Segment

Customers by Class	2014	2016	2017	2018	2019	2020	2021	2026	2013	2036
Residential	402,338	405,859	407,634	409,695	412,043	414,405	416,674	427,056	436,224	445,849
Small C&I	62,057	62,694	63,014	63,337	63,661	63,986	64,313	65,975	67,680	69,784
Medium C&I	4,207	4,210	4,211	4,213	4,214	4,216	4,217	4,225	4,232	4,241
Large C&I	1,486	1,486	1,487	1,487	1,487	1,487	1,487	1,488	1,489	1,490
Extra Large C&I	26	26	26	26	26	26	26	26	26	26
Total	**470,114**	**474,275**	**476,372**	**478,757**	**481,431**	**484,120**	**486,718**	**498,770**	**509,651**	**596,879**

NIPSCO provided the summer peak demand forecast for all customer classes combined. This forecast does not include any current or forecasted impacts from existing demand response program offered by NIPSCO. The demand distribution was developed using typical Midwest regional load factors by segment and calibrated them to match NIPSCO's actual energy and peak demand values[14] Table 7-3 presents the coincident peak forecast by segment.

[14] It should be noted that because of differing methodologies, models and segmentation, the system peak demand forecast used in the DR analysis is slightly different than that used in the EE analysis. This does not, however, materially affect the results and outcome of the study.

Table 7-3 Coincident Peak Projection by Segment (MW)

Peak MW by Customer Class	2014	2016	2017	2018	2019	2020	2021	2026	2031	2036
Residential	900	892	900	904	909	913	918	941	960	976
Small C&I	334	332	334	336	338	339	341	350	357	363
Medium C&I	322	319	322	323	325	327	328	337	343	349
Large C&I	403	400	403	405	407	409	411	422	430	438
Extra Large C&I	1,186	1,175	1,185	1,191	1,197	1,203	1,209	1,240	1,265	1,286
Total	**3,145**	**3,118**	**3,145**	**3,160**	**3,176**	**3,192**	**3,207**	**3,289**	**3,356**	**3,412**

Identify Demand Response Options

In this study a wide variety of possible demand-response and pricing options were considered. Below we describe those options that were ultimately included in the analysis and those that were screened out.

DR Options Included in the Analysis

The demand response options included in this study are described below.

Direct Load Control (DLC). The program entails control of eligible cooling units (central air conditioners and heat pumps) for the summer peak season as well as space heating units for the winter peak season. Residential participants that have electric water heaters are assumed to be eligible to include their water heater as a curtailable load for both the summer and winter peak seasons. Eligible customers for the DLC option include residential customers with cooling, heating and water heating equipment as well as small and medium C&I customers with space heating and central air conditioners. NIPSO has offered this program in the past for air conditioners for residential and small commercial. The program was discontinued in 2015. Events ran from June through September events. A total of 4 events were called with an average of 16.88 MW per event in 2015.The program was included in the analysis for exploratory purposes and expanded to include medium C&I customers as well.

Interruptible Load Tariffs. Large commercial customers enroll directly with the utility in an agreement to curtail their load during system contingencies. This program would be implemented by notifying customers of a curtailment event, typically a day in advance, and allowing them to respond with load shedding. They would be paid a credit for curtailed load, but charged at market rate if they do not curtail as a penalty for non-performance. In years past, programs like this have actually interrupted customer load at the utility point of service, but this is very uncommon in recent times, and the voluntary participation route is now the default standard for future implementation planning. This is NIPSCO largest and most successful current program. The program is aimed at their largest industrial customers, currently available only to Rates 632, 633, and 634. The program has six participants with a total of 174 economic interruptions called in 2014 with an average of 143 MW per event.

Third Party Aggregator Programs*.* Participating customers agree to reduce their demand by a specific amount or curtail their consumption to a pre-specified level. In return, they would typically receive a fixed incentive payment from the Aggregator in the form of capacity credits or reservation payments (expressed as $/kW-month or $/kW-year). Customers are paid to be on call even though actual load curtailments may not occur. The amount of the capacity payment varies with the load commitment. In addition to the fixed capacity payment, participants typically also receive a payment for energy reduction. Because it is a firm, contractual arrangement for a specific level of load reduction, enrolled load represents a firm resource and can be counted toward installed capacity (ICAP) requirements. Penalties are assessed for under-performance or non-performance. Events may be called on a day-of or day-ahead basis as conditions warrant.

This option is delivered by third party load aggregators that have streamlined processes for engaging customers with maximum demand typically greater than 100 kW, particularly those with flexible operations. Customers with 24x7 operations/continuous processes or with obligations to continue providing service (such as schools and hospitals) are often not good candidates. NIPSCO currently has a tariff that would accommodate this type of program, however there are no third party DR aggregators currently operating in the service territory, either independently with MISO or contractually with NIPSCO. For the analysis, it is assumed that this option will be offered to large and extra large C&I customers.

DR Options Screened Out

The following were qualitatively screened out:

- **Critical Peak Pricing (CPP)** involves significantly higher prices during relatively short critical peak periods on event days to encourage customers to reduce their usage. The customer incentive is a heavily discounted rate during off-peak hours (relative to a standard TOU rate). Event days are dispatched on relatively short notice (day ahead or day-of) typically for a limited number of days per year. Over time, event-trigger criteria become well-established so that customers can expect events based on hot weather or other factors. Events can also be called during times of system contingencies or emergencies.

  For participation in this rate-based option, it is preferable for customers to have advanced meters, primarily for bill settlement purposes. NIPSCO has no current tariffs and has no future plans to introduce AMI meters into their service territory, therefore this option was not included in the study.

- **Inclining Block Rate (IBR)** is considered a conservation rate that applies differing rates based on customer usage. This is a volumetric $ per kWh charge that is applied to a customer's bill. The rate increases as the amount of electricity consumed increases. Typically, the rate is separated into two blocks or tiers by a kWh threshold, the first block below the threshold is charged one rate and the second block above the threshold is charged another higher rate. Unlike other DR and rate based options, this option has low to zero operation, maintenance and incentive costs. However, introducing this rate option requires a significant amount of rate making and regulatory changes that may not be captured within the modeling.

- **Time of Use Tariff (TOU).** A TOU rate occurs when the rate for purchasing or using electricity is more expensive during a particular block of hours each day. Relative to a revenue-equivalent flat rate, the rate during on-peak hours is higher, while the rate during off-peak hours is lower. This provides customers with motivation to move consumption out of the higher-price on-peak hours into the lower cost off-peak hours. Larger price differentials provide an incentive for customers to shift consumption.

  Time-of-Use rates are not event-driven like the other DR programs considered here, but are rather a means to achieve predictable, permanent load shifting on a day-to-day basis from peak hours to off-peak hours. TOU rates can be established to be in effect every day of the year or seasonally. Since the summer peak is the time of most interest in this analysis, it is assumed that the TOU rate is in effect for the summer season. Time-of-use rates are typically not included as a DR option, per se, because customer response is not event driven. NIPSCO does not have future plans to include rate-based tariffs options, and therefore this program was qualitatively screened out.

- **Smart Appliance DLC.** This program is a relatively unproven and emerging technology. Existing research on impacts by appliance type show relatively low reductions. Additionally, the technical infrastructure investment costs are likely to be prohibitively high in terms of communication and control for enabling reductions from these devices.

- **Fast DR.** DR resources for providing ancillary services need to be Auto-DR enabled, thereby entailing high infrastructure costs. They need to be available 24x7 with a high degree of reliability. Therefore, participation is challenging and likely to be low. Overall, the option is

unlikely to be cost-effective under current system conditions. However, with increasing amount of renewable sources coming online, the value of flexible resources like Fast DR are likely to gain value.

- **Thermal Energy Storage.** These technologies have not experienced significant improvements in technology or price and are still not in the mainstream.

Mapping DR Options to NIPSCO Customers

For this study, four DR options were considered, including two options for the interruptible tariff. The objective of these options is to realize demand reductions from eligible customers during the highest load hours of the summer as defined by the utility. Each program type provides demand response using different load reduction and incentive strategies designed to target different types of customers. From the utility perspective, each of the different program types can be called with different notification time. Having a mix of programs provides load reduction that can be called under many different conditions.

NIPSCO has two existing demand response programs-- an Interruptible Load Tariff and a Third Party Curtailment program. The DLC CAC, their AC-Cycling Program, just concluded in 2015.

Table 7-4 shows the eligible customer classes for each DR option, the corresponding NIPSCO tariff, briefly indicates the load control mechanism, and the associated reliability.

Table 7-4 List of DR Options

DR Program	Eligible Customer Classes	Mechanism	Reliability
Central Air Conditioner Cycling Direct Load Control (DLC)	Residential, Small and Medium C&I	DLC Switch for Central Cooling Equipment	firm
Water Heater Cycling Direct Load Control (DLC)	Residential, Small and Medium C&I	DLC Switch for Water Heating Equipment	firm
Interruptible Load Tariffs	C&I, Large and above	Customer enacts their customized, mandatory curtailment plan. Penalties apply for non-performance.	firm
Interruptible Load Tariffs with Third Party Aggregator	C&I, Large and above	Customer enacts their customized, mandatory curtailment plan. Penalties apply for non-performance. Typically managed as a portfolio by third party contractor.	firm

Table 7-5 shows notification times typically associated with the DR options.

Table 7-5 Typical Notification Times for DR Options

DR Option	Notification Timing			
	Day-ahead	Two to four hours	30 minutes to one hour	Instantaneous to 10 min
Direct Load Control				X
Firm Curtailment Agreement & Interruptible Load Tariffs	X	X	X	

Program Participation Hierarchy

To avoid double counting of load reduction impacts, program-eligibility criteria were defined to ensure that customers do not participate in mutually exclusive programs at the same time. For example, large C&I customers cannot participate in the load curtailment program and a curtailment program run by aggregators, both of which could target the same load for curtailment on the same days.

Table 7-6 shows the participation hierarchy by customer class for applicable DR options.

Table 7-6 Participation Hierarchy in DR options by Customer Segment

Customer Class	Priority / Loading	DR Programs	Eligible Customers
Residential, Small C&I, Medium C&I	First and only option	Direct Load Control	Residential customers with eligible equipment Small and Medium C&I customers with eligible equipment
Large C&I, Extra Large C&I	First	Interruptible Load Tariffs	All Large C&I Customers
	Second	Third Party Aggregator	All Large C&I Customers not enrolled in Interruptible Load Tariffs

DR Program Key Assumptions

The next step is to develop the key data elements for the potential calculations: customer participation levels, per-customer load reduction, and program costs.

Program Participation Rates

Program participation were developed based on a combination of existing or past NIPSCO DR programs and the performance of similar programs within states geographically and demographically comparable to northern Indiana. Interruptible Load Tariff participation and overall impacts were calibrated to 2014 actual program performance. Residential DLC A/C was also developed by calibrating to 2014 program performance. Participation for other programs was developed by taking the 50th percentile of existing program performance of programs in states within the region.

New DR programs need time to ramp up and reach a steady state. During ramp up, customer education, marketing and recruitment, in addition to the physical implementation and installation of any hardware, software, telemetry, or other equipment required, takes place. For NIPSCO, it is assumed that programs ramp up over to five years, typical of industry experience.

Table 7-7 shows the participation assumptions for the potential scenarios in DR options by customer class. All programs, except the Interruptible Load Tariff for the extra large C&I segment, are to begin 2017. The Interruptible Load Tariff begins in 2016 to capture the existing performance for the tariff.

Table 7-7 Achievable Potential Participation Rates by Option and Customer Class (percent of eligible customers)

Customer Class	Option	Start Year	Yr 1	Yr 2	Yr 3	Yr 4	Yrs 5-19
Residential	DLC Central AC	2017	11.9%	13.9%	15.9%	18.0%	20.0%
Small C&I	DLC Central AC	2017	1.30%	2.20%	3.10%	4.10%	5.00%
Medium C&I	DLC Central AC	2017	1.30%	2.20%	3.10%	4.10%	5.00%
Residential	DLC Water Heating	2017	2.10%	3.70%	5.30%	6.90%	8.50%
Small C&I	DLC Water Heating	2017	0.80%	1.40%	2.00%	2.60%	3.20%
Medium C&I	DLC Water Heating	2017	0.80%	1.40%	2.00%	2.60%	3.20%
Large C&I	Interruptible Load Tariffs	2017	4.20%	7.30%	10.40%	13.50%	16.60%
Extra Large C&I	Interruptible Load Tariffs	2016	48.50%	49.10%	49.70%	50.40%	51.00%
Large C&I	Third Party Aggregator	2017	4.20%	7.30%	10.40%	13.50%	16.60%
Extra Large C&I	Third Party Aggregator	2017	4.20%	7.30%	10.40%	13.50%	16.60%

Load Reduction Impacts

The per-customer load reduction, multiplied by the total number of participating customers, provides the potential demand savings estimate. Load reduction impact assumptions are based on program performance for current or past NIPSCO programs and on secondary research for new programs. Interruptible Load Tariff impact was sourced from actual program performance. An average of the curtailed load was compared to the extra large segment's peak contribution. The percentage was scaled to match current program performance. For Residential DLC Central A/C, participation was sourced from NIPSCO, and adjusted to match previous program performance. The remaining program impacts were developed by taking an average of existing/past program performance from programs in states within the region. Table 7-8 presents the per-customer load reductions used for estimating the potential.

Table 7-8 Per-Unit Load Reduction by Option and Customer Class

Customer Class	Option	Data Element	Unit	Value
Large C&I	Interruptible Load Tariffs	Per Customer Peak Reduction (%)	% of Peak	18%
Extra Large C&I	Interruptible Load Tariffs	Per Customer Peak Reduction (%)	% of Peak	56%
Large C&I	Third Party Aggregator	Per Customer Peak Reduction (%)	% of Peak	18%
Extra Large C&I	Third Party Aggregator	Per Customer Peak Reduction (%)	% of Peak	18%
Residential	DLC Central AC	Per Customer Peak Reduction (kW)	kW	0.62
Small C&I	DLC Central AC	Per Customer Peak Reduction (kW)	kW	3.1
Medium C&I	DLC Central AC	Per Customer Peak Reduction (kW)	kW	3.1
Residential	DLC Water Heating	Per Customer Peak Reduction (kW)	kW	0.9
Small C&I	DLC Water Heating	Per Customer Peak Reduction (kW)	kW	2.7
Medium C&I	DLC Water Heating	Per Customer Peak Reduction (kW)	kW	2.7

Program Costs

Program costs include fixed and variable cost elements: program development costs, annual program administration costs, marketing and recruitment costs, enabling technology costs for purchase and installation, annual O&M costs, and participant incentives. These assumptions are based on actual program costs from existing or past NIPSCO programs and, for new programs, based on actual AEG program implementation experience, experience in developing program

costs for other similar studies, and secondary research. The assumptions are detailed in the following tables.

Table 7-9 Residential Direct Load Control (A/C and Water Heating) Program Cost Assumptions

Item	Unit	Value	Basis for Assumption
Program Development Cost	$/program	80,000	Assumed 2 FTEs to develop the program at an annual FTE cost of $80,000. That number is divided among the A\C and Water Heating DLC programs for the Residential sector.
Program Administration Cost	$/MW	5,000	Assumed an annual program administration cost of $5/kW-yr, based on program implementation experience.
Annual Marketing and Recruitment Costs	$/new participant	45	Initially assumed a one-time $40 payment to the customer for enrolling in the program, plus $50 per customer for marketing costs. Reduced in half, to reflect current NIPSCO spending (Ref: Review of utility program incentives, TVA Potential Study; Global Energy Partners, 2011)
Cost of Equip + Install for CAC	$/new participant	140	Assumes $60 capital cost for switch, plus $80 installation cost (Ref: PacifiCorp DSM Potential Study, 2013)
Cost of Equip + Install for Space Heating &Water Heating Control	$/new participant	100	Assumes $60 capital cost for switch, plus $40 installation cost (Ref: PacifiCorp DSM Potential Study, 2013)
Annual O&M cost	$/MW	5.00	Assumed the annual O&M cost to be 3.5% of the control equipment cost.
Per participant annual incentive for CAC	$/participant/yr.	40	NIPSCO's AC Cycling - $10/month incentive for AC, for 4 summer months (June-September)
Per participant annual incentive for Space Heating & Water Heating control	$/participant/yr.	40	Assumed to be the same as Central A/C incentive

Table 7-10 C&I Direct Load Control Program Cost Assumptions

Item	Unit	Value	Basis for Assumption
Program Development Cost	$/program	10,000	Assumed an additional $40,000 to run the C&I DLC programs, which is split equally across the four customer classes and programs. This cost is in addition to the Residential DLC programs, which assumes most of the development costs.
Program Administration Cost	$/MW-yr.	5,000	Assumed an annual program administration cost of $5/kW-yr, based on program implementation experience
Annual Marketing and Recruitment Costs	$/new participant	155	Assumed a one-time $80 payment to the customer for enrolling in the program, plus $75 per customer marketing costs. Per customer marketing costs for small commercial customers is assumed to be 50% higher compared to residential customers. Also, at sign-up, customers are paid double the amount paid to residential customers.
Cost of Equip + Install for CAC	$/technology	140	Assumed $60 capital cost for switch, plus $80 installation cost (Ref: PacifiCorp DSM Potential Study, 2013)
Cost of Equip + Install for Space Heating & Water Heating Control	$/technology	100	Assumed $60 capital cost for switch, plus $40 installation cost (Ref: PacifiCorp DSM Potential Study, 2013)
Annual O&M cost	$/participant/yr.	15	Assumed the annual O&M cost to be about 10% of the control equipment cost.
Per participant annual incentive for CAC	$/participant/yr.	40	Assumed to be the same as Residential.
Per participant annual incentive for Space & Water Heating control	$/participant/yr.	40	Assumed to be the same as Residential.

Table 7-11 C&I Interruptible Load Tariff Cost Assumptions

Item	Unit	Value	Basis for Assumption
Program Development Cost	$/program	50,000	Assumed that 1 FTE (@$100,000 annual cost) is required to develop interruptible tariffs. Assumed that this cost is equally split between the two customer classes.
Program Administration Cost	$/MW-yr	15,000	Assumed an annual program administration cost of $15/kW-yr. (Ref-TVA Potential Study, 2011; KCPL Potential Study, 2013). The administrative costs for Interruptible Load Tariffs are likely to be higher as compared to that for DLC option, due to paperwork associated with customer contracts and participation agreements, settlement, etc.
Annual Marketing and Recruitment Costs	$/new participant/ year	L: 200 XL: 250	Scaled up from initial assumption of $50 per participant, to reflect current NIPSCO spending.
Per kW Annual Incentive (Curtailment Agreement)	$/kW/year	102	Average of the two options provided in the current Interruptible Load Tariff. $8 and $9 per month incentive.
Per kWh Annual Incentive (Curtailment Agreement)	$/kWh/year	.005	Average of each incentive offered to the different rate codes within the tariff.

Table 7-12 C&I Third Party Aggregator Program Cost Assumptions

Item	Unit	Value	Basis for Assumption
Program Development Cost	$/program	50,000	Assumed that 1 FTE (@$100,000 annual cost) is required to develop interruptible tariffs. Assumed that this cost is equally split between the two customer classes (Med/Large C&I and Large C&I)
Program Administration Cost	$/MW-yr	15,000	Assumed an annual program administration cost of $15/kW-yr. (Ref-TVA Potential Study, 2011; KCPL Potential Study, 2013). The administrative costs for Interruptible Load Tariffs are likely to be higher as compared to that for DLC option, due to paperwork associated with customer contracts and participation agreements, settlement, etc.
Annual Marketing and Recruitment Costs	$/new participant/ year	L: 200 XL: 250	Reflects current NIPSCO spending.
Per kW Annual Incentive (Curtailment Agreement)	$/kW/year	50	KCP&L Demand Side Resource Potential Study, 2013; TVA Potential Study, 2011
Per kWh Annual Incentive (Curtailment Agreement)	$/kWh/year	.03	Based on Locational Marginal Pricing data for MISO.

Cost Effectiveness Assessment

The DR options are assessed based upon the TRC test utilizing NIPSCO-specific avoided costs, discount rate and line losses. Given the small number of hours impacted by DR programs, as well as customer pre-cooling or "snapback" that commonly increases energy usage before or after DR events, the analysis does not consider any energy impacts or benefits. As mentioned above, the costs are made up of program development costs, annual program administration costs, marketing and recruitment costs, enabling technology costs for purchase and installation, annual O&M costs, and participant incentives.

The cost-effectiveness of individual DR options are assessed with different program-start years until the first cost-effective year is identified. Demand savings for a particular option are

therefore realized only in years the option is cost-effective. Once an option is deployed, benefit-to-cost ratios were estimated for each contiguous program cycle independently throughout the study time period.

A more detailed cost effectiveness for program design was performed in DSMore by MMP, but initial estimates in AEG models indicate all benefit/cost ratios are above 1.00. The DSMore results are shown in the Cost Benefit Analysis section at the end of the chapter.

Program Lifetime

Calculation of cost effectiveness requires an assumption about DR program lifetimes. Table 7-13 presents lifetime assumptions by DR option. Third Party Aggregator options often have a contract term of three to five years.

Table 7-13 DR Program Life Assumptions

DR Option	Lifetime (Years)
Direct Load Control	10
Interruptible Load Tariffs	3
Third Party Aggregator	10

Demand Response Potential Results

In this section, the potential savings are presented for cost-effective DR programs only. It is important to note that the potential savings include savings from existing or past NIPSCO programs, which drives the large amount of cumulative potential. All impacts are presented at the generator with residential line losses at 2.41% and C&I line losses at 4.11%. All programs are cost-effective during the time horizon of the study for the achievable scenario. The potential case is broken down by DR option and customer class.

Summary of Potential Savings

Figure 7-1, and Table 7-14 present the aggregate demand response potential from all cost-effective DR options for all levels of potential and all scenarios for the summer season. Demand response peak savings range from 323.5 MW in 2016 to 526.6 MW in 2036 within the Achievable Potential case, which translates into 10.4% to 15.4% of NIPSCO's system peak reduction, respectively.

Figure 7-1 Summary of Demand Response Savings

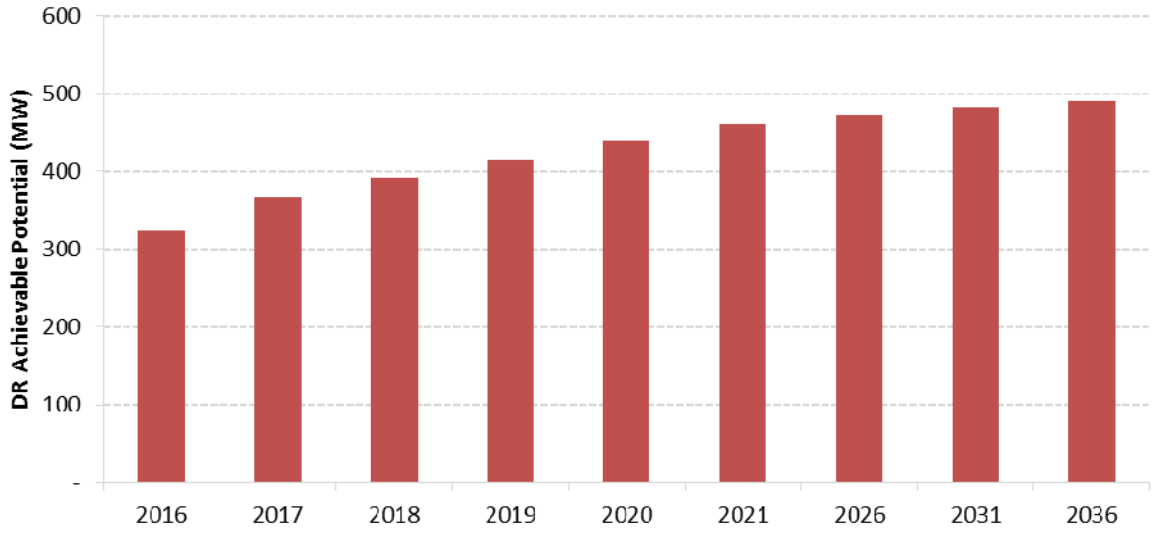


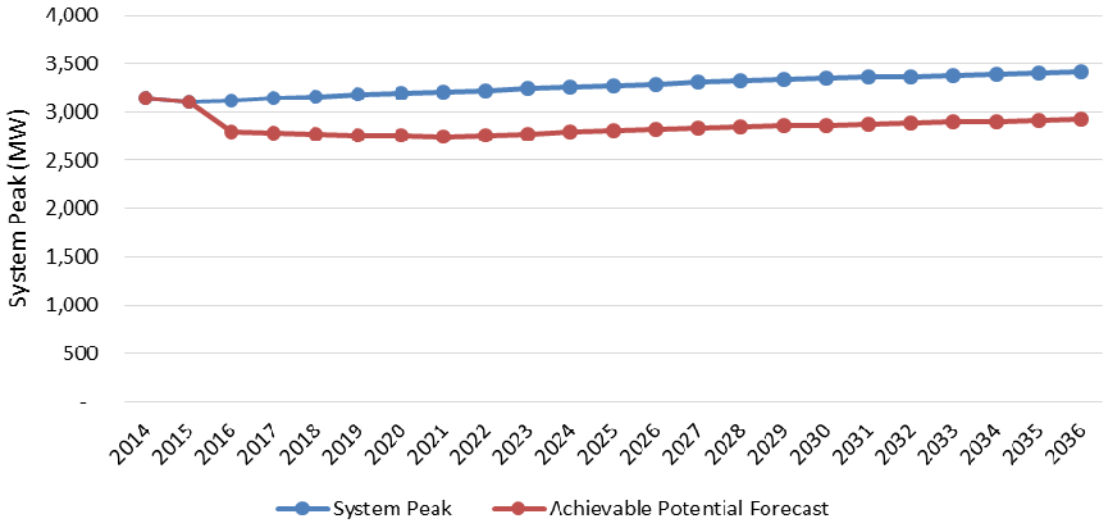
Table 7-14 Summary of Demand Response Savings

	2016	2017	2018	2019	2020	2021	2026	2031	2036
System Peak Projection (MW)	3,118	3,145	3,160	3,176	3,192	3,207	3,289	3,356	3,412
Incremental Achievable Potential (MW)	-	44	24	24	25	20	12	10	8
Cumulative Achievable Potential (MW)	323.5*	367	392	416	441	461	473	483	491
Cumulative Potential (% of System Peak)	10.4%	11.7%	12.4%	13.1%	13.8%	14.4%	14.4%	14.4%	14.4%

* Initial DR impacts of 323.5 MW are due to continuation of existing curtailment agreement programs with large C&I customers. These are not considered new savings, so incremental potential in 2016 is zero.

Figure 7-2 presents a comparison between the baseline projection and the achievable potential scenario. The large jump between 2015 and 2016 is due to the program start year. Interruptible Load Tariffs in 2016 are a continuation of the existing program, while new programs begin in 2017.

Figure 7-2 Achievable Potential vs. Baseline Projection



Potential Estimates by Option

Achievable potential reaches 527 MW in 2036, equal to reducing NIPSCO's forecast by 14.4%

- Top contributors are Interruptible Load Tariffs, and the DLC programs
- Interruptible Load Tariffs have the largest impacts, driven by large, unique industrial customers on the existing tariff

Figure 7-3 and Table 7-15 show savings by DR option for Achievable Potential.

Figure 7-3 Achievable Potential by DR Option

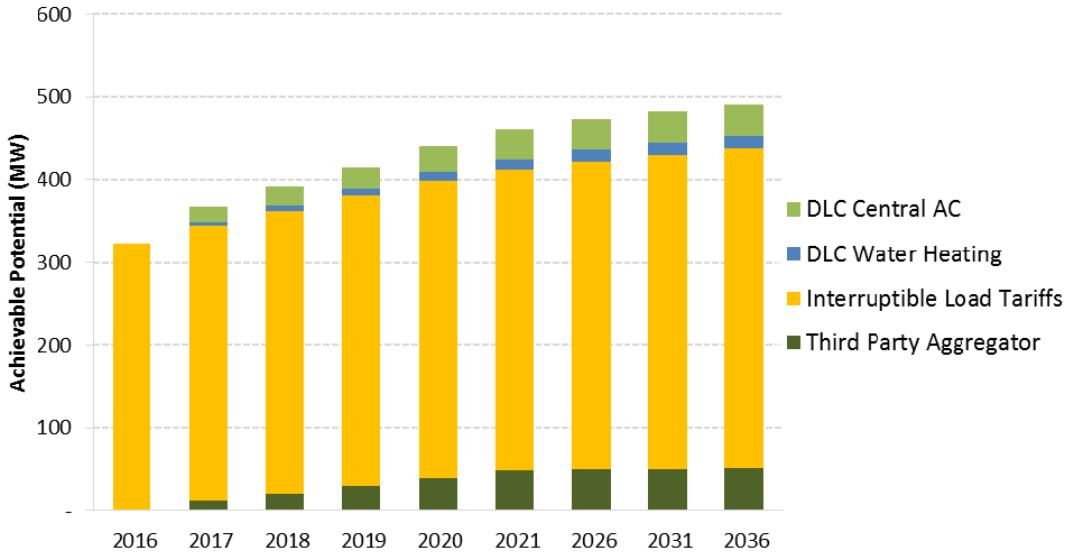


Table 7-15 Achievable Potential by DR Option

	2016	2017	2018	2019	2020	2021	2026	2031	2036
Weather Sensitive Peak (MW)	**3,118**	**3,145**	**3,160**	**3,176**	**3,192**	**3,207**	**3,289**	**3,356**	**3,412**
Achievable Potential (MW)									
DLC Central AC	-	18.4	22.5	26.7	31.0	35.3	36.2	37.0	37.7
DLC Water Heating	-	3.4	6.0	8.7	11.3	14.0	14.3	14.7	14.9
Interruptible Load Tariffs	323.5	333.6	341.9	350.2	358.7	362.8	372.0	379.6	385.9
Third Party Aggregator	-	12.1	21.2	30.4	39.8	49.2	50.4	51.5	52.3
Total Potential	**323.5**	**367.5**	**391.7**	**416.1**	**440.8**	**461.3**	**473.0**	**482.7**	**490.9**
Achievable Potential (% of Peak)									
DLC Central AC	0.0%	0.6%	0.7%	0.8%	1.0%	1.1%	1.1%	1.1%	1.1%
DLC Water Heating	0.0%	0.1%	0.2%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Interruptible Load Tariffs	10.4%	10.6%	10.8%	11.0%	11.2%	11.3%	11.3%	11.3%	11.3%
Third Party Aggregator	0.0%	0.4%	0.7%	1.0%	1.2%	1.5%	1.5%	1.5%	1.5%
Total Potential	**10.4%**	**11.7%**	**12.4%**	**13.1%**	**13.8%**	**14.4%**	**14.4%**	**14.4%**	**14.4%**

Potential Estimates by Class

DR potential by customer class is shown in Figure 7-4 and Table 7-16 for Achievable Potential. Key observations are:

- Extra Large C&I dominate the potential savings through the existing Interruptible Load Tariff.
- Residential begins to contribute to the peak reduction in 2017 when the DLC programs come online.

Figure 7-4 Achievable Potential by Class

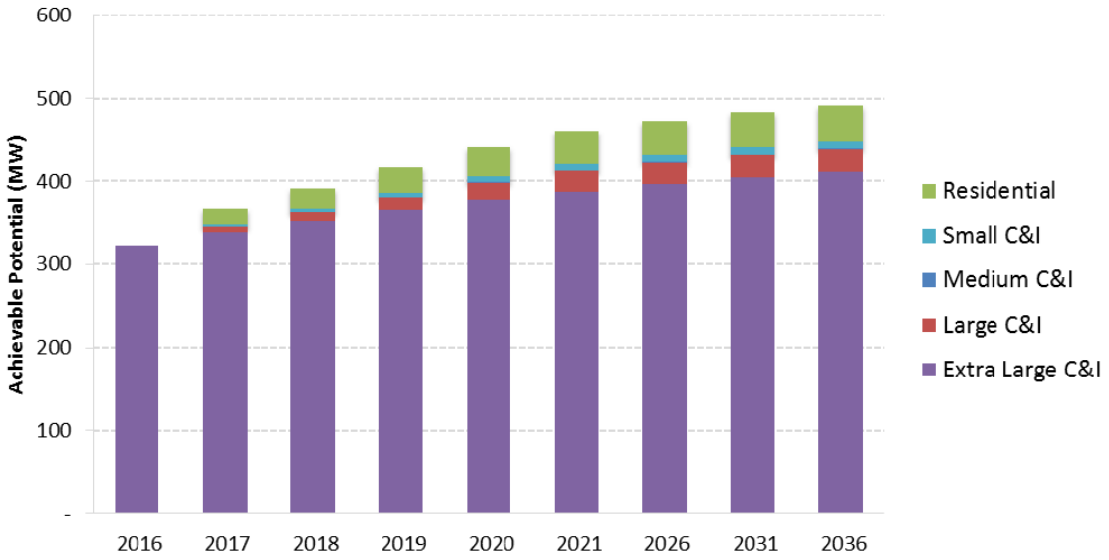


Table 7-16 Achievable Potential by DR Class

	2016	2017	2018	2019	2020	2021	2026	2031	2036
Weather Sensitive Peak (MW)	**3,118**	**3,145**	**3,160**	**3,176**	**3,192**	**3,207**	**3,289**	**3,356**	**3,412**
Achievable Potential (MW)									
Residential	-	19.6	24.7	29.9	35.2	40.5	41.5	42.4	43.1
Small C&I	-	2.0	3.6	5.1	6.7	8.3	8.5	8.7	9.0
Medium C&I	-	0.1	0.2	0.3	0.4	0.5	0.5	0.5	0.5
Large C&I	-	6.1	10.8	15.5	20.2	25.0	25.6	26.1	26.6
Extra Large C&I	323.5	339.6	352.3	365.2	378.3	387.0	396.8	404.9	411.7
Total Potential	**323.5**	**367.5**	**391.7**	**416.1**	**440.8**	**461.3**	**473.0**	**482.7**	**490.9**
Achievable Potential (% of Peak)									
Residential	0.0%	0.62%	0.78%	0.94%	1.10%	1.26%	1.26%	1.26%	1.26%
Small C&I	0.0%	0.06%	0.11%	0.16%	0.21%	0.26%	0.26%	0.26%	0.26%
Medium C&I	0.0%	0.00%	0.01%	0.01%	0.01%	0.02%	0.02%	0.02%	0.02%
Large C&I	0.0%	0.19%	0.34%	0.49%	0.63%	0.78%	0.78%	0.78%	0.78%
Extra Large C&I	10.4%	10.8%	11.2%	11.5%	11.9%	12.1%	12.1%	12.1%	12.1%
Total Potential	**10.4%**	**11.7%**	**12.4%**	**13.1%**	**13.8%**	**14.4%**	**14.4%**	**14.4%**	**14.4%**

Potential DR Program Costs

Table 7-17 and Figure 7-5present program cost estimates from several perspectives for both potential scenario along with 2036 DR potential for reference:

- Cumulative program costs for the achievable portfolio of DR options is approximately $1,372 million over 2016-2036, delivering 491 MW savings in 2036.
- Average program costs for 2016-2036 for NIPSCO to achieve this level of savings are estimated to be $68 million per year.
- Levelized costs over the 2016-2036 timeframe for the entire portfolio are estimated to range from $84/kW-year to $112/kW-year.

- Largest contributor to peak reduction, Interruptible Load Tariffs, costs are around $122 /kW-year.
    1. The Interruptible program is more costly per kW, but is called for more hours throughout the year such that it produces greater system benefits. The analysis assumed 120 hours based on the current program events.
    2. All other programs assumed 60 event hours.

Table 7-17 Achievable Potential Program Costs

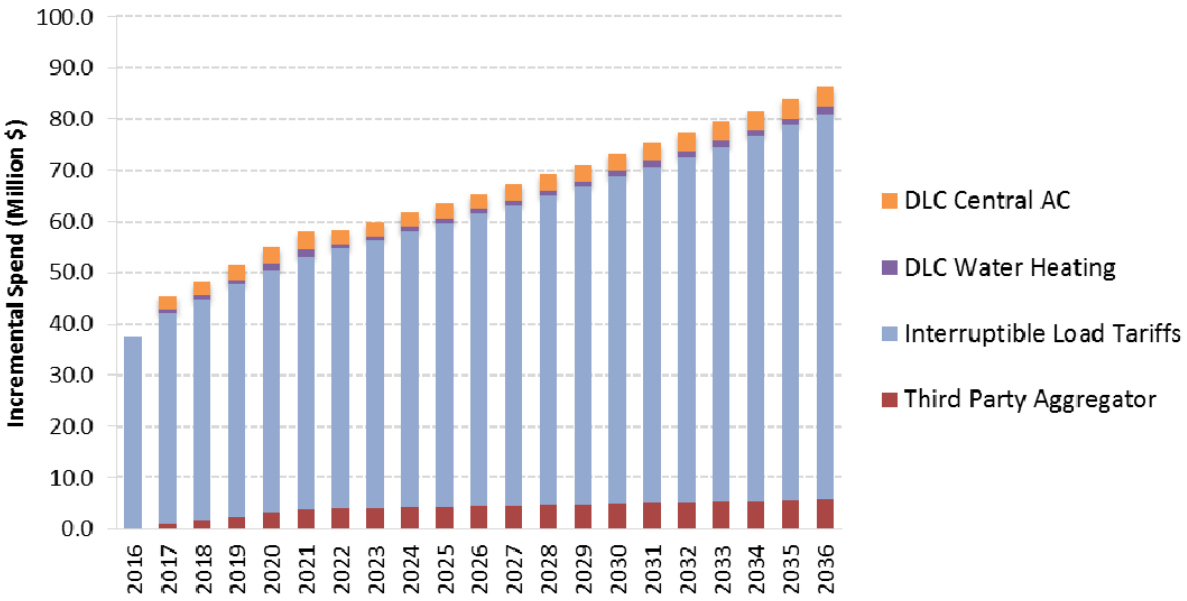
DR Option	2036 MW Potential	2016 – 2036 Cumulative Utility Spend (Million $)	2016 – 2036 Average Spend per Year (Million $)	2016 – 2036 Levelized Cost ($/kW-year)
DLC Central AC	37.7	68.1	3.4	112.1
DLC Water Heating	14.9	20.4	1.0	84.4
Interruptible Load Tariffs	385.9	1,199.5	60.0	121.8
Curtailment Agreements	52.3	84.5	4.2	74.8
Total	**490.9**	**1,372.5**	**68.6**	**-**

Table 7-18 and Figure 7-5 show the annual program costs by DR option for the potential scenario. The high costs in the beginning of the projection are due to the start-up costs of launching the programs, these eventually level out and rise slightly as most participants are incorporated into the program. The majority of costs are driven by the interruptible load tariff due to the high incentive. The DLC program's first year of activity in 2017 is assumed to simply re-engage customers and their already-installed switches that had been on NIPSCO's previous AC Cycling program. After 2017, the costs are high for several years in the near term as incremental, new participants are recruited and have switches installed by the program.

Table 7-18 Achievable Potential Incremental Program Costs

	2016	2017	2018	2019	2020	2021	2026	2031	2036
Incremental Spend (Million $)									
DLC Central AC	-	$2.6	$2.6	$2.9	$3.3	$3.7	$3.0	$3.5	$4.0
DLC Water Heating	-	$0.7	$0.7	$0.9	$1.1	$1.3	$1.0	$1.1	$1.3
Interruptible Load Tariffs	$37.4	$41.2	$43.2	$45.4	$47.6	$49.3	$57.0	$65.6	$75.1
Curtailment Agreements	-	$0.9	$1.6	$2.3	$3.0	$3.8	$4.4	$5.1	$5.8
Total	**$37.4**	**$45.4**	**$48.1**	**$51.5**	**$55.0**	**$58.1**	**$65.4**	**$75.2**	**$86.2**
Cumulative Spend (Million $)									
DLC Central AC	-	$2.6	$5.2	$8.1	$11.4	$15.1	$29.3	$45.7	$64.5
DLC Water Heating	-	$0.7	$1.4	$2.3	$3.4	$4.7	$9.2	$14.4	$20.4
Interruptible Load Tariffs	$37.4	$78.6	$121.8	$167.1	$214.7	$264.0	$533.1	$843.5	$1,199.5
Curtailment Agreements	-	$0.9	$2.5	$4.8	$7.8	$11.7	$32.6	$56.8	$84.5
Total	**$37.4**	**$82.8**	**$130.9**	**$182.4**	**$237.4**	**$295.5**	**$604.3**	**$960.4**	**$1,368.9**

Figure 7-5 Annual Achievable Potential Program Costs



Cost Benefit Analysis

To complete the cost benefit analysis of the DR programs, DSMore was used for modeling. The basic financial assumptions such as avoided costs and discount rates are the same as the energy efficiency analysis to assure consistency. As described above the inputs for the DR programs include the participation, implementation costs, incentives and demand savings. The DLC AC and Water Heating programs were divided into three sizes of customers; Residential, Small C&I, and Medium C&I, so that appropriate load shapes and rates could be applied. The Interruptible Load Tariffs and Curtailment Agreements were divided into two sizes; Large and Extra Large. Again appropriate load shapes and rates were applied.

Table 1-19 shows the cost benefit scores for the TRC, UCT, Participant and RIM tests. All tests are equal to or greater than one meaning they are cost effective. The TRC scores specifically are from 1.24 to 5.1. It is not unusual for these programs to be cost effective as the interruptions occur during the time of day/year when the avoided cost values are at their highest.

Table 7-19 Cost Effectiveness Scores for DR Programs

DR Program	TRC Ratio	UCT Ratio	PCT Ratio	RIM Ratio
Residential DLC Central AC	1.77	1.77	1.00	1.77
Small C&I DLC Central AC	5.06	5.06	1.00	5.06
Medium C&IDLC Central AC	4.72	4.72	1.69	3.72
Residential DLC Water Heating	2.23	2.23	1.00	2.23
Small C&IDLC Water Heating	5.10	5.10	1.00	5.10
Medium C&IDLC Water Heating	4.18	4.18	1.61	3.37
Large C&I Interruptible Load Tariffs	1.25	1.25	1.04	1.21
Extra Large C&I Interruptible Load Tariffs	1.24	1.24	1.00	1.24
Large C&I Curtailment Agreements	2.17	2.17	1.08	2.06
Extra Large C&I Curtailment Agreements	2.22	2.22	1.00	2.22

It should be noted that the TRC and UCT values are the same since incentives are considered a utility cost and not a transfer payment. This is due to the unknown nature of the incremental costs to participate by the customer. This is the more conservative assumption on incentives for the TRC and UCT tests. Also it is assumed that the measures interrupted will have a complete "rebound" or recovery period before or after the interruption resulting in the total kWh sales being equivalent to the period without interruption. Thus there is no lost revenue to the utility for the energy portion of the bill. For smaller customers with no demand charges, this means the TRC and RIM will be equal.

APPENDIX | A

Market Profiles

This appendix presents the market profiles for each sector and segment.

Table A-1 Residential Single Family Electric Market Profile

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	62.5%	2,493	1,557	319.9
Cooling	Room AC	33.0%	651	215	44.1
Cooling	Air-Source Heat Pump	1.1%	2,381	25	5.2
Cooling	Geothermal Heat Pump	0.3%	2,329	7	1.5
Space Heating	Electric Zonal Room Heat	1.4%	8,896	123	25.2
Space Heating	Electric Furnace	1.9%	15,124	291	59.7
Space Heating	Air-Source Heat Pump	1.1%	8,420	89	18.3
Space Heating	Geothermal Heat Pump	0.3%	6,516	21	4.2
Water Heating	Water Heater <= 55 Gal	9.4%	3,134	294	60.3
Water Heating	Water Heater > 55 Gal	4.2%	3,313	139	28.5
Interior Lighting	Screw-in	100.0%	847	847	174.1
Interior Lighting	Linear Fluorescent	100.0%	159	159	32.7
Interior Lighting	Specialty	100.0%	297	297	61.1
Exterior Lighting	Screw-in	100.0%	369	369	75.8
Appliances	Clothes Washer	96.4%	87	84	17.2
Appliances	Clothes Dryer	62.8%	785	493	101.3
Appliances	Dishwasher	62.7%	391	245	50.3
Appliances	Refrigerator	100.0%	735	735	150.9
Appliances	Freezer	49.3%	583	288	59.1
Appliances	Second Refrigerator	39.8%	1,036	412	84.6
Appliances	Stove	53.0%	472	250	51.4
Appliances	Microwave	100.0%	128	128	26.2
Electronics	Personal Computers	68.6%	182	125	25.6
Electronics	Monitor	82.5%	77	63	13.0
Electronics	Laptops	154.2%	48	74	15.3
Electronics	TVs	305.0%	163	499	102.4
Electronics	Printer/Fax/Copier	103.1%	59	61	12.5
Electronics	Set-top Boxes/DVR	318.8%	111	354	72.8
Electronics	Devices and Gadgets	100.0%	107	107	21.9
Miscellaneous	Pool Pump	2.3%	1,363	31	6.4
Miscellaneous	Pool Heater	0.3%	1,370	4	0.8
Miscellaneous	Hot Tub / Spa	5.3%	2,034	108	22.1
Miscellaneous	Furnace Fan	75.7%	740	560	115.1
Miscellaneous	Well pump	11.9%	561	67	13.8
Miscellaneous	Dehumidifiers	34.4%	619	213	43.8
Miscellaneous	Miscellaneous	100.0%	416	416	85.4
Total				**9,747**	**2,002.8**

Table A-2 Residential Multifamily Electric Market Profile

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	43.3%	902	391	23.7
Cooling	Room AC	49.2%	987	486	29.5
Cooling	Air-Source Heat Pump	0.3%	902	3	0.2
Cooling	Geothermal Heat Pump	0.0%	882	0	0.0
Space Heating	Electric Zonal Room Heat	7.0%	3,422	241	14.6
Space Heating	Electric Furnace	6.7%	4,987	333	20.2
Space Heating	Air-Source Heat Pump	0.3%	2,717	10	0.6
Space Heating	Geothermal Heat Pump	0.0%	2,102	0	0.0
Water Heating	Water Heater <= 55 Gal	8.8%	2,610	228	13.9
Water Heating	Water Heater > 55 Gal	6.4%	2,760	177	10.7
Interior Lighting	Screw-in	100.0%	584	584	35.4
Interior Lighting	Linear Fluorescent	100.0%	49	49	3.0
Interior Lighting	Specialty	100.0%	34	34	2.1
Exterior Lighting	Screw-in	100.0%	175	175	10.6
Appliances	Clothes Washer	35.9%	87	31	1.9
Appliances	Clothes Dryer	22.1%	698	154	9.4
Appliances	Dishwasher	36.2%	390	141	8.6
Appliances	Refrigerator	100.0%	732	732	44.4
Appliances	Freezer	11.7%	583	68	4.1
Appliances	Second Refrigerator	4.1%	1,032	42	2.5
Appliances	Stove	57.2%	287	164	10.0
Appliances	Microwave	99.3%	128	127	7.7
Electronics	Personal Computers	39.9%	182	73	4.4
Electronics	Monitor	48.0%	77	37	2.2
Electronics	Laptops	112.4%	48	54	3.3
Electronics	TVs	191.3%	163	313	19.0
Electronics	Printer/Fax/Copier	37.5%	59	22	1.3
Electronics	Set-top Boxes/DVR	192.4%	111	214	13.0
Electronics	Devices and Gadgets	100.0%	107	107	6.5
Miscellaneous	Pool Pump	0.0%	1,363	0	0.0
Miscellaneous	Pool Heater	0.0%	1,370	0	0.0
Miscellaneous	Hot Tub / Spa	0.0%	2,034	0	0.0
Miscellaneous	Furnace Fan	67.1%	405	272	16.5
Miscellaneous	Well pump	0.0%	556	0	0.0
Miscellaneous	Dehumidifiers	6.7%	619	41	2.5
Miscellaneous	Miscellaneous	100.0%	271	271	16.5
Total				**5,573**	**338.2**

Table A-3 Residential Mobile Home Electric Market Profile

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	31.8%	1,919	609	4.2
Cooling	Room AC	19.6%	532	104	0.7
Cooling	Air-Source Heat Pump	0.0%	1,919	0	0.0
Cooling	Geothermal Heat Pump	0.0%	1,689	0	0.0
Space Heating	Electric Zonal Room Heat	2.5%	6,237	155	1.1
Space Heating	Electric Furnace	5.0%	10,603	527	3.6
Space Heating	Air-Source Heat Pump	0.0%	5,755	0	0.0
Space Heating	Geothermal Heat Pump	0.0%	3,804	0	0.0
Water Heating	Water Heater <= 55 Gal	16.6%	2,084	346	2.4
Water Heating	Water Heater > 55 Gal	7.4%	2,203	164	1.1
Interior Lighting	Screw-in	100.0%	617	617	4.3
Interior Lighting	Linear Fluorescent	100.0%	101	101	0.7
Interior Lighting	Specialty	100.0%	117	117	0.8
Exterior Lighting	Screw-in	100.0%	235	235	1.6
Appliances	Clothes Washer	100.0%	82	82	0.6
Appliances	Clothes Dryer	79.7%	626	499	3.4
Appliances	Dishwasher	24.3%	362	88	0.6
Appliances	Refrigerator	100.0%	694	694	4.8
Appliances	Freezer	45.7%	553	253	1.7
Appliances	Second Refrigerator	17.3%	979	169	1.2
Appliances	Stove	24.8%	509	126	0.9
Appliances	Microwave	100.0%	121	121	0.8
Electronics	Personal Computers	34.8%	173	60	0.4
Electronics	Monitor	41.9%	73	31	0.2
Electronics	Laptops	72.0%	46	33	0.2
Electronics	TVs	234.2%	155	364	2.5
Electronics	Printer/Fax/Copier	27.1%	56	15	0.1
Electronics	Set-top Boxes/DVR	245.9%	106	260	1.8
Electronics	Devices and Gadgets	100.0%	101	101	0.7
Miscellaneous	Pool Pump	0.0%	1,295	0	0.0
Miscellaneous	Pool Heater	0.0%	1,301	0	0.0
Miscellaneous	Hot Tub / Spa	4.3%	1,932	83	0.6
Miscellaneous	Furnace Fan	63.0%	692	436	3.0
Miscellaneous	Well pump	0.0%	428	0	0.0
Miscellaneous	Dehumidifiers	8.7%	588	51	0.4
Miscellaneous	Miscellaneous	100.0%	219	219	1.5
Total				**6,662**	**45.9**

Table A-4 Residential Low Income Electric Market Profile

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	25.7%	2,158	556	71.8
Cooling	Room AC	57.6%	879	506	65.4
Cooling	Air-Source Heat Pump	3.0%	2,091	62	8.0
Cooling	Geothermal Heat Pump	0.0%	2,017	0	0.0
Space Heating	Electric Zonal Room Heat	3.8%	6,849	262	33.9
Space Heating	Electric Furnace	4.2%	11,283	474	61.2
Space Heating	Air-Source Heat Pump	3.0%	6,236	184	23.8
Space Heating	Geothermal Heat Pump	0.0%	4,741	0	0.0
Water Heating	Water Heater <= 55 Gal	15.5%	2,965	461	59.6
Water Heating	Water Heater > 55 Gal	7.1%	3,134	222	28.7
Interior Lighting	Screw-in	100.0%	653	653	84.5
Interior Lighting	Linear Fluorescent	100.0%	108	108	13.9
Interior Lighting	Specialty	100.0%	229	229	29.6
Exterior Lighting	Screw-in	100.0%	275	275	35.6
Appliances	Clothes Washer	53.8%	91	49	6.4
Appliances	Clothes Dryer	35.7%	774	277	35.8
Appliances	Dishwasher	35.9%	409	147	19.0
Appliances	Refrigerator	100.0%	770	770	99.5
Appliances	Freezer	25.1%	612	153	19.8
Appliances	Second Refrigerator	17.1%	1,085	185	23.9
Appliances	Stove	51.9%	422	219	28.3
Appliances	Microwave	99.7%	134	134	17.3
Electronics	Personal Computers	40.0%	191	76	9.9
Electronics	Monitor	48.1%	81	39	5.0
Electronics	Laptops	96.5%	51	49	6.3
Electronics	TVs	188.2%	172	323	41.8
Electronics	Printer/Fax/Copier	51.3%	62	32	4.1
Electronics	Set-top Boxes/DVR	194.4%	117	227	29.3
Electronics	Devices and Gadgets	100.0%	112	112	14.5
Miscellaneous	Pool Pump	0.0%	1,431	0	0.0
Miscellaneous	Pool Heater	0.0%	1,438	0	0.0
Miscellaneous	Hot Tub / Spa	2.3%	2,136	48	6.2
Miscellaneous	Furnace Fan	70.9%	630	447	57.8
Miscellaneous	Well pump	5.8%	575	33	4.3
Miscellaneous	Dehumidifiers	15.3%	650	99	12.8
Miscellaneous	Miscellaneous	100.0%	303	303	39.2
Total				**7,713**	**997.2**

Table A-5 Small Commercial Electric Market Profile

Average Market Profiles

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)
Cooling	Air-Cooled Chiller	4.4%	3.22	0.14	45.4
Cooling	Water-Cooled Chiller	5.9%	3.51	0.21	65.2
Cooling	RTU	55.0%	3.97	2.18	690.8
Cooling	Room AC	3.7%	4.05	0.15	47.6
Cooling	Air-Source Heat Pump	0.9%	3.97	0.04	11.7
Cooling	Geothermal Heat Pump	0.8%	2.42	0.02	6.2
Heating	Electric Furnace	10.3%	4.69	0.48	153.5
Heating	Electric Room Heat	3.5%	4.47	0.16	49.1
Heating	Air-Source Heat Pump	0.9%	3.84	0.04	11.3
Heating	Geothermal Heat Pump	0.8%	2.42	0.02	6.2
Ventilation	Ventilation	100.0%	0.88	0.88	278.6
Water Heating	Water Heater	42.3%	0.69	0.29	91.9
Interior Lighting	Screw-in	100.0%	0.51	0.51	160.2
Interior Lighting	High-Bay Fixtures	100.0%	0.86	0.86	271.4
Interior Lighting	Linear Fluorescent	100.0%	1.93	1.93	613.0
Exterior Lighting	Screw-in	100.0%	0.18	0.18	56.4
Exterior Lighting	HID	100.0%	1.06	1.06	334.5
Exterior Lighting	Linear Fluorescent	100.0%	0.12	0.12	36.6
Refrigeration	Walk-in Refrigerator	11.5%	0.28	0.03	10.1
Refrigeration	Reach-in Refrigerator	44.9%	0.06	0.03	8.9
Refrigeration	Glass Door Display	35.5%	0.06	0.02	7.2
Refrigeration	Open Display Case	35.5%	0.38	0.13	42.8
Refrigeration	Icemaker	35.5%	0.11	0.04	11.8
Refrigeration	Vending Machine	35.5%	0.05	0.02	5.5
Food Preparation	Oven	37.9%	0.06	0.02	7.4
Food Preparation	Fryer	43.9%	0.09	0.04	12.3
Food Preparation	Griddle	39.0%	0.08	0.03	10.0
Food Preparation	Dishwasher	14.6%	0.12	0.02	5.6
Food Preparation	Steamer	14.6%	0.09	0.01	4.1
Food Preparation	Hot Food Container	14.6%	0.02	0.00	0.8
Office Equipment	Desktop Computer	100.0%	0.59	0.59	187.0
Office Equipment	Laptop	100.0%	0.09	0.09	28.9
Office Equipment	Server	100.0%	0.17	0.17	55.0
Office Equipment	Monitor	100.0%	0.10	0.10	33.0
Office Equipment	Printer/Copier/Fax	100.0%	0.08	0.08	25.6
Office Equipment	POS Terminal	81.9%	0.05	0.04	12.0
Miscellaneous	Non-HVAC Motors	22.0%	0.15	0.03	10.5
Miscellaneous	Pool Pump	3.8%	0.02	0.00	0.3
Miscellaneous	Pool Heater	1.7%	0.03	0.00	0.2
Miscellaneous	Other	100.0%	0.91	0.91	288.03
Total				**11.67**	**3696.8**

Table A-6 Large Commercial Electric Market Profile

Average Market Profiles					
End Use	**Technology**	**Saturation**	**EUI (kWh)**	**Intensity (kWh/Sqft)**	**Usage (GWh)**
Cooling	Air-Cooled Chiller	9.1%	4.92	0.45	0.2
Cooling	Water-Cooled Chiller	48.4%	5.36	2.59	1.1
Cooling	RTU	23.6%	6.06	1.43	0.6
Cooling	Room AC	0.0%	6.19	0.00	0.0
Cooling	Air-Source Heat Pump	3.4%	6.06	0.20	0.1
Cooling	Geothermal Heat Pump	0.0%	3.69	0.00	0.0
Heating	Electric Furnace	3.2%	5.84	0.19	0.1
Heating	Electric Room Heat	6.7%	5.56	0.37	0.2
Heating	Air-Source Heat Pump	3.4%	5.36	0.18	0.1
Heating	Geothermal Heat Pump	0.0%	4.40	0.00	0.0
Ventilation	Ventilation	100.0%	3.24	3.24	1.4
Water Heating	Water Heater	46.9%	1.08	0.51	0.2
Interior Lighting	Screw-in	100.0%	0.48	0.48	0.2
Interior Lighting	High-Bay Fixtures	100.0%	0.79	0.79	0.3
Interior Lighting	Linear Fluorescent	100.0%	2.14	2.14	0.9
Exterior Lighting	Screw-in	100.0%	0.16	0.16	0.1
Exterior Lighting	HID	100.0%	1.01	1.01	0.4
Exterior Lighting	Linear Fluorescent	100.0%	0.12	0.12	0.1
Refrigeration	Walk-in Refrigerator	52.0%	0.27	0.14	0.1
Refrigeration	Reach-in Refrigerator	99.7%	0.06	0.06	0.0
Refrigeration	Glass Door Display	77.4%	0.06	0.05	0.0
Refrigeration	Open Display Case	77.4%	0.37	0.29	0.1
Refrigeration	Icemaker	44.9%	0.10	0.05	0.0
Refrigeration	Vending Machine	44.9%	0.10	0.04	0.0
Food Preparation	Oven	66.0%	0.08	0.05	0.0
Food Preparation	Fryer	76.4%	0.11	0.09	0.0
Food Preparation	Griddle	67.9%	0.10	0.07	0.0
Food Preparation	Dishwasher	25.4%	0.15	0.04	0.0
Food Preparation	Steamer	25.4%	0.11	0.03	0.0
Food Preparation	Hot Food Container	25.4%	0.02	0.01	0.0
Office Equipment	Desktop Computer	100.0%	1.64	1.64	0.7
Office Equipment	Laptop	100.0%	0.25	0.25	0.1
Office Equipment	Server	100.0%	0.16	0.16	0.1
Office Equipment	Monitor	100.0%	0.29	0.29	0.1
Office Equipment	Printer/Copier/Fax	100.0%	0.15	0.15	0.1
Office Equipment	POS Terminal	35.5%	0.02	0.01	0.0
Miscellaneous	Non-HVAC Motors	89.6%	0.36	0.32	0.1
Miscellaneous	Pool Pump	24.0%	0.05	0.01	0.0
Miscellaneous	Pool Heater	1.9%	0.07	0.00	0.0
Miscellaneous	Other	100.0%	2.08	2.08	0.90
Total				**19.70**	**8.6**

Table A-7 Small Industrial Electric Market Profile

Average Market Profiles					
End Use	**Technology**	**Saturation**	**EUI (kWh)**	**Intensity (kWh/Employee)**	**Usage (GWh)**
Cooling	Air-Cooled Chiller	4.4%	4,466	199	13.4
Cooling	Water-Cooled Chiller	5.9%	4,866	285	19.2
Cooling	RTU	55.0%	5,497	3,022	203.9
Cooling	Room AC	3.7%	5,617	208	14.1
Cooling	Air-Source Heat Pump	0.9%	5,497	51	3.4
Cooling	Geothermal Heat Pump	0.8%	3,350	27	1.8
Heating	Electric Furnace	10.3%	6,508	672	45.3
Heating	Electric Room Heat	3.5%	6,198	215	14.5
Heating	Air-Source Heat Pump	0.9%	5,319	49	3.3
Heating	Geothermal Heat Pump	0.8%	3,361	27	1.8
Ventilation	Ventilation	100.0%	1,219	1,219	82.2
Interior Lighting	Screw-in	100.0%	172	172	11.6
Interior Lighting	High-Bay Fixtures	100.0%	3,068	3,068	207.0
Interior Lighting	Linear Fluorescent	100.0%	500	500	33.7
Exterior Lighting	Screw-in	100.0%	34	34	2.3
Exterior Lighting	HID	100.0%	647	647	43.7
Exterior Lighting	Linear Fluorescent	100.0%	133	133	8.9
Process	Process Heating	100.0%	2,945	2,945	198.6
Process	Process Cooling	100.0%	771	771	52.0
Process	Process Refrigeration	100.0%	771	771	52.0
Process	Process Electro-Chemical	100.0%	73	73	5.0
Process	Process Other	100.0%	194	194	13.1
Motors	Pumps	100.0%	1,823	1,823	123.0
Motors	Fans & Blowers	100.0%	2,190	2,190	147.7
Motors	Compressed Air	100.0%	1,770	1,770	119.4
Motors	Conveyors	100.0%	3,745	3,745	252.6
Motors	Other Motors	100.0%	63	63	4.2
Miscellaneous	Miscellaneous	100.0%	1,501	1,501	101.3
	Total			**26,377**	**1,779.2**

Table A-8 Large Industrial Electric Market Profile

Average Market Profiles					
End Use	**Technology**	**Saturation**	**EUI (kWh)**	**Intensity (kWh/Employee)**	**Usage (GWh)**
Cooling	Air-Cooled Chiller	9.1%	5,849	530	0.5
Cooling	Water-Cooled Chiller	48.4%	6,372	3,082	3.1
Cooling	RTU	23.6%	7,199	1,701	1.7
Cooling	Room AC	0.0%	3,684	0	0.0
Cooling	Air-Source Heat Pump	3.4%	7,199	242	0.2
Cooling	Geothermal Heat Pump	0.0%	4,802	0	0.0
Heating	Electric Furnace	3.2%	6,941	223	0.2
Heating	Electric Room Heat	6.7%	6,610	440	0.4
Heating	Air-Source Heat Pump	3.4%	6,369	214	0.2
Heating	Geothermal Heat Pump	0.0%	4,248	0	0.0
Ventilation	Ventilation	100.0%	3,851	3,851	3.9
Interior Lighting	Screw-in	100.0%	399	399	0.4
Interior Lighting	High-Bay Fixtures	100.0%	7,121	7,121	7.2
Interior Lighting	Linear Fluorescent	100.0%	1,160	1,160	1.2
Exterior Lighting	Screw-in	100.0%	79	79	0.1
Exterior Lighting	HID	100.0%	1,502	1,502	1.5
Exterior Lighting	Linear Fluorescent	100.0%	308	308	0.3
Process	Process Heating	100.0%	67,873	67,873	68.8
Process	Process Cooling	100.0%	3,156	3,156	3.2
Process	Process Refrigeration	100.0%	3,156	3,156	3.2
Process	Process Electro-Chemical	100.0%	33,443	33,443	33.9
Process	Process Other	100.0%	2,085	2,085	2.1
Motors	Pumps	100.0%	8,308	8,308	8.4
Motors	Fans & Blowers	100.0%	12,070	12,070	12.2
Motors	Compressed Air	100.0%	10,088	10,088	10.2
Motors	Conveyors	100.0%	77,020	77,020	78.1
Motors	Other Motors	100.0%	6,228	6,228	6.3
Miscellaneous	Miscellaneous	100.0%	3,684	3,684	3.7
	Total			**247,963**	**251.4**

APPENDIX | **B**

Market Adoption Rates

This embedded spreadsheet file presents the market adoption rates that were applied to economic potential to estimate achievable potential.

NIPSCO Appendix B Tables 2015.xlsx

APPENDIX | **C**

Measure Data

Please see measure-level assumptions and details in the file "*NIPSCO Electric Measure Summary - All Sectors.xlsx.*"

Applied Energy Group, Inc.
500 Ygnacio Valley Road, Suite 250
Walnut Creek, CA 94596

P: 510.982.3525
F: 925.284.3147

Table 1: Budget per Program

Program Name	2016	2017	2018	2019	2020	2021	2022
HVAC	$ 920,905	$ 935,369	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204
Lighting	$ 924,281	$ 887,200	$ 955,260	$ 955,260	$ 955,260	$ 955,260	$ 955,260
Home Energy Analysis	$ 1,198,974	$ 1,205,266	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912
Appliance Recycling	$ 992,659	$ 958,273	$ 961,751	$ 961,751	$ 961,751	$ 961,751	$ 961,751
Low Income Appliance Replacement	$ 552,315	$ 549,591	$ 576,643	$ 576,643	$ 576,643	$ 576,643	$ 576,643
School Education	$ 423,644	$ 411,404	$ 412,284	$ 412,284	$ 412,284	$ 412,284	$ 412,284
Behavioral	$ 598,650	$ 634,655	$ 734,387	$ 734,387	$ 734,387	$ 734,387	$ 734,387
IQW	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870
Prescriptive	$ 2,422,549	$ 2,347,418	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931
Custom	$ 4,089,844	$ 3,964,399	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946
New Construction	$ 319,352	$ 302,892	$ 322,669	$ 322,669	$ 322,669	$ 322,669	$ 322,669
Small Business Direct Install	$ 600,592	$ 585,060	$ 623,026	$ 623,026	$ 623,026	$ 623,026	$ 623,026
Retro Commisioning	$ 352,639	$ 336,035	$ 357,950	$ 357,950	$ 357,950	$ 357,950	$ 357,950

Source: For 2016-2018 data, 2016 Final SOWs for Residential and Commercial programs
2019-2040 is forecasted as 2018.

Table 1: Budget per Program

Program Name	2023	2024	2025	2026	2027	2028	2029
HVAC	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204
Lighting	$ 955,260	$ 955,260	$ 955,260	$ 955,260	$ 955,260	$ 955,260	$ 955,260
Home Energy Analysis	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912
Appliance Recycling	$ 961,751	$ 961,751	$ 961,751	$ 961,751	$ 961,751	$ 961,751	$ 961,751
Low Income Appliance Replacement	$ 576,643	$ 576,643	$ 576,643	$ 576,643	$ 576,643	$ 576,643	$ 576,643
School Education	$ 412,284	$ 412,284	$ 412,284	$ 412,284	$ 412,284	$ 412,284	$ 412,284
Behavioral	$ 734,387	$ 734,387	$ 734,387	$ 734,387	$ 734,387	$ 734,387	$ 734,387
IQW	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870
Prescriptive	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931
Custom	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946
New Construction	$ 322,669	$ 322,669	$ 322,669	$ 322,669	$ 322,669	$ 322,669	$ 322,669
Small Business Direct Install	$ 623,026	$ 623,026	$ 623,026	$ 623,026	$ 623,026	$ 623,026	$ 623,026
Retro Commisioning	$ 357,950	$ 357,950	$ 357,950	$ 357,950	$ 357,950	$ 357,950	$ 357,950

Source: For 2016-2018 data, 2016 Final SOWs for Residential and Commercial programs
2019-2040 is forecasted as 2018.

Table 1: Budget per Program

Program Name	2030	2031	2032	2033	2034	2035	2036	2037
HVAC	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204	$ 1,022,204
Lighting	$ 955,260	$ 955,260	$ 955,260	$ 955,260	$ 955,260	$ 955,260	$ 955,260	$ 955,260
Home Energy Analysis	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912	$ 1,233,912
Appliance Recycling	$ 961,751	$ 961,751	$ 961,751	$ 961,751	$ 961,751	$ 961,751	$ 961,751	$ 961,751
Low Income Appliance Replacement	$ 576,643	$ 576,643	$ 576,643	$ 576,643	$ 576,643	$ 576,643	$ 576,643	$ 576,643
School Education	$ 412,284	$ 412,284	$ 412,284	$ 412,284	$ 412,284	$ 412,284	$ 412,284	$ 412,284
Behavioral	$ 734,387	$ 734,387	$ 734,387	$ 734,387	$ 734,387	$ 734,387	$ 734,387	$ 734,387
IQW	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870	$ 249,870
Prescriptive	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931	$ 2,499,931
Custom	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946	$ 4,221,946
New Construction	$ 322,669	$ 322,669	$ 322,669	$ 322,669	$ 322,669	$ 322,669	$ 322,669	$ 322,669
Small Business Direct Install	$ 623,026	$ 623,026	$ 623,026	$ 623,026	$ 623,026	$ 623,026	$ 623,026	$ 623,026
Retro Commisioning	$ 357,950	$ 357,950	$ 357,950	$ 357,950	$ 357,950	$ 357,950	$ 357,950	$ 357,950

Source: For 2016-2018 data, 2016 Final SOWs for Residential and Commercial programs
2019-2040 is forecasted as 2018.

Table 2: Total Utility Cost per Program

End Use Sector	2016	2017	2018	2019	2020	2021	2022
Residential Appliances	$650,293.62	$683,999.60	$729,349.46	$772,685.13	$842,012.81	$982,110.75	$1,053,071.56
Residential Cooling	$4,828,071.16	$5,034,077.12	$5,344,512.72	$5,783,280.54	$6,192,164.11	$6,554,484.09	$7,746,689.84
Residential Exterior Lighting	$570,482.37	$575,333.47	$483,949.21	$384,633.95	$313,061.08	$328,207.18	$278,194.00
Residential Heating	$180,351.91	$209,966.49	$236,626.06	$262,521.06	$301,288.04	$321,662.77	$342,730.25
Residential Interior Lighting	$4,197,495.58	$3,929,057.25	$3,300,432.31	$2,662,179.75	$3,420,830.69	$3,285,979.49	$2,845,202.86
Residential Miscellaneous	$80,874.11	$90,907.31	$101,766.82	$112,123.29	$122,726.25	$132,023.34	$138,940.60
Residential Water Heating	$17,056.67	$18,355.20	$19,772.72	$21,306.45	$22,969.83	$23,603.08	$25,332.67
Commercial Cooling	$2,194,974.32	$2,320,210.69	$2,784,066.89	$3,023,052.10	$3,354,315.37	$4,110,225.38	$4,484,295.08
Commercial Exterior Lighting	$723,546.76	$761,494.11	$716,403.39	$774,591.79	$703,239.20	$741,471.27	$773,314.31
Commercial Food Preparation	$58,586.77	$60,193.30	$67,377.21	$71,580.98	$75,771.18	$79,766.02	$84,792.43
Commercial Heating	$1,178.13	$1,131.71	$1,220.67	$1,243.16	$1,393.40	$1,537.26	$1,678.12
Commercial Interior Lighting	$5,260,190.12	$5,138,371.13	$5,164,573.66	$5,582,248.57	$2,098,984.48	$2,211,250.25	$2,307,545.63
Commercial Miscellaneous	$571.83	$595.83	$643.62	$670.49	$693.39	$712.22	$728.37
Commercial Office Equipment	$40,087.90	$48,361.13	$53,918.62	$58,085.85	$57,648.21	$59,910.70	$63,720.73
Commercial Refrigeration	$22,324.02	$22,401.89	$23,041.50	$24,521.00	$25,910.65	$27,206.76	$28,440.95
Commercial Ventilation	$1,529.18	$2,371.55	$3,358.90	$4,429.72	$5,590.58	$6,843.40	$8,193.29
Commercial Water Heating	$250,835.18	$284,476.97	$297,272.86	$305,103.53	$280,013.70	$331,562.02	$346,149.77
Industrial Cooling	$582,189.47	$559,355.63	$502,482.85	$553,408.41	$600,567.36	$737,870.00	$799,810.53
Industrial Exterior Lighting	$67,819.04	$69,319.30	$62,219.97	$63,393.03	$70,600.74	$75,375.78	$78,942.34
Industrial Heating	$1,480.41	$1,518.69	$1,540.63	$1,570.91	$2,082.33	$2,592.24	$3,058.95
Industrial Interior Lighting	$988,236.14	$948,582.15	$873,744.62	$891,103.20	$471,513.17	$504,749.88	$525,949.88
Industrial Motors	$76,344.43	$81,513.93	$86,355.09	$91,065.50	$95,975.02	$148,531.05	$155,488.24
Demand Response Res/ Comm AC	$0.00	$2,605,899.00	$3,194,347.22	$3,419,888.34	$3,699,829.82	$4,017,766.81	$2,652,046.60
Demand Response Res/Comm Water Heating	$0.00	$698,967.38	$727,358.97	$893,727.92	$1,069,110.51	$1,253,502.47	$845,339.72

 Source: Aggregation Results, Financial Results Tab, Utililty Costs F99:F123 [from files in: MMP 020716 (MP) and MMP 021216 022316 (MP-DR)]

Table 2: Total Utility Cost per Program

End Use Sector	2023	2024	2025	2026	2027	2028	2029
Residential Appliances	$1,129,161.32	$1,208,958.41	$1,279,023.90	$1,354,891.01	$1,433,118.56	$1,469,390.78	$1,511,250.19
Residential Cooling	$8,627,470.66	$10,747,255.55	$11,222,119.87	$11,850,122.70	$12,503,626.29	$13,140,518.23	$13,772,535.01
Residential Exterior Lighting	$288,824.62	$252,548.22	$262,253.79	$274,152.54	$271,217.19	$267,234.43	$282,977.79
Residential Heating	$365,036.48	$388,123.52	$409,473.87	$452,117.09	$495,211.93	$538,358.39	$580,842.07
Residential Interior Lighting	$2,959,641.33	$2,293,536.82	$2,518,237.25	$2,625,861.51	$2,625,991.33	$2,673,016.40	$2,783,066.28
Residential Miscellaneous	$146,311.49	$158,422.90	$170,026.80	$181,650.09	$193,746.94	$205,963.38	$217,854.38
Residential Water Heating	$27,162.67	$29,085.54	$31,072.59	$33,152.31	$35,365.31	$37,695.19	$40,096.14
Commercial Cooling	$4,887,787.57	$5,292,076.02	$5,588,905.36	$7,260,718.82	$10,237,983.05	$11,375,998.76	$12,239,876.76
Commercial Exterior Lighting	$815,568.34	$841,596.60	$845,748.19	$965,417.12	$1,021,054.05	$1,010,289.33	$1,008,481.29
Commercial Food Preparation	$89,673.76	$95,362.77	$96,821.98	$100,826.34	$96,503.49	$96,436.52	$100,831.91
Commercial Heating	$1,817.57	$1,841.76	$1,775.66	$1,982.91	$2,252.61	$2,597.75	$2,643.44
Commercial Interior Lighting	$2,435,006.08	$2,931,742.61	$2,982,996.14	$3,320,096.41	$3,500,230.50	$3,521,359.57	$4,022,267.10
Commercial Miscellaneous	$742.74	$748.54	$749.64	$790.38	$798.63	$827.45	$1,011.25
Commercial Office Equipment	$68,243.83	$72,999.32	$85,343.49	$92,330.75	$95,232.49	$98,929.60	$102,638.20
Commercial Refrigeration	$29,647.81	$31,387.13	$44,506.89	$47,419.00	$47,991.73	$49,791.30	$66,851.45
Commercial Ventilation	$9,647.39	$11,209.66	$12,778.32	$14,566.46	$16,356.11	$18,259.24	$20,283.53
Commercial Water Heating	$361,272.48	$372,909.55	$390,154.79	$456,259.82	$463,220.85	$481,446.63	$517,224.44
Industrial Cooling	$896,044.79	$899,329.02	$900,738.78	$1,013,643.36	$1,196,468.85	$1,364,679.83	$1,372,301.63
Industrial Exterior Lighting	$85,597.92	$84,108.62	$84,542.43	$96,024.21	$106,570.67	$105,677.15	$105,620.69
Industrial Heating	$3,526.13	$3,548.74	$3,592.43	$3,598.40	$4,614.99	$5,598.14	$5,416.45
Industrial Interior Lighting	$569,943.31	$581,464.61	$580,967.58	$656,304.54	$724,214.00	$716,883.66	$709,313.98
Industrial Motors	$162,894.75	$170,261.71	$177,585.86	$263,184.09	$274,403.58	$285,787.95	$297,408.35
Demand Response Res/ Comm AC	$2,729,091.96	$2,806,438.75	$2,885,575.88	$2,967,982.22	$3,052,723.05	$3,138,174.63	$3,227,259.73
Demand Response Res/Comm Water Heating	$869,990.53	$894,853.72	$920,285.22	$946,660.40	$973,768.08	$1,001,208.74	$1,029,699.66

 Source: Aggregation Results, Financial Results Tab, Utililty Costs F99:F123 [from files in: MMP 020716 (MP) and MMP 021216 022316 (MP-DR)]

Table 2: Total Utility Cost per Program

End Use Sector	2030	2031	2032	2033	2034	2035	2036	2037
Residential Appliances	$1,558,177.31	$1,612,300.51	$1,758,305.75	$1,801,329.37	$1,788,993.71	$1,848,897.33	$1,901,909.94	$0.00
Residential Cooling	$15,229,843.29	$16,835,361.92	$21,140,094.06	$22,141,644.04	$22,122,802.00	$23,078,109.48	$23,965,089.86	$0.00
Residential Exterior Lighting	$312,417.30	$302,031.30	$283,603.99	$267,171.60	$265,470.36	$265,741.73	$264,485.27	$0.00
Residential Heating	$574,637.60	$593,256.19	$615,986.23	$640,506.16	$670,873.46	$706,302.77	$737,199.66	$0.00
Residential Interior Lighting	$3,181,722.22	$3,050,354.24	$2,904,244.44	$2,783,303.67	$2,823,985.32	$2,837,116.08	$2,848,292.00	$0.00
Residential Miscellaneous	$230,212.46	$232,139.82	$234,716.10	$278,298.15	$280,211.72	$285,124.86	$288,632.01	$0.00
Residential Water Heating	$42,663.19	$45,402.94	$48,215.15	$51,050.21	$44,905.61	$46,761.07	$48,648.92	$0.00
Commercial Cooling	$12,938,651.42	$14,566,538.46	$15,389,803.33	$16,439,847.82	$16,569,519.56	$17,100,158.93	$19,676,334.44	$0.00
Commercial Exterior Lighting	$984,322.35	$1,030,727.30	$1,013,914.26	$1,036,785.65	$1,065,818.30	$1,097,065.98	$1,132,077.87	$0.00
Commercial Food Preparation	$95,384.00	$99,775.07	$105,526.29	$116,954.61	$126,931.86	$137,607.99	$146,238.39	$0.00
Commercial Heating	$2,220.74	$2,398.68	$2,371.16	$2,976.99	$3,061.99	$3,146.18	$3,196.35	$0.00
Commercial Interior Lighting	$4,269,921.84	$4,471,021.01	$4,997,550.46	$5,164,273.51	$5,728,394.45	$6,187,425.31	$6,407,257.08	$0.00
Commercial Miscellaneous	$1,005.55	$1,030.05	$1,022.00	$1,029.56	$1,036.34	$1,051.40	$1,055.23	$0.00
Commercial Office Equipment	$105,206.42	$113,036.10	$117,497.21	$123,751.99	$129,894.52	$138,078.74	$143,304.52	$0.00
Commercial Refrigeration	$101,512.39	$112,594.97	$116,747.45	$138,184.84	$135,630.84	$138,969.18	$143,235.32	$0.00
Commercial Ventilation	$22,293.70	$26,780.50	$30,256.78	$34,069.06	$32,212.58	$35,509.89	$38,989.25	$0.00
Commercial Water Heating	$505,070.29	$586,734.27	$605,718.25	$688,032.39	$686,855.41	$701,943.56	$853,751.65	$0.00
Industrial Cooling	$1,378,020.42	$1,391,862.05	$1,389,431.00	$1,390,604.90	$1,386,419.26	$1,365,982.07	$1,567,824.55	$0.00
Industrial Exterior Lighting	$104,954.54	$104,819.86	$105,600.12	$107,116.85	$109,767.75	$112,280.68	$114,670.74	$0.00
Industrial Heating	$5,186.54	$4,996.96	$4,866.15	$4,769.80	$4,628.81	$4,521.11	$4,371.17	$0.00
Industrial Interior Lighting	$705,301.51	$703,942.68	$709,482.77	$718,480.00	$733,953.96	$748,912.96	$762,863.17	$0.00
Industrial Motors	$309,378.52	$465,297.01	$485,631.97	$506,085.49	$606,521.55	$629,099.82	$752,296.17	$0.00
Demand Response Res/ Comm AC	$3,319,900.41	$3,413,366.69	$3,506,563.29	$3,604,402.42	$3,705,034.00	$3,807,574.12	$3,912,950.49	$0.00
Demand Response Res/Comm Water Heating	$1,059,246.36	$1,089,184.86	$1,119,222.75	$1,150,561.55	$1,182,776.79	$1,215,655.64	$1,249,426.37	$0.00

 Source: Aggregation Results, Financial Results Tab, Utililty Costs F99:F123 [from files in: MMP 020716 (MP) and MMP 021216 022316 (MP-DR)]

End Use Sector	2016	2017	2018	2019	2020	2021	2022
Residential Appliances	$125,918.85	$259,742.89	$406,849.42	$570,512.82	$753,114.44	$969,051.46	$1,205,843.42
Residential Cooling	$2,967,523.71	$4,136,188.84	$5,098,467.00	$6,428,893.45	$7,547,165.67	$8,755,607.01	$10,580,847.91
Residential Exterior Lighting	$262,844.99	$531,620.25	$770,654.25	$980,009.81	$359,848.94	$453,471.47	$539,068.87
Residential Heating	$5,912.53	$12,758.93	$20,887.39	$30,776.46	$41,689.15	$53,894.29	$67,423.46
Residential Interior Lighting	$1,244,380.15	$2,441,652.06	$3,506,468.81	$4,451,241.09	$1,815,377.17	$2,396,229.11	$2,933,660.38
Residential Miscellaneous	$14,318.62	$30,042.39	$47,761.75	$67,813.29	$89,706.80	$113,545.44	$139,064.81
Residential Water Heating	$15,432.14	$31,731.46	$49,329.31	$68,451.26	$88,524.07	$144,916.44	$159,925.63
Commercial Cooling	$808,080.87	$1,644,845.68	$2,589,507.20	$3,590,477.51	$4,676,524.38	$5,913,206.56	$7,199,729.07
Commercial Exterior Lighting	$143,829.46	$266,924.82	$402,409.57	$564,047.77	$673,043.25	$857,546.57	$1,058,919.24
Commercial Food Preparation	$28,961.74	$59,029.86	$93,313.40	$131,022.95	$171,442.03	$215,052.06	$262,921.36
Commercial Heating	$57.73	$112.78	$175.81	$247.10	$326.62	$417.54	$520.18
Commercial Interior Lighting	$855,110.34	$1,652,722.67	$2,436,705.30	$3,371,055.12	$4,644,491.30	$5,865,590.52	$7,163,409.92
Commercial Miscellaneous	$565.65	$1,166.28	$1,843.30	$2,590.82	$3,385.58	$4,237.92	$5,146.44
Commercial Office Equipment	$165,071.77	$370,456.67	$613,668.80	$894,704.42	$1,178,065.36	$1,482,143.75	$1,621,717.38
Commercial Refrigeration	$9,195.68	$18,507.55	$28,503.78	$39,887.21	$52,240.06	$65,775.62	$80,498.70
Commercial Ventilation	$65.45	$216.48	$465.52	$822.13	$1,284.44	$1,837.75	$2,515.38
Commercial Water Heating	$95,185.40	$204,706.23	$322,132.16	$447,831.65	$560,821.79	$681,290.70	$809,233.43
Industrial Cooling	$75,714.43	$149,440.54	$217,597.13	$298,604.57	$381,735.67	$487,164.33	$597,943.22
Industrial Exterior Lighting	$16,919.17	$29,791.89	$44,159.14	$60,324.25	$75,401.20	$94,200.47	$114,868.68
Industrial Heating	$21.96	$44.37	$68.50	$95.83	$131.45	$177.05	$232.51
Industrial Interior Lighting	$138,892.37	$240,873.94	$351,645.72	$474,377.49	$714,969.08	$903,826.90	$1,107,991.25
Industrial Motors	$72,482.30	$151,129.99	$235,263.88	$326,974.71	$425,405.46	$554,767.04	$691,903.11
Demand Response Res/ Comm AC	$0.00	$8,586,223.22	$10,753,153.13	$13,018,937.49	$15,407,943.17	$17,921,829.60	$18,403,925.17
Demand Response Res/Comm Water Heating	$0.00	$1,603,094.34	$2,877,259.56	$4,213,452.03	$5,620,953.96	$7,102,895.04	$7,293,940.33

 Source: Aggregation Results, Financial Results Tab, F159:F183 [from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

End Use Sector	2023	2024	2025	2026	2027	2028	2029
Residential Appliances	$1,465,696.94	$2,195,731.12	$2,742,416.27	$3,052,628.92	$3,340,488.24	$3,709,196.43	$4,162,776.88
Residential Cooling	$12,360,840.05	$14,965,211.11	$18,109,867.93	$21,368,517.91	$23,637,203.93	$26,295,987.81	$28,783,731.23
Residential Exterior Lighting	$632,028.69	$780,578.27	$1,000,489.87	$1,001,124.49	$1,000,423.03	$1,018,056.14	$1,063,902.60
Residential Heating	$82,467.86	$99,170.22	$147,651.47	$172,078.28	$199,370.05	$229,650.07	$263,013.51
Residential Interior Lighting	$3,518,026.72	$5,544,496.14	$7,208,378.82	$7,456,749.07	$7,770,824.31	$8,217,733.55	$8,819,598.13
Residential Miscellaneous	$166,460.57	$196,645.99	$255,569.76	$311,570.23	$351,283.25	$376,755.55	$403,341.93
Residential Water Heating	$175,354.00	$191,334.66	$233,614.61	$306,886.41	$326,300.23	$347,461.63	$370,134.56
Commercial Cooling	$8,595,233.29	$10,105,756.47	$12,131,630.35	$13,955,981.41	$15,968,608.85	$18,264,503.32	$20,703,137.47
Commercial Exterior Lighting	$1,281,853.02	$1,545,549.30	$2,231,303.45	$2,570,049.19	$2,938,370.58	$3,317,739.28	$3,711,719.12
Commercial Food Preparation	$315,070.52	$372,517.37	$469,460.70	$525,365.62	$581,815.85	$639,714.94	$702,962.03
Commercial Heating	$635.77	$759.68	$1,114.16	$1,282.78	$1,473.47	$1,693.03	$1,923.57
Commercial Interior Lighting	$8,563,091.42	$10,945,835.61	$13,976,458.95	$15,973,079.06	$18,041,829.64	$20,182,186.95	$22,466,726.99
Commercial Miscellaneous	$6,113.01	$7,137.03	$9,093.32	$9,510.03	$9,918.54	$10,302.78	$10,898.85
Commercial Office Equipment	$1,743,295.01	$1,860,345.56	$2,256,006.59	$2,464,375.65	$2,686,576.76	$2,915,408.46	$3,144,972.36
Commercial Refrigeration	$96,488.19	$127,996.61	$146,428.19	$163,736.38	$180,049.76	$198,374.25	$217,367.18
Commercial Ventilation	$3,336.64	$4,318.66	$6,816.03	$8,718.31	$10,152.08	$12,156.79	$14,413.70
Commercial Water Heating	$945,495.75	$1,089,250.20	$1,401,422.87	$1,576,032.56	$1,747,588.93	$1,928,598.71	$2,127,337.17
Industrial Cooling	$723,610.46	$852,577.80	$1,024,734.30	$1,171,526.53	$1,346,349.03	$1,544,145.36	$1,746,085.82
Industrial Exterior Lighting	$138,172.73	$162,814.74	$232,042.68	$265,924.48	$304,236.55	$343,690.34	$384,391.18
Industrial Heating	$298.75	$369.35	$558.73	$651.99	$770.36	$914.25	$1,059.85
Industrial Interior Lighting	$1,335,603.04	$1,766,730.48	$2,288,396.90	$2,625,479.74	$3,004,740.08	$3,391,577.35	$3,786,702.08
Industrial Motors	$844,550.65	$991,772.40	$1,305,010.26	$1,534,381.11	$1,742,760.55	$1,957,337.15	$2,181,094.54
Demand Response Res/ Comm AC	$18,895,314.26	$19,420,730.10	$19,971,029.94	$20,459,483.63	$20,970,990.58	$21,476,674.76	$21,985,362.08
Demand Response Res/Comm Water Heating	$7,488,673.31	$7,696,902.14	$7,914,969.03	$8,108,563.77	$8,311,299.69	$8,511,737.34	$8,713,369.41

 Source: Aggregation Results, Financial Results Tab, F159:F183 [from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

End Use Sector	2030	2031	2032	2033	2034	2035	2036	2037
Residential Appliances	$4,475,923.60	$4,816,267.97	$5,923,843.57	$6,305,598.30	$7,035,189.35	$7,420,741.82	$7,937,895.95	$4,464,857.88
Residential Cooling	$32,024,549.15	$35,984,892.60	$41,654,943.23	$45,356,207.71	$49,245,705.99	$51,953,699.01	$60,587,493.30	$35,995,840.27
Residential Exterior Lighting	$1,081,233.81	$1,092,843.31	$1,118,400.24	$1,133,472.75	$1,163,729.84	$1,190,797.52	$1,212,604.60	$3,701,904.54
Residential Heating	$297,245.91	$335,629.97	$376,831.41	$421,069.26	$454,600.05	$488,871.48	$524,183.58	$523,053.05
Residential Interior Lighting	$8,848,010.54	$8,925,548.75	$9,110,678.44	$9,220,390.81	$9,601,478.18	$9,912,923.18	$10,198,869.32	$23,769,310.79
Residential Miscellaneous	$432,375.59	$463,952.80	$496,775.64	$538,951.92	$588,696.35	$634,773.16	$706,793.57	$638,531.58
Residential Water Heating	$393,757.00	$550,244.86	$577,841.34	$609,512.05	$706,063.16	$731,104.15	$833,024.89	$442,352.59
Commercial Cooling	$23,090,168.73	$25,924,545.34	$28,393,891.95	$31,115,107.02	$34,002,008.57	$36,911,749.02	$40,235,730.06	$37,228,240.35
Commercial Exterior Lighting	$4,091,440.63	$4,299,614.73	$4,491,101.59	$4,715,964.57	$4,940,250.32	$5,168,100.54	$5,398,784.55	$6,979,253.84
Commercial Food Preparation	$765,437.63	$830,421.53	$898,291.97	$971,655.53	$1,019,070.75	$1,070,444.01	$1,120,892.41	$1,088,193.82
Commercial Heating	$2,130.59	$2,306.00	$2,490.12	$2,725.13	$2,976.45	$3,236.07	$3,503.58	$3,534.08
Commercial Interior Lighting	$24,649,946.10	$26,227,781.04	$28,127,137.65	$29,744,932.48	$31,436,495.27	$32,932,102.32	$34,552,641.70	$38,135,253.57
Commercial Miscellaneous	$11,470.87	$12,104.78	$12,726.54	$13,357.19	$14,009.01	$14,707.87	$15,369.84	$14,466.39
Commercial Office Equipment	$3,362,954.19	$3,570,328.51	$3,765,229.12	$3,984,060.56	$4,221,911.36	$4,491,411.52	$4,789,441.63	$4,175,234.82
Commercial Refrigeration	$235,639.92	$267,596.76	$311,086.82	$317,600.64	$345,575.62	$369,871.75	$395,358.61	$373,871.33
Commercial Ventilation	$16,270.11	$19,411.89	$21,980.19	$25,805.56	$31,324.67	$35,476.39	$40,087.47	$27,540.66
Commercial Water Heating	$2,180,379.29	$2,240,346.44	$2,285,415.02	$2,369,228.23	$2,488,523.75	$2,598,594.25	$2,719,270.89	$2,772,858.10
Industrial Cooling	$1,951,345.17	$2,124,665.94	$2,302,902.53	$2,490,351.86	$2,666,831.17	$2,826,088.12	$3,044,373.16	$3,005,855.33
Industrial Exterior Lighting	$425,431.50	$441,670.04	$458,228.39	$479,045.22	$500,902.92	$523,758.49	$545,990.85	$648,558.89
Industrial Heating	$1,206.11	$1,362.22	$1,523.09	$1,689.55	$1,860.66	$2,037.21	$2,219.15	$2,305.48
Industrial Interior Lighting	$4,174,657.07	$4,346,960.72	$4,534,606.44	$4,751,340.19	$4,977,430.72	$5,185,111.33	$5,385,105.85	$4,890,617.97
Industrial Motors	$2,418,670.69	$2,779,491.34	$3,070,237.43	$3,376,670.30	$3,662,796.50	$3,956,769.94	$4,401,502.02	$4,428,493.03
Demand Response Res/ Comm AC	$22,505,405.51	$23,049,559.68	$23,606,846.52	$24,173,837.74	$24,750,956.91	$25,358,424.16	$25,975,877.38	$0.00
Demand Response Res/Comm Water Heating	$8,919,502.69	$9,135,197.15	$9,356,111.62	$9,580,878.75	$9,809,665.66	$10,050,489.04	$10,295,277.74	$0.00

 Source: Aggregation Results, Financial Results Tab, F159:F183 [from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Table 4: Participants

End Use Sector	2016	2017	2018	2019	2020	2021	2022
Residential Appliances	3864	7821	11925	16158	20661	25736	31021
Residential Cooling	89415	33964	26770	35866	44250	53313	63035
Residential Exterior Lighting	57243	114097	161185	198030	252074	308254	355462
Residential Heating	84	180	285	399	521	648	780
Residential Interior Lighting	374343	724455	1013912	1242884	1752643	2242128	2660392
Residential Miscellaneous	1136	2330	3588	4900	6266	7671	9085
Residential Water Heating	1049	2151	3312	4533	5819	6879	7987
Commercial Cooling	1508	3066	4702	6401	8173	10018	11936
Commercial Exterior Lighting	24849	50048	74036	99272	131548	164684	198082
Commercial Food Preparation	1003	1993	3039	4102	5181	6273	7401
Commercial Heating	4	8	12	15	20	24	29
Commercial Interior Lighting	69916	136384	204413	275947	369881	466293	563420
Commercial Miscellaneous	50	101	156	212	270	328	387
Commercial Office Equipment	3660	8010	12771	17808	22747	27816	29474
Commercial Refrigeration	659	1285	1900	2551	3232	3937	4662
Commercial Ventilation	1	4	7	11	16	21	28
Commercial Water Heating	929	1924	2942	3973	4956	5959	6983
Industrial Cooling	68	136	204	275	348	425	506
Industrial Exterior Lighting	3218	6420	9242	12043	15806	19653	23507
Industrial Heating	0	0	1	1	1	1	2
Industrial Interior Lighting	28394	54151	78653	103038	134728	167859	201229
Industrial Motors	170	348	531	719	913	1142	1377
Demand Response Res/ Comm AC	0	24325	28932	33606	38333	43102	43331
Demand Response Res/Comm Water Heating	0	3240	5698	8187	10703	13244	13315

Source: Aggregation Results, Financial Results Tab, Column G Total Participants
[from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Table 4: Participants

End Use Sector	2023	2024	2025	2026	2027	2028	2029
Residential Appliances	36536	41709	47035	52524	56794	60868	64562
Residential Cooling	73170	83679	94440	103317	112613	121723	131114
Residential Exterior Lighting	404046	446148	489476	477112	464245	460089	468271
Residential Heating	916	1057	1203	1359	1526	1703	1889
Residential Interior Lighting	3090645	3425674	3786811	3785019	3802773	3881883	4033099
Residential Miscellaneous	10510	12006	13564	15147	16787	17466	18181
Residential Water Heating	9145	10354	11610	12719	13869	15062	16294
Commercial Cooling	13931	16001	18129	20349	22788	25328	27945
Commercial Exterior Lighting	233077	268277	303093	338091	374111	409153	443686
Commercial Food Preparation	8558	9780	11018	11677	12329	12977	13798
Commercial Heating	33	38	43	48	53	58	64
Commercial Interior Lighting	665238	768095	869868	971918	1076917	1179114	1280101
Commercial Miscellaneous	446	506	564	575	585	592	611
Commercial Office Equipment	30738	31887	33664	35983	38287	40501	42576
Commercial Refrigeration	5406	6136	6722	7153	7615	8076	8526
Commercial Ventilation	36	45	55	66	77	91	105
Commercial Water Heating	8029	9090	10159	11257	12355	13470	14627
Industrial Cooling	591	677	763	854	950	1050	1151
Industrial Exterior Lighting	27602	31595	35562	39550	43842	48059	52360
Industrial Heating	2	3	3	3	4	5	5
Industrial Interior Lighting	236942	272797	308110	342596	379831	416183	451937
Industrial Motors	1618	1865	2117	2373	2635	2901	3173
Demand Response Res/ Comm AC	43555	43769	43974	44175	44373	44564	44752
Demand Response Res/Comm Water Heating	13383	13449	13512	13574	13635	13694	13752

Source: Aggregation Results, Financial Results Tab, Column G Total Participants
[from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Table 4: Participants

End Use Sector	2030	2031	2032	2033	2034	2035	2036	2037
Residential Appliances	68230	71903	76081	78286	80127	81832	83396	77980
Residential Cooling	140801	150747	162026	173660	182064	190424	198025	186064
Residential Exterior Lighting	463458	454403	451000	443263	441330	437793	432096	388109
Residential Heating	2068	2248	2431	2616	2720	2818	2910	2796
Residential Interior Lighting	3950913	3866926	3829365	3758661	3782879	3777983	3758115	3390250
Residential Miscellaneous	18926	19656	20368	21481	22572	23664	24592	23292
Residential Water Heating	17569	18330	19104	19887	20267	20607	20903	19246
Commercial Cooling	30618	33294	36031	38829	41406	43850	46316	41181
Commercial Exterior Lighting	470953	477650	483108	489029	494250	498825	502478	467848
Commercial Food Preparation	14552	15287	15989	16708	17078	17455	17766	16605
Commercial Heating	67	70	73	78	82	87	92	91
Commercial Interior Lighting	1359768	1382656	1406474	1426531	1444614	1459279	1471269	1369552
Commercial Miscellaneous	627	643	657	669	682	695	705	645
Commercial Office Equipment	44433	45842	46997	48343	49808	51533	53371	45148
Commercial Refrigeration	9021	9512	9973	10474	10902	11250	11545	10592
Commercial Ventilation	120	136	153	172	188	204	221	214
Commercial Water Heating	15419	16195	16976	17858	18678	19489	20294	17828
Industrial Cooling	1253	1346	1440	1536	1618	1698	1775	1685
Industrial Exterior Lighting	55616	55944	56288	56875	57467	58032	58406	54348
Industrial Heating	6	6	7	7	7	8	8	8
Industrial Interior Lighting	481829	486557	493908	501449	508889	514507	518524	483481
Industrial Motors	3449	3731	4017	4308	4569	4830	5090	4686
Demand Response Res/ Comm AC	44942	45129	45304	45477	45647	45814	45977	0
Demand Response Res/Comm Water Heating	13810	13868	13922	13976	14028	14080	14131	0

Source: Aggregation Results, Financial Results Tab, Column G Total Participants
[from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Table 5: Total Participant Cost per Program

End Use Sector	2016	2017	2018	2019	2020	2021	2022
Residential Appliances	$594,301.45	$624,947.25	$666,158.39	$705,407.52	$764,258.96	$898,010.34	$962,919.42
Residential Cooling	$4,513,917.35	$4,714,647.72	$5,001,840.98	$5,391,949.98	$5,773,580.98	$6,112,708.28	$7,071,966.94
Residential Exterior Lighting	$320,184.13	$325,953.28	$276,720.11	$221,937.47	$96,933.65	$103,283.91	$88,959.57
Residential Heating	$152,294.80	$177,250.57	$199,757.00	$221,615.87	$258,277.98	$275,752.54	$294,054.95
Residential Interior Lighting	$2,519,086.92	$2,357,449.62	$1,996,225.07	$1,625,900.07	$1,518,264.39	$1,448,556.32	$1,277,434.15
Residential Miscellaneous	$75,526.70	$84,845.83	$94,934.64	$104,555.55	$114,407.04	$123,045.74	$129,464.84
Residential Water Heating	$13,756.24	$14,838.60	$16,021.83	$17,303.98	$18,696.49	$20,138.93	$21,632.89
Commercial Cooling	$2,201,071.71	$2,329,695.75	$2,797,539.51	$3,040,868.01	$3,376,857.90	$4,137,886.67	$4,517,489.08
Commercial Exterior Lighting	$703,627.61	$742,062.67	$695,708.44	$753,599.69	$588,107.53	$624,002.57	$656,581.81
Commercial Food Preparation	$58,366.99	$59,966.59	$67,124.15	$71,313.32	$75,489.84	$79,472.49	$84,487.66
Commercial Heating	$1,178.13	$1,131.71	$1,220.67	$1,243.16	$1,393.40	$1,537.26	$1,678.12
Commercial Interior Lighting	$5,201,026.29	$5,080,655.05	$5,103,103.13	$5,519,894.42	$1,928,312.61	$2,039,872.79	$2,143,558.35
Commercial Miscellaneous	$261.09	$275.71	$301.77	$318.49	$333.65	$347.10	$359.46
Commercial Office Equipment	$22,909.15	$28,293.11	$32,701.09	$36,217.04	$35,732.35	$37,085.09	$39,552.86
Commercial Refrigeration	$20,858.99	$21,261.28	$22,244.74	$23,985.90	$25,633.85	$27,192.68	$28,697.64
Commercial Ventilation	$1,529.18	$2,371.55	$3,358.90	$4,429.72	$5,590.58	$6,843.40	$8,193.29
Commercial Water Heating	$250,835.18	$284,476.97	$297,272.86	$305,103.53	$280,013.70	$331,562.02	$346,149.77
Industrial Cooling	$582,189.47	$559,355.63	$502,482.85	$553,408.41	$600,567.36	$737,870.00	$799,810.53
Industrial Exterior Lighting	$65,817.31	$67,382.71	$60,367.84	$61,597.19	$63,115.57	$68,212.15	$72,277.83
Industrial Heating	$1,480.41	$1,518.69	$1,540.63	$1,570.91	$2,082.33	$2,592.24	$3,058.95
Industrial Interior Lighting	$964,090.79	$925,222.53	$850,010.28	$867,503.88	$345,880.29	$374,022.11	$396,067.39
Industrial Motors	$76,344.43	$81,513.93	$86,355.09	$91,065.50	$95,975.02	$148,531.05	$155,488.24
Demand Response Res/ Comm AC	$0.00	$1,056,215.02	$1,286,793.32	$1,531,027.96	$1,788,802.45	$2,060,203.96	$2,121,467.10
Demand Response Res/Comm Water Heating	$0.00	$140,680.18	$253,443.77	$372,962.26	$499,448.68	$633,062.88	$651,880.24

Source: Aggregation Results, Financial Results Tab, J6:J30
[from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Table 5: Total Participant Cost per Program

End Use Sector	2023	2024	2025	2026	2027	2028	2029
Residential Appliances	$1,032,295.01	$1,105,047.74	$1,169,038.34	$1,238,301.96	$1,309,751.85	$1,343,451.77	$1,382,172.81
Residential Cooling	$7,915,147.72	$9,999,736.92	$10,440,129.19	$11,029,709.27	$11,642,935.18	$12,237,835.91	$12,827,904.25
Residential Exterior Lighting	$93,842.38	$83,356.40	$87,926.46	$93,354.05	$93,784.03	$93,823.48	$100,862.77
Residential Heating	$313,436.05	$333,483.46	$352,038.33	$388,470.97	$425,295.29	$462,192.26	$498,510.91
Residential Interior Lighting	$1,346,667.00	$1,025,712.04	$1,157,502.66	$1,221,721.04	$1,240,572.63	$1,288,449.16	$1,352,666.93
Residential Miscellaneous	$136,307.05	$147,577.49	$158,375.82	$169,192.43	$180,450.14	$191,819.44	$202,886.34
Residential Water Heating	$23,214.52	$24,877.49	$26,597.26	$28,398.33	$30,315.64	$32,335.22	$34,417.82
Commercial Cooling	$4,926,958.37	$5,337,684.92	$5,640,999.95	$7,320,215.80	$10,304,910.73	$11,450,843.08	$12,323,156.16
Commercial Exterior Lighting	$691,377.21	$717,217.17	$722,062.90	$830,946.22	$884,790.54	$874,949.67	$873,239.03
Commercial Food Preparation	$89,358.39	$95,037.82	$96,500.64	$100,491.07	$96,176.81	$96,105.56	$100,494.13
Commercial Heating	$1,817.57	$1,841.76	$1,775.66	$1,982.91	$2,252.61	$2,597.75	$2,643.44
Commercial Interior Lighting	$2,253,296.57	$2,753,001.58	$2,802,719.55	$3,131,303.75	$3,314,732.83	$3,330,383.88	$3,825,589.17
Commercial Miscellaneous	$371.14	$378.66	$383.84	$409.58	$418.77	$438.98	$542.70
Commercial Office Equipment	$42,728.59	$46,253.19	$54,213.97	$59,250.71	$61,645.38	$64,753.11	$67,864.29
Commercial Refrigeration	$30,180.51	$31,944.99	$45,612.68	$48,832.37	$49,672.27	$52,216.15	$70,030.95
Commercial Ventilation	$9,647.39	$11,209.66	$12,778.32	$14,566.46	$16,356.11	$18,259.24	$20,283.53
Commercial Water Heating	$361,272.48	$372,909.55	$390,154.79	$456,259.82	$463,220.85	$481,446.63	$517,224.44
Industrial Cooling	$896,044.79	$899,329.02	$900,738.78	$1,013,643.36	$1,196,468.85	$1,364,679.83	$1,372,301.63
Industrial Exterior Lighting	$78,464.32	$76,798.36	$77,016.84	$88,256.75	$98,711.64	$97,671.16	$96,465.95
Industrial Heating	$3,526.13	$3,548.74	$3,592.43	$3,598.40	$4,614.99	$5,598.14	$5,416.45
Industrial Interior Lighting	$430,204.81	$441,206.73	$442,297.38	$506,526.89	$566,187.66	$560,733.63	$553,705.75
Industrial Motors	$162,894.75	$170,261.71	$177,585.86	$263,184.09	$274,403.58	$285,787.95	$297,408.35
Demand Response Res/ Comm AC	$2,184,255.24	$2,248,327.33	$2,313,742.72	$2,380,803.62	$2,449,595.15	$2,519,907.25	$2,592,070.91
Demand Response Res/Comm Water Heating	$671,167.98	$690,854.26	$710,957.25	$731,567.97	$752,712.35	$774,327.86	$796,514.17

Source: Aggregation Results, Financial Results Tab, J6:J30
[from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Table 5: Total Participant Cost per Program

End Use Sector	2030	2031	2032	2033	2034	2035	2036	2037
Residential Appliances	$1,425,493.19	$1,475,336.31	$1,610,326.13	$1,649,951.58	$1,637,726.22	$1,692,453.93	$1,740,893.44	$0.00
Residential Cooling	$14,030,227.34	$15,581,333.81	$19,829,204.40	$20,772,924.10	$20,788,943.15	$21,689,764.56	$22,526,034.38	$0.00
Residential Exterior Lighting	$113,035.82	$110,904.59	$105,670.91	$100,999.36	$101,806.47	$103,368.63	$104,334.51	$0.00
Residential Heating	$493,934.83	$510,425.21	$530,664.25	$552,347.14	$579,053.88	$610,076.39	$636,813.99	$0.00
Residential Interior Lighting	$1,578,037.47	$1,528,036.81	$1,476,576.77	$1,436,885.08	$1,481,040.22	$1,505,982.25	$1,531,455.25	$0.00
Residential Miscellaneous	$214,387.93	$216,227.78	$218,664.82	$259,394.35	$261,138.51	$265,720.10	$268,989.22	$0.00
Residential Water Heating	$36,645.17	$39,023.11	$41,465.53	$43,929.73	$38,763.35	$40,398.17	$42,062.93	$0.00
Commercial Cooling	$13,030,329.12	$14,667,713.07	$15,500,431.45	$16,560,470.37	$16,700,650.48	$17,214,050.36	$19,807,220.84	$0.00
Commercial Exterior Lighting	$850,629.61	$893,655.80	$880,654.23	$903,274.75	$930,775.28	$960,971.38	$994,526.52	$0.00
Commercial Food Preparation	$95,052.51	$99,421.75	$105,178.48	$116,598.25	$126,566.65	$137,234.00	$145,860.63	$0.00
Commercial Heating	$2,220.74	$2,398.68	$2,371.16	$2,976.99	$3,061.99	$3,146.18	$3,196.35	$0.00
Commercial Interior Lighting	$4,067,003.55	$4,262,910.21	$4,792,894.03	$4,958,980.15	$5,519,459.60	$5,976,752.39	$6,194,110.47	$0.00
Commercial Miscellaneous	$545.81	$565.41	$567.24	$577.70	$587.80	$602.70	$611.26	$0.00
Commercial Office Equipment	$69,795.63	$75,388.41	$78,893.07	$83,775.41	$88,713.65	$94,895.31	$99,235.51	$0.00
Commercial Refrigeration	$106,030.51	$117,859.55	$122,846.06	$145,696.95	$143,322.23	$147,870.57	$153,041.71	$0.00
Commercial Ventilation	$22,293.70	$26,780.50	$30,256.78	$34,069.06	$32,212.58	$35,509.89	$38,989.25	$0.00
Commercial Water Heating	$505,070.29	$586,734.27	$605,718.25	$688,032.39	$686,855.41	$701,943.56	$853,751.65	$0.00
Industrial Cooling	$1,378,020.42	$1,391,862.05	$1,389,431.00	$1,390,604.90	$1,386,419.26	$1,365,982.07	$1,567,824.55	$0.00
Industrial Exterior Lighting	$95,668.52	$95,760.26	$96,731.92	$98,371.45	$100,886.95	$103,368.87	$105,803.93	$0.00
Industrial Heating	$5,186.54	$4,996.96	$4,866.15	$4,769.80	$4,628.81	$4,521.11	$4,371.17	$0.00
Industrial Interior Lighting	$549,775.37	$550,706.34	$557,924.89	$567,681.25	$582,093.71	$596,590.65	$610,736.49	$0.00
Industrial Motors	$309,378.52	$465,297.01	$485,631.97	$506,085.49	$606,521.55	$629,099.82	$752,296.17	$0.00
Demand Response Res/ Comm AC	$2,666,341.89	$2,742,458.93	$2,820,020.78	$2,899,544.60	$2,981,133.13	$3,064,717.77	$3,150,401.73	$0.00
Demand Response Res/Comm Water Heating	$819,348.42	$842,752.76	$866,607.39	$891,067.85	$916,165.46	$941,880.19	$968,243.52	$0.00

Source: Aggregation Results, Financial Results Tab, J6:J30
[from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Energy Savings per Participant (kWh)									
End Use Sector	2016	2017	2018	2019	2020	2021	2022	2023	2024
Residential Appliances	277.3	278.3	279.1	280.0	283.1	286.9	289.7	291.7	371.6
Residential Cooling	266.0	780.8	985.0	830.6	731.9	658.9	617.8	583.3	566.2
Residential Exterior Lighting	64.7	64.7	64.7	64.7	18.1	18.1	18.1	18.1	19.6
Residential Heating	1,828.5	1,831.4	1,833.0	1,834.3	1,827.6	1,823.0	1,819.2	1,815.9	1,813.0
Residential Interior Lighting	45.3	45.3	45.3	45.3	12.7	12.7	12.7	12.7	17.5
Residential Miscellaneous	103.1	104.0	104.8	105.5	106.2	106.8	107.3	107.8	108.2
Residential Water Heating	181.8	179.5	176.7	173.2	169.6	228.3	210.5	195.5	182.5
Commercial Cooling	1,885.6	1,863.3	1,866.5	1,855.2	1,845.9	1,863.5	1,854.2	1,846.3	1,837.9
Commercial Exterior Lighting	141.1	128.6	127.1	126.6	110.0	107.8	106.5	105.4	106.0
Commercial Food Preparation	203.2	205.0	207.6	209.8	211.9	213.7	215.6	217.4	218.5
Commercial Heating	346.7	347.2	347.0	346.9	347.5	348.3	349.3	350.2	350.8
Commercial Interior Lighting	118.9	116.4	112.0	111.0	110.1	106.8	104.5	102.5	109.7
Commercial Miscellaneous	104.6	104.6	104.6	104.6	104.6	104.6	104.6	104.6	104.6
Commercial Office Equipment	470.1	475.0	481.1	486.6	487.6	487.1	488.3	488.3	486.8
Commercial Refrigeration	156.9	159.7	162.2	163.3	164.0	164.5	164.9	165.3	187.5
Commercial Ventilation	1,234.1	1,610.9	1,827.9	1,925.9	1,986.2	1,984.0	1,975.5	1,964.7	1,952.6
Commercial Water Heating	1,149.5	1,176.5	1,180.0	1,173.8	1,145.0	1,122.6	1,103.8	1,087.5	1,071.6
Industrial Cooling	3,812.3	3,682.3	3,516.1	3,503.4	3,461.1	3,514.4	3,533.5	3,568.6	3,570.1
Industrial Exterior Lighting	116.1	101.4	101.3	101.2	93.0	90.0	88.3	87.1	86.1
Industrial Heating	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9
Industrial Interior Lighting	50.8	45.5	44.6	44.4	49.8	49.1	48.8	48.5	54.0
Industrial Motors	5,273.5	5,310.8	5,273.6	5,218.9	5,193.1	5,208.2	5,197.3	5,214.4	5,130.0
Demand Response Res/ Comm AC	-	43.9	45.3	46.3	47.1	47.7	47.7	47.7	47.7
Demand Response Res/Comm Water Heating	-	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Total	20,346.1	21,232.5	21,462.6	21,328.9	21,083.1	21,124.2	21,035.2	21,000.6	20,969.9

Demand Savings per Participant (kW)									
End Use Sector	2016	2017	2018	2019	2020	2021	2022	2023	2024
Residential Appliances	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Residential Cooling	0.3	0.8	1.0	0.8	0.7	0.7	0.6	0.6	0.6
Residential Exterior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential Heating	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Residential Interior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential Miscellaneous	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Residential Water Heating	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Commercial Cooling	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial Exterior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Food Preparation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Heating	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial Interior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Office Equipment	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Ventilation	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4
Commercial Water Heating	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Industrial Cooling	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Industrial Exterior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial Heating	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Industrial Interior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial Motors	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8
Demand Response Res/ Comm AC	-	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Demand Response Res/Comm Water Heating	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	5.3	5.9	6.1	5.9	5.8	5.8	5.7	5.7	5.7

Source: Aggregation Results, Financial Results Tab, NET Per Participant
C37:C61 (kW net) and I37:I61 (kWh net) [from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Energy Savings per Participant (kWh)													
End Use Sector	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Residential Appliances	360.1	350.8	347.3	353.7	369.8	366.8	363.8	408.6	410.3	434.3	435.3	445.1	255.6
Residential Cooling	548.8	594.3	579.0	571.8	561.3	556.2	556.6	558.8	548.1	553.3	545.7	622.9	382.2
Residential Exterior Lighting	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	64.7
Residential Heating	1,810.5	1,808.9	1,807.9	1,807.4	1,807.2	1,806.3	1,805.1	1,803.8	1,802.3	1,799.9	1,797.1	1,794.3	1,792.5
Residential Interior Lighting	17.6	17.7	17.9	18.1	18.2	18.1	18.1	18.1	18.1	18.1	18.2	18.2	45.6
Residential Miscellaneous	108.4	115.5	114.5	115.2	115.5	116.1	116.6	117.0	117.0	118.1	117.9	122.6	113.6
Residential Water Heating	171.0	199.9	189.8	181.2	173.8	167.0	216.9	212.0	208.4	229.8	227.0	247.2	137.9
Commercial Cooling	1,816.7	1,824.2	1,818.1	1,828.2	1,837.1	1,827.3	1,857.8	1,836.8	1,829.8	1,833.6	1,850.5	1,868.6	1,895.9
Commercial Exterior Lighting	105.4	105.6	105.8	105.9	105.9	106.6	106.5	106.0	105.9	105.8	105.7	105.6	141.2
Commercial Food Preparation	219.2	226.0	231.3	235.8	237.9	239.8	241.1	242.7	244.5	244.1	244.0	244.2	246.7
Commercial Heating	351.4	352.4	354.2	356.3	358.3	364.5	365.4	366.3	361.6	357.6	353.6	349.6	344.6
Commercial Interior Lighting	108.1	107.7	106.8	106.2	106.1	106.7	108.6	111.6	113.1	114.8	115.6	116.9	136.4
Commercial Miscellaneous	104.6	104.6	104.6	104.6	104.6	104.6	104.6	104.6	104.6	104.6	104.6	104.6	104.6
Commercial Office Equipment	482.9	481.0	480.0	479.8	479.7	478.9	478.4	477.6	476.7	475.8	474.6	473.9	473.7
Commercial Refrigeration	167.2	171.2	172.3	174.3	176.2	175.9	183.9	198.1	186.6	189.2	190.3	192.2	192.0
Commercial Ventilation	1,869.8	1,929.1	1,838.4	1,823.3	1,809.1	1,725.7	1,741.6	1,680.5	1,692.4	1,807.0	1,808.2	1,811.9	1,234.1
Commercial Water Heating	1,056.6	1,044.7	1,027.7	1,013.2	1,002.3	949.1	900.7	850.2	812.6	791.3	767.8	747.9	841.5
Industrial Cooling	3,557.5	3,552.4	3,582.0	3,626.5	3,654.1	3,667.0	3,632.7	3,595.8	3,562.0	3,534.0	3,487.6	3,500.2	3,606.2
Industrial Exterior Lighting	85.2	85.1	85.2	85.2	84.8	85.6	85.2	84.7	84.5	84.2	84.1	83.9	103.2
Industrial Heating	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9	2,515.9
Industrial Interior Lighting	53.8	54.1	54.4	54.6	54.7	55.2	55.2	55.1	55.2	55.3	55.3	55.3	52.3
Industrial Motors	5,039.9	5,130.0	5,104.1	5,065.5	5,023.5	4,987.1	5,149.5	5,121.0	5,089.1	5,044.0	4,993.0	5,092.0	5,405.2
Demand Response Res/ Comm AC	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	47.7	-
Demand Response Res/Comm Water Heating	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	-
Total	20,679.2	20,899.6	20,765.7	20,751.2	20,724.7	20,549.1	20,732.8	20,593.7	20,467.3	20,539.6	20,420.7	20,641.7	20,085.7

Demand Savings per Participant (kW)													
End Use Sector	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Residential Appliances	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Residential Cooling	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.4
Residential Exterior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential Heating	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Residential Interior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential Miscellaneous	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Residential Water Heating	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Commercial Cooling	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Commercial Exterior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Food Preparation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Heating	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial Interior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Office Equipment	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Commercial Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial Ventilation	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2
Commercial Water Heating	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2
Industrial Cooling	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2
Industrial Exterior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial Heating	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Industrial Interior Lighting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial Motors	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9
Demand Response Res/ Comm AC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-
Demand Response Res/Comm Water Heating	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-
Total	5.6	5.7	5.7	5.7	5.7	5.6	5.7	5.6	5.6	5.6	5.6	5.7	5.3

Source: Aggregation Results, Financial Results Tab, NET Per Participant
C37:C61 (kW net) and I37:I61 (kWh net) [from files in: MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Energy Savings per Participant (kWh)										
End Use Sector	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential Appliances	1,396,152.3	2,836,461.7	4,335,166.5	5,892,148.9	7,603,768.6	9,608,247.0	11,699,727.3	13,880,196.1	20,186,672.7	22,058,202.3
Residential Cooling	24,363,891.7	29,988,485.3	33,045,804.1	37,312,919.1	40,764,244.5	44,294,689.5	49,117,061.7	53,822,564.3	59,740,479.2	65,354,580.8
Residential Exterior Lighting	3,988,664.5	7,950,160.0	11,231,267.2	13,798,623.7	4,922,230.0	6,019,268.0	6,941,112.3	7,889,836.6	9,435,984.1	10,352,377.9
Residential Heating	176,073.3	376,255.7	596,591.1	835,267.9	1,089,129.9	1,353,486.4	1,627,263.9	1,910,813.7	2,204,102.1	2,505,146.6
Residential Interior Lighting	18,260,042.3	35,314,117.7	49,413,057.6	60,568,779.9	23,990,369.8	30,719,304.2	36,470,781.0	42,387,071.6	64,668,383.3	71,660,051.5
Residential Miscellaneous	157,266.0	325,144.7	504,391.2	693,693.6	892,941.6	1,098,579.2	1,307,298.2	1,519,669.1	1,741,266.7	1,971,330.7
Residential Water Heating	201,140.9	407,449.7	617,428.8	828,409.2	1,041,277.5	1,656,729.4	1,773,886.3	1,886,054.2	1,993,289.2	2,095,081.3
Commercial Cooling	3,554,067.4	7,140,750.0	10,969,866.0	14,843,940.4	18,857,864.5	23,336,087.5	27,665,271.8	32,152,207.6	36,761,225.7	41,170,194.5
Commercial Exterior Lighting	4,125,086.5	7,574,296.9	11,072,090.0	14,790,729.6	17,016,678.6	20,876,956.8	24,815,226.9	28,888,188.9	33,465,117.3	37,579,613.3
Commercial Food Preparation	254,729.7	510,806.8	788,561.5	1,075,913.6	1,372,112.9	1,675,836.0	1,994,213.7	2,325,203.3	2,671,591.6	3,018,685.4
Commercial Heating	1,710.8	3,309.6	4,996.9	6,673.5	8,491.2	10,434.5	12,493.0	14,658.8	16,801.5	18,810.8
Commercial Interior Lighting	9,783,116	18,681,972	26,938,608	36,028,227	47,900,873	58,579,010	69,300,413	80,239,265	99,094,452	110,674,476
Commercial Miscellaneous	6,502.0	13,200.6	20,353.6	27,718.9	35,246.4	42,886.4	50,605.6	58,381.1	66,120.7	73,774.9
Commercial Office Equipment	2,151,109.1	4,755,862.2	7,680,769.4	10,831,518.0	13,864,279.8	16,938,021.9	17,989,990.8	18,762,174.9	19,402,101.2	20,321,684.7
Commercial Refrigeration	129,349.1	256,598.6	385,182.2	520,787.8	662,635.4	809,638.0	961,187.3	1,116,973.0	1,438,512.7	1,405,238.4
Commercial Ventilation	2,263.9	7,426.5	15,436.9	25,768.5	38,642.6	52,994.7	69,510.9	88,260.4	109,269.8	127,584.6
Commercial Water Heating	1,335,322.1	2,829,981.9	4,340,041.8	5,829,675.3	7,092,671.4	8,361,594.9	9,634,765.8	10,914,253.1	12,176,483.9	13,417,685.5
Industrial Cooling	321,758.1	626,787.2	897,478.3	1,202,623.8	1,503,750.7	1,869,147.6	2,235,418.9	2,636,103.5	3,020,570.5	3,394,029.1
Industrial Exterior Lighting	439,680.4	765,857.4	1,100,968.2	1,434,222.7	1,729,030.3	2,080,652.2	2,443,070.9	2,827,039.1	3,201,646.2	3,562,760.7
Industrial Heating	656.6	1,313.7	1,964.1	2,611.0	3,447.7	4,463.9	5,633.8	6,949.4	8,241.2	9,517.0
Industrial Interior Lighting	1,696,163.1	2,897,218.6	4,124,715.8	5,386,177.6	7,895,005.3	9,695,888.8	11,542,900.3	13,505,702.8	17,320,345.0	19,492,949.8
Industrial Motors	1,122,500.9	2,307,457.0	3,498,725.5	4,691,255.2	5,924,774.7	7,435,510.2	8,946,876.0	10,548,054.2	11,958,959.0	13,334,140.6
Demand Response Res/ Comm AC	-	1,078,460.9	1,323,516.2	1,571,886.5	1,822,938.3	2,076,255.1	2,087,132.8	2,097,823.0	2,108,105.7	2,118,017.4
Demand Response Res/Comm Water Heating	-	200,565.8	352,749.3	506,729.4	662,412.6	819,642.0	823,933.7	828,152.0	832,210.8	836,124.4
Total	73,467,246.8	126,849,940.8	173,259,730.1	218,706,301.2	206,694,817.6	249,415,323.9	289,515,775.4	330,305,596.0	403,621,931.7	446,552,058.4

Demand Savings per Participant (kW)										
End Use Sector	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential Appliances	448.8	911.2	1,391.9	1,890.5	2,439.1	3,083.8	3,755.9	4,456.2	6,425.1	7,030.2
Residential Cooling	24,418.4	30,051.7	33,111.1	37,382.8	40,835.8	44,364.1	49,191.7	53,899.8	59,822.9	65,441.1
Residential Exterior Lighting	-	-	-	-	-	-	-	-	-	-
Residential Heating	51.9	110.8	175.7	246.1	320.8	398.7	479.4	562.9	649.3	738.0
Residential Interior Lighting	3,889.4	7,514.2	10,510.6	12,882.4	5,120.4	6,565.9	7,801.9	9,073.3	13,928.5	15,437.8
Residential Miscellaneous	140.3	285.2	435.6	590.5	750.0	911.9	1,073.1	1,234.3	1,401.6	1,574.5
Residential Water Heating	55.8	113.1	171.5	230.3	289.8	455.6	490.3	523.7	555.8	586.6
Commercial Cooling	1,398.7	2,810.2	4,317.1	5,841.7	7,421.3	9,183.7	10,887.4	12,653.2	14,467.0	16,202.1
Commercial Exterior Lighting	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.0
Commercial Food Preparation	46.1	92.5	142.7	194.7	248.3	303.3	360.9	420.8	483.5	546.4
Commercial Heating	0.4	0.8	1.3	1.7	2.2	2.6	3.2	3.7	4.3	4.8
Commercial Interior Lighting	1,850.6	3,534.0	5,095.8	6,815.3	9,061.2	11,081.1	13,109.2	15,178.5	18,745.2	20,935.8
Commercial Miscellaneous	2.6	5.2	8.0	10.9	13.9	16.9	19.9	23.0	26.0	29.0
Commercial Office Equipment	389.3	860.8	1,390.2	1,960.4	2,509.4	3,065.7	3,256.1	3,395.8	3,511.7	3,678.1
Commercial Refrigeration	23.4	46.4	69.7	94.3	119.9	146.5	174.0	202.2	260.4	254.3
Commercial Ventilation	0.4	1.3	2.8	4.7	7.0	9.6	12.6	16.0	19.8	23.1
Commercial Water Heating	241.7	512.2	785.5	1,055.1	1,283.7	1,513.4	1,743.8	1,975.4	2,203.9	2,428.5
Industrial Cooling	111.0	216.3	309.7	415.0	518.9	645.0	771.3	909.5	1,042.1	1,170.9
Industrial Exterior Lighting	82.1	143.1	205.7	267.9	323.0	388.7	456.4	528.1	598.1	665.6
Industrial Heating	0.1	0.3	0.4	0.6	0.8	1.0	1.2	1.5	1.8	2.1
Industrial Interior Lighting	316.9	541.2	770.5	1,006.2	1,474.9	1,811.3	2,156.4	2,523.0	3,235.7	3,641.5
Industrial Motors	181.2	372.6	564.9	757.4	956.6	1,200.5	1,444.6	1,703.1	1,930.9	2,152.9
Demand Response Res/ Comm AC	-	844.4	1,199.6	1,558.6	1,921.1	2,286.9	2,298.2	2,309.3	2,320.4	2,331.2
Demand Response Res/Comm Water Heating	-	215.8	379.5	544.8	711.8	880.4	884.7	889.0	893.2	897.4
Total	33,649.3	49,183.5	61,040.1	73,752.4	76,330.4	88,317.2	100,372.8	112,483.2	132,528.0	145,773.0

Source: Aggregation Results, Financial Results Tab, NET Per Participant K37:K61 (kW net)
and Q37:Q61 (kWh net) [from files in:MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Energy Savings per Participant (kWh)												
End Use Sector	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Residential Appliances	23,996,261.2	25,674,626.8	28,030,380.5	31,062,343.5	32,549,253.3	33,999,836.5	40,390,321.3	41,736,253.4	45,220,446.1	46,286,996.5	48,232,567.7	25,887,004.2
Residential Cooling	77,417,441.1	82,218,771.0	87,750,870.3	92,768,168.7	98,701,668.9	105,751,070.6	114,236,680.7	120,221,412.0	127,317,609.6	131,407,516.5	156,083,986.2	90,080,223.2
Residential Exterior Lighting	10,090,942.4	9,818,866.6	9,730,997.2	9,904,088.5	9,802,320.1	9,610,825.1	9,538,884.0	9,375,270.5	9,334,403.6	9,259,621.9	9,139,148.1	27,044,748.0
Residential Heating	2,829,726.4	3,176,908.6	3,545,380.0	3,933,422.5	4,305,940.3	4,680,336.5	5,058,153.1	5,440,237.6	5,653,638.2	5,852,795.5	6,039,391.5	5,800,714.6
Residential Interior Lighting	72,197,103.8	73,246,845.5	75,421,106.1	78,817,759.3	76,988,212.0	75,313,555.3	74,533,923.8	73,129,442.8	73,826,099.8	73,870,007.0	73,641,193.2	166,313,908.8
Residential Miscellaneous	2,343,960.2	2,575,845.4	2,694,541.2	2,813,733.3	2,941,845.6	3,067,727.1	3,191,256.0	3,362,629.8	3,567,186.5	3,734,084.7	4,035,201.2	3,539,753.6
Residential Water Heating	2,683,274.5	2,778,353.6	2,881,637.5	2,990,055.3	3,098,157.7	4,199,110.2	4,278,110.8	4,377,613.3	4,919,842.0	4,939,626.7	5,458,371.3	2,803,139.4
Commercial Cooling	46,399,536.9	51,790,166.4	57,880,481.5	64,171,024.6	69,935,995.8	77,314,942.5	82,727,769.7	88,813,085.9	94,903,104.7	101,433,674.6	108,183,756.0	97,591,227.8
Commercial Exterior Lighting	41,985,520.4	46,549,811.0	50,962,813.8	55,276,526.1	59,068,922.3	59,825,043.9	60,218,365.9	60,933,298.7	61,510,460.2	62,008,836.4	62,404,412.9	77,732,130.1
Commercial Food Preparation	3,298,098.3	3,564,164.3	3,825,391.6	4,103,915.1	4,362,486.8	4,607,256.7	4,850,358.5	5,105,818.3	5,211,321.8	5,324,626.5	5,422,698.8	5,120,562.7
Commercial Heating	20,991.2	23,364.3	26,009.2	28,626.5	30,712.7	31,999.4	33,260.7	35,036.3	36,835.2	38,552.5	40,168.7	39,001.3
Commercial Interior Lighting	123,154,551	135,316,614	147,376,861	159,747,319	170,688,064	176,702,044	184,671,429	189,854,910	195,043,023	198,491,457	202,333,026	219,839,387
Commercial Miscellaneous	75,241.0	76,490.8	77,466.5	79,905.4	81,997.8	84,080.1	85,876.6	87,555.9	89,201.9	90,936.5	92,258.2	84,309.8
Commercial Office Equipment	21,633,517.0	22,973,757.1	24,290,252.5	25,531,453.8	26,599,720.0	27,412,314.9	28,055,075.9	28,807,418.1	29,623,410.9	30,570,470.8	31,616,475.1	26,733,548.0
Commercial Refrigeration	1,531,015.3	1,639,544.6	1,759,487.5	1,878,244.0	1,983,946.8	2,186,256.0	2,469,036.8	2,442,685.4	2,578,333.8	2,676,033.6	2,773,281.5	2,541,700.1
Commercial Ventilation	157,966.5	178,025.3	206,267.5	236,593.6	258,344.5	296,157.9	322,196.3	363,444.4	423,911.2	461,398.5	500,912.5	330,708.6
Commercial Water Heating	14,699,500.8	15,871,690.9	17,058,737.2	18,326,594.2	18,293,111.6	18,234,059.3	18,040,549.1	18,137,733.4	18,475,594.3	18,703,983.0	18,971,330.2	18,752,671.2
Industrial Cooling	3,791,458.9	4,252,585.4	4,760,348.4	5,258,576.2	5,743,872.1	6,112,169.7	6,473,317.7	6,840,347.7	7,149,282.2	7,401,909.7	7,764,673.6	7,597,752.7
Industrial Exterior Lighting	3,961,064.5	4,395,269.8	4,815,186.4	5,222,129.8	5,603,958.2	5,608,396.6	5,608,513.8	5,651,343.5	5,695,668.4	5,740,357.9	5,766,135.8	6,601,068.1
Industrial Heating	10,763.7	12,323.7	14,169.8	15,912.5	17,540.4	19,070.6	20,524.5	21,914.7	23,231.0	24,485.3	25,668.4	25,668.4
Industrial Interior Lighting	21,801,150.9	24,311,395.4	26,744,422.9	29,103,976.9	31,271,167.8	31,621,519.8	32,026,404.9	32,578,761.7	33,133,184.8	33,495,964.7	33,753,977.7	29,745,238.7
Industrial Motors	15,218,223.3	16,810,562.2	18,371,507.9	19,924,395.7	21,503,210.5	24,014,759.6	25,714,799.2	27,406,911.6	28,807,641.8	30,143,238.5	32,400,369.5	31,662,336.5
Demand Response Res/ Comm AC	2,127,778.1	2,137,424.4	2,146,773.1	2,156,043.9	2,165,383.7	2,174,572.4	2,183,316.4	2,191,945.8	2,200,497.3	2,208,897.5	2,217,183.0	-
Demand Response Res/Comm Water Heating	839,978.9	843,788.9	847,482.3	851,145.4	854,835.6	858,466.8	861,924.0	865,336.3	868,718.3	872,041.2	875,319.3	-
Total	492,265,066.8	530,237,195.8	571,218,571.9	614,201,953.4	646,850,668.1	673,725,571.7	705,590,049.2	727,780,407.6	755,612,647.1	775,037,513.4	817,771,505.9	845,866,802.6

Demand Savings per Participant (kW)												
End Use Sector	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Residential Appliances	7,656.1	8,194.3	8,956.7	9,944.2	10,417.0	10,877.2	12,857.2	13,273.7	14,351.9	14,679.5	15,297.8	8,359.2
Residential Cooling	77,518.7	82,320.5	87,848.2	92,867.5	98,805.4	105,857.5	114,352.6	120,333.1	127,434.1	131,526.9	156,251.6	90,145.8
Residential Exterior Lighting	-	-	-	-	-	-	-	-	-	-	-	-
Residential Heating	833.6	935.9	1,044.4	1,158.7	1,268.5	1,378.7	1,490.0	1,602.6	1,665.5	1,724.1	1,779.1	1,708.8
Residential Interior Lighting	15,564.5	15,804.6	16,286.2	17,028.3	16,628.8	16,266.3	16,097.0	15,793.1	15,947.8	15,959.9	15,913.5	35,728.1
Residential Miscellaneous	1,845.6	2,019.2	2,076.5	2,133.6	2,195.8	2,258.8	2,321.9	2,434.6	2,570.6	2,681.2	2,888.1	2,514.9
Residential Water Heating	747.5	776.4	807.7	840.5	873.2	1,187.6	1,211.7	1,241.7	1,394.3	1,402.6	1,545.0	822.8
Commercial Cooling	18,260.0	20,381.5	22,778.3	25,253.8	27,522.6	30,426.5	32,556.6	34,951.5	37,348.1	39,918.2	42,574.6	38,406.0
Commercial Exterior Lighting	1.2	1.3	1.4	1.6	1.7	1.7	1.8	1.8	1.8	1.9	1.9	2.4
Commercial Food Preparation	596.9	645.1	692.4	742.8	789.6	833.9	877.9	924.1	943.2	963.7	981.5	926.8
Commercial Heating	5.3	5.9	6.6	7.3	7.8	8.1	8.4	8.9	9.3	9.8	10.2	9.9
Commercial Interior Lighting	23,296.6	25,597.2	27,878.6	30,218.6	32,288.3	33,425.9	34,933.4	35,913.9	36,895.4	37,547.7	38,274.4	41,586.0
Commercial Miscellaneous	29.6	30.1	30.5	31.4	32.3	33.1	33.8	34.5	35.1	35.8	36.3	33.2
Commercial Office Equipment	3,915.5	4,158.1	4,396.4	4,621.0	4,814.4	4,961.5	5,077.8	5,214.0	5,361.7	5,533.1	5,722.4	4,838.6
Commercial Refrigeration	277.1	296.7	318.5	340.0	359.1	395.7	446.9	442.1	466.7	484.3	501.9	460.0
Commercial Ventilation	28.6	32.2	37.3	42.8	46.8	53.6	58.3	65.8	76.7	83.5	90.7	59.9
Commercial Water Heating	2,660.5	2,872.7	3,087.5	3,317.0	3,310.9	3,300.3	3,265.2	3,282.8	3,344.0	3,385.3	3,433.7	3,394.1
Industrial Cooling	1,308.0	1,466.9	1,642.0	1,813.8	1,981.1	2,108.1	2,232.6	2,359.1	2,465.7	2,552.7	2,677.7	2,620.3
Industrial Exterior Lighting	740.0	821.1	899.5	975.5	1,046.9	1,047.7	1,047.7	1,055.7	1,064.0	1,072.3	1,077.1	1,233.1
Industrial Heating	2.4	2.7	3.1	3.5	3.8	4.2	4.5	4.8	5.1	5.4	5.6	5.6
Industrial Interior Lighting	4,072.8	4,541.7	4,996.2	5,437.0	5,841.9	5,907.3	5,983.0	6,086.2	6,189.7	6,257.5	6,305.7	5,556.8
Industrial Motors	2,457.1	2,714.2	2,966.3	3,217.0	3,471.9	3,877.4	4,151.9	4,425.1	4,651.3	4,866.9	5,231.3	5,112.2
Demand Response Res/ Comm AC	2,342.0	2,352.8	2,363.5	2,374.2	2,384.9	2,395.6	2,406.1	2,416.6	2,427.0	2,437.4	2,447.8	-
Demand Response Res/Comm Water Heating	901.6	905.8	910.0	914.1	918.3	922.5	926.6	930.7	934.8	938.9	943.1	-
Total	165,061.1	176,877.0	190,027.8	203,284.3	215,010.8	227,529.2	242,342.9	252,796.2	265,583.8	274,068.7	303,991.1	243,524.5

Source: Aggregation Results, Financial Results Tab, NET Per Participant K37:K61 (kW net)
and Q37:Q61 (kWh net) [from files in:MMP 071916 (MP Revised) and MMP 021216 022316 (MP-DR)]

Table 8: DSM Gross Savings Goals (kWh)

Program Name	2016	2017	2018	2019	2020	2021	2022
HVAC	2,434,536	2,528,877	2,777,768	2,777,768	2,777,768	2,777,768	2,777,768
Lighting	12,232,273	11,140,327	10,522,611	10,522,611	10,522,611	10,522,611	10,522,611
Home Energy Analysis	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783
Appliance Recycling	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922
Low Income Appliance Replacement	780,624	780,624	780,624	780,624	780,624	780,624	780,624
School Education	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270
Behavioral	12,636,036	19,656,056	26,676,076	26,676,076	26,676,076	26,676,076	26,676,076
IQW	189,092	189,092	189,092	189,092	189,092	189,092	189,092
Prescriptive	20,671,500	20,581,500	21,910,500	21,910,500	21,910,500	21,910,500	21,910,500
Custom	34,452,500	34,302,500	36,517,500	36,517,500	36,517,500	36,517,500	36,517,500
New Construction	4,823,350	4,802,350	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450
Small Business Direct Install	4,134,300	4,116,300	4,382,100	4,382,100	4,382,100	4,382,100	4,382,100
Reto Commisioning	4,823,350	4,802,350	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450

 Source: For 2016-2018 data, 2016 Final SOWs for Residential and Commercial programs (page 2 of each contract); 2019-2040 is forecasted as 2018.

Table 8: DSM Gross Savings Goals (kWh)

Program Name	2023	2024	2025	2026	2027	2028	2029
HVAC	2,777,768	2,777,768	2,777,768	2,777,768	2,777,768	2,777,768	2,777,768
Lighting	10,522,611	10,522,611	10,522,611	10,522,611	10,522,611	10,522,611	10,522,611
Home Energy Analysis	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783
Appliance Recycling	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922
Low Income Appliance Replacement	780,624	780,624	780,624	780,624	780,624	780,624	780,624
School Education	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270
Behavioral	26,676,076	26,676,076	26,676,076	26,676,076	26,676,076	26,676,076	26,676,076
IQW	189,092	189,092	189,092	189,092	189,092	189,092	189,092
Prescriptive	21,910,500	21,910,500	21,910,500	21,910,500	21,910,500	21,910,500	21,910,500
Custom	36,517,500	36,517,500	36,517,500	36,517,500	36,517,500	36,517,500	36,517,500
New Construction	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450
Small Business Direct Install	4,382,100	4,382,100	4,382,100	4,382,100	4,382,100	4,382,100	4,382,100
Reto Commisioning	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450

 Source: For 2016-2018 data, 2016 Final SOWs for Residential and Commercial programs (page 2 of each contract); 2019-2040 is forecasted as 2018.

Table 8: DSM Gross Savings Goals (kWh)

Program Name	2030	2031	2032	2033	2034	2035	2036	2037
HVAC	2,777,768	2,777,768	2,777,768	2,777,768	2,777,768	2,777,768	2,777,768	2,777,768
Lighting	10,522,611	10,522,611	10,522,611	10,522,611	10,522,611	10,522,611	10,522,611	10,522,611
Home Energy Analysis	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783	4,038,783
Appliance Recycling	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922	3,591,922
Low Income Appliance Replacement	780,624	780,624	780,624	780,624	780,624	780,624	780,624	780,624
School Education	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270	3,529,270
Behavioral	26,676,076	26,676,076	26,676,076	26,676,076	26,676,076	26,676,076	26,676,076	26,676,076
IQW	189,092	189,092	189,092	189,092	189,092	189,092	189,092	189,092
Prescriptive	21,910,500	21,910,500	21,910,500	21,910,500	21,910,500	21,910,500	21,910,500	21,910,500
Custom	36,517,500	36,517,500	36,517,500	36,517,500	36,517,500	36,517,500	36,517,500	36,517,500
New Construction	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450
Small Business Direct Install	4,382,100	4,382,100	4,382,100	4,382,100	4,382,100	4,382,100	4,382,100	4,382,100
Reto Commisioning	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450	5,112,450

 Source: For 2016-2018 data, 2016 Final SOWs for Residential and Commercial programs (page 2 of each contract); 2019-2040 is forecasted as 2018.

RECEIVED
November 1, 2016
INDIANA UTILITY
REGULATORY COMMISSION

Overview

Strategist®, a computer software system developed by Ventyx, LLC, supports electric utility decision analysis and corporate strategic planning. The system combines quality planning software, a proven track record, Ventyx's commitment to ongoing maintenance and support, comprehensive user documentation (online help), and fast response to client needs. Strategist® is available as a demand-side management analysis system, as a least cost resource optimization system, as a comprehensive planning tool for quick evaluation of hundreds of alternatives, as a finance and rates planning system and as selected application modules that complement planning capabilities already in place. Strategist® consists of the following application modules:

- Load Forecast Adjustment (LFA)
- Generation and Fuel (GAF)
- PROVIEW (PRV)
- Capital Expenditure and Recovery (CER)
- Differential Cost Effectiveness COST (DCE)
- Dynamic Marketing Program Design (DPD)
- Financial Reporting and Analysis (FIR)
- Class Revenue (CRM)
- Holding Company (HCM)

Strategist®: Evolution of the Industry Leader

Strategist® is fully supported by the technical and consulting services of Ventyx, LLC. Strategist® is an evolving product, enhanced and upgraded continuously.

Strategist®'s development since 1982 (originally known as PROSCREEN II) has proceeded in lockstep with that of the industry. In its earliest versions, PROSCREEN II was well suited for engineering, economic, and rudimentary financial analysis of central generating station alternatives. It was a major advance from then prevailing practices because financial consequences and constraints of resource decisions were an integral part of analysis. This advance allowed utilities to make the difficult decisions to cancel nuclear units or postpone base load additions on the basis of severe financial risk and strain.

In the early 1980's, PROSCREEN II added a comprehensive and integrated financial model, to represent the creative financing methods utilities required when faced with the period's record-high interest rates.

In response to the competitive pressures many utilities faced in the 1980's, PROSCREEN II incorporated dynamic cost allocation and class-by-class revenue analysis capabilities.

3301 Windy Ridge Parkway
Suite 200
Atlanta, GA 30339

tel 770-952-8444
fax 770-989-4231
www.ventyx.com

In the late 1980's, Ventyx's optimization experts developed PROVIEW, adding the ability to simultaneously optimize supply and demand-side alternatives, a major step forward in integrated resource planning.

To address the industry need for fast, dynamic evaluation of demand-side management (DSM) measures, Ventyx added Differential Cost Effectiveness Module (DCE), a dynamic and detailed DSM analysis tool. Recent DCE enhancements have made it a powerful tool in the new, competitive utility environment. These include differential financial results, useful in customer profitability and retention analysis, and periodic avoided cost reporting, for determining how a utility's energy and capacity costs vary by time of day and season.

In 1990, PROSCREEN II's Generation and Fuel Module was enhanced by the addition of emissions reporting and dispatch, allowing full evaluation of compliance planning strategies.
Ventyx added the Network Economy Interchange capability to PROSCREEN II to help utilities address the new issues related to competition. And as utilities approach a competitive industry and consider restructuring options, PROSCREEN II's Holding Company Module simplifies and automates the evaluation of regulated and non-regulated Strategic Business Units (SBUs).

The PROSCREEN II User Interface (UI) was introduced to PC users in early 1992 addressing the industry need to evaluate and present the results of many options under numerous conditions in a quick and organized manner. The Strategist® User Interface (UI) was unveiled in 1999 to provide for easier data input, organization, and reporting. The Windows-like feel of the interface allows users to quickly link data directly to Excel using Formula Service, organize and view data in Topics, and take advantage of customized reporting in Report Agent.

General Description

Strategist®'s advantage as an integrated planning system is its strength in all functional areas of utility planning. Strategist® allows analysts to address all aspects of an integrated planning study at the depth and accuracy level required for informed decisions. Hourly chronological load patterns are recognized. Production cost simulations are comprehensive, yet fast.

Financial analyses are accurate and thorough. Rate-level determinations reflect each utility's customer class definition and cost-of-service allocation factors. The system employs dynamic programming to develop optimal portfolios of resources. Sophisticated screening methodologies are available to develop and refine strategic marketing initiatives, identify market potential, and build portfolios of initiatives.

In Strategist®, integrated resource screening and optimization is accomplished within a single system that handles strategic marketing programs, production costing, environmental reporting, capital budgeting, and financial, tax, and revenue forecasts on a

rate class basis. Using a single, integrated software system for demand- and supply-side analysis of all resource types makes these studies much more manageable, ensures consistency in data assumptions, and provides credible, auditable results.

With Strategist®, utility management can examine many more options in a shorter period of time. The system has been designed to streamline the many steps in a comprehensive integrated planning effort and to handle the mechanics. This minimizes human error, inconsistencies, and repetitive data entry. For instance, if a combustion turbine's in-service date is delayed in the optimization program, the new in-service date is automatically specified to the production costing module as well as the capital budgeting and financial modules. The module also performs year-by-year "round robin" processing in order to appropriately address price elasticity.

Strategist® provides a wide variety of standard reports ranging from unit by unit generating statistics to construction project accounting reports to comprehensive pro forma financial results. The system includes full input summaries and detailed diagnostics.

Load Forecast Adjustment (LFA)

The Load Forecast Adjustment (LFA) Module is a multi-purpose tool for creating and modifying load forecasts and evaluating marketing and conservation programs. Using the LFA, a strategic planner may address key issues related to future electricity or gas demand and impacts attributed to each customer group. Results from this analysis can be automatically transferred to other Strategist® modules to determine production costs, system reliability, cost-effectiveness of marketing initiatives, financing and revenue requirements, and a variety of other indicators affected by loads.

Because availability of load data is often limited, the LFA is designed to process data at the level of detail readily available. Load data is processed in the LFA by user-defined load groups. It is possible to define these load groups as very detailed or very summary in scope. The LFA categorizes group data based on availability of hourly load shapes. Customer groups for which shapes are not available are processed differently than those with shapes.

A key feature of the LFA is its ability to accommodate different levels of detail for different categories of load. If load shapes are unavailable or not needed for some customer groups, the user can easily organize the data to allow the LFA to approximate the missing information. For example, a study which analyzes the loss of a large industrial customer may need detailed modeling of only those rate classes affected by the reallocation of costs. Hourly load shapes could be entered for these classes, and the user need only enter peak, energy, and coincidence factors for any remaining classes.

The analysis of programs which lack historic data, such as new demand-side technologies, will also benefit from the LFA's unique features. For example, a relamping program may be quickly modeled with estimates of energy savings per customer and reductions in peak demand. The model then schedules the hourly impact of these programs based upon optional rules specified by the user. Conversely, the evaluation of programs such as direct control of end-use loads (DLC hardware) can be based on more detailed data such as estimated net changes in seasonal demand, energy, and hourly customer shapes.

The LFA Module calculates the impact of changing prices on the initial forecast. When processing in round robin mode, the modified load forecast is passed to the Generation and Fuel (GAF) Module for production costing and to the Financial Reporting and Analysis (FIR) Module for financial analysis. The new electric prices developed in the FIR are then used for further price impacts in subsequent years of the Strategist® simulation.

The LFA Module may be used in conjunction with the Differential Cost Effectiveness (DCE) Module, PROVIEW and other Strategist® modules to evaluate marketing and conservation programs. The recommended process for evaluating these programs

includes three separate stages: screening, integrated demand/supply optimization, and detailed analysis. The process can be likened to a funnel, as depicted in Figure OV-2. The LFA Module plays an important role in each of these stages.

Screening of marketing initiatives is accomplished through use of the LFA Module in conjunction with the DCE and GAF Modules. Programs in the LFA Module database are evaluated one at a time and are ranked based on cost effectiveness measures from the following perspectives: utility, participant, community (total resource), society, typical consumer (RIM), and any user-defined benefit/cost measures. Capacity deferral costs or benefits are calculated using the capacity credit logic in the LFA and/or the reliability/reserve margin equalization logic in the GAF. Energy benefits or costs are calculated with a separate GAF production cost run for each program.

The cost effectiveness measures calculated in the initial screening of marketing alternatives will result in a multi-objective decision space. DCE pivots off this accumulated information and develops packages of alternatives which may be used as discrete levels of investment, energy, or peak demand impact that may compete against supply-side options in a fully integrated resource optimization.

Integrated optimization of marketing programs may be accomplished by the LFA Module in conjunction with the GAF Module and PROVIEW. LFA load groups representing marketing initiatives are identified as explicit options in PROVIEW along with supply options. The optimal mix of demand and supply options is developed using PROVIEW's dynamic programming capability. Several load groups may be easily combined into a single PROVIEW alternative if desired. In addition to the optimal plan, PROVIEW develops multiple suboptimal portfolios for further analysis.

The user also has available the same inputs to examine alternate marketing program penetrations. These "penetration factor" inputs make it easy to examine in detail the production, financial, and rate impacts of specific programs.

General Capabilities

- The module provides a comprehensive demand-side program evaluation capability, with inputs for program cost, load impact, timing, and capital costs.
- Load impacts may be input chronologically for each program, or may be determined by the module based on inputs for peak, energy, and program type.
- The module, in conjunction with the GAF Module, provides for the dispatch of Direct Load Control (DLC). The module develops the data for DLC, including the characteristics of the underlying load to be controlled, the contribution of the DLC capacity to system reserves, the minimum savings required before DLC is dispatched economically, and the constraints to DLC operation. DLC is dispatched in the GAF according to an economic decision rule both to reduce peak and to maintain reliability.

- Load shape data may be supplied in detail if data is available or at an aggregate level for those groups which do not have adequate load shape data. The LFA Module thus allows the user to quickly develop a load shape projection for the company and system total, but gradually expand the detail of modeling as data availability increases.
- Load data can be defined in varying levels of detail. The degree of data aggregation is determined by the user. Any number of data "groups" may be specified. Data groups are summed to "class" totals. Class totals are summed to company totals. Data groups may correspond to end-uses, rate categories, customer categories, class totals, or even company totals.
- MWH data may be input seasonally or annually. If the user desires, the MWH for each season may be specified as a percent of the annual value. Peak load in MW or as a load factor may be input. If peak loads are not input for a group, peak is determined from input load profiles.
- End-use or DSM load shapes are determined from a variety of input formats. The user may enter a typical week profile directly for each season; enter typical daily load shapes and the frequency that each load shape occurs; or enter typical weekday, weekend day, and peak day load profiles. An EEI format preprocessor is part of the system. DSM programs can be specified as load impact "after" the program or as a combined "before and after" input.
- Class load profiles are computed to determine class peak and company load profile and peak demand.
- Most calculations are performed seasonally, where seasons are defined by the number of seasons and number of days in each season.
- The module provides a mechanism to reconcile the electric price assumption underlying the load forecast and the electric price resulting from the Strategist® simulation. This mechanism is intended to reflect a company's existing load forecasting process.
- Price response can be specified in a flexible manner. The LFA Module allows a variable lag structure input with lag coefficients specified for as many as ten prior years.
- Block energy rates, block demand rates, time of use rates, seasonal demand rates, and seasonal customer rates can be modeled to determine revenue by load class. These revenue values are passed to the DPD module and the FIR module.
- Results are reported by end-use group, by class, and by company.
- Numerous diagnostics supplement the standard reports.

Module Methodology

The LFA Module allows the user to create electric company load forecasts to be transferred to the GAF Module for production costing purposes. The LFA processes the components of company load at a class and group level, where load groups sum to load classes and load classes sum to total company load. The contribution of class loads to company load also provides important transfer information for use in the Class Revenue Module (CRM) of Strategist®. In addition to the company load and class transfers, the

LFA provides estimates of total marketing program costs and customer costs for use in the CER, FIR, and PROVIEW Modules.

Company peak, energy, and load shape are developed for each season defined in the Strategist® database. Seasons are identified by the number of days in each season. A user-defined number of seasons may be modeled, the maximum being defined at the time of the Strategist® delivery. Each season's load shape is represented by a chronological 168-hour load profile called a typical weekly profile.

Data is entered at the group level and consists of a seasonal forecast of non-coincident peak, sales, and a typical weekly shape. This shape may be input as a typical week or the profile can be built from a library of typical daily load shapes; or the profile can be built from a library of typical weekdays, weekend days, and peak days; or this profile may be processed from EEI data.

Costs (benefits) associated with marketing initiatives may be provided explicitly for each program, including fixed, variable and one-time implementation costs (benefits) for both the utility as well as the customer. The following marketing program expenses, customer costs and benefits may be modeled:

- Customer Fixed Costs
- New Participants One-Time Costs
- Customer Variable Costs
- Utility Fixed Expense
- Utility New Participants Expense
- Utility Variable Expense
- New Participants Incentive Payment
- Variable Incentive Payment
- Fuel Switch Savings (Costs)
- New Participants External Costs (Benefits)
- Variable External Costs (Benefits)

The shape impacts of marketing programs may be specified or a variety of automated system load inputs may be specified. Automated inputs include:

- Peak Shave
- Unscheduled Reduction
- Peak Build
- Unscheduled Build
- Valley Build
- Valley Shave
- Percent Conservation
- Percent Growth

Dispatchable direct load control (DLC) programs may be evaluated in conjunction with the GAF Module. Strategist®'s DLC algorithm links the LFA and GAF Modules allowing dispatch decisions for DLC to benefit from the commitment, outage, and cost information available in the generating unit logic while retaining the chronology of load information. Loads available for control are developed in the LFA as well as a number of inputs associated with the description of payback and contractual use limitations (daily, monthly, and yearly for both hours and events). Each load group with load available for control is passed to the production costing module and evaluated against the expected marginal operating costs that would be experienced had no load control been available.

The LFA Module first develops energy sales and peak demand for each load group by multiplying the inputs by a user-defined penetration factor (less persistence) and by adjusting for price elasticity impacts. For groups which have shape data input, the LFA compares the load factor of the group shape to the implied load factor in the group peak and sales forecast. Any discrepancy is eliminated by modifying the load profile. Finally, the module develops the group requirements shape by scaling the sales shape by the user input group loss factor for the season.

Once each group has been processed, the hourly profiles are summed to create class load profiles and the class profiles are in turn summed to produce total company loads which are transferred to the GAF Module.

In many instances, peak, energy, and profile data requirements cannot be obtained for every load group represented in the database. In such cases the module will allow the following combinations of minimum data inputs:

1. Load shape and sales forecast: Non-coincident peak will be calculated by fitting the given energy under the given shape.
2. Load shape and non-coincident peak: Sales will be developed for each hour by multiplying the normalized shape against the input peak.

In the event that an hourly profile is unavailable for an input load group, the user has the ability to input peak, sales, and a coincidence factor for the load group. The user must also input an aggregate company shape representing the load profile of all groups for which hourly profile data is not entered, plus any other groups with hourly profile data which the user may wish to include in the aggregate shape. The module will first process all groups and classes which are included in the aggregate shape and which have a defined load shape. It will subtract the sum of these given load profiles from the input aggregate load profile. The resulting "residual" shape is assumed to be associated with all of the load groups for which shape information was not provided.

The LFA user also has the option of having the model calculate the impact of changing prices on the initial load forecast. This is accomplished by having the user input the base prices assumed in the initial load forecast, as well as the peak and energy elasticity coefficients for each load group modeled. Elasticity can be performed at either the average system price level or at the load class level with the alternate prices either being input directly by the user or being transferred from the FIR/CRM Module. The latter option requires the use of the round robin processing methodology.

When calculating the impacts of price elasticity, the LFA evaluates the impact of changing price on each individual load group before summing the modified profiles to the class and company level. Only the adjusted load is passed on to the GAF Module.

For combination electric and gas utilities that use Class Revenue, the gas sales forecast may be housed in the LFA Module for later use in the classification, allocation and revenue requirement calculations.

3301 Windy Ridge Parkway
Suite 200
Atlanta, GA 30339

tel 770-952-8444
fax 770-989-4231
www.ventyx.com

Generation and Fuel (GAF)

The Generation and Fuel (GAF) Module simulates power system operation using proven probabilistic methods. It provides production costs and generation reliability measures that are essential to supply and demand planning. The GAF Module fulfills a strategic planning role in that it requires less computer resources than more detailed production costing modules, without sacrificing overall accuracy.

General Capabilities

- The GAF Module uses probabilistic production costing techniques to simulate the effects of forced outages.
- Most module calculations are performed seasonally, where seasons are defined by number of seasons and by number of days per season.
- Sales, purchases, and hydro generation are accounted for on a seasonal basis.
- The user can explicitly define an hour-by-hour schedule for a transaction or simply specify when the transaction tends to occur (during peak load hours, low load hours, or randomly) and the GAF will schedule the transaction appropriately.
- Thermal generating units are represented by capacity segments; each segment may have a distinct heat rate, which may be input as average, incremental, or coefficients of a quadratic input/output equation. Availability is defined for the entire unit; a partial availability may also be input to represent times when a unit may only operate at minimum capacity. The units which are classified as must-run are committed first, followed by enough other units to satisfy a user-input commitment criterion. The remaining units are committed on an economic start-up and dispatch basis, subject to fuel limits and spinning reserve requirements.
- The dispatch of thermal units and economy energy may be performed on a seasonal or annual basis.
- Pumped hydro projects and direct load control programs are economically dispatched on a seasonal basis, based on marginal cost.
- Units are dispatched to conform to upper and lower limitations on fuel usage.
- Unit dispatch is performed on an 'as burned' or replacement cost of fuel basis.
- Unit, company and system emissions are calculated based on actual runtimes and fuel usage. Emissions allowances are purchased or sold on the basis of system performance and the inputs for allowance cost and allowance base for each effluent. The cost of allowances is reflected in the dispatch lambda used in dispatch order decisions.
- Environmental externalities are calculated for emissions, emergency energy, and direct load control.
- Multi-company dispatch with interchange accounting for holding companies or power pool simulation is provided.
- Numerous diagnostic reports which document detailed calculations are provided.

Production Costing Methodology

The production costing procedure consists of two stages. In the first stage, the operation of hydro generation and sale and purchase transactions are simulated. The pumped storage facilities and direct load control programs are then economically dispatched based on the constructed marginal cost curve of the system. The result of this first stage is the remaining annual or seasonal thermal load duration curve. In the second stage, the expected operation of the thermal generating units within the year is simulated by a probabilistic technique. The results are the production costs and system reliability indices.

Dispatch of Non-Thermal Resources

System load data is passed in the form of a typical 168-hour weekly load shape to the GAF from the LFA Module. Then, the dispatch of non-thermal resources is performed. The user may specify the order in which these resources are dispatched, or use the following default order:

1. The transactions (sales or purchases) that are input in the form of hourly values for each season are added to (in the case of sales) or subtracted from (in the case of purchases) the chronological load curves.

2. The transactions that are characterized by seasonal capacity and energy are scheduled. For each sale transaction, the user chooses whether the sale is a valley fill or peak build sale, or is to be applied uniformly to the load curves. For each purchase transaction, the user chooses whether the purchase is a peak shave or valley reduction purchase, or is to be applied uniformly to the load curves.

3. The hydro generating units are dispatched one at a time. Each hydro unit has a minimum (must-run) MW capacity, a maximum MW capacity, and a total energy (MWH) for the season. The remaining load, after steps 1 and 2, is first modified by subtracting from it the minimum hydro generation for every hour. The remaining hydro energy is used for peak shaving. This peak-shaving energy is calculated by subtracting the minimum hydro generation from the total hydro energy. The peak-shaving capacity is the difference between the maximum MW capacity and the minimum MW capacity of the unit.

4. Pumped storage hydro is scheduled. Storage dispatch is based on the expected generation cost at each hour before storage, pond storage limitations, cycle efficiency, and minimum savings. The storage algorithm works from highest cost hour down for generation and from lowest cost hour up for pumping, reducing the remaining load at high cost hours and increasing the load at low cost hours. This process is performed subject to the minimum savings and pond limit constraints. An option is available for the capacity of storage not used for economic reasons to be used for reliability purposes.

5. Direct load control devices are scheduled. The LFA Module provides information on underlying loads that are available for control and DLC dispatch parameters. All DLC devices are dispatched simultaneously so as to achieve the greatest possible savings and in such a way that a new peak is avoided. However, there is the added flexibility of defining a user-specified order in which the DLC devices will be dispatched. Payback is explicitly considered in addition to contractual constraints such as maximum number of interruptions and maximum hours of interruptions for each program.

If several companies are being modeled, non-thermal resources may be dispatched for a specified company or group of companies. This allows modeling of different types of systems such as a Genco and Disco where the generating company's non-thermal resources will be dispatched to meet the load of the distribution company. This type of logic is also useful for interconnected power systems where a resource should be scheduled based on market value in addition to native load requirements. After the dispatch of non-thermal resources is completed, the remaining load is served by thermal generating units. The thermal dispatch is performed on a seasonal or an annual basis as determined by the user for each water year. If annual dispatch is chosen, the modified seasonal load curves are combined into an annual load curve.

Dispatch of Thermal Resources

Each generating unit may be represented with up to seven capacity segments. Each capacity segment may have a distinct heat rate. A unit may be designated as a must-run unit, in which case its minimum segment is dispatched before any upper segment in the system. Other thermal unit inputs include commission date, retirement date, immature forced outage rate, mature forced outage rate, and partial forced outage rate at the minimum capacity level.

Planned maintenance may be explicitly modeled for each generating unit by specifying the start and end dates for each maintenance, or by entering a start date and number of weeks of maintenance in each year. Optionally, the annual number of weeks of maintenance may be specified, in which case maintenance is scheduled for the unit to levelize reserves or emergency energy across seasons. Maintenance may be handled as either a deration of the unit's capacity, or as an adjustment to its forced outage rate.

The widely accepted probabilistic production costing procedure is used to project the operation of each generating unit. The minimum segments of the must-run units are dispatched first, followed by enough other minimum segments to satisfy a user-defined dispatch commitment criterion. The remaining segments are dispatched in an economic order approximating the economic dispatch procedure of a system operator. Sufficient on-line capacity reserves are maintained to satisfy user-defined spinning reserve requirements. Fuel limits are monitored during the thermal unit dispatch. If fuel limits are exceeded, the system modifies the fuel mixtures and/or energy outputs of the generating units, resulting in a departure from economic dispatch. The impact of economy energy purchases and sales are determined on an economic basis.

After all available resources have been utilized, several reliability indices are determined. Among these are:

- Expected hours with negative margin (Loss of Load Hours, or LOLH)
- Expected emergency energy
- Reserve Margin

Alternatively, reliability measures, such as LOLH and expected emergency energy, may be fixed so that equivalent capacity benefits for DSM programs may be calculated. The GAF has the ability to calculate the equivalent capacity benefit of an incremental change in load based on a broad reliability measure. This relieves the user of the uncertain task of estimating a capacity benefit which for many DSM programs (e.g. direct load control) may be difficult to measure. This is a significant improvement over the traditional calculation of the impact on the reserve margin (peak hour impact).

Emissions are calculated each season on a unit-by-unit basis. Removal efficiency characteristics of each unit are input. The individual unit results are then aggregated into company and system emissions totals and rates. The cost of emissions, whether such cost is in the form of allowance purchase price, emissions tax, or emissions externalities result from the thermal dispatch. Separate inputs allow these emissions costs to be included in a unit's dispatch lambda if desired.

Network Economy Interchange (NEI)

The Network Economy Interchange (NEI) feature of the GAF helps reduce operating costs for a group of interconnected utilities by developing the most beneficial unit dispatch schedule for the group.

In a situation where there is unlimited transmission capacity between interconnected systems, the interchange process reaches economic equilibrium. At equilibrium, the marginal costs of all systems are virtually identical. To reach the point of equilibrium, the NEI feature performs interchange among interconnected systems in order to levelize the marginal costs. Interchange is economical as long as the difference in marginal cost is greater than the connection charges among systems.

In power systems, particularly large systems covering major geographical areas, unlimited transmission capacities seldom exist, due to physical or contractual transmission limits. To neglect transmission capacity limits is to overestimate the benefit of economy interchange. This problem may not be severe if transmission constraints are not binding. However, in transmission-poor systems, overestimation of economy interchange benefits may distort overall system production costs.

The NEI feature provides a marginal cost-based algorithm for economy interchange among connected systems, while considering losses on transmission lines and enforcing

transmissions limits for all hours. NEI accomplishes this by systematically matching potential buyers and sellers and incrementally equalizing their marginal costs.

The billing and accounting logic of the Network Economy Interchange reflects the market clearing price of the system. Therefore, if there are no losses, no connection charges, and no tie constraints, the marginal cost of the buyer will equal the marginal cost of the seller and the energy generated will equal the energy received. If there are differences between the buyer's cost and seller's revenue, the losses or surplus revenue is split between them based on the transfer point. If a third party is involved, then the losses and surplus revenue are allocated to the buyer, seller, and/or third parties based on their ownership.

After all other load modifications are complete (transactions, hydro, pumped hydro, and direct load control), the GAF implements economy interchange. Interchange results are used to modify hourly loads of the internal companies. The GAF then executes the thermal dispatch for every internal company. If there is more than one internal company, the NEI feature sums company outputs to obtain the pool results.

PROVIEW (PRV)

The PROVIEW (PRV) Module is a resource planning model which determines the least-cost balanced demand and supply plan for a utility system under prescribed sets of constraints and assumptions. PROVIEW incorporates a wide variety of expansion planning parameters including alternative technologies, unit conversions, cogenerators, unit capacity sizes, load management, marketing and conservation programs, fuel costs, reliability limits, emissions trading and environmental compliance options in order to develop a coordinated integrated plan which would be best suited for the utility. PROVIEW works in concert with the GAF Module to simulate the operation of a utility system. PROVIEW's optimization logic then determines the cost and reliability effects of adding resources to the system or modifying the load through demand-side management (DSM) or marketing programs.

The module allows modeling of emissions-related constraints, emissions allowance trading, and emissions reduction alternatives (e.g. scrubbers, fuel switching). These capabilities are used both to develop optimal environmental compliance strategies and to incorporate resource planning.

Programs are screened by using the LFA Module in conjunction with DCE and the GAF Module. Programs in the LFA Module database are evaluated one at a time and are ranked based on industry standard cost effectiveness measures such as participant cost, utility cost, total resource cost, societal cost, and ratepayer impact measure (average rate). Groups of programs are then developed into portfolios based on the results of the ranking process. The LFA allows detailed treatment of system, class or end-use loads, enabling you to specify demand side or marketing programs on an hourly chronological basis. Capacity deferral benefits or costs are calculated using the capacity credit logic in the LFA and/or the reliability equalization logic in the GAF. Energy benefits or costs are calculated with a separate GAF production cost run for each program.

Once portfolios of programs have been developed, the LFA Module is used in conjunction with PROVIEW to perform integrated demand and supply optimization. LFA load groups representing DSM or marketing programs or portfolios of programs are specified as explicit PROVIEW alternatives. In this way, the programs compete on a "level playing field" with supply options. The optimal demand/supply plan is then developed using PROVIEW's dynamic programming capability. In addition to the optimal plan, PROVIEW retains multiple suboptimal demand/supply plans for further analysis.

The final step in evaluation of DSM or marketing programs involves use of the LFA Module in conjunction with all modules of Strategist®. The CER Module provides the annual capital expenditure impacts of the programs and allows assessment of program costs which are capitalized. The FIR Module allows the evaluation of the impact of the programs on average rates, rate increase requirements and timing, and financial performance. The impact of programs on class rates and cross subsidy issues may be thoroughly evaluated in the CRM.

General Capabilities

- Data input is structured in a similar manner to Strategist® GAF data.
- PROVIEW provides quick turn-around time by eliminating options that are not feasible and by eliminating unnecessary detail.
- PROVIEW allows for a full enumeration of all combinations of expansion options and/or demand-side management or marketing programs through its Dynamic Programming option. The system can thus be highly rigorous in its determination of a least-cost expansion plan for the entire planning period.
- Production cost calculations are performed for each alternative through the execution of the GAF Module. Demand side programs and associated sales impacts are computed through the execution of the LFA Module.
- PROVIEW uses the economic carrying charge as the capital cost representation during the study period optimization. After the study period rankings have been determined, the plans will be re-ranked over the planning period horizon using actual year by year revenue requirements. If these are not input, then levelized revenue requirements will be used.
- PROVIEW explicitly handles end effects in determination of the least cost plan. The end effects analysis approximates the capital and production cost of replacing the resulting utility system in kind over the user-input end effects period.
- PROVIEW provides for one of five objective functions to be used in the least-cost optimization: minimization of utility costs, minimization of average study period rates, minimization of total societal cost (total resource cost), minimization of total resource costs, or maximization of total unit profitability.
- PROVIEW will also evaluate any expansion plan optimized by one of the five objective functions mentioned above with regard to financial performance. The expansion plans may be re-ranked based on electric revenue, corporate value of the firm, economic value added, earnings per share, or value per share.
- PROVIEW provides numerous constraints for the user to reduce the number of options to consider. Minimum and maximum number to add, minimum and maximum reserve or loss of load hours, and first year available to add are but a few. PROVIEW can define alternatives as mutually exclusive or inclusive in a year. It can also restrict alternatives to be dependent upon certain other alternatives being in service (the second unit in a station is dependent upon the first unit having been constructed). PROVIEW also allows options such as phased construction of combined cycle units to be evaluated quickly. Maximum emissions levels can also be specified to reduce the alternatives considered.
- A PROVIEW optimization may be performed for the entire pool when multi-company summation logic is used. PROVIEW allows constraints to be entered at both the system level and for each company in the pool.

- When using Multi-Company, PROVIEW allows the addition of alternatives which are owned by a company other than the company (or pool) which is being optimized.
- PROVIEW allows complete evaluation of suboptimal plans. All plans are saved in PROVIEW's database for subsequent reporting and analysis. The user may specify the ranking of significantly different plans. Significantly different plans are developed as of a certain year of the analysis.
- Numerous diagnostics which explain in detail how PROVIEW reaches its optimal plan decision are available.
- PROVIEW results include a database that contains the results of all plans. The analyst can select any of these plans to be automatically set up in the LFA, GAF, CER, and FIR Modules for more extensive evaluation.

Module Inputs

PROVIEW requires the data supplied by the user to be separated into two sections: the first section characterizes the existing utility system and the other section characterizes the potential expansion or marketing initiative options. The existing utility system data set is composed of the Strategist® GAF and LFA Module data sets, which are fully described in the GAF Module online help and LFA Module online help. Briefly, data requirements for the existing system are grouped according to load, hydro unit, transaction, thermal unit, storage unit, fuel type, fuel class, and general parameter data. Data requirements for the existing load forecast are grouped according to load group, load shape, load class, and parameter data.

The data required for the planning alternative section contains information relating to alternative resources that may be added or marketing programs that may be implemented. Data in this section defines alternative unit characteristics, construction costs, resource addition limits, and resulting system reliability constraints. Alternative option information is specified in a general manner so that any proposed available option can be commissioned at any time during the study period.

Module Methodology

PROVIEW's Dynamic Programming calculations are summarized as follows:

1. A capital cost table is constructed. This table contains the economic carrying for every alternative for each year of the study.
2. Feasible current-year states (combinations of alternatives) are determined by examining every combination of user-defined resource additions or marketing programs. Feasible states are those which meet reliability dependency and tunnel constraints. One-year capital and production costs are calculated and used to determine the accumulated cost-to-date. Each feasible state description is saved along with the associated accumulated cost-to-date.
3. The module repeatedly analyzes and saves feasible states for each year during the planning period. At the end of this planning period, a matrix of possible states for

each year has been constructed. Note that each feasible state in the final year represents the end product of a different expansion plan.

4. Each potential expansion plan is subjected to end effects analysis. The end effects analysis adds to the accumulated cost-to-date of the capital and production cost of replacing the resulting utility system in kind, over a user-specified end effects period.
5. The module traces back through the matrix of feasible states to identify the components of the optimal plan and the components of each sub-optimal plan.
6. The optimal plan is set up in the LFA, GAF, CER, and FIR for subsequent analysis and reporting. All plans are saved in the database.

3301 Windy Ridge Parkway
Suite 200
Atlanta, GA 30339

tel 770-952-8444
fax 770-989-4231
www.ventyx.com

Capital Expenditure and Recovery (CER)

The Capital Expenditure and Recovery (CER) Module provides a method of readily comparing and evaluating the economics of generation alternatives. In addition, the CER Module, through its interaction with the Financial Reporting and Analysis (FIR) Module, allows the strategic planner to analyze the financial implications of an individual project or an entire construction program.

General Capabilities

- The CER Module allows the strategic planner to examine the financial effects on the company's consolidated operations of construction alternatives intended to meet the forecasted system demand. Complete economic evaluation reports using both minimum revenue requirements (MRR) and discounted cash flow techniques are available.
- The CER Module simulates the financial effects resulting from changes in the treatment of the tax effects of depreciation allowances for funds used during construction (AFUDC).
- Any number of major projects (those which close to plant at the end of the expenditure stream) and blanket projects (those which close to plant as expenditures are made) can be evaluated. Highly flexible logic allows users to specify close to plant amounts for book and tax purposes on a project-by-project basis. DSM projects can be modeled to capitalize expenses associated with conservation programs.
- The CER provides for a convenient method of examining alternate plans. A project's in-service date may be changed with a single command. All annual expenditures for that project are automatically shifted, taking inflation and escalation rates into account.
- A variety of reports display results for individual projects, for user-defined aggregations of projects, and for the entire system.
- Project phase-ins and disallowances are easily analyzed. Through interaction with the FIR Module, the user may examine the rate and financial impacts of alternative regulatory treatment of canceled or partially canceled projects.
- The CER Module allows for a project-to-GAF-unit tie. Fuel cost and O&M expense can then be passed to the CER by project for use in its revenue requirements calculations. The CER, if desired, will also use the GAF unit's commission date as the project in-service date. Thus, unit slippage can be assessed in both the GAF and CER with only one data change.
- Using the project-to-GAF-unit tie, the PROVIEW Module will output a CER database for the selected plan containing the appropriate in-service dates for expansion units.

Accounting, Tax, and Economic Calculations

The accounting and tax calculations are separated into three stages: construction period calculations, in-service date (close to plant) calculations, and service life calculations. The module is run for the number of years specified by the user. However, construction and commercial operation may start at any time during a year, and all calculations will be adjusted accordingly.

Construction Period Calculations

The construction period begins with the construction start date and ends immediately before the in-service date. Items calculated for this period include:

- Capital Expenditures - These are entered either as annual amounts in constant base year dollars or as nominal dollars. If desired, a total dollar amount to be spent can be input, along with an S-curve to distribute the expenditures over an appropriate range of years. Individual project escalation rates may be specified, as well as a general inflation rate applicable to all capital costs. For a blanket project, the user can input annual percentages or dollar amounts of expenditures to be closed to plant. These amounts can vary for book and tax purposes.
- Construction Work In Progress (CWIP) - Capital expenditures and AFUDC are added to this account each year during construction.
- CWIP in Rate Base - This value is calculated by multiplying a user-specified percentage of CWIP in the rate base for each project in each year by the amount of construction work in progress.
- AFUDC - The balance of CWIP less cumulative AFUDC is multiplied by the eligible percentage and the AFUDC rate to compute the AFUDC for the current year. If the user elects to compound AFUDC, the entire CWIP balance can be used in this calculation.
- Overheads - If desired, capitalized overheads are deducted for tax purposes during the construction period but are capitalized for financial reporting purposes.

In-Service Date Calculations

For major projects, the CWIP balance is closed to plant at the end of the in-service date. This includes any expenditures and AFUDC for the current year. Closing is assumed to take place on the last day of the in-service month. For major projects with expenditures after the in-service date, expenditures are closed to plant in the year they are made. For blanket projects, amounts are closed in the years following their expenditure according to a user-input schedule. This schedule can be specified as either percentage or dollar amounts, and can vary for book and tax purposes for the same project.

Service Life Calculations

In each year after a project has been closed to plant, the following calculations are made for that project:

- Book Depreciation - Book basis is the total amount closed to plant, including AFUDC. Depreciation can be calculated using any of the methods available for calculating tax depreciation, although the straight-line method is the default.
- Tax Depreciation - Tax basis is the amount closed to plant less any AFUDC included in the closed to plant amount and less any capitalized overheads which have already been deducted for tax purposes. One of twelve depreciation methods may be used. They are:
  - Double Declining Balance (DDB)
  - Straight Line (SL)
  - Sum of the Years Digit (SYD)
  - DDB switching to SL
  - SYD switching to SL
  - DDB switching to SYD and SL
  - User Specified Percentage
  - 150% Declining Balance switching to SL
  - 150% Declining Balance
  - Units of Production
  - Do Not Calculate Depreciation

Tax depreciation for the first in-service year is calculated using one of four methods: fraction of the year, half-year convention, modified half-year convention, or mid-quarter convention.

- Tax and Insurance Cost - User-specified rates for property taxes, other taxes, and insurance costs are applied to the amount closed to plant excluding AFUDC.
- Nuclear Fuel - The GAF Module provides annual fuel burn and fuel cost for each nuclear unit. The CER Module calculates the capital expenditures using the annual nuclear fuel burn from the GAF Module for either a single nuclear fuel project or multiple nuclear fuel projects. Book depreciation is equal to nuclear fuel cost in each year and tax depreciation is calculated using the project capital expenditures and the plant closing schedule. DOE nuclear waste disposal costs may be modeled.
- Decommissioning Costs - The CER Module accounts for the practice of recovering an estimate of decommissioning costs over the life of the plant.

Economic Calculations

The CER Module also calculates the annual present worth and the accumulated present worth of the revenue requirements associated with each project. Reports show the determination of present worth of revenue requirements using both a minimum revenue requirements and a discounted cash flow approach. This enables the CER Module to be used for engineering economic evaluations of specific projects, including life-cycle economic comparisons of alternative projects.

System analysis reports are also available for investigation of the revenue requirements for an entire plan, including fuel and O&M as transferred from the GAF Module.

The CER also evaluates capital projects within an unregulated, competitive environment. Using the unit profitability features in the GAF, the CER determines revenue for a project based on energy, capacity, and ancillary revenue. Operating and capital expenditures are subtracted from the revenue to determine total operating income. Profitability reports show this information at the project, project class, and system level. An internal rate of return is also calculated for each project based on annual net cash income versus construction expenditures.

3301 Windy Ridge Parkway
Suite 200
Atlanta, GA 30339

tel 770-952-8444
fax 770-989-4231
www.ventyx.com

Hourly System Demand (Native Load)

2013 Hourly Native Load: The hourly demand for NIPSCO's native load is stated in MW, Hour Ending, and Central Standard Time ("CST"). Native load includes losses, but does not include wholesale or off-system sales.

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
01/01	1,703	1,625	1,585	1,570	1,553	1,537	1,552	1,583	1,584	1,619	1,654	1,632
	1,645	1,664	1,616	1,630	1,670	1,769	1,850	1,881	1,909	1,900	1,887	1,794
01/02	1,725	1,740	1,762	1,734	1,712	1,793	1,867	1,997	2,041	2,102	2,091	2,066
	2,037	2,032	2,021	2,068	2,062	2,159	2,300	2,352	2,292	2,255	2,189	2,073
01/03	2,000	1,985	2,000	1,985	1,988	2,043	2,126	2,153	2,230	2,267	2,270	2,275
	2,310	2,311	2,314	2,254	2,228	2,317	2,384	2,330	2,363	2,345	2,238	2,123
01/04	2,099	2,028	2,004	1,998	1,988	2,062	2,111	2,281	2,293	2,303	2,327	2,293
	2,307	2,296	2,224	2,218	2,169	2,227	2,323	2,282	2,257	2,234	2,188	2,070
01/05	1,963	1,910	1,875	1,878	1,866	1,887	1,944	1,932	1,963	1,975	1,952	1,929
	1,928	1,918	1,923	1,940	1,963	2,058	2,110	2,063	2,058	2,028	2,005	1,917
01/06	1,812	1,823	1,784	1,739	1,705	1,715	1,729	1,755	1,724	1,758	1,781	1,810
	1,800	1,825	1,816	1,804	1,863	1,928	1,991	2,007	2,021	1,983	1,916	1,857
01/07	1,872	1,792	1,730	1,750	1,865	1,921	2,053	2,171	2,187	2,201	2,110	2,167
	2,129	2,124	2,099	2,032	2,059	2,113	2,175	2,168	2,159	2,139	2,096	1,979
01/08	1,929	1,880	1,840	1,788	1,837	1,892	2,065	2,135	2,140	2,093	2,104	2,085
	2,110	2,116	2,065	2,034	2,044	2,062	2,171	2,148	2,184	2,044	1,997	1,973
01/09	1,925	1,902	1,865	1,833	1,827	1,875	1,962	2,069	2,107	2,065	2,098	2,068
	2,061	2,081	2,070	2,043	1,986	2,072	2,139	2,172	2,155	2,122	2,066	1,995
01/10	1,927	1,887	1,863	1,863	1,810	1,883	1,975	2,144	2,135	2,173	2,158	2,131
	2,142	2,100	2,077	2,031	2,080	2,143	2,231	2,206	2,219	2,103	2,059	1,977
01/11	1,855	1,860	1,838	1,828	1,831	1,903	2,011	2,077	2,135	2,168	2,132	2,111
	2,129	2,066	2,107	2,030	2,071	2,030	2,089	2,009	1,979	1,941	1,879	1,824
01/12	1,747	1,706	1,652	1,641	1,678	1,684	1,743	1,753	1,756	1,759	1,801	1,800
	1,770	1,761	1,746	1,719	1,749	1,836	1,895	1,885	1,856	1,883	1,877	1,843
01/13	1,747	1,690	1,653	1,614	1,682	1,682	1,652	1,666	1,707	1,746	1,751	1,797
	1,819	1,804	1,833	1,828	1,871	1,893	1,985	1,996	1,978	1,974	1,887	1,824
01/14	1,795	1,764	1,749	1,757	1,769	1,855	1,961	2,095	2,164	2,193	2,163	2,181
	2,215	2,222	2,152	2,148	2,079	2,132	2,201	2,211	2,191	2,203	2,140	2,041
01/15	1,985	1,964	1,963	1,919	1,936	2,035	2,073	2,119	2,083	2,045	2,069	2,089
	2,022	2,054	2,121	2,065	2,028	2,185	2,200	2,164	2,229	2,124	2,103	1,999
01/16	1,900	1,938	1,854	1,855	1,879	1,943	2,037	2,138	2,112	2,157	2,136	2,135
	2,135	2,108	2,065	2,076	2,050	2,123	2,201	2,117	2,149	2,092	2,036	1,930
01/17	1,836	1,768	1,801	1,790	1,774	1,925	2,018	2,141	2,057	2,058	2,073	2,067
	2,076	2,048	2,075	2,068	2,066	2,168	2,250	2,235	2,238	2,216	2,131	2,033
01/18	1,910	1,934	1,981	1,966	1,989	2,037	2,099	2,244	2,260	2,283	2,289	2,237
	2,266	2,262	2,179	2,112	2,072	2,100	2,209	2,193	2,192	2,144	2,130	2,007
01/19	1,976	1,915	1,842	1,881	1,891	1,839	1,862	1,912	1,904	1,918	1,921	1,939
	1,911	1,852	1,856	1,902	1,848	1,879	1,976	1,996	1,951	1,965	1,931	1,799
01/20	1,775	1,832	1,812	1,774	1,752	1,774	1,803	1,897	1,899	1,908	1,879	1,881
	1,887	1,910	1,906	1,893	1,912	1,990	2,082	2,083	2,057	2,023	2,022	1,952
01/21	1,912	1,897	1,907	1,934	1,947	2,007	2,060	2,192	2,232	2,223	2,260	2,281
	2,279	2,281	2,234	2,182	2,161	2,221	2,332	2,328	2,316	2,284	2,199	2,187
01/22	2,155	2,068	2,019	1,991	1,994	2,054	2,198	2,272	2,267	2,285	2,297	2,301
	2,250	2,249	2,144	2,114	2,102	2,158	2,233	2,207	2,189	2,205	2,176	2,103
01/23	2,081	2,004	1,990	1,980	2,028	2,033	2,107	2,230	2,259	2,271	2,224	2,250
	2,281	2,251	2,118	2,052	2,098	2,232	2,361	2,341	2,342	2,276	2,239	2,192
01/24	2,093	2,070	2,081	2,052	2,082	2,184	2,233	2,314	2,278	2,281	2,338	2,303
	2,279	2,263	2,269	2,189	2,181	2,248	2,333	2,352	2,342	2,296	2,183	2,111
01/25	2,060	2,011	1,978	2,030	1,992	2,101	2,180	2,248	2,246	2,216	2,236	2,267
	2,272	2,276	2,294	2,222	2,187	2,193	2,214	2,200	2,177	2,149	2,140	2,016
01/26	1,908	1,938	1,925	1,926	1,901	1,891	1,935	1,985	1,965	2,029	2,045	1,989
	1,945	1,875	1,874	1,896	1,896	1,899	2,009	1,959	1,984	1,942	1,858	1,794
01/27	1,755	1,748	1,747	1,671	1,700	1,729	1,746	1,780	1,775	1,833	1,821	1,842
	1,814	1,846	1,879	1,933	1,994	2,073	2,057	2,106	2,127	2,069	2,013	1,939
01/28	1,846	1,867	1,819	1,836	1,789	1,828	1,947	2,002	2,047	2,042	2,087	2,129
	2,132	2,134	2,044	2,013	2,016	2,053	2,148	2,141	2,126	2,114	2,027	1,940
01/29	1,931	1,762	1,783	1,742	1,774	1,783	1,788	1,929	1,916	1,940	1,968	1,944
	1,915	1,909	1,876	1,856	1,890	1,955	1,982	1,966	1,980	1,942	1,889	1,826
01/30	1,752	1,699	1,632	1,623	1,676	1,713	1,855	1,961	2,026	2,049	2,023	2,053
	2,059	2,106	2,095	2,029	2,061	2,109	2,165	2,260	2,205	2,189	2,205	2,069
01/31	2,000	1,997	1,979	1,924	1,927	2,039	2,153	2,239	2,263	2,245	2,253	2,283
	2,260	2,268	2,270	2,210	2,193	2,189	2,336	2,406	2,397	2,301	2,264	2,196

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
02/01	2,133	2,086	2,062	2,047	2,040	2,050	2,141	2,251	2,327	2,334	2,314	2,350
	2,322	2,327	2,273	2,204	2,226	2,218	2,323	2,288	2,264	2,214	2,175	2,128
02/02	2,084	1,986	2,003	1,927	1,927	1,955	1,986	2,036	1,984	2,022	1,998	2,029
	1,994	1,947	1,911	1,895	1,944	1,985	2,068	2,104	2,084	1,970	1,931	1,875
02/03	1,806	1,753	1,781	1,780	1,738	1,715	1,741	1,758	1,794	1,884	1,881	1,879
	1,866	1,866	1,877	1,850	1,875	1,863	1,946	1,890	1,909	1,937	1,913	1,861
02/04	1,839	1,836	1,782	1,768	1,846	1,926	2,033	2,124	2,173	2,226	2,262	2,262
	2,268	2,238	2,214	2,132	2,145	2,162	2,218	2,204	2,228	2,200	2,124	2,015
02/05	2,008	1,881	1,865	1,818	1,907	1,916	2,087	2,162	2,156	2,122	2,145	2,156
	2,153	2,105	2,124	2,082	2,043	2,069	2,152	2,146	2,129	2,102	2,043	1,964
02/06	1,924	1,902	1,906	1,869	1,895	1,978	2,038	2,084	2,130	2,139	2,114	2,113
	2,114	2,125	2,086	2,054	2,091	2,155	2,237	2,276	2,291	2,218	2,063	2,016
02/07	1,984	1,955	1,985	1,995	2,019	2,066	2,168	2,239	2,217	2,239	2,207	2,188
	2,176	2,164	2,088	2,048	2,081	2,196	2,225	2,276	2,260	2,201	2,117	2,023
02/08	1,988	1,942	1,956	1,984	1,981	2,038	2,153	2,187	2,225	2,229	2,293	2,260
	2,166	2,198	2,229	2,156	2,161	2,203	2,254	2,300	2,262	2,237	2,146	2,079
02/09	2,007	1,992	1,940	1,942	1,883	1,856	1,891	1,860	1,892	1,953	1,980	1,944
	1,933	1,934	1,895	1,889	1,834	1,836	1,918	1,953	1,954	1,959	1,913	1,854
02/10	1,803	1,771	1,743	1,737	1,732	1,741	1,756	1,795	1,755	1,798	1,816	1,834
	1,825	1,833	1,811	1,797	1,852	1,868	1,934	1,990	1,938	1,888	1,861	1,838
02/11	1,797	1,744	1,734	1,706	1,775	1,888	1,998	2,075	2,123	2,178	2,200	2,166
	2,190	2,144	2,127	2,065	2,072	2,085	2,193	2,159	2,149	2,132	2,049	2,001
02/12	1,902	1,910	1,861	1,873	1,864	1,844	1,933	2,027	1,978	2,051	2,110	2,091
	2,062	2,035	2,014	2,046	2,044	2,103	2,111	2,141	2,104	2,089	2,013	1,945
02/13	1,832	1,820	1,816	1,838	1,815	1,877	2,012	2,102	2,082	2,102	2,121	2,107
	2,069	2,056	2,003	2,001	1,971	1,998	2,152	2,195	2,161	2,149	2,130	2,034
02/14	1,977	1,976	1,921	1,939	1,916	1,971	2,122	2,159	2,163	2,169	2,196	2,182
	2,143	2,160	2,084	2,145	2,125	2,169	2,220	2,126	2,105	2,177	2,086	1,990
02/15	1,963	1,936	1,914	1,921	1,919	1,976	2,108	2,159	2,181	2,203	2,204	2,170
	2,133	2,148	2,163	2,149	2,123	2,108	2,092	2,181	2,158	2,108	2,025	1,956
02/16	1,895	1,907	1,871	1,803	1,773	1,804	1,864	1,880	1,907	1,921	1,957	1,983
	1,949	1,950	1,918	1,915	1,913	1,979	2,071	2,114	2,062	2,035	1,983	1,925
02/17	1,864	1,900	1,803	1,837	1,852	1,869	1,875	1,840	1,832	1,916	1,895	1,890
	1,792	1,775	1,809	1,827	1,848	1,872	1,964	2,006	2,015	2,003	2,002	1,933
02/18	1,868	1,829	1,815	1,835	1,839	1,858	1,943	1,996	1,933	1,970	1,977	1,950
	1,993	1,961	2,025	1,993	2,015	2,068	2,107	2,114	2,108	2,078	1,968	1,914
02/19	1,896	1,845	1,809	1,873	1,967	2,051	2,177	2,248	2,258	2,262	2,293	2,270
	2,296	2,300	2,256	2,138	2,167	2,203	2,234	2,243	2,221	2,170	2,136	2,031
02/20	1,967	1,854	1,913	1,937	1,960	1,979	2,111	2,202	2,236	2,230	2,220	2,183
	2,172	2,156	2,181	2,122	2,122	2,133	2,209	2,267	2,198	2,177	2,130	2,035
02/21	2,052	2,042	1,990	1,971	1,959	2,020	2,130	2,205	2,169	2,214	2,278	2,271
	2,297	2,273	2,246	2,207	2,187	2,218	2,276	2,366	2,337	2,311	2,190	2,166
02/22	2,100	2,104	2,036	2,061	2,013	2,073	2,141	2,164	2,159	2,221	2,214	2,275
	2,244	2,248	2,248	2,199	2,140	2,190	2,238	2,260	2,228	2,118	2,131	2,031
02/23	1,951	1,938	1,944	1,897	1,810	1,874	1,914	1,949	1,946	1,933	1,951	1,971
	1,970	1,921	1,931	1,933	1,933	1,985	2,054	2,094	2,115	2,063	1,977	1,911
02/24	1,829	1,835	1,829	1,771	1,755	1,803	1,811	1,805	1,809	1,824	1,810	1,776
	1,801	1,763	1,771	1,773	1,813	1,895	1,935	2,001	2,002	1,964	1,972	1,865
02/25	1,842	1,810	1,802	1,814	1,857	1,919	2,015	2,087	2,132	2,127	2,143	2,105
	2,045	2,042	2,089	1,974	1,988	2,039	2,129	2,193	2,190	2,118	2,080	2,009
02/26	1,893	1,858	1,875	1,881	1,846	1,892	1,984	2,064	2,044	2,078	2,122	2,152
	2,135	2,132	2,073	2,107	2,100	2,131	2,118	2,115	2,124	2,071	2,006	1,947
02/27	1,831	1,789	1,826	1,828	1,844	1,880	1,997	2,072	2,195	2,210	2,167	2,249
	2,205	2,197	2,136	2,092	2,166	2,150	2,192	2,209	2,254	2,195	2,133	2,122
02/28	2,016	1,974	1,971	1,940	1,937	2,015	2,122	2,117	2,125	2,158	2,168	2,194
	2,215	2,200	2,159	2,164	2,083	2,131	2,182	2,258	2,254	2,195	2,175	2,068

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
03/01	1,886	1,873	1,922	1,938	1,892	1,961	2,050	2,091	2,119	2,127	2,134	2,151
	2,057	2,039	2,007	2,043	2,001	2,013	2,106	2,082	2,095	2,105	2,075	1,945
03/02	1,860	1,811	1,792	1,818	1,737	1,707	1,853	1,879	1,878	1,928	1,971	1,988
	1,951	1,933	1,912	1,932	1,933	1,967	1,956	2,035	2,003	1,983	1,961	1,854
03/03	1,841	1,797	1,781	1,763	1,711	1,725	1,774	1,741	1,737	1,741	1,789	1,763
	1,738	1,707	1,679	1,749	1,758	1,748	1,807	1,952	1,951	1,923	1,897	1,847
03/04	1,750	1,763	1,757	1,779	1,820	1,942	2,034	2,089	2,110	2,131	2,123	2,088
	2,065	2,086	2,099	2,058	1,976	2,032	2,093	2,116	2,088	2,052	2,029	1,949
03/05	1,889	1,856	1,845	1,816	1,820	1,901	1,994	2,043	2,009	2,011	2,025	2,029
	2,071	2,032	2,058	2,065	2,040	2,027	2,130	2,195	2,132	2,075	2,018	1,879
03/06	1,822	1,827	1,866	1,840	1,849	1,961	2,000	2,056	2,074	2,136	2,134	2,131
	2,125	2,110	2,101	2,125	2,064	2,101	2,137	2,191	2,205	2,156	2,059	1,980
03/07	1,911	1,822	1,830	1,789	1,810	1,885	2,007	2,016	2,008	2,067	2,080	2,076
	2,044	2,076	2,012	2,016	1,998	2,019	2,039	2,137	2,183	2,159	2,087	1,988
03/08	1,997	1,908	1,811	1,850	1,898	1,968	2,057	2,087	2,120	2,153	2,184	2,179
	2,125	2,102	2,114	2,068	2,019	2,013	2,030	2,100	2,110	2,115	2,014	1,979
03/09	1,893	1,869	1,879	1,840	1,746	1,784	1,839	1,907	1,912	1,960	1,900	1,903
	1,875	1,812	1,806	1,802	1,775	1,832	1,938	1,954	1,945	1,916	1,813	1,764
03/10	1,720	1,671	1,651	1,670	1,630	1,645	1,715	1,700	1,731	1,748	1,800	1,789
	1,741	1,722	1,702	1,745	1,768	1,783	1,874	1,836	1,835	1,825	1,768	1,742
03/11	1,730	1,737	1,755	1,765	1,830	1,945	2,059	2,064	2,040	2,042	2,070	2,140
	2,114	2,092	2,047	2,052	2,033	2,052	2,118	2,152	2,110	2,046	1,962	1,904
03/12	1,845	1,826	1,795	1,797	1,864	1,966	2,061	2,053	2,041	2,060	2,081	2,070
	2,037	2,003	1,985	1,955	1,979	1,971	1,979	2,081	2,100	2,033	1,943	1,888
03/13	1,825	1,820	1,806	1,826	1,874	2,026	2,112	2,129	2,134	2,126	2,181	2,163
	2,175	2,181	2,109	2,092	2,077	2,027	2,017	2,079	2,086	2,063	1,982	1,963
03/14	1,935	1,907	1,868	1,904	1,952	2,082	2,141	2,139	2,127	2,163	2,178	2,144
	2,165	2,135	2,095	2,082	2,040	2,038	2,120	2,172	2,141	2,093	2,033	1,986
03/15	1,945	1,927	1,929	1,939	2,006	2,085	2,150	2,129	2,135	2,121	2,174	2,205
	2,167	2,111	2,072	2,024	1,991	2,050	2,080	2,101	2,079	2,022	1,993	1,907
03/16	1,825	1,835	1,927	1,912	1,858	1,915	1,916	1,967	1,997	2,021	2,059	2,013
	2,029	2,015	1,943	1,921	1,919	1,893	1,904	1,927	1,962	1,915	1,867	1,811
03/17	1,742	1,723	1,745	1,731	1,733	1,803	1,822	1,836	1,839	1,853	1,808	1,835
	1,813	1,812	1,833	1,773	1,856	1,859	1,866	1,914	1,927	1,892	1,905	1,856
03/18	1,801	1,776	1,780	1,829	1,895	1,981	2,117	2,100	2,139	2,147	2,177	2,196
	2,226	2,160	2,120	2,088	2,060	2,039	2,061	2,108	2,087	2,053	1,963	1,936
03/19	1,863	1,865	1,854	1,861	1,971	2,055	2,141	2,133	2,145	2,174	2,175	2,168
	2,123	2,108	2,036	1,987	1,983	1,991	2,007	2,094	2,107	2,046	1,988	1,926
03/20	1,880	1,870	1,814	1,832	1,961	2,025	2,088	2,146	2,182	2,141	2,164	2,108
	2,171	2,124	2,107	2,064	2,048	2,078	2,113	2,165	2,119	2,043	2,036	1,983
03/21	1,893	1,895	1,926	1,946	1,992	2,089	2,222	2,261	2,301	2,302	2,287	2,291
	2,246	2,191	2,093	2,061	2,009	2,039	2,054	2,123	2,131	2,031	2,001	1,928
03/22	1,935	1,945	1,952	1,911	1,973	2,031	2,156	2,105	2,097	2,143	2,135	2,133
	2,086	2,042	1,964	1,932	1,958	2,009	2,006	2,089	2,115	2,017	2,015	1,906
03/23	1,875	1,888	1,873	1,891	1,898	1,954	2,009	1,985	1,970	1,981	1,973	1,959
	1,942	1,920	1,909	1,869	1,891	1,855	1,883	1,967	2,018	1,993	1,936	1,865
03/24	1,888	1,865	1,781	1,801	1,799	1,829	1,866	1,888	1,934	1,925	1,908	1,959
	1,913	1,909	1,899	1,908	1,904	1,945	2,019	2,075	2,034	2,024	1,952	1,876
03/25	1,831	1,888	1,886	1,901	1,952	2,000	2,110	2,134	2,154	2,187	2,230	2,198
	2,167	2,150	2,105	2,087	2,095	2,094	2,083	2,143	2,120	2,009	1,995	1,940
03/26	1,863	1,841	1,795	1,795	1,861	1,951	2,023	2,018	1,994	2,016	1,971	1,971
	1,964	2,025	1,982	1,931	1,968	1,990	2,038	2,086	2,103	2,025	1,955	1,878
03/27	1,826	1,783	1,849	1,854	1,950	2,025	2,103	2,077	2,125	2,102	2,104	2,128
	2,168	2,160	2,075	1,991	1,962	1,906	1,947	2,063	2,049	2,049	1,934	1,852
03/28	1,847	1,878	1,839	1,872	1,901	2,026	2,136	2,075	2,096	2,089	2,043	1,985
	1,994	1,984	1,948	1,956	1,913	1,986	1,993	2,084	2,087	1,960	1,914	1,821
03/29	1,802	1,770	1,802	1,806	1,850	1,866	1,899	1,891	1,913	1,906	1,866	1,837
	1,915	1,952	1,875	1,820	1,866	1,831	1,837	1,903	1,960	1,901	1,817	1,774
03/30	1,753	1,770	1,760	1,727	1,738	1,848	1,822	1,807	1,842	1,786	1,783	1,721
	1,737	1,722	1,709	1,686	1,705	1,683	1,704	1,832	1,858	1,793	1,736	1,713
03/31	1,661	1,621	1,621	1,600	1,588	1,648	1,666	1,666	1,717	1,703	1,647	1,640
	1,633	1,672	1,604	1,585	1,590	1,626	1,634	1,753	1,768	1,754	1,776	1,711

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
04/01	1,645	1,718	1,664	1,700	1,713	1,843	1,942	1,985	1,984	1,977	1,993	1,969
	1,983	1,954	1,909	1,849	1,865	1,841	1,877	1,976	2,017	1,955	1,901	1,845
04/02	1,790	1,796	1,817	1,827	1,876	1,957	2,012	1,985	1,962	1,950	1,947	1,926
	1,941	1,977	1,889	1,917	1,884	1,854	1,863	1,957	1,991	1,944	1,873	1,859
04/03	1,838	1,827	1,788	1,837	1,785	1,891	1,975	1,985	2,014	2,029	2,005	2,011
	1,960	1,911	1,830	1,834	1,835	1,778	1,802	1,890	1,920	1,953	1,844	1,801
04/04	1,777	1,755	1,781	1,805	1,891	1,926	1,964	1,956	1,976	1,972	1,953	1,975
	1,986	1,930	1,897	1,910	1,870	1,832	1,870	1,985	1,979	1,939	1,811	1,804
04/05	1,773	1,757	1,780	1,796	1,783	1,900	1,948	1,968	1,959	1,951	1,970	2,000
	1,978	1,938	1,905	1,859	1,850	1,837	1,873	1,972	1,984	1,941	1,841	1,742
04/06	1,672	1,727	1,705	1,681	1,687	1,725	1,721	1,740	1,775	1,809	1,734	1,732
	1,701	1,678	1,645	1,677	1,685	1,653	1,600	1,705	1,764	1,704	1,663	1,598
04/07	1,556	1,505	1,495	1,510	1,537	1,557	1,563	1,576	1,583	1,601	1,595	1,569
	1,627	1,616	1,593	1,584	1,563	1,628	1,674	1,762	1,742	1,712	1,679	1,651
04/08	1,610	1,539	1,538	1,576	1,678	1,806	1,903	1,865	1,863	1,846	1,862	1,792
	1,798	1,812	1,757	1,736	1,702	1,688	1,684	1,711	1,747	1,710	1,641	1,605
04/09	1,563	1,514	1,498	1,497	1,556	1,643	1,746	1,764	1,791	1,839	1,892	1,882
	1,914	1,943	1,937	1,897	1,842	1,891	1,879	1,939	1,913	1,854	1,758	1,665
04/10	1,619	1,566	1,578	1,603	1,685	1,810	1,893	1,955	2,022	2,082	2,055	2,014
	2,010	1,987	1,933	1,908	1,938	1,956	1,971	2,029	1,987	1,959	1,874	1,820
04/11	1,729	1,777	1,768	1,793	1,830	1,954	1,975	1,979	2,074	2,066	2,066	2,019
	2,049	2,071	2,017	2,027	1,970	1,999	1,981	2,031	2,029	1,940	1,872	1,855
04/12	1,825	1,798	1,729	1,780	1,818	1,924	2,051	2,080	2,087	2,103	2,144	2,175
	2,128	2,138	2,096	2,012	1,969	1,948	1,982	1,989	1,972	1,933	1,786	1,777
04/13	1,763	1,746	1,688	1,685	1,686	1,729	1,772	1,784	1,802	1,861	1,888	1,872
	1,841	1,805	1,780	1,788	1,808	1,826	1,830	1,841	1,853	1,861	1,722	1,627
04/14	1,559	1,569	1,498	1,523	1,612	1,633	1,653	1,640	1,704	1,724	1,666	1,681
	1,686	1,700	1,714	1,703	1,679	1,754	1,745	1,785	1,797	1,695	1,731	1,746
04/15	1,685	1,650	1,732	1,728	1,746	1,848	1,901	1,922	1,956	1,955	1,975	1,963
	1,990	1,995	1,989	1,866	1,896	1,917	1,954	1,946	1,948	1,920	1,832	1,764
04/16	1,738	1,682	1,725	1,724	1,707	1,793	1,874	1,955	1,968	1,956	1,955	1,987
	2,020	2,017	1,913	1,860	1,875	1,845	1,900	1,983	1,986	1,929	1,877	1,800
04/17	1,744	1,683	1,636	1,672	1,762	1,876	1,947	1,939	1,993	2,028	2,021	2,034
	2,051	2,044	1,975	1,928	1,994	1,965	1,983	2,027	2,015	1,948	1,872	1,843
04/18	1,784	1,751	1,716	1,741	1,813	1,911	1,965	1,972	2,034	2,050	2,057	2,050
	2,084	2,106	2,039	2,006	1,995	1,958	1,966	1,944	1,959	1,821	1,750	1,709
04/19	1,690	1,672	1,674	1,682	1,773	1,874	1,936	1,961	1,974	1,974	1,998	2,070
	2,092	2,074	1,979	1,912	1,967	1,953	1,956	1,964	1,978	1,927	1,847	1,773
04/20	1,735	1,711	1,650	1,659	1,716	1,777	1,766	1,814	1,835	1,845	1,797	1,802
	1,822	1,832	1,782	1,749	1,747	1,759	1,763	1,811	1,851	1,845	1,728	1,707
04/21	1,701	1,716	1,677	1,677	1,703	1,722	1,748	1,740	1,727	1,743	1,755	1,796
	1,804	1,765	1,717	1,758	1,768	1,787	1,766	1,804	1,859	1,877	1,826	1,806
04/22	1,770	1,769	1,768	1,809	1,807	1,914	1,952	1,967	1,973	1,990	1,992	1,965
	1,937	1,963	1,879	1,857	1,808	1,796	1,794	1,817	1,873	1,796	1,786	1,742
04/23	1,688	1,670	1,690	1,676	1,754	1,815	1,899	1,895	1,934	1,943	2,004	1,952
	1,942	1,982	1,903	1,890	1,848	1,884	1,931	1,949	1,987	1,880	1,772	1,700
04/24	1,663	1,628	1,641	1,658	1,702	1,789	1,842	1,857	1,868	1,888	1,896	1,904
	1,865	1,877	1,845	1,767	1,757	1,729	1,727	1,775	1,814	1,790	1,688	1,633
04/25	1,609	1,621	1,610	1,644	1,717	1,756	1,831	1,904	1,941	1,950	1,932	1,978
	1,959	1,911	1,889	1,856	1,797	1,759	1,731	1,759	1,826	1,820	1,707	1,650
04/26	1,627	1,620	1,679	1,721	1,739	1,849	1,882	1,945	1,946	1,897	1,923	1,911
	1,892	1,912	1,895	1,881	1,873	1,803	1,770	1,819	1,831	1,789	1,673	1,596
04/27	1,589	1,565	1,556	1,579	1,591	1,615	1,565	1,572	1,568	1,573	1,592	1,620
	1,626	1,656	1,636	1,642	1,645	1,667	1,688	1,722	1,784	1,744	1,660	1,602
04/28	1,567	1,554	1,565	1,585	1,584	1,575	1,579	1,597	1,616	1,657	1,650	1,666
	1,673	1,734	1,710	1,691	1,735	1,713	1,762	1,789	1,813	1,803	1,725	1,670
04/29	1,681	1,631	1,672	1,706	1,761	1,848	1,850	1,900	1,929	1,992	1,979	1,994
	2,031	2,022	1,865	1,875	1,861	1,828	1,832	1,868	1,921	1,853	1,778	1,690
04/30	1,678	1,653	1,638	1,658	1,731	1,788	1,884	1,907	1,971	2,001	1,970	1,985
	2,013	2,052	1,952	1,940	1,918	1,923	1,898	1,934	1,959	1,904	1,829	1,719

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
05/01	1,675	1,638	1,592	1,662	1,705	1,796	1,893	1,916	1,979	2,035	2,045	2,093
	2,113	2,110	2,023	2,091	2,110	2,088	2,063	2,052	2,113	2,029	1,913	1,832
05/02	1,819	1,816	1,710	1,685	1,699	1,777	1,836	1,912	1,939	2,007	2,023	2,008
	2,034	2,016	1,941	1,932	1,904	1,850	1,839	1,867	1,887	1,799	1,788	1,741
05/03	1,716	1,739	1,729	1,713	1,749	1,847	1,876	1,955	1,947	1,991	2,044	2,074
	2,044	2,024	1,958	1,908	1,897	1,836	1,882	1,945	1,959	1,841	1,769	1,760
05/04	1,716	1,683	1,683	1,703	1,754	1,716	1,690	1,745	1,749	1,817	1,794	1,780
	1,770	1,773	1,824	1,840	1,835	1,798	1,754	1,803	1,856	1,835	1,798	1,660
05/05	1,632	1,604	1,600	1,603	1,580	1,609	1,617	1,679	1,656	1,663	1,682	1,704
	1,684	1,687	1,750	1,771	1,795	1,780	1,779	1,780	1,827	1,823	1,754	1,725
05/06	1,696	1,666	1,674	1,689	1,689	1,804	1,898	1,950	2,034	2,033	2,026	2,024
	2,059	2,039	2,013	1,933	1,939	1,962	1,955	1,937	1,952	1,882	1,758	1,735
05/07	1,714	1,707	1,683	1,696	1,705	1,790	1,852	1,898	1,938	1,949	1,912	1,899
	1,921	1,941	1,877	1,871	1,831	1,820	1,797	1,824	1,873	1,848	1,721	1,702
05/08	1,636	1,645	1,652	1,633	1,682	1,789	1,830	1,898	1,973	1,963	1,985	2,033
	2,064	2,106	2,045	1,999	2,024	1,974	1,955	1,952	1,986	1,966	1,795	1,735
05/09	1,703	1,695	1,675	1,644	1,691	1,769	1,838	1,899	2,036	2,029	2,067	2,052
	2,084	2,127	2,044	2,000	1,979	1,931	1,938	1,920	2,004	1,950	1,854	1,755
05/10	1,744	1,747	1,691	1,735	1,747	1,847	1,881	1,975	2,022	2,064	2,110	2,130
	2,131	2,049	1,970	1,933	1,913	1,933	1,924	1,947	1,994	1,928	1,828	1,783
05/11	1,697	1,737	1,686	1,702	1,696	1,664	1,718	1,784	1,832	1,786	1,833	1,784
	1,797	1,781	1,770	1,779	1,790	1,781	1,771	1,784	1,856	1,812	1,685	1,682
05/12	1,651	1,614	1,595	1,608	1,600	1,562	1,591	1,677	1,680	1,687	1,660	1,664
	1,661	1,684	1,679	1,691	1,707	1,751	1,706	1,681	1,848	1,805	1,753	1,694
05/13	1,705	1,719	1,647	1,675	1,750	1,807	1,892	1,972	1,966	1,981	1,981	1,953
	1,938	1,949	1,831	1,834	1,839	1,790	1,730	1,790	1,871	1,844	1,776	1,719
05/14	1,673	1,660	1,661	1,661	1,717	1,791	1,854	1,865	1,881	1,939	1,927	1,971
	1,983	2,011	2,010	2,000	2,013	1,984	2,017	2,066	2,078	2,040	1,944	1,830
05/15	1,796	1,760	1,747	1,742	1,817	1,888	1,933	2,016	2,071	2,100	2,161	2,166
	2,198	2,163	2,183	2,131	2,125	2,144	2,075	2,087	2,119	2,039	1,884	1,835
05/16	1,741	1,730	1,667	1,711	1,701	1,780	1,826	1,907	1,914	1,970	2,044	2,074
	2,117	2,177	2,156	2,206	2,192	2,172	2,095	1,985	2,065	2,030	1,883	1,815
05/17	1,739	1,688	1,771	1,731	1,792	1,897	1,943	2,021	2,065	2,087	2,125	2,157
	2,143	2,144	2,092	2,066	2,076	2,037	1,985	1,950	1,994	1,935	1,851	1,767
05/18	1,715	1,700	1,676	1,686	1,705	1,719	1,714	1,730	1,777	1,859	1,930	1,928
	1,959	2,014	2,003	1,978	1,986	1,958	1,954	2,007	2,018	1,997	1,859	1,791
05/19	1,737	1,716	1,691	1,649	1,603	1,619	1,658	1,773	1,855	1,901	1,962	1,814
	1,909	1,988	2,030	2,106	2,184	2,214	2,164	2,166	2,185	2,130	2,038	1,996
05/20	1,939	1,885	1,886	1,876	1,922	1,954	2,073	2,200	2,312	2,409	2,400	2,406
	2,493	2,578	2,497	2,565	2,522	2,507	2,450	2,409	2,435	2,407	2,300	2,181
05/21	2,086	2,030	1,967	1,905	1,886	1,941	2,005	2,045	2,103	2,173	2,212	2,248
	2,301	2,347	2,372	2,400	2,442	2,396	2,332	2,334	2,329	2,277	2,164	2,083
05/22	1,961	1,904	1,877	1,942	1,965	2,052	2,113	2,180	2,238	2,274	2,340	2,376
	2,376	2,398	2,364	2,293	2,293	2,320	2,280	2,265	2,321	2,180	2,069	1,993
05/23	1,887	1,844	1,818	1,813	1,891	1,942	1,992	1,983	2,023	2,094	2,074	2,063
	2,072	2,027	2,009	1,997	1,963	1,921	1,950	1,953	1,954	1,880	1,869	1,810
05/24	1,835	1,806	1,786	1,786	1,849	1,886	1,972	2,019	2,067	2,088	2,062	2,038
	2,040	2,056	1,985	1,948	1,934	1,932	1,913	1,929	1,981	1,959	1,890	1,780
05/25	1,781	1,704	1,640	1,655	1,620	1,634	1,661	1,691	1,762	1,754	1,736	1,777
	1,773	1,741	1,700	1,696	1,724	1,752	1,780	1,809	1,873	1,825	1,715	1,668
05/26	1,618	1,601	1,579	1,543	1,563	1,549	1,562	1,589	1,621	1,661	1,636	1,657
	1,671	1,726	1,670	1,719	1,709	1,719	1,709	1,753	1,801	1,726	1,679	1,618
05/27	1,585	1,647	1,618	1,575	1,581	1,539	1,537	1,549	1,613	1,679	1,676	1,676
	1,698	1,688	1,663	1,728	1,768	1,780	1,809	1,827	1,900	1,855	1,806	1,763
05/28	1,647	1,711	1,694	1,726	1,755	1,818	1,893	1,975	2,048	2,079	2,125	2,129
	2,126	2,177	2,152	2,207	2,127	2,205	2,144	2,132	2,168	2,099	1,995	1,881
05/29	1,840	1,777	1,763	1,783	1,836	1,923	2,004	2,058	2,102	2,218	2,235	2,286
	2,343	2,417	2,331	2,353	2,357	2,311	2,228	2,216	2,292	2,291	2,140	1,988
05/30	1,938	1,811	1,838	1,825	1,897	1,977	2,057	2,157	2,235	2,363	2,433	2,453
	2,481	2,549	2,548	2,461	2,444	2,380	2,348	2,343	2,334	2,318	2,226	2,085
05/31	2,002	1,914	1,923	1,893	1,898	1,992	2,053	2,148	2,168	2,197	2,264	2,311
	2,306	2,333	2,323	2,264	2,223	2,195	2,204	2,151	2,117	2,021	1,939	1,830

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
06/01	1,840	1,785	1,713	1,705	1,716	1,696	1,691	1,774	1,837	1,901	1,974	2,006
	2,022	1,978	2,033	2,014	1,983	1,977	1,948	1,948	1,980	1,933	1,841	1,748
06/02	1,681	1,616	1,617	1,629	1,605	1,545	1,540	1,573	1,572	1,594	1,616	1,614
	1,618	1,618	1,589	1,612	1,613	1,654	1,623	1,656	1,748	1,752	1,722	1,667
06/03	1,648	1,624	1,618	1,648	1,692	1,791	1,861	1,895	1,898	1,913	1,950	1,958
	1,953	1,970	1,901	1,927	1,918	1,889	1,879	1,868	1,918	1,882	1,840	1,810
06/04	1,756	1,692	1,649	1,640	1,681	1,714	1,765	1,794	1,836	1,877	1,903	1,911
	1,923	1,946	1,930	1,914	1,861	1,813	1,819	1,829	1,838	1,873	1,772	1,718
06/05	1,669	1,644	1,606	1,636	1,645	1,737	1,806	1,855	1,912	1,933	1,976	2,002
	2,029	2,062	2,080	2,097	2,067	1,994	1,984	1,975	2,058	1,993	1,901	1,794
06/06	1,693	1,665	1,680	1,695	1,716	1,802	1,854	1,928	1,988	2,027	2,054	2,057
	2,082	2,125	2,101	2,076	1,986	1,939	1,909	1,886	1,983	1,981	1,920	1,834
06/07	1,767	1,760	1,736	1,740	1,788	1,812	1,863	1,977	2,028	2,078	2,091	2,092
	2,068	2,062	2,063	2,006	2,035	1,996	1,969	1,914	1,982	1,952	1,864	1,801
06/08	1,761	1,696	1,654	1,595	1,577	1,618	1,609	1,636	1,687	1,773	1,837	1,869
	1,871	1,874	1,884	1,848	1,835	1,847	1,820	1,841	1,894	1,870	1,776	1,713
06/09	1,640	1,629	1,596	1,590	1,581	1,646	1,680	1,733	1,786	1,807	1,842	1,918
	1,946	1,966	2,010	2,055	2,071	2,026	2,023	2,027	2,087	2,078	1,999	1,910
06/10	1,902	1,814	1,743	1,781	1,794	1,910	1,986	2,112	2,196	2,282	2,322	2,351
	2,328	2,310	2,340	2,285	2,244	2,175	2,130	2,063	2,014	2,014	1,885	1,837
06/11	1,738	1,731	1,717	1,717	1,768	1,819	1,913	2,036	2,029	2,138	2,236	2,304
	2,335	2,394	2,404	2,418	2,386	2,328	2,293	2,276	2,281	2,207	2,087	2,040
06/12	1,975	1,915	1,855	1,868	1,942	1,998	2,045	2,129	2,194	2,299	2,342	2,361
	2,400	2,442	2,504	2,521	2,483	2,485	2,470	2,322	2,227	2,151	2,067	1,976
06/13	1,892	1,818	1,841	1,801	1,855	1,904	1,949	2,023	2,169	2,220	2,224	2,167
	2,116	2,143	2,152	2,189	2,125	2,090	2,096	2,065	2,144	2,081	2,006	1,875
06/14	1,860	1,828	1,836	1,873	1,835	1,901	1,960	2,026	2,133	2,176	2,207	2,205
	2,166	2,167	2,215	2,194	2,233	2,151	2,115	2,078	2,089	2,052	1,977	1,860
06/15	1,776	1,757	1,756	1,757	1,747	1,768	1,717	1,761	1,866	1,932	1,954	1,999
	1,946	1,975	1,965	1,987	1,998	2,005	1,970	1,929	1,990	1,940	1,861	1,799
06/16	1,722	1,687	1,688	1,670	1,638	1,609	1,600	1,637	1,718	1,828	1,901	1,967
	2,058	2,077	2,136	2,148	2,228	2,269	2,228	2,188	2,181	2,197	2,064	1,980
06/17	1,913	1,834	1,777	1,870	1,929	1,963	2,021	2,162	2,305	2,386	2,500	2,615
	2,662	2,678	2,721	2,677	2,626	2,580	2,570	2,468	2,411	2,309	2,152	2,061
06/18	1,954	1,880	1,793	1,734	1,777	1,810	1,869	1,917	2,034	2,053	2,097	2,139
	2,177	2,141	2,116	2,076	2,120	2,042	2,021	1,961	2,031	2,008	1,892	1,771
06/19	1,743	1,698	1,647	1,663	1,766	1,796	1,859	1,939	2,003	2,111	2,150	2,173
	2,179	2,266	2,244	2,262	2,257	2,230	2,196	2,128	2,183	2,124	1,995	1,871
06/20	1,829	1,786	1,767	1,774	1,832	1,864	1,949	2,070	2,136	2,261	2,323	2,383
	2,407	2,445	2,454	2,532	2,557	2,558	2,493	2,481	2,485	2,373	2,210	2,044
06/21	1,976	1,939	1,899	1,922	1,961	1,990	2,095	2,291	2,291	2,391	2,581	2,658
	2,708	2,663	2,598	2,485	2,412	2,332	2,292	2,217	2,276	2,251	2,156	2,029
06/22	1,965	1,905	1,891	1,879	1,876	1,877	1,873	1,958	2,070	2,170	2,269	2,269
	2,362	2,358	2,403	2,409	2,449	2,401	2,378	2,354	2,328	2,225	2,081	1,954
06/23	1,831	1,729	1,730	1,668	1,689	1,672	1,757	1,841	2,042	2,144	2,283	2,350
	2,427	2,481	2,508	2,527	2,551	2,546	2,478	2,346	2,373	2,341	2,207	2,045
06/24	1,957	1,910	1,917	1,928	2,010	2,086	2,228	2,281	2,328	2,398	2,478	2,509
	2,543	2,615	2,628	2,647	2,689	2,694	2,438	2,219	2,146	2,083	1,956	1,893
06/25	1,833	1,826	1,815	1,843	1,906	1,954	2,040	2,068	2,163	2,230	2,341	2,406
	2,512	2,572	2,669	2,676	2,683	2,626	2,567	2,517	2,484	2,347	2,216	2,047
06/26	1,942	1,936	1,877	1,893	1,975	2,053	2,115	2,184	2,189	2,275	2,275	2,304
	2,342	2,438	2,464	2,471	2,413	2,383	2,382	2,397	2,390	2,317	2,168	1,998
06/27	1,859	1,881	1,907	1,889	1,949	2,026	2,126	2,262	2,313	2,472	2,601	2,689
	2,776	2,838	2,889	2,813	2,858	2,740	2,614	2,462	2,487	2,475	2,276	2,086
06/28	1,959	1,938	1,915	1,912	1,979	1,999	2,047	2,224	2,309	2,401	2,497	2,498
	2,540	2,581	2,571	2,574	2,516	2,434	2,343	2,245	2,175	2,137	2,008	1,895
06/29	1,787	1,743	1,708	1,725	1,688	1,667	1,631	1,721	1,851	1,961	1,906	1,867
	1,881	1,958	1,966	2,003	1,978	1,996	1,931	1,866	1,946	1,927	1,804	1,717
06/30	1,668	1,651	1,609	1,589	1,576	1,563	1,613	1,667	1,723	1,800	1,852	1,871
	1,926	1,931	1,971	2,013	2,026	2,031	1,970	2,005	2,014	1,973	1,878	1,769

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
07/01	1,740	1,720	1,674	1,690	1,791	1,804	1,840	1,924	2,008	2,096	2,110	2,130
	2,150	2,142	2,098	2,103	2,143	2,118	2,107	2,036	2,094	2,091	1,957	1,848
07/02	1,777	1,673	1,671	1,681	1,718	1,742	1,869	1,851	1,900	1,988	2,037	2,055
	2,044	2,038	1,968	1,871	1,814	1,834	1,853	1,911	1,963	1,937	1,787	1,712
07/03	1,665	1,642	1,626	1,622	1,678	1,780	1,850	1,936	1,987	2,103	2,123	2,132
	2,118	2,102	2,055	2,036	2,058	2,036	2,025	2,033	2,063	1,994	1,918	1,801
07/04	1,736	1,714	1,656	1,625	1,654	1,607	1,603	1,645	1,722	1,800	1,839	1,887
	1,944	1,980	1,947	1,961	1,934	1,938	1,915	1,867	1,863	1,842	1,766	1,721
07/05	1,658	1,602	1,568	1,538	1,591	1,639	1,668	1,770	1,869	1,994	2,086	2,155
	2,229	2,254	2,318	2,336	2,409	2,357	2,330	2,248	2,213	2,201	2,099	2,000
07/06	1,892	1,857	1,857	1,823	1,801	1,763	1,773	1,881	1,961	2,087	2,184	2,198
	2,220	2,199	2,169	2,185	2,197	2,167	2,151	2,164	2,133	2,099	2,013	1,914
07/07	1,834	1,787	1,773	1,728	1,751	1,731	1,737	1,824	1,895	2,013	2,066	2,159
	2,245	2,305	2,340	2,416	2,424	2,416	2,355	2,352	2,332	2,329	2,183	2,082
07/08	1,994	1,912	1,907	1,869	1,917	2,006	2,070	2,212	2,337	2,393	2,460	2,425
	2,410	2,392	2,388	2,465	2,450	2,476	2,476	2,459	2,438	2,450	2,275	2,157
07/09	2,061	1,988	1,966	1,952	1,989	2,050	2,149	2,276	2,362	2,440	2,532	2,616
	2,628	2,558	2,525	2,471	2,437	2,470	2,506	2,477	2,464	2,469	2,364	2,224
07/10	2,136	2,062	2,006	2,044	2,023	2,129	2,199	2,396	2,519	2,577	2,642	2,669
	2,661	2,650	2,594	2,569	2,527	2,488	2,395	2,314	2,303	2,236	2,076	1,965
07/11	1,884	1,820	1,782	1,786	1,869	1,896	1,974	2,093	2,234	2,295	2,322	2,401
	2,434	2,419	2,439	2,439	2,437	2,430	2,369	2,265	2,249	2,193	2,086	1,957
07/12	1,876	1,830	1,788	1,803	1,847	1,881	1,892	2,043	2,167	2,248	2,285	2,373
	2,396	2,397	2,469	2,443	2,469	2,458	2,452	2,394	2,356	2,258	2,086	1,892
07/13	1,855	1,810	1,833	1,770	1,755	1,785	1,821	1,878	1,976	2,073	2,129	2,226
	2,305	2,351	2,379	2,425	2,455	2,453	2,432	2,353	2,262	2,231	2,116	2,009
07/14	1,958	1,891	1,892	1,858	1,809	1,790	1,796	1,902	1,996	2,117	2,264	2,309
	2,407	2,470	2,562	2,586	2,656	2,621	2,578	2,568	2,503	2,412	2,271	2,161
07/15	2,066	2,030	1,953	1,987	2,059	2,127	2,225	2,366	2,498	2,689	2,813	2,880
	2,977	3,022	3,014	2,993	2,957	2,950	2,915	2,795	2,795	2,693	2,550	2,386
07/16	2,206	2,192	2,151	2,138	2,160	2,207	2,290	2,406	2,528	2,683	2,770	2,848
	2,932	2,985	2,958	2,981	2,999	3,003	2,965	2,783	2,768	2,699	2,571	2,390
07/17	2,274	2,177	2,082	2,065	2,141	2,190	2,276	2,406	2,583	2,704	2,810	2,935
	2,990	3,066	3,073	3,105	3,085	3,043	2,987	2,884	2,815	2,717	2,585	2,451
07/18	2,289	2,217	2,152	2,127	2,156	2,241	2,356	2,496	2,673	2,809	2,933	3,024
	3,073	3,161	3,168	3,199	3,157	3,069	2,995	2,934	2,854	2,807	2,712	2,560
07/19	2,438	2,349	2,284	2,209	2,335	2,350	2,410	2,578	2,711	2,904	2,987	3,042
	3,130	3,192	3,172	3,123	3,137	3,123	3,018	2,924	2,894	2,820	2,680	2,495
07/20	2,415	2,342	2,214	2,195	2,110	2,098	2,156	2,268	2,324	2,479	2,550	2,612
	2,705	2,726	2,739	2,752	2,748	2,703	2,647	2,519	2,485	2,405	2,285	2,154
07/21	2,070	1,997	1,961	1,861	1,825	1,813	1,871	1,929	2,044	2,158	2,262	2,379
	2,442	2,502	2,577	2,590	2,611	2,539	2,466	2,472	2,513	2,428	2,313	2,208
07/22	2,121	2,064	2,013	2,015	2,046	2,097	2,184	2,332	2,434	2,516	2,601	2,679
	2,764	2,809	2,831	2,808	2,811	2,799	2,771	2,693	2,675	2,596	2,419	2,299
07/23	2,217	2,136	2,087	2,082	2,135	2,132	2,152	2,261	2,385	2,482	2,534	2,585
	2,576	2,588	2,545	2,531	2,488	2,369	2,289	2,197	2,147	2,117	2,016	1,900
07/24	1,849	1,845	1,816	1,846	1,909	1,864	1,902	1,982	2,062	2,153	2,186	2,204
	2,249	2,247	2,213	2,232	2,259	2,209	2,172	2,122	2,165	2,155	2,097	1,932
07/25	1,936	1,923	1,874	1,870	1,926	1,947	1,971	2,068	2,139	2,212	2,258	2,310
	2,347	2,395	2,367	2,376	2,431	2,441	2,385	2,357	2,393	2,301	2,156	2,002
07/26	1,911	1,889	1,849	1,853	1,864	1,961	1,986	2,079	2,104	2,265	2,251	2,291
	2,268	2,276	2,327	2,272	2,267	2,232	2,166	2,158	2,193	2,151	2,034	1,929
07/27	1,826	1,816	1,706	1,768	1,741	1,760	1,769	1,800	1,846	1,893	1,911	1,897
	1,926	1,952	1,947	1,945	1,920	1,869	1,833	1,839	1,854	1,802	1,755	1,679
07/28	1,646	1,631	1,603	1,588	1,591	1,629	1,593	1,587	1,656	1,711	1,723	1,735
	1,751	1,763	1,822	1,847	1,865	1,893	1,887	1,830	1,817	1,781	1,785	1,747
07/29	1,686	1,694	1,647	1,650	1,735	1,770	1,799	1,881	1,921	2,012	2,034	2,032
	2,086	2,133	2,127	2,140	2,147	2,134	2,119	2,070	2,075	2,030	1,981	1,883
07/30	1,818	1,811	1,807	1,829	1,854	1,884	1,924	1,934	2,025	2,029	2,063	2,117
	2,206	2,217	2,170	2,109	2,078	2,049	2,074	2,083	2,094	2,010	1,971	1,883
07/31	1,836	1,790	1,760	1,758	1,815	1,907	1,954	2,006	2,103	2,172	2,207	2,196
	2,217	2,211	2,170	2,154	2,141	2,163	2,138	2,093	2,101	2,097	1,995	1,924

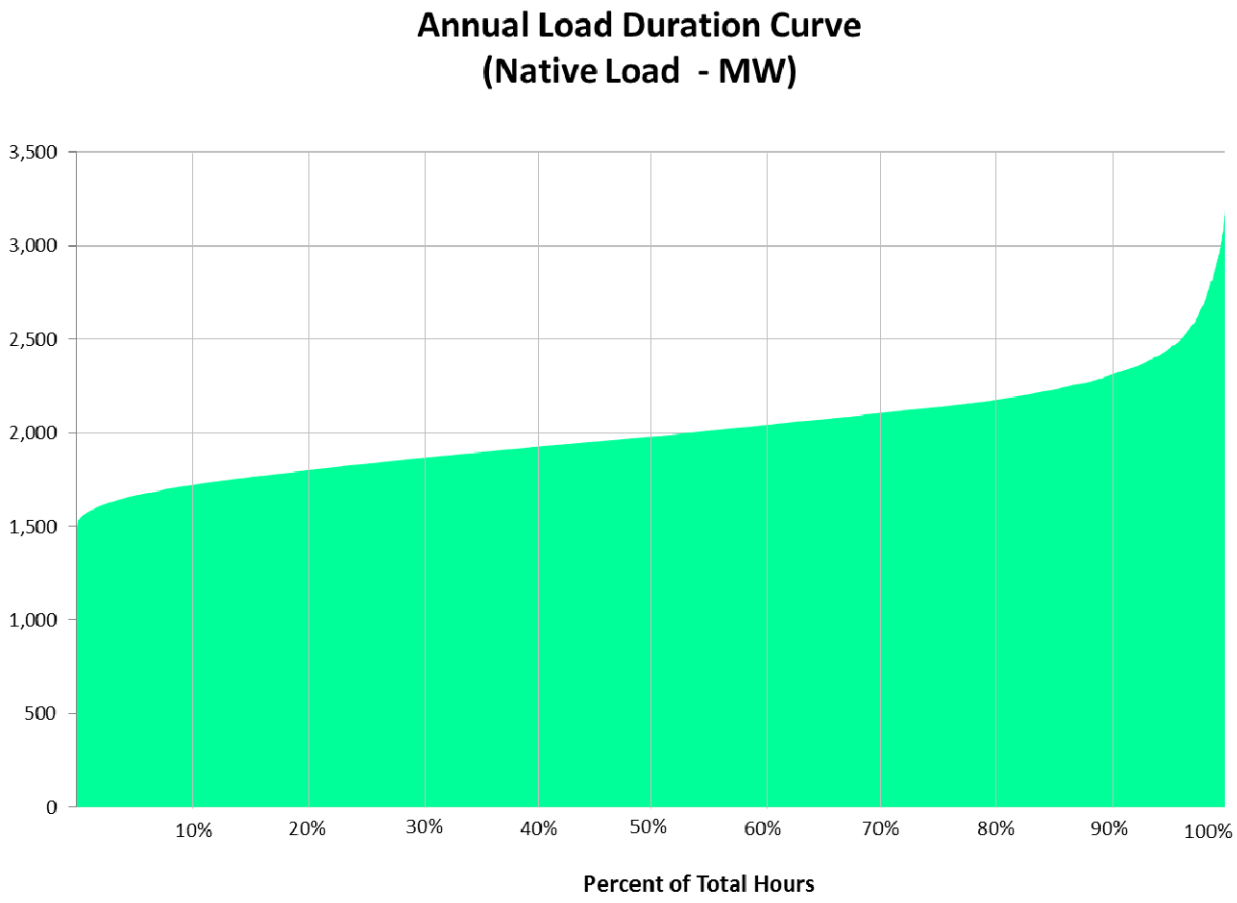
Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
08/01	1,863	1,792	1,859	1,866	1,901	1,902	1,930	2,019	2,118	2,197	2,260	2,328
	2,332	2,404	2,403	2,370	2,322	2,331	2,297	2,239	2,262	2,206	2,084	1,978
08/02	1,919	1,876	1,884	1,865	1,898	1,948	1,971	2,010	2,072	2,117	2,132	2,125
	2,211	2,349	2,362	2,369	2,399	2,343	2,265	2,211	2,255	2,158	2,078	1,997
08/03	1,912	1,805	1,823	1,769	1,789	1,805	1,800	1,844	1,869	1,953	2,116	2,114
	2,126	2,176	2,139	2,141	2,113	2,103	2,022	1,953	1,971	1,912	1,805	1,736
08/04	1,704	1,668	1,650	1,629	1,638	1,613	1,582	1,621	1,649	1,740	1,840	1,851
	1,882	1,895	1,903	1,914	2,013	1,954	1,926	1,865	1,887	1,948	1,864	1,781
08/05	1,733	1,744	1,720	1,713	1,726	1,845	1,857	1,963	1,985	2,039	2,077	2,128
	2,190	2,150	2,167	2,122	2,107	2,081	2,091	2,077	2,117	2,061	1,965	1,867
08/06	1,847	1,734	1,721	1,774	1,840	1,867	1,907	1,965	2,046	2,092	2,199	2,246
	2,294	2,318	2,350	2,386	2,382	2,423	2,300	2,294	2,327	2,223	2,072	1,972
08/07	1,964	1,926	1,864	1,890	1,931	1,988	2,026	2,122	2,216	2,375	2,483	2,561
	2,664	2,758	2,756	2,700	2,657	2,622	2,543	2,493	2,505	2,413	2,261	2,123
08/08	2,026	1,918	1,925	1,890	1,901	1,967	2,001	2,083	2,167	2,250	2,325	2,373
	2,409	2,466	2,467	2,411	2,368	2,340	2,291	2,225	2,289	2,224	2,098	1,962
08/09	1,915	1,912	1,926	1,918	1,932	2,030	2,055	2,076	2,143	2,251	2,311	2,449
	2,511	2,553	2,568	2,671	2,646	2,629	2,540	2,508	2,503	2,337	2,179	2,141
08/10	2,068	1,931	1,812	1,765	1,794	1,833	1,820	1,872	1,993	2,084	2,227	2,265
	2,318	2,331	2,323	2,338	2,377	2,317	2,167	2,113	2,152	2,065	1,934	1,808
08/11	1,777	1,741	1,671	1,621	1,685	1,664	1,634	1,674	1,780	1,861	1,992	2,033
	2,058	2,030	2,136	2,217	2,226	2,233	2,251	2,220	2,200	2,145	2,093	2,017
08/12	1,969	1,924	1,865	1,846	1,890	1,998	2,028	2,121	2,231	2,369	2,455	2,560
	2,581	2,659	2,693	2,585	2,554	2,469	2,410	2,336	2,395	2,282	2,139	2,018
08/13	1,942	1,918	1,893	1,893	1,927	1,958	1,991	2,006	2,041	2,086	2,095	2,127
	2,141	2,177	2,112	2,110	2,163	2,121	2,055	2,045	2,091	1,995	1,889	1,828
08/14	1,797	1,757	1,717	1,740	1,786	1,818	1,895	1,975	2,014	2,015	2,037	2,085
	2,121	2,126	2,137	2,091	2,063	2,005	1,978	1,996	2,081	2,003	1,908	1,774
08/15	1,755	1,780	1,735	1,730	1,837	1,919	1,955	1,964	2,045	2,065	2,140	2,181
	2,141	2,229	2,155	2,159	2,153	2,152	2,136	2,128	2,197	2,092	1,982	1,878
08/16	1,851	1,762	1,763	1,817	1,807	1,911	1,931	2,037	2,108	2,160	2,187	2,258
	2,259	2,243	2,268	2,263	2,211	2,234	2,198	2,136	2,200	2,123	1,968	1,877
08/17	1,807	1,772	1,760	1,757	1,758	1,745	1,719	1,746	1,811	1,874	1,935	1,940
	1,982	2,018	2,047	2,021	2,034	2,062	2,000	1,952	1,982	1,890	1,831	1,778
08/18	1,737	1,680	1,630	1,593	1,545	1,567	1,561	1,579	1,660	1,736	1,855	1,898
	1,951	1,987	1,978	2,018	2,026	2,059	2,000	2,017	2,059	1,956	1,881	1,784
08/19	1,691	1,650	1,651	1,626	1,712	1,759	1,809	1,923	2,018	2,170	2,273	2,326
	2,394	2,528	2,526	2,545	2,508	2,499	2,409	2,391	2,414	2,297	2,117	1,988
08/20	1,926	1,887	1,896	1,849	1,806	1,848	1,894	2,001	2,054	2,160	2,252	2,332
	2,406	2,494	2,511	2,545	2,594	2,549	2,496	2,422	2,369	2,265	2,143	1,994
08/21	1,906	1,876	1,820	1,866	1,877	1,957	2,082	2,164	2,296	2,429	2,534	2,667
	2,769	2,877	2,862	2,898	2,928	2,887	2,787	2,764	2,715	2,552	2,393	2,270
08/22	2,159	2,091	2,087	2,066	2,125	2,191	2,256	2,346	2,417	2,414	2,427	2,367
	2,391	2,404	2,354	2,318	2,303	2,222	2,253	2,268	2,293	2,218	2,100	1,983
08/23	1,942	1,903	1,855	1,868	1,950	2,003	2,072	2,108	2,173	2,302	2,399	2,408
	2,472	2,509	2,521	2,531	2,512	2,490	2,425	2,348	2,294	2,157	2,065	1,924
08/24	1,849	1,780	1,759	1,727	1,738	1,773	1,718	1,787	1,835	1,927	2,027	2,113
	2,187	2,261	2,308	2,329	2,383	2,376	2,296	2,232	2,219	2,075	1,951	1,863
08/25	1,769	1,736	1,693	1,683	1,658	1,675	1,640	1,674	1,765	1,858	1,950	2,088
	2,226	2,338	2,344	2,441	2,496	2,493	2,426	2,376	2,371	2,271	2,128	2,026
08/26	1,940	1,884	1,868	1,873	1,931	2,007	2,087	2,168	2,269	2,407	2,471	2,614
	2,714	2,839	2,873	2,875	2,871	2,813	2,730	2,681	2,634	2,509	2,354	2,261
08/27	2,134	2,064	2,028	1,981	2,003	2,166	2,287	2,269	2,313	2,454	2,618	2,741
	2,859	2,946	2,930	2,931	2,949	2,956	2,903	2,833	2,826	2,686	2,495	2,351
08/28	2,249	2,156	2,138	2,060	2,075	2,172	2,259	2,396	2,501	2,601	2,612	2,674
	2,708	2,754	2,693	2,610	2,563	2,494	2,475	2,486	2,485	2,363	2,221	2,108
08/29	2,067	1,949	1,960	1,970	1,989	2,084	2,192	2,274	2,357	2,477	2,584	2,649
	2,732	2,797	2,814	2,857	2,817	2,775	2,718	2,642	2,606	2,393	2,239	2,161
08/30	2,063	1,973	1,882	1,885	1,936	2,088	2,183	2,275	2,433	2,527	2,646	2,767
	2,899	3,053	3,080	3,110	3,037	3,012	2,912	2,750	2,630	2,524	2,343	2,203
08/31	2,092	2,027	1,927	1,895	1,931	1,906	1,936	1,955	2,049	2,067	2,130	2,151
	2,162	2,197	2,158	2,156	2,166	2,178	2,177	2,184	2,189	2,126	2,036	1,921

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
09/01	1,849	1,820	1,801	1,749	1,749	1,743	1,742	1,766	1,850	1,979	2,066	2,152
	2,232	2,254	2,274	2,357	2,348	2,345	2,300	2,285	2,273	2,193	2,031	1,915
09/02	1,905	1,847	1,788	1,727	1,726	1,776	1,743	1,779	1,852	1,941	2,018	2,040
	2,082	2,127	2,117	2,099	2,100	2,033	2,008	2,006	1,999	1,908	1,796	1,775
09/03	1,754	1,701	1,662	1,709	1,769	1,878	1,979	2,061	2,090	2,104	2,141	2,153
	2,184	2,203	2,233	2,236	2,253	2,225	2,138	2,152	2,130	1,995	1,917	1,821
09/04	1,825	1,832	1,767	1,789	1,790	1,882	1,887	1,923	2,016	2,162	2,247	2,340
	2,347	2,447	2,427	2,446	2,501	2,448	2,455	2,394	2,356	2,266	2,138	1,997
09/05	1,943	1,891	1,900	1,866	1,921	2,076	2,102	2,156	2,186	2,233	2,294	2,352
	2,365	2,443	2,423	2,402	2,426	2,371	2,332	2,333	2,275	2,162	2,105	1,982
09/06	1,926	1,867	1,872	1,869	1,899	1,972	2,000	2,041	2,130	2,162	2,182	2,207
	2,240	2,317	2,313	2,321	2,373	2,314	2,291	2,282	2,253	2,198	2,109	1,990
09/07	1,887	1,825	1,796	1,747	1,773	1,771	1,784	1,807	1,872	1,925	2,001	2,067
	2,154	2,276	2,281	2,263	2,264	2,228	2,243	2,247	2,235	2,130	2,015	1,895
09/08	1,872	1,811	1,782	1,740	1,757	1,754	1,783	1,784	1,858	1,959	2,032	2,108
	2,198	2,264	2,227	2,228	2,235	2,173	2,205	2,208	2,227	2,107	1,975	1,893
09/09	1,862	1,800	1,784	1,788	1,893	1,990	2,076	2,159	2,324	2,467	2,598	2,684
	2,790	2,906	2,957	3,060	3,077	3,020	2,883	2,908	2,911	2,734	2,594	2,424
09/10	2,313	2,274	2,174	2,145	2,122	2,178	2,234	2,291	2,401	2,550	2,682	2,805
	2,851	2,952	2,953	2,959	2,930	2,865	2,796	2,767	2,664	2,541	2,365	2,156
09/11	2,028	2,001	1,975	1,973	1,992	2,108	2,216	2,298	2,405	2,526	2,622	2,759
	2,864	3,025	3,079	3,065	2,907	2,790	2,680	2,705	2,595	2,479	2,343	2,214
09/12	2,119	2,107	2,075	1,982	2,027	2,190	2,257	2,317	2,279	2,337	2,427	2,538
	2,593	2,594	2,634	2,581	2,479	2,371	2,271	2,263	2,270	2,155	2,050	1,919
09/13	1,831	1,818	1,848	1,855	1,857	1,897	1,987	2,032	2,009	2,057	2,064	2,071
	2,047	2,136	2,070	2,010	2,003	1,897	1,862	1,887	1,913	1,794	1,770	1,706
09/14	1,679	1,612	1,599	1,632	1,568	1,640	1,681	1,657	1,744	1,731	1,833	1,804
	1,790	1,804	1,856	1,820	1,826	1,791	1,826	1,878	1,858	1,783	1,694	1,662
09/15	1,611	1,539	1,566	1,566	1,576	1,554	1,557	1,573	1,629	1,670	1,655	1,710
	1,713	1,724	1,695	1,708	1,730	1,749	1,780	1,818	1,760	1,765	1,720	1,677
09/16	1,646	1,648	1,636	1,670	1,744	1,810	1,916	1,913	1,939	1,971	1,991	2,028
	1,976	1,937	2,012	1,944	1,934	1,941	1,936	2,026	2,020	1,982	1,851	1,720
09/17	1,695	1,673	1,672	1,701	1,720	1,800	1,896	1,858	1,904	1,936	1,957	1,969
	1,977	1,982	1,960	1,909	1,904	1,909	1,895	1,952	1,973	1,913	1,845	1,751
09/18	1,689	1,665	1,671	1,665	1,712	1,803	1,890	1,912	1,949	2,015	2,067	2,094
	2,056	2,110	2,186	2,168	2,190	2,198	2,190	2,222	2,140	2,083	2,022	1,892
09/19	1,895	1,841	1,850	1,816	1,868	1,901	1,979	2,017	2,076	2,140	2,159	2,168
	2,193	2,231	2,204	2,228	2,153	2,154	2,155	2,238	2,186	2,134	2,049	1,984
09/20	1,888	1,821	1,803	1,768	1,807	1,911	1,996	2,053	2,131	2,215	2,165	2,215
	2,215	2,198	2,224	2,200	2,132	2,149	2,133	2,110	2,113	2,003	1,850	1,815
09/21	1,776	1,753	1,696	1,670	1,658	1,670	1,706	1,711	1,739	1,759	1,823	1,783
	1,789	1,801	1,780	1,810	1,794	1,807	1,821	1,863	1,865	1,795	1,715	1,684
09/22	1,632	1,600	1,574	1,589	1,554	1,558	1,596	1,607	1,641	1,697	1,634	1,615
	1,608	1,628	1,610	1,683	1,686	1,633	1,695	1,759	1,753	1,712	1,629	1,588
09/23	1,547	1,535	1,540	1,533	1,627	1,688	1,740	1,775	1,864	1,893	1,905	1,906
	1,869	1,916	1,894	1,919	1,893	1,862	1,847	1,916	1,893	1,820	1,767	1,711
09/24	1,658	1,607	1,589	1,548	1,623	1,712	1,767	1,766	1,845	1,907	1,941	1,935
	1,914	1,926	1,931	1,892	1,889	1,871	1,891	1,968	1,941	1,882	1,784	1,707
09/25	1,638	1,655	1,655	1,706	1,787	1,842	1,886	1,938	1,983	2,029	2,032	2,053
	2,098	2,150	2,129	2,095	2,062	2,050	1,988	2,069	2,062	1,891	1,875	1,820
09/26	1,824	1,782	1,745	1,757	1,831	1,909	1,980	2,026	2,035	2,091	2,098	2,108
	2,168	2,198	2,159	2,100	2,029	1,998	2,071	2,160	2,127	2,072	1,938	1,827
09/27	1,763	1,756	1,736	1,736	1,748	1,827	1,916	1,941	1,994	2,032	2,075	2,073
	2,049	2,137	2,171	2,173	2,178	2,157	2,136	2,145	2,044	1,953	1,872	1,768
09/28	1,721	1,681	1,644	1,622	1,636	1,651	1,686	1,662	1,762	1,810	1,845	1,881
	1,969	1,957	1,962	1,999	2,006	1,974	1,994	2,021	2,014	1,941	1,870	1,775
09/29	1,714	1,686	1,655	1,625	1,609	1,580	1,622	1,640	1,643	1,662	1,685	1,675
	1,658	1,746	1,734	1,735	1,772	1,788	1,816	1,866	1,860	1,765	1,724	1,685
09/30	1,621	1,630	1,628	1,634	1,690	1,800	1,884	1,921	1,960	1,969	1,997	2,063
	2,071	2,109	2,066	2,028	2,033	2,039	2,041	2,055	2,026	2,001	1,898	1,787

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
10/01	1,768	1,742	1,691	1,671	1,752	1,796	1,880	1,921	1,999	2,012	2,028	2,028
	2,047	2,078	1,981	2,051	1,992	1,978	2,007	2,025	1,998	1,917	1,802	1,756
10/02	1,728	1,686	1,670	1,679	1,763	1,803	1,932	1,960	2,008	2,012	2,072	2,109
	2,166	2,266	2,213	2,185	2,189	2,156	2,203	2,186	2,156	2,070	1,904	1,802
10/03	1,767	1,716	1,721	1,706	1,753	1,831	1,970	2,038	2,123	2,185	2,196	2,227
	2,214	2,223	2,261	2,250	2,275	2,258	2,268	2,265	2,233	2,150	2,006	1,903
10/04	1,901	1,847	1,841	1,749	1,835	1,910	2,024	2,054	2,131	2,226	2,268	2,303
	2,375	2,411	2,370	2,371	2,359	2,314	2,299	2,256	2,225	2,159	2,089	1,983
10/05	1,902	1,864	1,848	1,824	1,831	1,838	1,906	1,892	2,004	2,085	2,112	2,109
	2,139	2,225	2,224	2,170	2,185	2,157	2,182	2,129	2,111	2,009	1,964	1,886
10/06	1,822	1,751	1,696	1,661	1,665	1,665	1,675	1,669	1,680	1,674	1,694	1,744
	1,727	1,759	1,745	1,787	1,808	1,780	1,832	1,855	1,817	1,765	1,677	1,609
10/07	1,553	1,552	1,538	1,562	1,641	1,759	1,847	1,900	1,947	1,983	2,005	1,999
	1,999	1,975	1,934	1,891	1,851	1,852	1,991	1,967	1,959	1,942	1,852	1,771
10/08	1,757	1,756	1,732	1,740	1,774	1,863	1,971	1,965	1,976	2,020	1,951	2,015
	2,038	2,065	2,041	2,049	1,991	1,981	2,058	2,059	2,031	1,930	1,847	1,789
10/09	1,735	1,690	1,700	1,692	1,688	1,804	1,919	1,903	1,916	1,935	1,992	1,986
	2,006	2,024	1,987	1,929	1,958	1,933	2,008	2,050	2,030	1,930	1,829	1,740
10/10	1,756	1,726	1,680	1,727	1,759	1,837	1,949	1,946	1,991	2,005	2,055	2,063
	2,103	2,137	2,077	2,048	2,080	2,055	2,098	2,090	2,028	1,962	1,885	1,829
10/11	1,796	1,754	1,749	1,715	1,779	1,872	1,974	2,000	2,017	2,043	2,055	2,078
	2,104	2,115	2,124	2,076	2,093	2,038	2,036	2,020	1,966	1,894	1,797	1,722
10/12	1,677	1,668	1,674	1,649	1,677	1,644	1,642	1,700	1,752	1,786	1,809	1,818
	1,882	1,811	1,839	1,833	1,832	1,810	1,888	1,911	1,868	1,868	1,747	1,606
10/13	1,540	1,530	1,492	1,483	1,487	1,533	1,539	1,509	1,558	1,588	1,635	1,627
	1,629	1,622	1,583	1,619	1,639	1,640	1,665	1,688	1,621	1,627	1,633	1,584
10/14	1,580	1,572	1,611	1,604	1,659	1,740	1,870	1,997	2,103	2,145	2,092	2,067
	2,057	2,070	1,972	1,958	1,969	1,945	1,944	1,977	1,959	1,917	1,792	1,758
10/15	1,695	1,705	1,669	1,652	1,680	1,756	1,854	1,886	1,865	1,901	1,935	1,962
	1,976	1,967	1,890	1,880	1,884	1,888	1,943	1,944	1,896	1,827	1,725	1,630
10/16	1,579	1,593	1,593	1,585	1,673	1,788	1,932	1,990	1,951	1,976	1,997	2,054
	2,078	2,028	1,966	1,908	1,879	1,896	1,996	1,977	1,953	1,880	1,819	1,757
10/17	1,717	1,679	1,698	1,690	1,758	1,860	1,949	2,041	2,065	2,076	2,024	1,981
	2,014	1,998	1,927	1,921	1,941	1,941	1,983	1,967	2,010	1,907	1,893	1,838
10/18	1,802	1,795	1,776	1,809	1,874	1,899	2,052	1,984	2,078	2,046	2,084	2,124
	2,100	2,118	2,030	2,011	1,980	1,969	2,017	1,985	1,981	1,938	1,845	1,796
10/19	1,773	1,717	1,768	1,707	1,725	1,758	1,782	1,872	1,900	1,878	1,789	1,806
	1,801	1,801	1,841	1,884	1,865	1,900	1,927	1,931	1,889	1,829	1,765	1,723
10/20	1,627	1,613	1,578	1,569	1,606	1,628	1,619	1,610	1,679	1,648	1,704	1,709
	1,742	1,698	1,717	1,726	1,743	1,814	1,894	1,922	1,908	1,882	1,793	1,784
10/21	1,720	1,741	1,730	1,780	1,757	1,830	2,004	2,058	2,080	2,079	2,085	2,093
	2,051	1,943	1,936	1,958	1,965	1,997	2,032	2,042	2,067	1,974	1,899	1,831
10/22	1,780	1,769	1,798	1,809	1,906	1,975	2,070	2,020	1,984	2,044	2,031	2,024
	2,074	1,962	2,004	2,004	1,937	1,966	2,002	2,046	2,026	1,927	1,839	1,783
10/23	1,825	1,814	1,800	1,814	1,868	1,954	2,100	2,088	2,050	2,096	2,086	2,102
	2,074	2,155	2,077	2,067	2,058	2,143	2,140	2,166	2,136	2,044	2,009	1,947
10/24	1,917	1,876	1,864	1,846	1,849	1,944	2,039	2,063	2,096	2,082	2,028	1,983
	2,053	2,106	2,020	2,046	2,063	2,082	2,123	2,107	2,069	2,025	2,021	1,963
10/25	1,926	1,944	1,908	1,921	1,954	2,054	2,134	2,071	2,133	2,123	2,114	2,143
	2,079	2,088	2,001	2,041	2,025	2,029	2,159	2,115	2,098	2,092	2,008	1,922
10/26	1,831	1,850	1,809	1,756	1,778	1,793	1,866	1,870	1,926	1,932	1,912	1,877
	1,865	1,844	1,840	1,824	1,827	1,903	1,921	1,892	1,889	1,858	1,846	1,768
10/27	1,737	1,700	1,722	1,704	1,717	1,716	1,756	1,739	1,742	1,802	1,784	1,761
	1,789	1,734	1,692	1,736	1,741	1,773	1,927	1,875	1,866	1,848	1,767	1,729
10/28	1,670	1,744	1,713	1,718	1,850	1,929	2,093	2,151	2,129	2,131	2,138	2,144
	2,111	2,084	2,100	2,020	2,005	2,060	2,075	2,047	2,026	1,979	1,834	1,804
10/29	1,764	1,795	1,738	1,741	1,789	1,926	1,993	2,053	2,036	2,030	1,950	1,965
	1,967	1,933	1,874	1,899	1,837	1,912	1,985	1,970	1,920	1,827	1,790	1,750
10/30	1,706	1,644	1,701	1,714	1,739	1,809	1,935	2,016	2,015	2,001	2,028	2,025
	1,994	2,022	1,974	1,940	2,000	2,050	2,107	2,107	2,086	2,050	1,907	1,852
10/31	1,842	1,810	1,776	1,751	1,860	1,953	2,082	2,144	2,193	2,203	2,182	2,195
	2,175	2,179	2,090	2,043	1,978	2,064	2,129	2,086	2,025	1,994	1,945	1,872

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
11/01	1,809	1,816	1,797	1,816	1,835	1,882	1,970	2,043	2,031	2,019	2,014	1,992
	1,966	1,982	1,943	1,909	1,925	1,975	1,941	1,991	1,969	1,903	1,885	1,773
11/02	1,775	1,738	1,749	1,728	1,684	1,754	1,797	1,796	1,863	1,893	1,892	1,904
	1,907	1,885	1,884	1,862	1,882	1,931	1,932	1,924	1,855	1,856	1,752	1,714
11/03	1,704	1,673	1,681	1,670	1,685	1,670	1,721	1,719	1,771	1,729	1,744	1,712
	1,712	1,778	1,768	1,715	1,728	1,740	1,876	1,877	1,878	1,861	1,809	1,774
11/04	1,726	1,722	1,714	1,697	1,721	1,836	1,911	2,014	2,046	2,049	2,110	2,062
	2,053	2,042	1,997	2,001	1,962	2,024	2,066	2,085	2,064	2,032	1,951	1,919
11/05	1,862	1,897	1,840	1,805	1,800	1,887	1,933	1,963	1,916	1,937	1,962	1,970
	1,954	1,953	1,981	1,911	1,879	1,978	1,984	1,992	1,992	1,989	1,925	1,858
11/06	1,774	1,709	1,761	1,727	1,705	1,771	1,902	1,966	2,032	2,073	2,083	2,079
	2,076	2,065	2,043	2,065	2,098	2,191	2,190	2,177	2,142	2,107	2,059	1,939
11/07	1,921	1,909	1,904	1,896	1,883	1,984	2,039	2,148	2,180	2,164	2,137	2,151
	2,149	2,151	2,169	2,074	2,126	2,165	2,255	2,209	2,181	2,169	2,138	2,037
11/08	1,936	1,921	1,942	1,965	1,933	1,952	2,073	2,113	2,128	2,174	2,181	2,113
	2,100	2,096	2,120	2,045	2,014	2,112	2,168	2,126	2,072	2,055	2,069	1,988
11/09	1,893	1,784	1,762	1,798	1,759	1,784	1,821	1,827	1,824	1,884	1,928	1,881
	1,858	1,851	1,834	1,833	1,778	1,799	1,887	1,915	1,954	1,939	1,931	1,812
11/10	1,789	1,754	1,731	1,681	1,708	1,718	1,763	1,747	1,781	1,771	1,783	1,748
	1,732	1,737	1,729	1,725	1,737	1,842	1,922	1,932	1,938	1,882	1,812	1,803
11/11	1,770	1,769	1,734	1,756	1,765	1,830	1,891	1,984	2,030	2,091	2,170	2,105
	2,069	2,013	2,033	2,084	2,129	2,210	2,233	2,224	2,130	2,121	2,049	2,010
11/12	1,915	1,862	1,820	1,839	1,896	1,941	2,019	2,100	2,041	2,024	2,062	2,054
	2,032	2,005	2,042	2,013	1,974	2,048	2,168	2,147	2,110	2,048	2,033	1,977
11/13	1,912	1,909	1,900	1,883	1,869	1,887	2,016	2,092	2,065	2,144	2,140	2,087
	2,048	2,054	2,110	2,120	2,146	2,131	2,241	2,234	2,204	2,174	2,118	2,063
11/14	1,980	1,942	1,916	1,873	1,872	1,936	2,061	2,072	2,093	2,125	2,170	2,131
	2,101	2,100	2,140	2,068	2,031	2,078	2,189	2,177	2,114	2,038	1,956	1,894
11/15	1,826	1,797	1,830	1,785	1,853	1,869	1,980	2,095	2,101	2,145	2,115	2,128
	2,153	2,152	2,148	2,052	2,105	2,113	2,194	2,138	2,071	2,064	2,014	1,933
11/16	1,871	1,835	1,808	1,839	1,811	1,788	1,834	1,887	1,896	1,997	1,996	1,982
	1,952	1,894	1,941	1,944	1,921	1,986	2,023	2,001	1,982	1,981	1,896	1,832
11/17	1,751	1,718	1,708	1,711	1,686	1,711	1,687	1,739	1,731	1,759	1,787	1,829
	1,843	1,840	1,767	1,711	1,715	1,766	1,836	1,861	1,840	1,879	1,846	1,811
11/18	1,784	1,733	1,707	1,690	1,762	1,842	1,933	2,036	2,071	2,073	2,079	2,068
	2,090	2,073	2,077	2,017	2,020	2,072	2,169	2,149	2,169	2,112	2,011	1,963
11/19	1,910	1,881	1,845	1,795	1,774	1,856	1,915	2,025	2,010	2,011	2,003	2,012
	2,005	2,001	2,007	1,960	2,000	2,054	2,082	2,108	2,093	2,088	2,029	1,936
11/20	1,840	1,807	1,859	1,866	1,854	1,886	2,035	2,112	2,133	2,152	2,149	2,163
	2,126	2,106	2,118	2,126	2,091	2,192	2,257	2,257	2,220	2,160	2,139	2,037
11/21	1,900	1,913	1,881	1,832	1,865	1,898	1,958	2,092	2,146	2,182	2,172	2,196
	2,131	2,138	2,117	2,141	2,127	2,191	2,219	2,119	2,092	2,058	2,008	1,933
11/22	1,841	1,812	1,773	1,782	1,810	1,808	1,958	2,025	2,115	2,145	2,139	2,151
	2,132	2,117	2,131	2,044	2,106	2,137	2,228	2,178	2,145	2,139	2,089	1,962
11/23	1,922	1,892	1,894	1,818	1,830	1,811	1,859	1,897	1,931	1,977	2,018	1,989
	1,983	1,995	2,014	2,036	2,099	2,194	2,226	2,204	2,202	2,146	2,117	2,009
11/24	1,950	1,912	1,872	1,887	1,900	1,910	1,899	1,942	1,958	1,963	1,966	1,961
	1,912	1,972	1,945	1,916	1,951	2,074	2,163	2,171	2,144	2,137	2,065	2,009
11/25	1,940	1,933	1,896	1,893	1,936	1,986	2,107	2,205	2,194	2,186	2,192	2,209
	2,216	2,209	2,209	2,161	2,190	2,246	2,324	2,313	2,261	2,233	2,191	2,064
11/26	2,004	2,009	2,019	2,019	2,002	2,051	2,176	2,260	2,229	2,223	2,239	2,254
	2,268	2,244	2,177	2,215	2,215	2,262	2,290	2,292	2,248	2,228	2,136	2,069
11/27	1,983	1,936	1,962	1,952	2,003	2,044	2,123	2,224	2,261	2,287	2,245	2,256
	2,178	2,182	2,151	2,120	2,112	2,185	2,235	2,185	2,173	2,129	2,102	1,914
11/28	1,826	1,772	1,776	1,767	1,801	1,805	1,820	1,824	1,826	1,872	1,948	1,899
	1,889	1,828	1,783	1,770	1,792	1,875	1,852	1,846	1,919	1,912	1,862	1,851
11/29	1,801	1,785	1,762	1,739	1,739	1,740	1,768	1,816	1,794	1,833	1,854	1,848
	1,857	1,846	1,785	1,796	1,864	1,979	1,982	1,997	2,011	2,015	1,956	1,870
11/30	1,827	1,780	1,769	1,773	1,751	1,820	1,816	1,836	1,853	1,946	1,893	1,862
	1,854	1,816	1,760	1,727	1,800	1,927	1,985	1,936	1,970	1,945	1,905	1,843

Date	HOUR ENDING											
	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
12/01	1,777	1,749	1,735	1,687	1,682	1,703	1,747	1,774	1,790	1,791	1,822	1,825
	1,804	1,814	1,767	1,834	1,850	1,954	2,051	2,040	2,006	1,980	1,888	1,824
12/02	1,813	1,780	1,799	1,773	1,836	1,885	1,984	2,066	2,119	2,141	2,166	2,182
	2,150	2,139	2,141	2,102	2,055	2,167	2,192	2,183	2,166	2,142	2,136	2,024
12/03	1,950	1,910	1,861	1,898	1,889	1,906	2,008	2,112	2,018	1,990	1,992	1,965
	1,987	1,997	1,977	1,924	1,931	1,986	2,027	2,080	2,056	2,076	2,001	1,933
12/04	1,832	1,794	1,748	1,755	1,760	1,798	1,897	2,021	2,061	2,091	2,110	2,113
	2,087	2,103	2,181	2,141	2,156	2,189	2,273	2,260	2,246	2,175	2,119	2,066
12/05	1,965	1,925	1,881	1,853	1,945	2,015	2,102	2,207	2,206	2,281	2,287	2,315
	2,322	2,286	2,290	2,256	2,336	2,328	2,397	2,358	2,367	2,353	2,312	2,178
12/06	2,135	2,118	2,101	2,050	2,017	2,052	2,181	2,269	2,349	2,393	2,407	2,414
	2,432	2,419	2,396	2,336	2,310	2,415	2,425	2,452	2,416	2,412	2,362	2,247
12/07	2,111	2,099	2,075	2,034	2,023	2,030	2,085	2,134	2,066	2,140	2,179	2,149
	2,138	2,070	2,087	2,074	2,047	2,150	2,260	2,248	2,195	2,187	2,148	2,090
12/08	2,021	1,982	1,976	1,939	1,939	1,947	1,974	1,986	1,977	1,983	2,011	2,057
	2,000	2,044	2,055	2,078	2,124	2,206	2,260	2,233	2,254	2,194	2,133	2,038
12/09	1,956	1,957	1,931	1,914	1,935	1,974	2,115	2,216	2,260	2,295	2,325	2,389
	2,369	2,349	2,365	2,332	2,364	2,394	2,423	2,404	2,430	2,377	2,347	2,238
12/10	2,172	2,126	2,106	2,100	2,085	2,133	2,282	2,394	2,383	2,349	2,378	2,339
	2,319	2,285	2,306	2,230	2,240	2,343	2,433	2,394	2,388	2,383	2,323	2,262
12/11	2,173	2,148	2,159	2,150	2,191	2,164	2,229	2,349	2,357	2,357	2,399	2,367
	2,328	2,381	2,379	2,303	2,390	2,419	2,528	2,481	2,470	2,429	2,388	2,316
12/12	2,213	2,194	2,154	2,136	2,140	2,201	2,306	2,437	2,449	2,468	2,471	2,426
	2,366	2,338	2,316	2,361	2,305	2,377	2,466	2,454	2,384	2,352	2,281	2,227
12/13	2,161	2,124	2,104	2,118	2,130	2,145	2,244	2,338	2,362	2,334	2,347	2,335
	2,264	2,203	2,215	2,228	2,163	2,322	2,387	2,348	2,359	2,310	2,287	2,198
12/14	2,123	2,065	2,050	2,029	1,993	2,016	2,037	2,087	2,080	2,116	2,159	2,165
	2,115	2,132	2,110	2,151	2,165	2,241	2,274	2,248	2,226	2,209	2,121	2,055
12/15	2,010	1,985	1,935	1,957	1,912	1,879	1,917	1,974	2,004	2,013	2,069	2,104
	2,065	2,045	2,031	2,086	2,134	2,269	2,355	2,322	2,338	2,275	2,266	2,192
12/16	2,129	2,095	2,061	2,072	2,102	2,143	2,172	2,301	2,312	2,308	2,282	2,283
	2,312	2,295	2,262	2,183	2,192	2,270	2,346	2,377	2,368	2,361	2,263	2,166
12/17	2,085	2,077	2,040	2,071	2,100	2,100	2,157	2,249	2,236	2,288	2,271	2,218
	2,219	2,224	2,155	2,110	2,142	2,243	2,307	2,318	2,328	2,328	2,252	2,139
12/18	2,032	2,054	2,081	2,083	2,102	2,256	2,234	2,422	2,337	2,327	2,339	2,346
	2,331	2,348	2,347	2,328	2,304	2,377	2,492	2,456	2,428	2,410	2,378	2,232
12/19	2,070	2,021	2,022	2,087	2,041	2,126	2,217	2,268	2,247	2,266	2,245	2,192
	2,202	2,274	2,284	2,227	2,180	2,292	2,350	2,312	2,353	2,293	2,264	2,220
12/20	2,103	2,023	1,978	1,972	1,995	1,993	2,088	2,180	2,224	2,189	2,219	2,209
	2,157	2,175	2,150	2,175	2,184	2,279	2,286	2,266	2,238	2,195	2,141	2,086
12/21	1,961	1,928	1,911	1,882	1,863	1,835	1,860	1,958	1,996	2,041	2,013	2,026
	2,058	2,053	2,054	2,017	2,034	2,159	2,165	2,199	2,146	2,087	2,007	1,900
12/22	1,824	1,786	1,725	1,725	1,703	1,798	1,768	1,812	1,870	1,826	1,922	1,974
	1,988	1,981	1,937	1,991	2,066	2,172	2,202	2,200	2,170	2,097	2,069	2,021
12/23	1,986	1,946	1,941	1,954	1,956	1,971	2,057	2,120	2,164	2,153	2,168	2,217
	2,219	2,182	2,125	2,132	2,130	2,223	2,262	2,285	2,253	2,288	2,236	2,144
12/24	2,063	1,955	1,887	1,900	1,913	1,955	1,994	2,025	2,108	2,067	2,041	2,034
	2,044	2,025	2,008	1,925	1,913	2,019	2,079	2,040	1,989	1,959	1,947	1,906
12/25	1,830	1,792	1,752	1,717	1,695	1,685	1,692	1,744	1,791	1,796	1,797	1,785
	1,810	1,759	1,736	1,734	1,747	1,817	1,854	1,881	1,883	1,873	1,856	1,790
12/26	1,727	1,708	1,671	1,695	1,711	1,786	1,896	1,970	2,016	2,072	2,140	2,165
	2,133	2,140	2,090	2,077	2,063	2,122	2,210	2,209	2,194	2,152	2,119	2,040
12/27	1,946	1,920	1,890	1,896	1,860	1,887	1,976	2,114	2,159	2,151	2,153	2,107
	2,054	2,119	2,097	2,029	2,088	2,114	2,144	2,144	2,139	2,099	2,093	1,967
12/28	1,901	1,901	1,881	1,860	1,867	1,880	1,896	1,935	1,962	1,970	1,949	1,952
	1,954	1,906	1,938	1,918	1,934	2,019	2,069	2,089	2,078	2,010	1,969	1,911
12/29	1,887	1,814	1,788	1,808	1,793	1,784	1,819	1,846	1,833	1,859	1,906	1,923
	1,968	1,974	2,037	2,027	2,025	2,114	2,158	2,103	2,087	2,087	2,040	1,987
12/30	1,906	1,903	1,876	1,873	1,910	1,977	2,058	2,125	2,158	2,138	2,095	2,094
	2,083	2,100	2,103	2,075	2,149	2,253	2,308	2,305	2,251	2,248	2,177	2,083
12/31	2,007	1,959	1,930	1,927	1,946	1,950	1,996	2,059	2,103	2,101	2,152	2,146
	2,181	2,189	2,158	2,125	2,110	2,162	2,226	2,221	2,155	2,128	2,100	2,027


Annual Load Duration Curve
(Native Load - MW)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Total Hours

Seasonal Load Shapes (Hours 1 – 40)

Seasonal Load Shape																	
Hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Emergency Min	Economic Min	Economic Max - 400	Economic Max	NDC Emergency Max
1	2,464	2,478	2,468	2,475	2,160	2,056	1,944	1,882	1,784	2,160	2,480	2,473	1235	1520	2891	3291	3405
2	2,431	2,436	2,488	2,449	2,162	1,990	1,902	1,850	1,759	2,190	2,461	2,447	1235	1520	2891	3291	3405
3	2,393	2,409	2,493	2,467	2,140	1,955	1,853	1,826	1,743	2,185	2,426	2,430	1235	1520	2891	3291	3405
4	2,418	2,406	2,527	2,510	2,144	2,003	1,854	1,816	1,738	2,210	2,422	2,425	1235	1520	2891	3291	3405
5	2,449	2,472	2,605	2,564	2,194	2,058	1,919	1,868	1,807	2,291	2,474	2,465	1235	1520	2891	3291	3405
6	2,530	2,566	2,734	2,726	2,258	2,148	1,969	1,959	1,887	2,408	2,582	2,519	1235	1520	2891	3291	3405
7	2,666	2,701	2,892	2,811	2,369	2,244	2,031	2,003	1,948	2,593	2,703	2,630	1235	1520	2891	3291	3405
8	2,813	2,800	2,915	2,838	2,480	2,343	2,150	2,105	1,987	2,690	2,841	2,742	1235	1520	2891	3291	3405
9	2,869	2,827	2,935	2,857	2,594	2,419	2,246	2,190	2,069	2,741	2,879	2,789	1235	1520	2891	3291	3405
10	2,879	2,874	2,957	2,873	2,697	2,489	2,347	2,314	2,132	2,768	2,902	2,795	1235	1520	2891	3291	3405
11	2,866	2,902	2,989	2,885	2,758	2,564	2,409	2,389	2,188	2,762	2,958	2,795	1235	1520	2891	3291	3405
12	2,912	2,869	2,997	2,850	2,842	2,615	2,434	2,479	2,232	2,756	2,926	2,828	1235	1520	2891	3291	3405
13	2,910	2,873	2,980	2,867	3,008	2,630	2,482	2,544	2,246	2,728	2,928	2,820	1235	1520	2891	3291	3405
14	2,912	2,835	2,951	2,869	3,199	2,654	2,504	2,620	2,289	2,680	2,906	2,802	1235	1520	2891	3291	3405
15	2,834	2,859	2,910	2,767	2,951	2,658	2,496	2,642	2,299	2,636	2,912	2,785	1235	1520	2891	3291	3405
16	2,782	2,761	2,880	2,703	2,843	2,643	2,506	2,608	2,300	2,598	2,912	2,742	1235	1520	2891	3291	3405
17	2,761	2,780	2,838	2,688	2,754	2,627	2,506	2,585	2,297	2,586	2,950	2,758	1235	1520	2891	3291	3405
18	2,827	2,825	2,856	2,670	2,678	2,589	2,500	2,540	2,268	2,607	3,070	2,864	1235	1520	2891	3291	3405
19	2,937	2,924	2,904	2,690	2,600	2,500	2,482	2,482	2,231	2,669	3,199	2,920	1235	1520	2891	3291	3405
20	2,932	2,932	2,961	2,743	2,570	2,389	2,415	2,443	2,272	2,666	3,146	2,927	1235	1520	2891	3291	3405
21	2,909	2,934	2,922	2,798	2,605	2,353	2,420	2,462	2,258	2,658	3,061	2,904	1235	1520	2891	3291	3405
22	2,887	2,884	2,837	2,718	2,533	2,298	2,376	2,356	2,175	2,592	2,993	2,891	1235	1520	2891	3291	3405
23	2,787	2,780	2,763	2,631	2,411	2,172	2,241	2,209	2,063	2,447	2,873	2,826	1235	1520	2891	3291	3405
24	2,672	2,685	2,687	2,545	2,326	2,108	2,119	2,095	1,961	2,376	2,775	2,699	1235	1520	2891	3291	3405
25	2,619	2,604	2,593	2,489	2,233	2,019	2,020	2,022	1,931	2,330	2,674	2,603	1235	1520	2891	3291	3405
26	2,501	2,534	2,568	2,448	2,224	1,977	1,964	1,959	1,889	2,330	2,653	2,540	1235	1520	2891	3291	3405
27	2,465	2,506	2,534	2,463	2,188	1,934	1,941	1,942	1,848	2,293	2,605	2,488	1235	1520	2891	3291	3405
28	2,412	2,518	2,527	2,467	2,180	1,923	1,941	1,931	1,849	2,289	2,578	2,507	1235	1520	2891	3291	3405
29	2,430	2,565	2,613	2,538	2,201	1,978	1,976	1,952	1,883	2,365	2,580	2,516	1235	1520	2891	3291	3405
30	2,482	2,605	2,737	2,648	2,285	2,024	2,008	2,019	1,970	2,475	2,669	2,544	1235	1520	2891	3291	3405
31	2,580	2,767	2,857	2,771	2,366	2,104	2,081	2,081	2,050	2,595	2,773	2,644	1235	1520	2891	3291	3405
32	2,675	2,875	2,867	2,798	2,421	2,167	2,150	2,123	2,076	2,615	2,877	2,745	1235	1520	2891	3291	3405
33	2,661	2,853	2,847	2,833	2,478	2,235	2,244	2,177	2,145	2,619	2,824	2,748	1235	1520	2891	3291	3405
34	2,658	2,879	2,872	2,852	2,530	2,301	2,329	2,265	2,211	2,658	2,823	2,734	1235	1520	2891	3291	3405
35	2,687	2,932	2,869	2,875	2,541	2,378	2,392	2,360	2,270	2,628	2,847	2,744	1235	1520	2891	3291	3405
36	2,675	2,932	2,864	2,864	2,563	2,429	2,449	2,432	2,306	2,654	2,855	2,711	1235	1520	2891	3291	3405
37	2,646	2,924	2,849	2,893	2,588	2,480	2,482	2,498	2,323	2,683	2,844	2,723	1235	1520	2891	3291	3405
38	2,659	2,899	2,839	2,935	2,633	2,510	2,482	2,558	2,359	2,657	2,825	2,715	1235	1520	2891	3291	3405
39	2,614	2,863	2,802	2,824	2,612	2,528	2,438	2,550	2,362	2,600	2,826	2,686	1235	1520	2891	3291	3405
40	2,581	2,832	2,760	2,797	2,633	2,518	2,397	2,568	2,341	2,625	2,789	2,613	1235	1520	2891	3291	3405

Seasonal Load Shapes (Hours 41 – 80)

Seasonal Load Shape																	
Hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Emergency Min	Economic Min	Economic Max - 400	Economic Max	NDC Emergency Max
41	2,590	2,825	2,770	2,757	2,612	2,509	2,368	2,598	2,336	2,560	2,778	2,618	1235	1520	2891	3291	3405
42	2,695	2,877	2,774	2,766	2,608	2,442	2,350	2,588	2,309	2,583	2,872	2,724	1235	1520	2891	3291	3405
43	2,776	2,913	2,834	2,788	2,572	2,412	2,342	2,512	2,270	2,655	2,935	2,805	1235	1520	2891	3291	3405
44	2,758	2,923	2,939	2,873	2,591	2,380	2,295	2,471	2,302	2,668	2,940	2,800	1235	1520	2891	3291	3405
45	2,791	2,901	2,935	2,895	2,617	2,394	2,292	2,476	2,268	2,622	2,907	2,765	1235	1520	2891	3291	3405
46	2,718	2,851	2,843	2,800	2,557	2,339	2,251	2,361	2,171	2,504	2,876	2,755	1235	1520	2891	3291	3405
47	2,674	2,772	2,748	2,681	2,416	2,209	2,146	2,215	2,063	2,391	2,797	2,691	1235	1520	2891	3291	3405
48	2,579	2,667	2,632	2,573	2,309	2,101	2,026	2,098	1,941	2,313	2,699	2,601	1235	1520	2891	3291	3405
49	2,496	2,555	2,556	2,526	2,236	2,033	1,956	2,039	1,877	2,277	2,585	2,492	1235	1520	2891	3291	3405
50	2,470	2,491	2,538	2,467	2,185	1,995	1,908	1,987	1,873	2,238	2,535	2,467	1235	1520	2891	3291	3405
51	2,422	2,523	2,550	2,444	2,157	1,937	1,862	1,942	1,855	2,248	2,576	2,453	1235	1520	2891	3291	3405
52	2,401	2,527	2,556	2,491	2,187	1,958	1,872	1,946	1,877	2,254	2,558	2,442	1235	1520	2891	3291	3405
53	2,427	2,541	2,654	2,551	2,245	2,032	1,918	1,976	1,923	2,319	2,559	2,457	1235	1520	2891	3291	3405
54	2,489	2,609	2,794	2,710	2,353	2,103	1,978	2,044	2,025	2,432	2,613	2,507	1235	1520	2891	3291	3405
55	2,615	2,759	2,886	2,817	2,433	2,170	2,041	2,128	2,103	2,608	2,781	2,556	1235	1520	2891	3291	3405
56	2,766	2,861	2,923	2,846	2,505	2,248	2,150	2,230	2,172	2,644	2,890	2,712	1235	1520	2891	3291	3405
57	2,805	2,923	2,960	2,905	2,578	2,301	2,255	2,325	2,271	2,640	2,923	2,719	1235	1520	2891	3291	3405
58	2,832	2,936	2,957	2,953	2,633	2,389	2,346	2,426	2,406	2,661	2,980	2,732	1235	1520	2891	3291	3405
59	2,813	2,916	2,984	2,935	2,677	2,424	2,398	2,489	2,516	2,702	2,967	2,761	1235	1520	2891	3291	3405
60	2,813	2,926	2,965	2,930	2,723	2,451	2,432	2,571	2,656	2,729	2,956	2,760	1235	1520	2891	3291	3405
61	2,813	2,895	3,003	2,901	2,758	2,481	2,452	2,642	2,780	2,740	2,902	2,755	1235	1520	2891	3291	3405
62	2,814	2,886	2,981	2,877	2,783	2,553	2,460	2,707	3,002	2,787	2,895	2,783	1235	1520	2891	3291	3405
63	2,759	2,843	2,918	2,790	2,721	2,576	2,426	2,689	3,199	2,713	2,900	2,823	1235	1520	2891	3291	3405
64	2,732	2,796	2,876	2,736	2,701	2,592	2,424	2,650	3,013	2,664	2,903	2,811	1235	1520	2891	3291	3405
65	2,729	2,824	2,834	2,768	2,712	2,556	2,419	2,627	2,856	2,678	2,908	2,884	1235	1520	2891	3291	3405
66	2,845	2,853	2,821	2,733	2,694	2,521	2,393	2,575	2,719	2,703	2,995	3,008	1235	1520	2891	3291	3405
67	2,971	2,973	2,857	2,753	2,635	2,505	2,349	2,516	2,606	2,776	3,072	3,199	1235	1520	2891	3291	3405
68	2,991	3,026	2,956	2,841	2,628	2,447	2,295	2,503	2,576	2,785	3,048	3,096	1235	1520	2891	3291	3405
69	2,965	3,011	2,944	2,846	2,692	2,457	2,296	2,513	2,479	2,752	3,009	3,020	1235	1520	2891	3291	3405
70	2,909	2,955	2,894	2,815	2,611	2,383	2,247	2,393	2,340	2,649	2,951	2,932	1235	1520	2891	3291	3405
71	2,856	2,860	2,791	2,678	2,437	2,258	2,142	2,249	2,232	2,515	2,898	2,854	1235	1520	2891	3291	3405
72	2,729	2,776	2,712	2,611	2,333	2,123	2,024	2,113	2,100	2,416	2,738	2,724	1235	1520	2891	3291	3405
73	2,623	2,716	2,649	2,538	2,260	2,024	1,972	2,052	2,053	2,390	2,626	2,571	1235	1520	2891	3291	3405
74	2,583	2,688	2,624	2,540	2,212	1,992	1,931	1,977	2,004	2,339	2,595	2,519	1235	1520	2891	3291	3405
75	2,588	2,661	2,617	2,529	2,165	2,008	1,882	1,981	1,985	2,321	2,575	2,472	1235	1520	2891	3291	3405
76	2,559	2,654	2,642	2,569	2,158	2,002	1,873	1,969	1,942	2,316	2,537	2,479	1235	1520	2891	3291	3405
77	2,550	2,650	2,703	2,668	2,208	2,062	1,928	2,015	1,998	2,385	2,555	2,495	1235	1520	2891	3291	3405
78	2,682	2,732	2,867	2,777	2,298	2,138	1,957	2,077	2,107	2,503	2,625	2,583	1235	1520	2891	3291	3405
79	2,797	2,891	3,036	2,846	2,374	2,228	2,022	2,132	2,169	2,653	2,712	2,705	1235	1520	2891	3291	3405
80	2,927	2,952	3,060	2,874	2,451	2,356	2,137	2,204	2,219	2,718	2,801	2,817	1235	1520	2891	3291	3405

Seasonal Load Shapes (Hours 81 – 120)

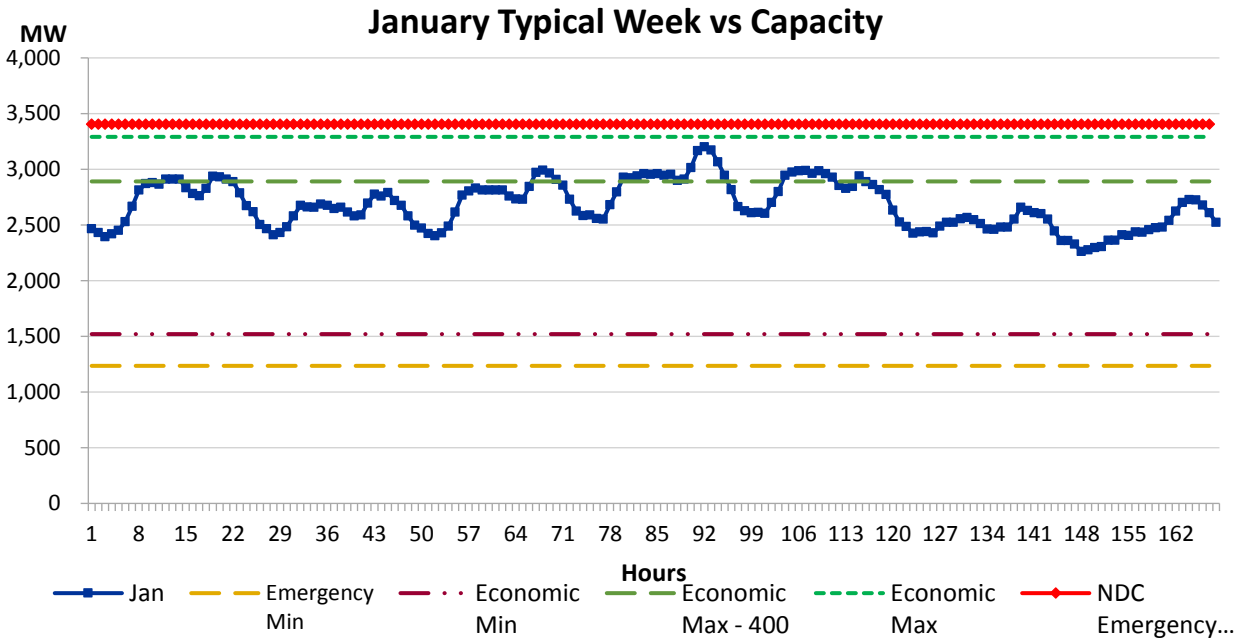
	Seasonal Load Shape																
Hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Emergency Min	Economic Min	Economic Max - 400	Economic Max	NDC Emergency Max
81	2,921	2,938	3,114	2,952	2,522	2,467	2,274	2,289	2,234	2,780	2,839	2,827	1235	1520	2891	3291	3405
82	2,938	2,976	3,199	2,957	2,601	2,601	2,390	2,351	2,292	2,802	2,872	2,880	1235	1520	2891	3291	3405
83	2,959	3,001	3,133	2,946	2,645	2,704	2,488	2,419	2,337	2,785	2,901	2,897	1235	1520	2891	3291	3405
84	2,953	3,000	3,061	2,952	2,647	2,787	2,609	2,452	2,386	2,775	2,884	2,882	1235	1520	2891	3291	3405
85	2,959	3,003	3,016	2,972	2,681	2,888	2,727	2,474	2,425	2,804	2,847	2,858	1235	1520	2891	3291	3405
86	2,944	2,997	2,972	2,950	2,708	3,041	2,867	2,534	2,464	2,827	2,829	2,862	1235	1520	2891	3291	3405
87	2,955	2,931	2,874	2,885	2,659	3,199	2,997	2,512	2,451	2,756	2,825	2,844	1235	1520	2891	3291	3405
88	2,898	2,938	2,851	2,870	2,634	3,058	3,199	2,496	2,423	2,738	2,772	2,825	1235	1520	2891	3291	3405
89	2,911	2,924	2,789	2,808	2,606	2,928	3,006	2,465	2,365	2,746	2,779	2,813	1235	1520	2891	3291	3405
90	3,014	3,025	2,825	2,778	2,549	2,795	2,848	2,436	2,314	2,763	2,859	2,887	1235	1520	2891	3291	3405
91	3,165	3,118	2,864	2,778	2,528	2,679	2,693	2,410	2,297	2,816	2,929	2,984	1235	1520	2891	3291	3405
92	3,199	3,199	2,968	2,841	2,503	2,577	2,559	2,371	2,340	2,793	2,871	2,955	1235	1520	2891	3291	3405
93	3,172	3,138	2,974	2,869	2,546	2,604	2,489	2,401	2,305	2,754	2,854	2,944	1235	1520	2891	3291	3405
94	3,066	3,086	2,867	2,769	2,480	2,529	2,396	2,296	2,218	2,668	2,808	2,897	1235	1520	2891	3291	3405
95	2,944	2,960	2,793	2,630	2,392	2,376	2,262	2,167	2,119	2,592	2,732	2,842	1235	1520	2891	3291	3405
96	2,815	2,839	2,682	2,587	2,289	2,205	2,121	2,057	2,007	2,502	2,642	2,744	1235	1520	2891	3291	3405
97	2,663	2,788	2,667	2,551	2,247	2,120	2,017	2,002	1,928	2,470	2,552	2,642	1235	1520	2891	3291	3405
98	2,625	2,744	2,626	2,528	2,211	2,087	1,952	1,949	1,890	2,444	2,525	2,592	1235	1520	2891	3291	3405
99	2,609	2,706	2,622	2,536	2,213	2,060	1,899	1,928	1,889	2,424	2,515	2,556	1235	1520	2891	3291	3405
100	2,612	2,718	2,629	2,584	2,202	2,074	1,871	1,940	1,881	2,401	2,508	2,544	1235	1520	2891	3291	3405
101	2,602	2,696	2,677	2,639	2,246	2,104	1,925	1,979	1,903	2,488	2,530	2,534	1235	1520	2891	3291	3405
102	2,700	2,756	2,758	2,807	2,354	2,140	1,971	2,080	1,980	2,592	2,551	2,557	1235	1520	2891	3291	3405
103	2,798	2,892	2,869	2,917	2,418	2,212	2,000	2,136	2,056	2,750	2,688	2,688	1235	1520	2891	3291	3405
104	2,946	2,965	2,866	2,983	2,515	2,364	2,127	2,208	2,099	2,737	2,781	2,818	1235	1520	2891	3291	3405
105	2,973	3,009	2,888	3,008	2,553	2,431	2,221	2,311	2,151	2,837	2,802	2,879	1235	1520	2891	3291	3405
106	2,984	3,040	2,906	3,022	2,592	2,509	2,360	2,420	2,203	2,887	2,842	2,871	1235	1520	2891	3291	3405
107	2,989	3,053	2,918	3,101	2,636	2,600	2,408	2,516	2,208	2,946	2,839	2,889	1235	1520	2891	3291	3405
108	2,963	3,063	2,921	3,199	2,662	2,621	2,471	2,625	2,229	3,031	2,819	2,870	1235	1520	2891	3291	3405
109	2,985	2,998	2,879	3,121	2,651	2,629	2,511	2,752	2,225	3,094	2,812	2,820	1235	1520	2891	3291	3405
110	2,960	3,017	2,849	3,072	2,636	2,626	2,535	2,902	2,287	3,199	2,808	2,823	1235	1520	2891	3291	3405
111	2,928	3,014	2,790	2,975	2,567	2,619	2,576	3,026	2,284	3,049	2,790	2,805	1235	1520	2891	3291	3405
112	2,854	2,945	2,750	2,876	2,515	2,567	2,548	3,199	2,265	2,982	2,712	2,776	1235	1520	2891	3291	3405
113	2,826	2,925	2,735	2,859	2,496	2,549	2,575	3,027	2,260	2,924	2,759	2,769	1235	1520	2891	3291	3405
114	2,843	2,949	2,758	2,805	2,469	2,470	2,547	2,902	2,217	2,857	2,841	2,891	1235	1520	2891	3291	3405
115	2,938	3,012	2,797	2,811	2,463	2,416	2,496	2,749	2,192	2,888	2,896	2,926	1235	1520	2891	3291	3405
116	2,888	3,053	2,857	2,865	2,466	2,342	2,436	2,614	2,192	2,826	2,873	2,916	1235	1520	2891	3291	3405
117	2,862	3,014	2,881	2,869	2,497	2,361	2,419	2,558	2,166	2,779	2,828	2,897	1235	1520	2891	3291	3405
118	2,816	2,934	2,825	2,801	2,408	2,324	2,362	2,408	2,069	2,708	2,803	2,855	1235	1520	2891	3291	3405
119	2,772	2,867	2,757	2,636	2,306	2,216	2,229	2,250	1,978	2,587	2,758	2,812	1235	1520	2891	3291	3405
120	2,633	2,771	2,645	2,539	2,218	2,098	2,083	2,133	1,895	2,477	2,624	2,691	1235	1520	2891	3291	3405

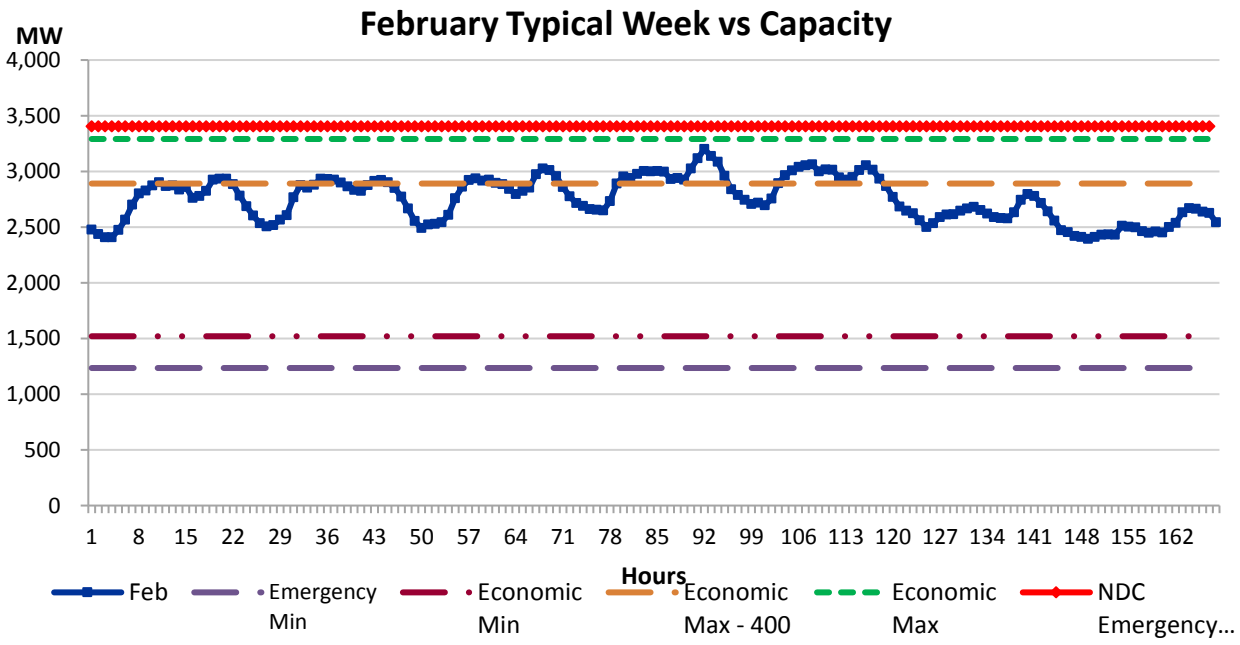
Seasonal Load Shapes (Hours 121 – 168)

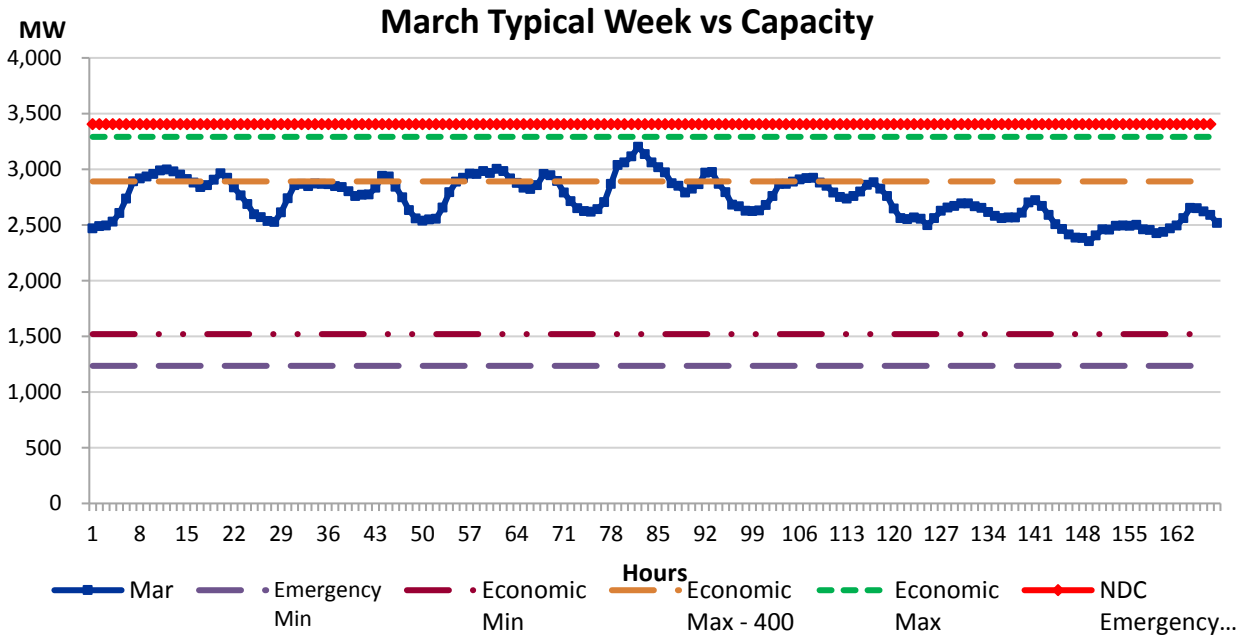
	Seasonal Load Shape																
Hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Emergency Min	Economic Min	Economic Max - 400	Economic Max	NDC Emergency Max
121	2,525	2,684	2,560	2,490	2,147	2,031	2,001	2,036	1,839	2,394	2,559	2,563	1235	1520	2891	3291	3405
122	2,484	2,646	2,551	2,486	2,121	1,975	1,961	1,943	1,789	2,364	2,487	2,531	1235	1520	2891	3291	3405
123	2,426	2,624	2,567	2,430	2,078	1,938	1,907	1,888	1,753	2,362	2,474	2,507	1235	1520	2891	3291	3405
124	2,436	2,560	2,555	2,431	2,097	1,924	1,893	1,849	1,737	2,306	2,467	2,471	1235	1520	2891	3291	3405
125	2,440	2,500	2,496	2,459	2,106	1,910	1,856	1,866	1,728	2,330	2,434	2,453	1235	1520	2891	3291	3405
126	2,428	2,533	2,561	2,520	2,093	1,915	1,856	1,874	1,753	2,337	2,467	2,457	1235	1520	2891	3291	3405
127	2,489	2,589	2,625	2,511	2,108	1,891	1,884	1,858	1,785	2,391	2,514	2,494	1235	1520	2891	3291	3405
128	2,521	2,612	2,655	2,543	2,160	1,964	1,961	1,900	1,780	2,436	2,546	2,569	1235	1520	2891	3291	3405
129	2,523	2,614	2,670	2,568	2,213	2,066	2,031	1,972	1,853	2,518	2,580	2,566	1235	1520	2891	3291	3405
130	2,554	2,648	2,691	2,608	2,243	2,160	2,137	2,043	1,881	2,551	2,671	2,617	1235	1520	2891	3291	3405
131	2,567	2,667	2,694	2,580	2,266	2,205	2,198	2,152	1,953	2,531	2,679	2,628	1235	1520	2891	3291	3405
132	2,546	2,681	2,665	2,585	2,259	2,221	2,238	2,182	1,961	2,527	2,649	2,625	1235	1520	2891	3291	3405
133	2,512	2,653	2,651	2,572	2,268	2,236	2,294	2,221	2,005	2,552	2,632	2,616	1235	1520	2891	3291	3405
134	2,463	2,622	2,615	2,565	2,272	2,250	2,312	2,264	2,040	2,550	2,600	2,583	1235	1520	2891	3291	3405
135	2,461	2,589	2,581	2,518	2,268	2,274	2,313	2,262	2,051	2,571	2,598	2,592	1235	1520	2891	3291	3405
136	2,480	2,581	2,561	2,522	2,266	2,276	2,331	2,264	2,055	2,560	2,590	2,582	1235	1520	2891	3291	3405
137	2,480	2,578	2,565	2,533	2,280	2,272	2,335	2,282	2,054	2,560	2,611	2,587	1235	1520	2891	3291	3405
138	2,551	2,633	2,567	2,541	2,265	2,268	2,303	2,274	2,031	2,580	2,710	2,710	1235	1520	2891	3291	3405
139	2,657	2,743	2,610	2,532	2,256	2,229	2,270	2,197	2,054	2,629	2,769	2,771	1235	1520	2891	3291	3405
140	2,628	2,795	2,702	2,605	2,301	2,204	2,223	2,150	2,087	2,610	2,749	2,775	1235	1520	2891	3291	3405
141	2,610	2,778	2,721	2,668	2,363	2,249	2,188	2,166	2,078	2,575	2,744	2,728	1235	1520	2891	3291	3405
142	2,600	2,715	2,670	2,632	2,321	2,195	2,139	2,075	1,995	2,511	2,718	2,677	1235	1520	2891	3291	3405
143	2,551	2,639	2,590	2,492	2,193	2,077	2,047	1,969	1,905	2,431	2,645	2,594	1235	1520	2891	3291	3405
144	2,445	2,558	2,505	2,404	2,114	1,981	1,944	1,877	1,835	2,319	2,537	2,496	1235	1520	2891	3291	3405
145	2,358	2,470	2,462	2,349	2,063	1,895	1,881	1,800	1,799	2,233	2,477	2,434	1235	1520	2891	3291	3405
146	2,359	2,455	2,413	2,334	2,031	1,844	1,831	1,759	1,755	2,189	2,430	2,376	1235	1520	2891	3291	3405
147	2,327	2,420	2,386	2,294	2,010	1,828	1,812	1,712	1,741	2,154	2,408	2,332	1235	1520	2891	3291	3405
148	2,261	2,410	2,382	2,316	1,990	1,808	1,763	1,682	1,719	2,131	2,393	2,318	1235	1520	2891	3291	3405
149	2,274	2,393	2,353	2,368	1,973	1,795	1,748	1,682	1,715	2,150	2,403	2,294	1235	1520	2891	3291	3405
150	2,295	2,411	2,406	2,387	1,970	1,783	1,745	1,680	1,704	2,172	2,413	2,313	1235	1520	2891	3291	3405
151	2,305	2,429	2,459	2,408	1,998	1,817	1,753	1,654	1,728	2,188	2,434	2,340	1235	1520	2891	3291	3405
152	2,360	2,434	2,456	2,411	2,088	1,875	1,815	1,687	1,742	2,167	2,461	2,382	1235	1520	2891	3291	3405
153	2,363	2,432	2,491	2,439	2,117	1,961	1,902	1,766	1,795	2,211	2,493	2,402	1235	1520	2891	3291	3405
154	2,409	2,510	2,495	2,474	2,148	2,035	2,004	1,854	1,867	2,229	2,487	2,401	1235	1520	2891	3291	3405
155	2,405	2,504	2,490	2,453	2,157	2,106	2,083	1,968	1,889	2,264	2,507	2,466	1235	1520	2891	3291	3405
156	2,438	2,496	2,499	2,470	2,126	2,156	2,150	2,027	1,928	2,272	2,496	2,504	1235	1520	2891	3291	3405
157	2,434	2,464	2,458	2,498	2,153	2,213	2,215	2,091	1,959	2,287	2,479	2,489	1235	1520	2891	3291	3405
158	2,456	2,448	2,454	2,507	2,202	2,234	2,264	2,125	2,002	2,262	2,523	2,498	1235	1520	2891	3291	3405
159	2,472	2,458	2,424	2,477	2,216	2,266	2,329	2,154	1,986	2,237	2,483	2,490	1235	1520	2891	3291	3405
160	2,480	2,451	2,437	2,478	2,265	2,297	2,363	2,213	2,022	2,281	2,434	2,538	1235	1520	2891	3291	3405
161	2,541	2,499	2,469	2,481	2,299	2,327	2,392	2,257	2,035	2,302	2,456	2,584	1235	1520	2891	3291	3405
162	2,623	2,537	2,493	2,531	2,321	2,335	2,369	2,252	2,018	2,327	2,557	2,715	1235	1520	2891	3291	3405
163	2,700	2,632	2,560	2,555	2,289	2,290	2,322	2,217	2,041	2,431	2,686	2,794	1235	1520	2891	3291	3405
164	2,726	2,669	2,651	2,625	2,297	2,268	2,305	2,186	2,070	2,439	2,702	2,762	1235	1520	2891	3291	3405
165	2,723	2,662	2,648	2,651	2,385	2,308	2,289	2,196	2,057	2,397	2,688	2,752	1235	1520	2891	3291	3405
166	2,679	2,639	2,621	2,605	2,332	2,295	2,232	2,147	1,989	2,368	2,675	2,697	1235	1520	2891	3291	3405
167	2,610	2,625	2,589	2,558	2,253	2,191	2,129	2,057	1,893	2,286	2,598	2,639	1235	1520	2891	3291	3405
168	2,523	2,542	2,516	2,524	2,197	2,081	2,035	1,967	1,828	2,233	2,553	2,556	1235	1520	2891	3291	3405

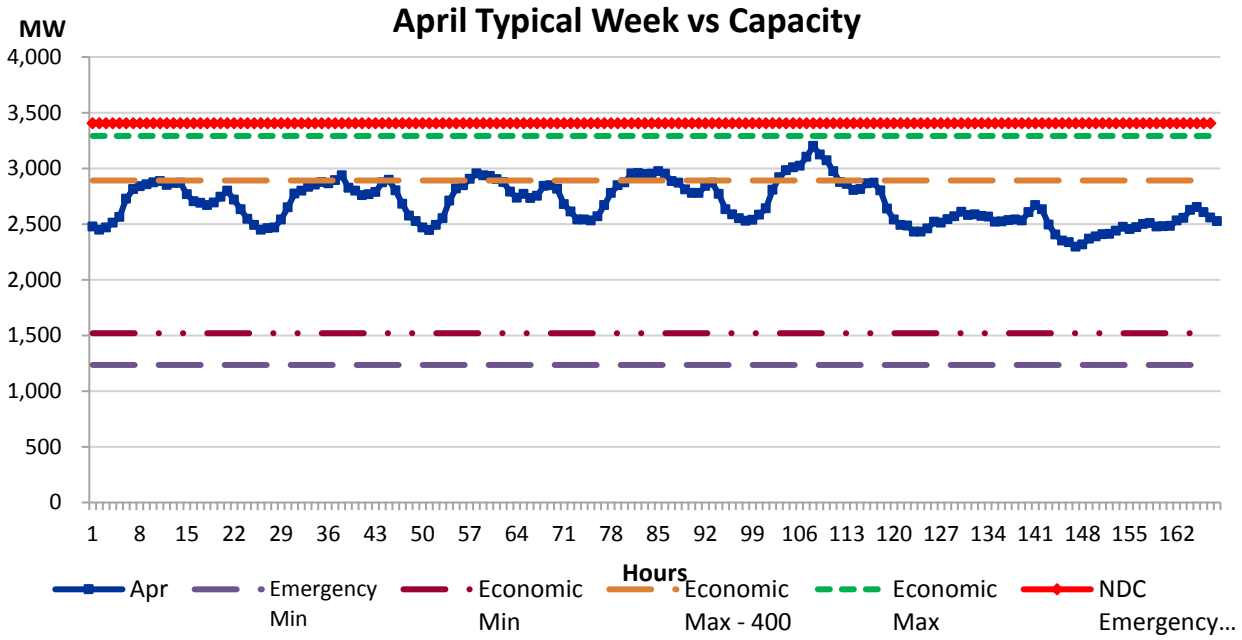
Unit	Level Number (MW)				NDC
	Fourth	Third	Second	First	
	Emergency Min	Economic Min	Economic Max - 400	Economic Max	Emergency Max
Bailly 7	100	100		150	160
Bailly 8	150	180		310	320
Michigan City 12	310	310		430	469
Schahfer 14	235	270		420	431
Schahfer 15	190	260		440	472
Schahfer 17	125	200		355	361
Schahfer 18	125	200		355	361
Sugar Creek	0	0		535	535
Schahfer 16A	0	0		78	78
Schahfer 16B	0	0		77	77
Bailly 10	0	0		31	31
Norway	0	0		4	4
Oakdale	0	0		6	6
Buffalo Ridge	0	0		50	50
Barton	0	0		50	50
TOTAL	**1,235**	**1,520**	**2,891**	**3,291**	**3,405**

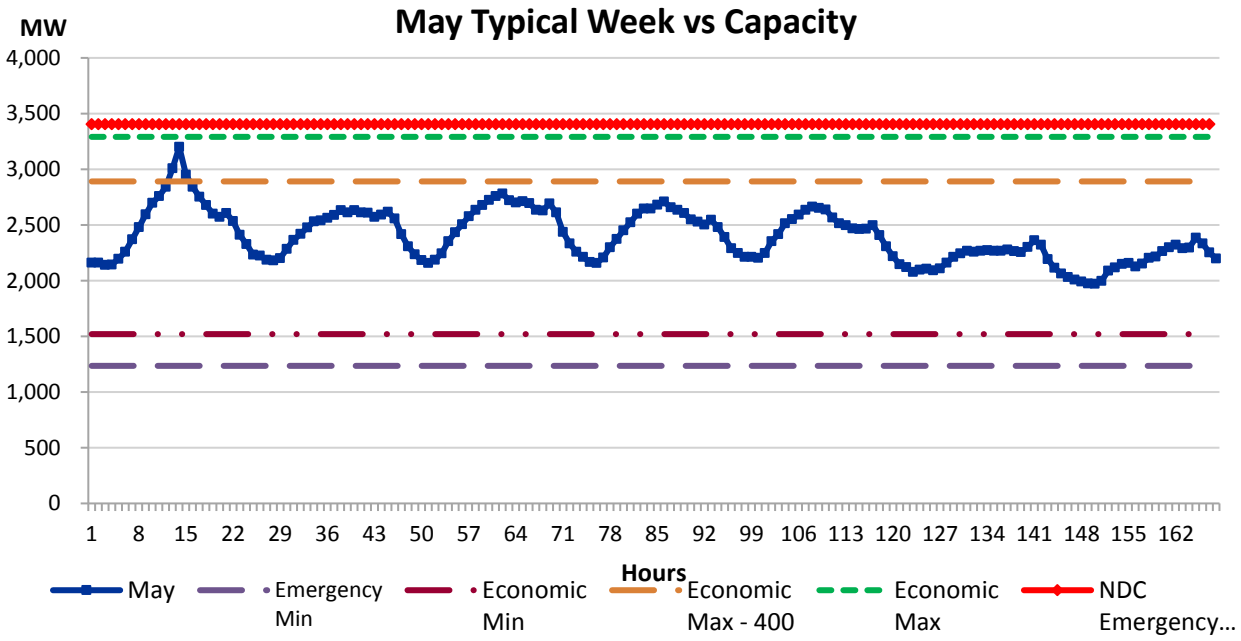
Note: Second Level = First Economic Max - 400 MW

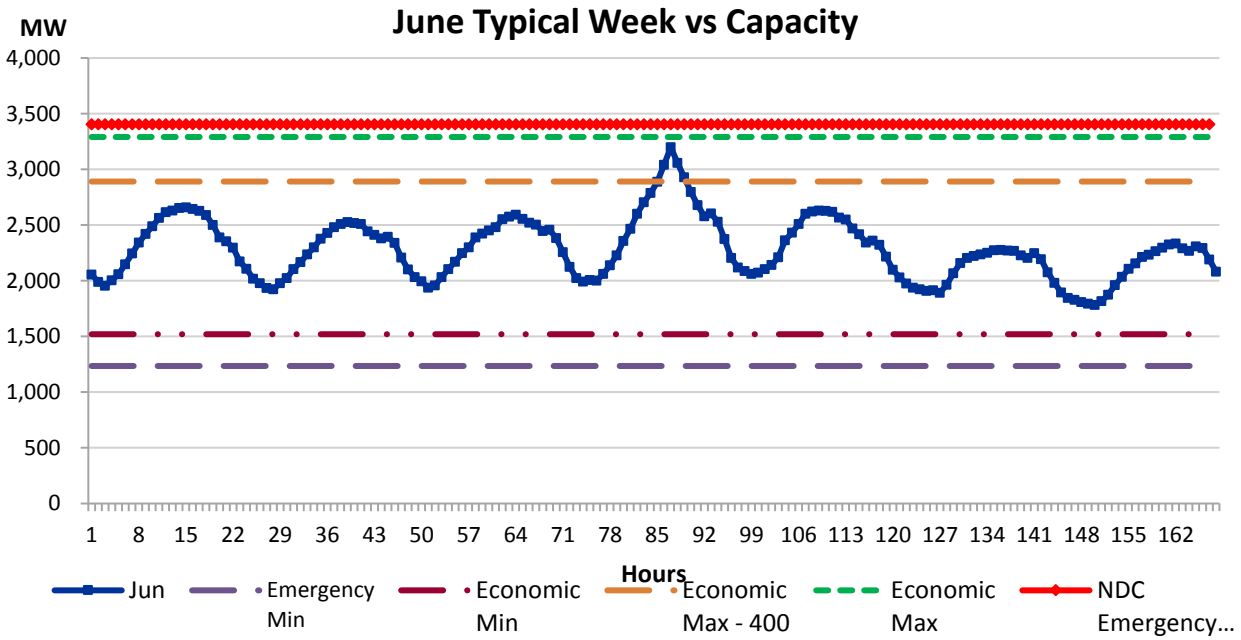

January Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Jan
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...

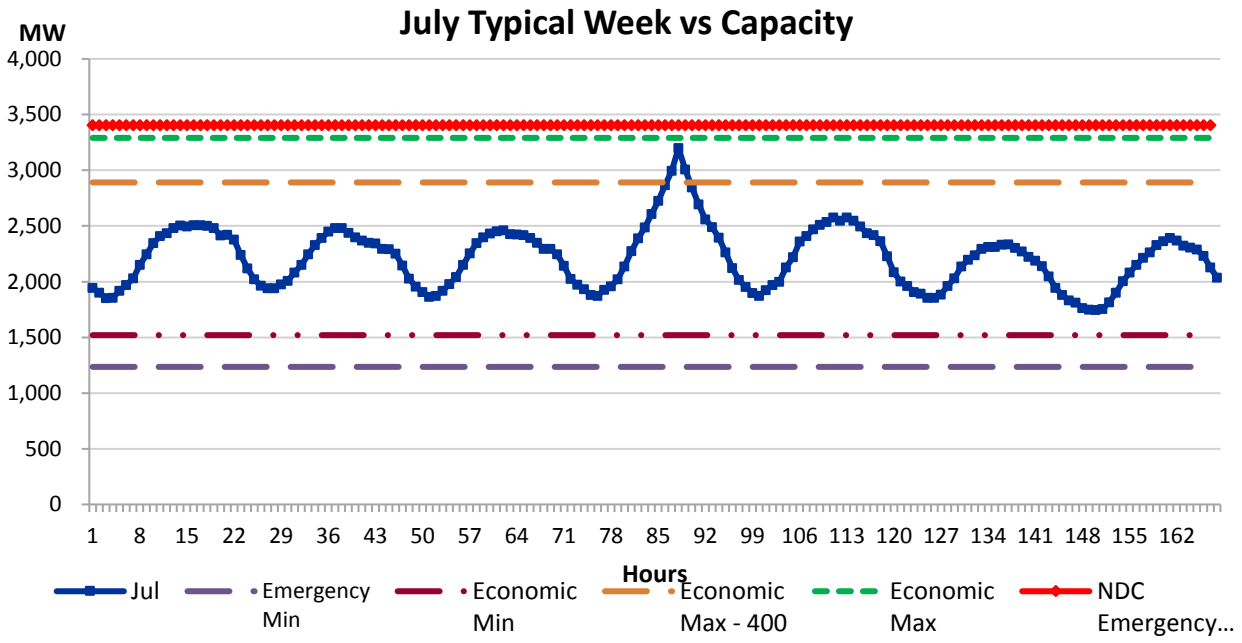

February Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Feb
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...

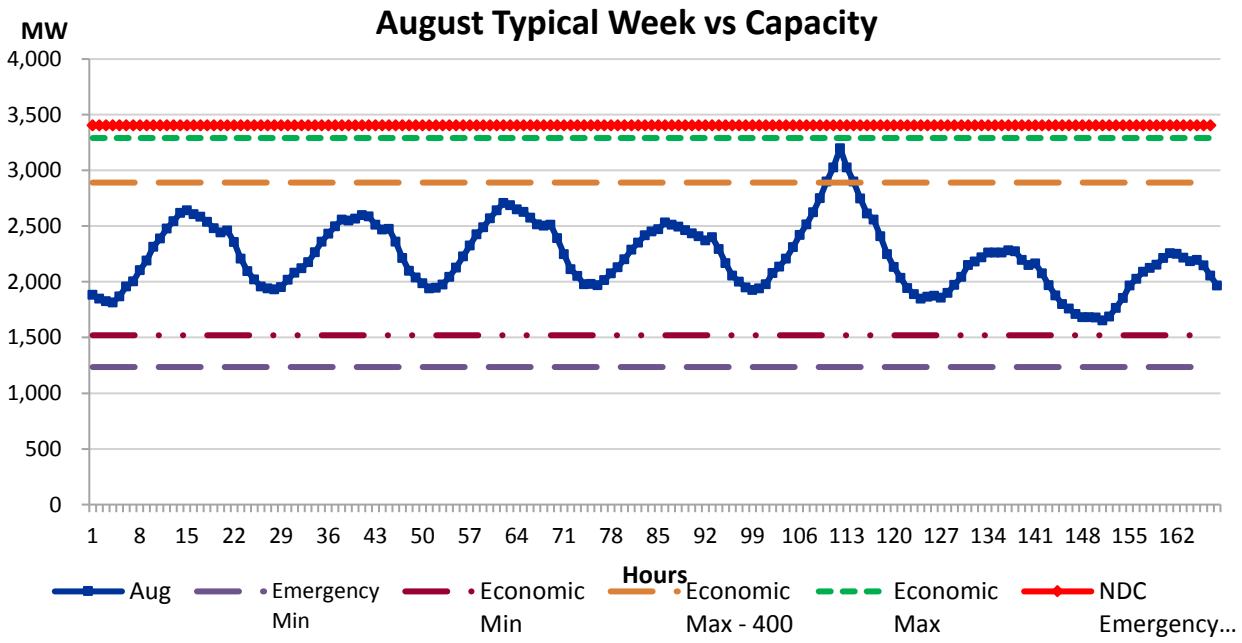

March Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Mar
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...

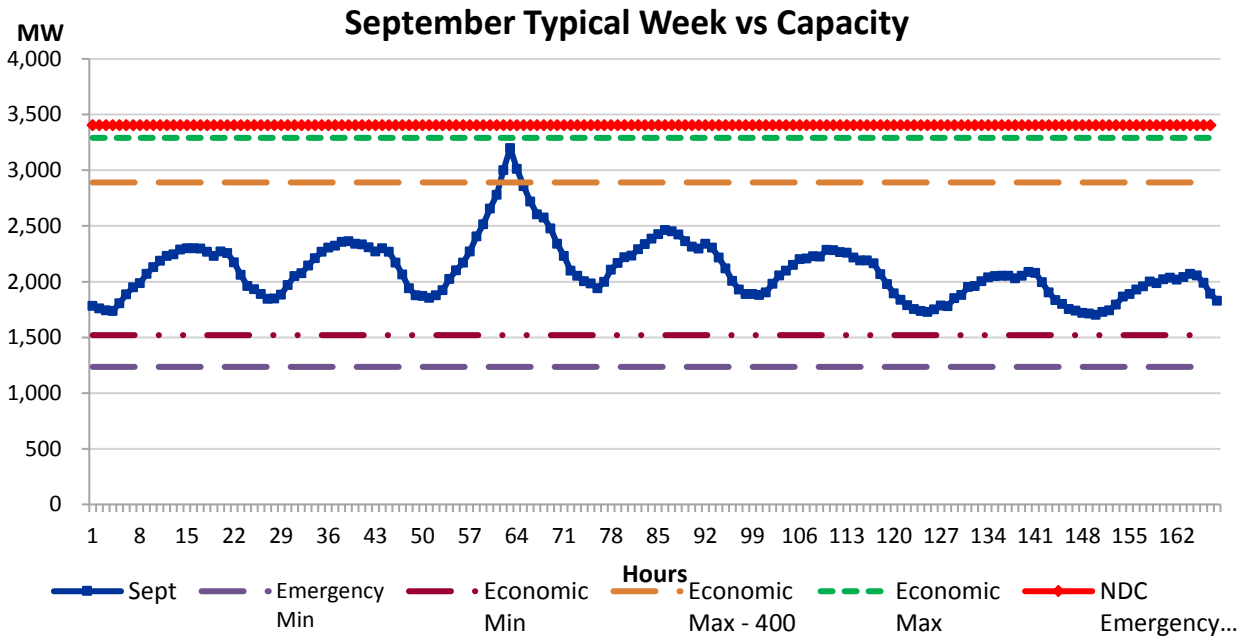

April Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Apr
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...

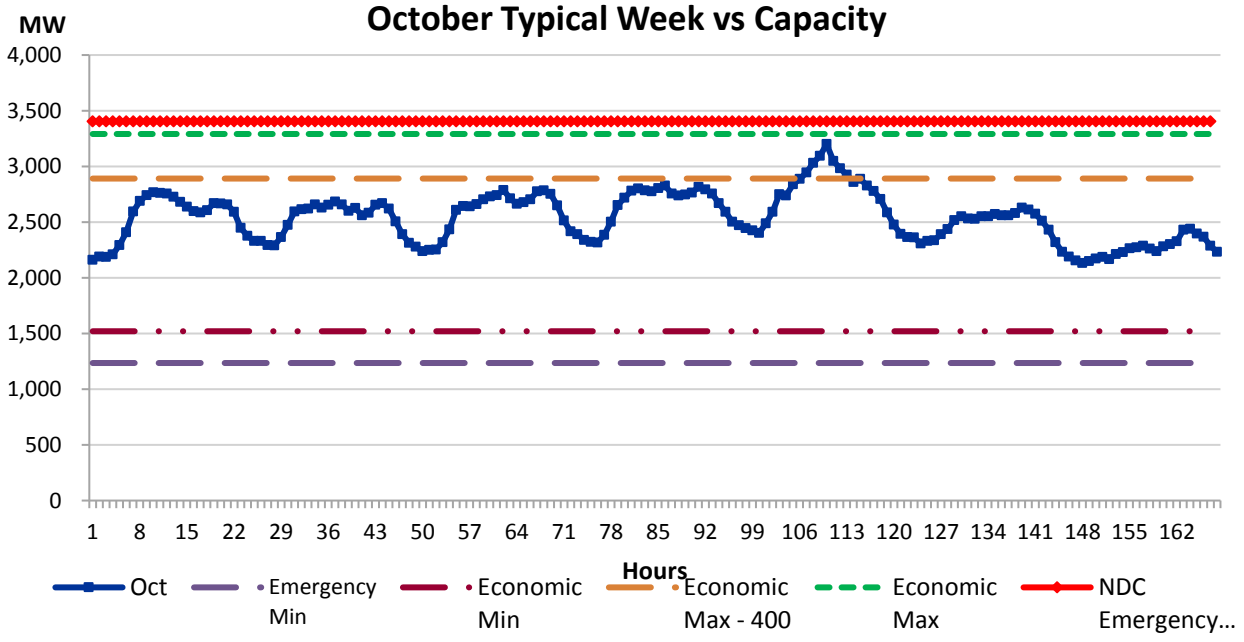

May Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
May
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...

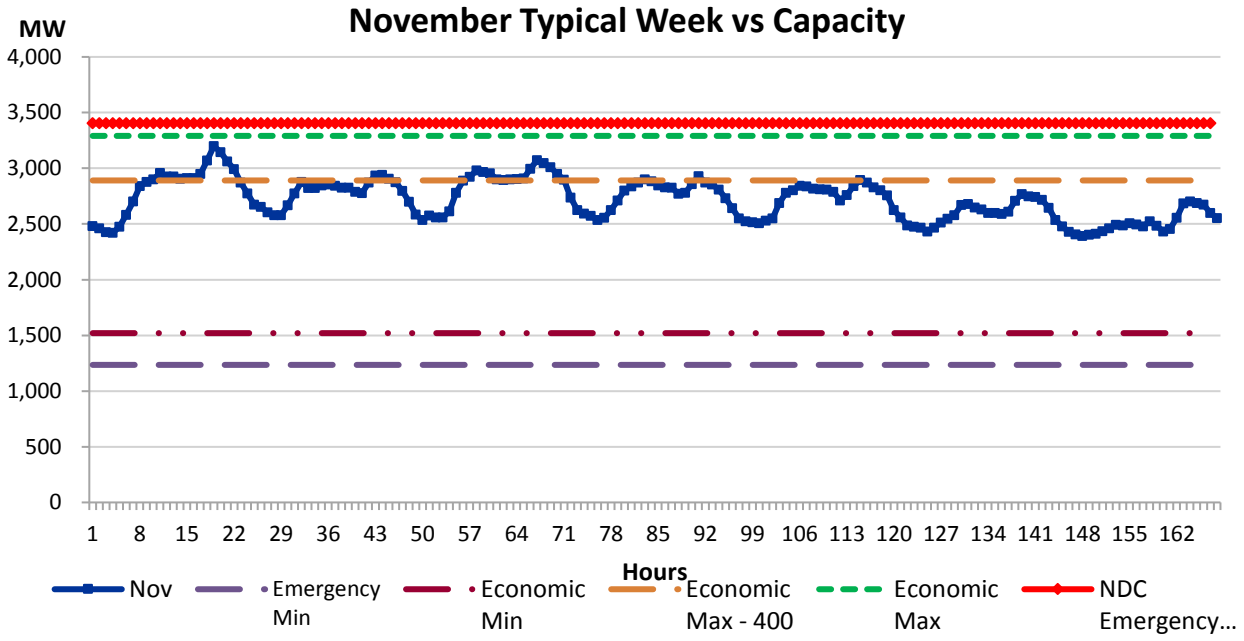

June Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Jun
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...

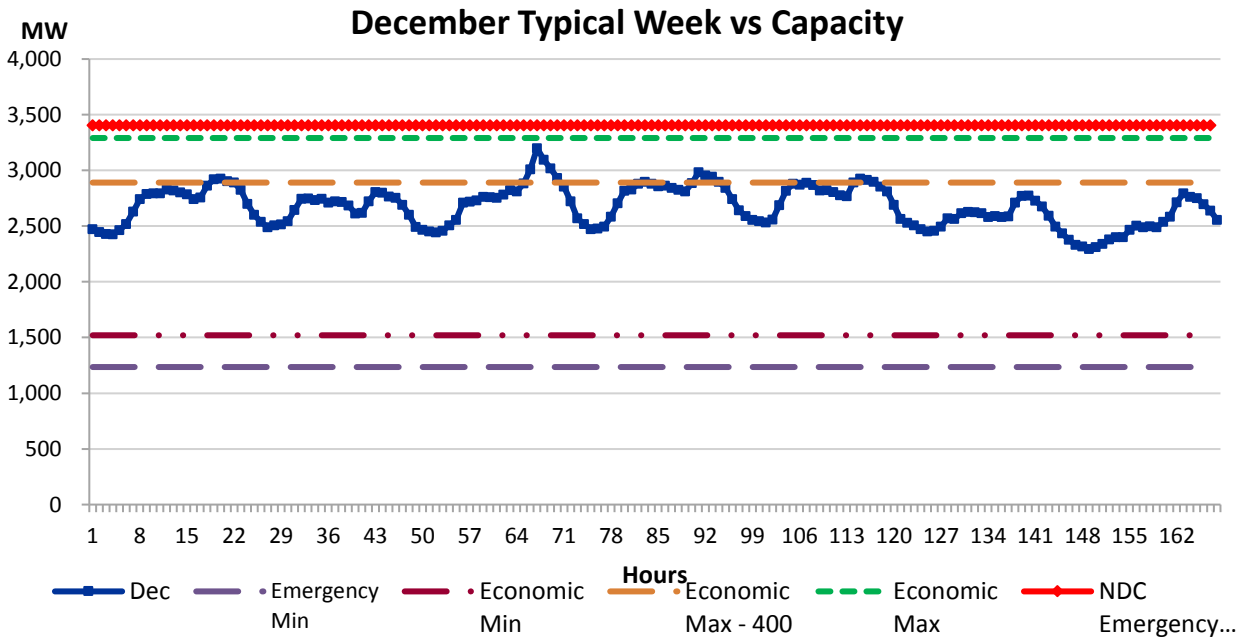

July Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Jul
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...


August Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Aug
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...


September Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Sept
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...


October Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Oct
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...


November Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Nov
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...

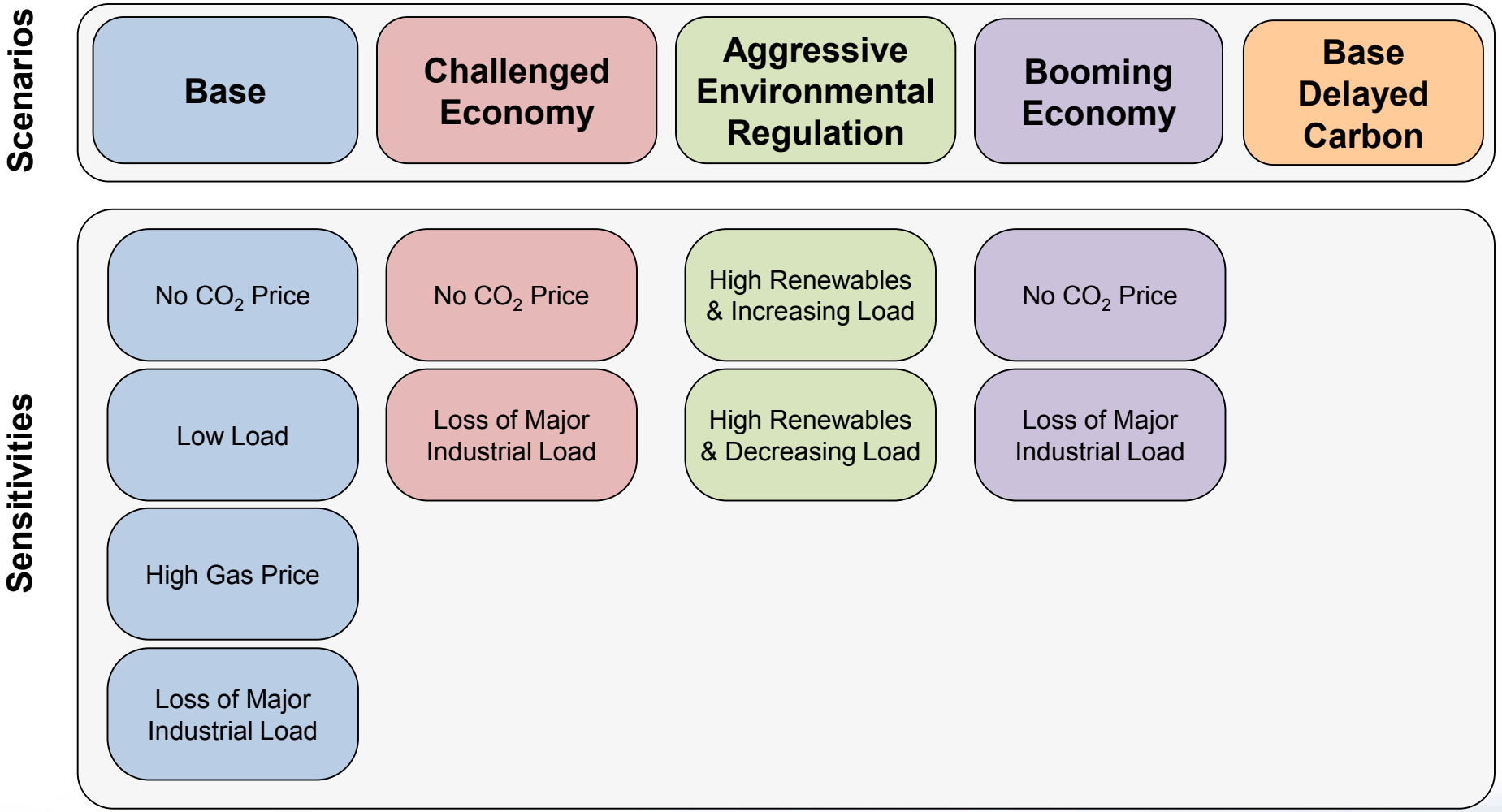

December Typical Week vs Capacity
MW
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106 113 120 127 134 141 148 155 162
Hours
Dec
Emergency Min
Economic Min
Economic Max - 400
Economic Max
NDC Emergency...

RECEIVED
November 1, 2016
INDIANA UTILITY
REGULATORY COMMISSION

Appendix F: Exhibit 1

Scenarios Planning Variable Breadth and Diversity

Scenarios And Sensitivities



Sources and Notes: Definitions adapted from *Electricity Director's Final Report 2014-2015 Integrated Resources Plans*, IURC, p. 9; Varying one "element" of a scenario to create a sensitivity may require changes to multiple variables to ensure that input data are properly correlated; For example, a low gas price sensitivity also requires correlated (lower) electricity prices

Scenarios And Sensitivities Variables Descriptions

Scenarios & Sensitivities	NIPSCO Load	CO_2 Price	Natural Gas Price	Power Price	RPS
Base (B)	**Base Load**	**Base**	**Base**	**Base**	**No**
No CO_2 Price (Bs1)	Base Load	No	Base No CO_2	Base No CO_2	No
Low Load (Bs2)	Low Load	Base	Base	Base	No
High Gas Price (Bs3)	Base Load	Base	High	High	No
Loss of Major Industrial Load (Bs4)	Base, Loss Major Industrial	Base	Base	Base	No
Challenged Economy (CE)	**Low Load**	**Base**	**Low**	**Low**	**No**
No CO_2 Price (CEs1)	Low Load	No	Low No CO_2	Low No CO_2	No
Loss of Major Industrial Load (CEs2)	Low, Loss Major Industrial	Base	Low	Low	No
Aggressive Environmental Regulation (AE)	**Base Load**	**High**	**High**	**High**	**No**
High Renewables & Increasing Load (AEs1)	High Load	High	Very High	Very High	Yes
High Renewables & Decreasing Load (AEs2)	Low Load	High	Very High	Very High	Yes
Booming Economy (BE)	**High Load**	**Base**	**High**	**High**	**No**
No CO_2 Price (BEs1)	High Load	No	Base no CO_2	Base no CO_2	No
Major Industrial Load (BEs2)	Base, Loss Major Industrial	Base	High	High	No
Base Delayed Carbon (BDC)	**Base Load**	**Base BDC**	**Base BDC**	**Base BDC**	**No**

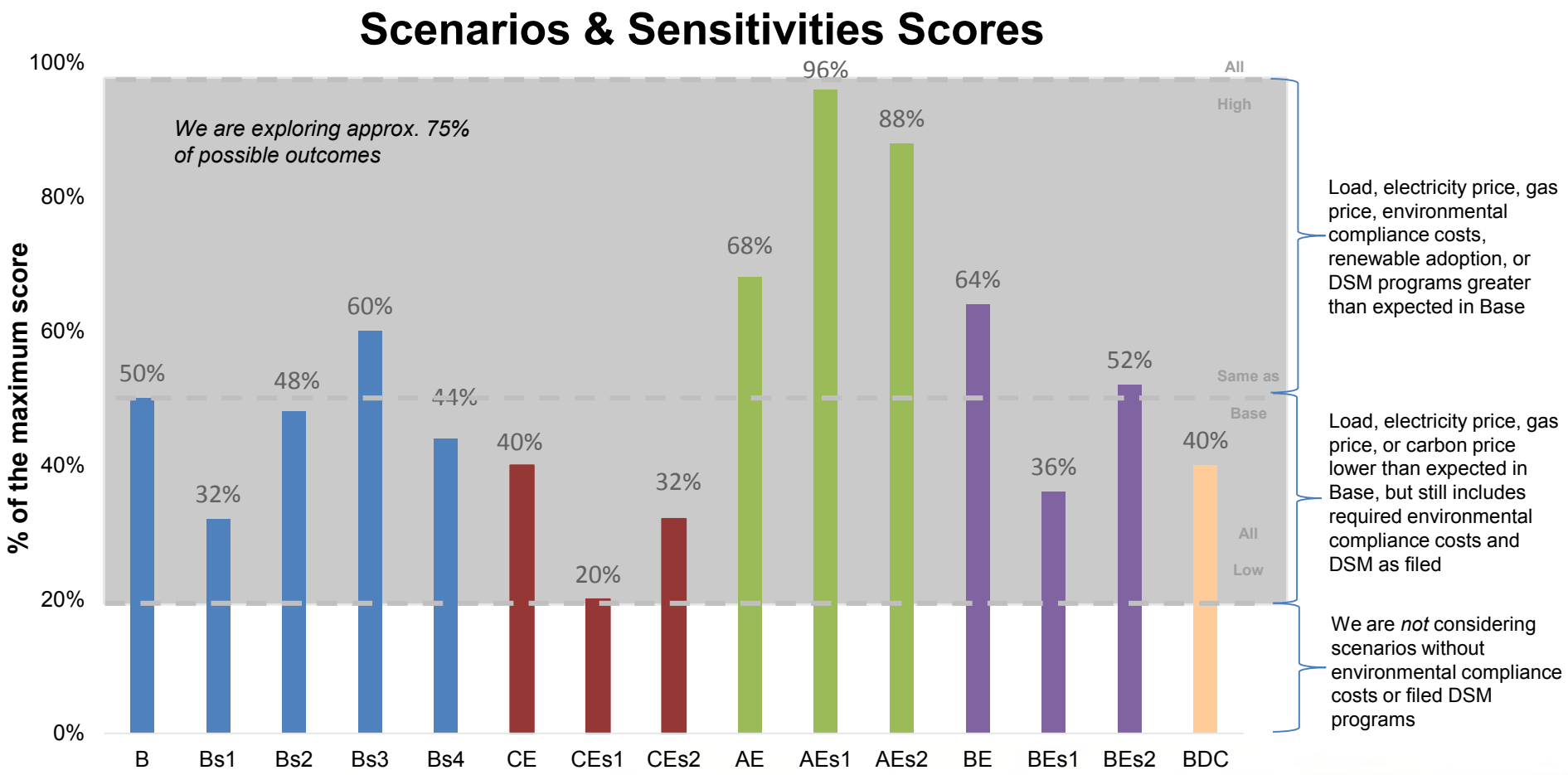
Scenarios And Sensitivities Scoring

Scenarios & Sensitivities	Load	CO_2 Price	Natural Gas Price	Power Price	RPS	Total Score
Base	4	3	3	3	0	16
No CO_2 Price	4	0	2	2	0	10
Low Load	3	3	3	3	0	15
High Gas Price	4	3	4	4	0	19
No Major Industrial Load	2	3	3	3	0	14
Challenged Economy	3	3	2	2	0	12
No CO_2 Price	3	0	1	1	0	6
No Major Industrial Load	1	3	2	2	0	10
Aggressive Environmental Regulation	4	5	4	4	0	21
High Renewables & Increasing Load	5	5	5	5	4	29
High Renewables & Decreasing Load	3	5	5	5	4	27
Booming Economy	5	3	4	4	0	20
No CO_2 Price & Low Gas Prices	5	0	2	2	0	10
No Major Industrial Load	2	3	4	4	0	17
Base Delayed Carbon	4	2	2	2	0	10

Scoring Key

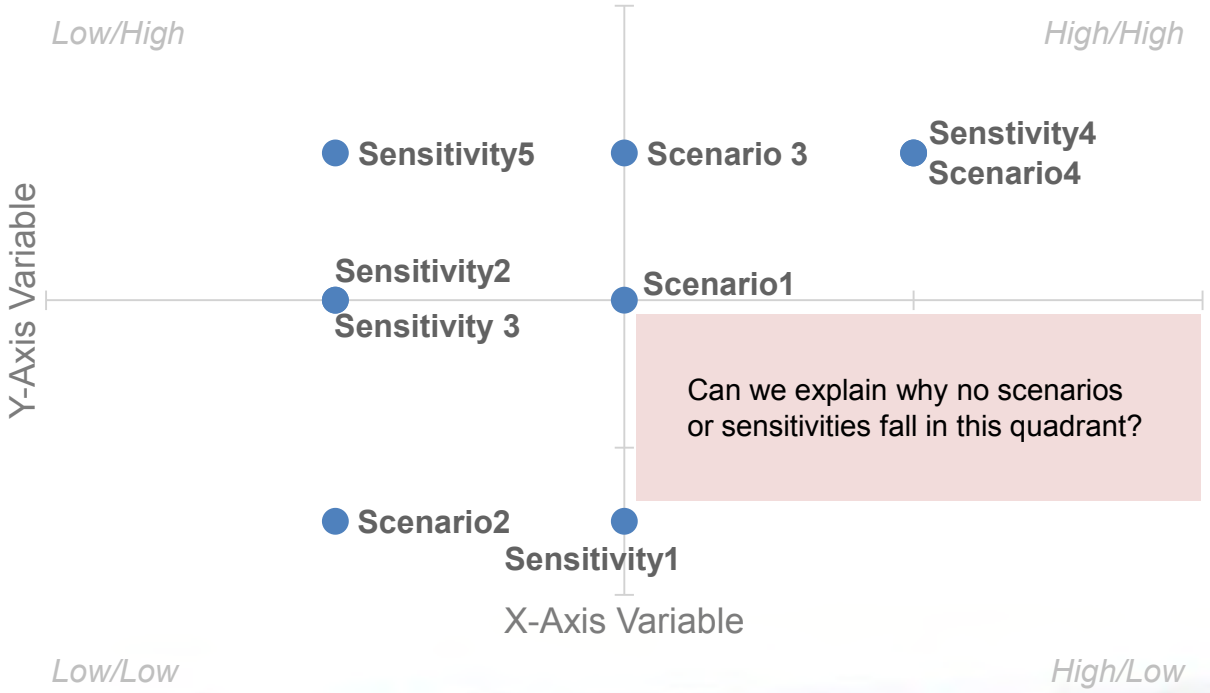
0	1	2	3	4	5
Not Available	Very Low	Low	Medium	High	Very High

Scenario Variable Diversity Analysis



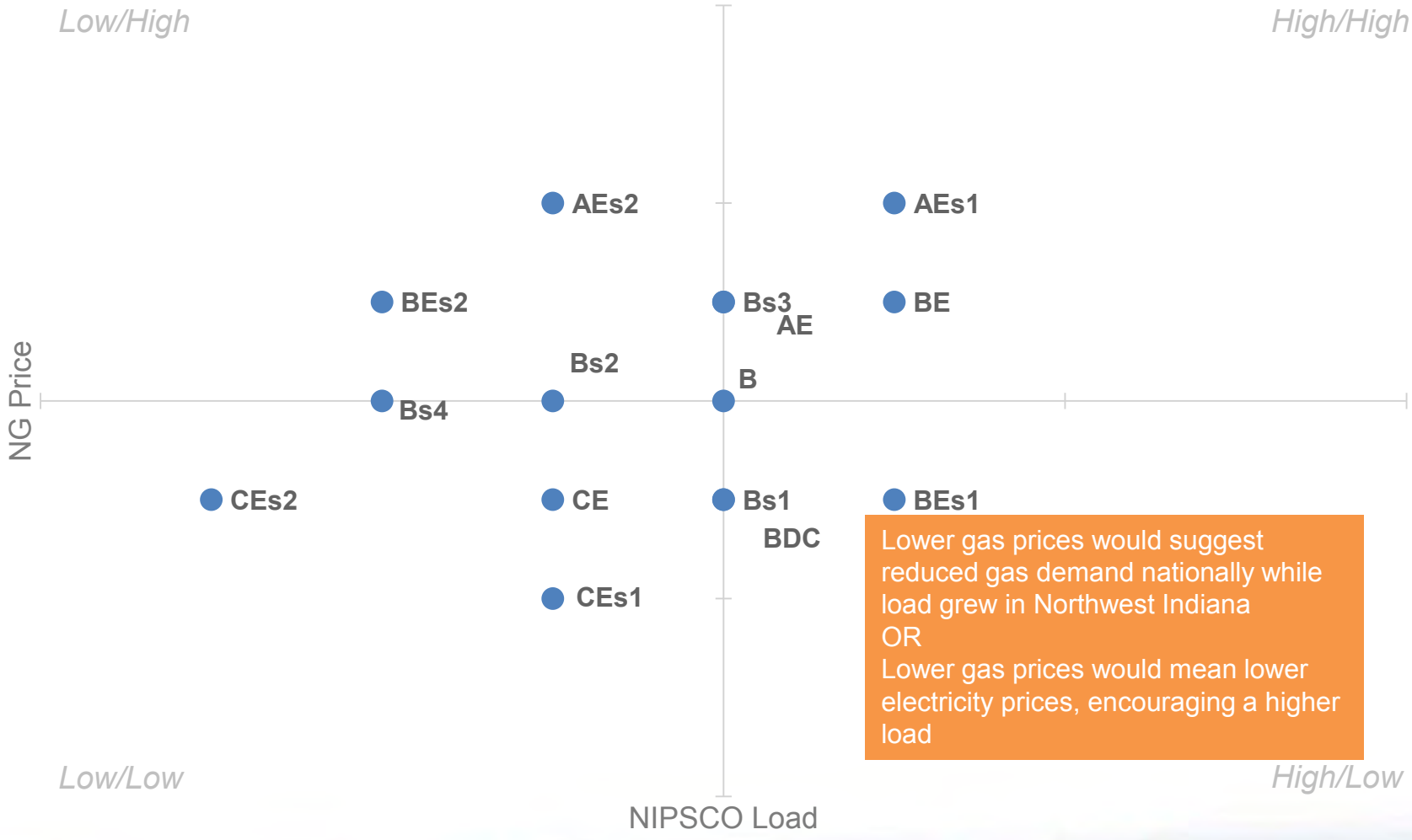
Scenario Variable Breadth Analysis Template

- Map every scenario against each pair of variables
  - Chart origin (0,0) corresponds to a Scenario Score of 3 for both variables
  - The Business As Usual (BAU1) scenario falls on the origin in all charts except with RPS[1]
  - Variable plots above or below the origin correspond to expected values above or below BAU respectively
  - Electricity price and NG price are not mapped because they are always correlated
- Check for understanding when no scenarios fall within a quadrant



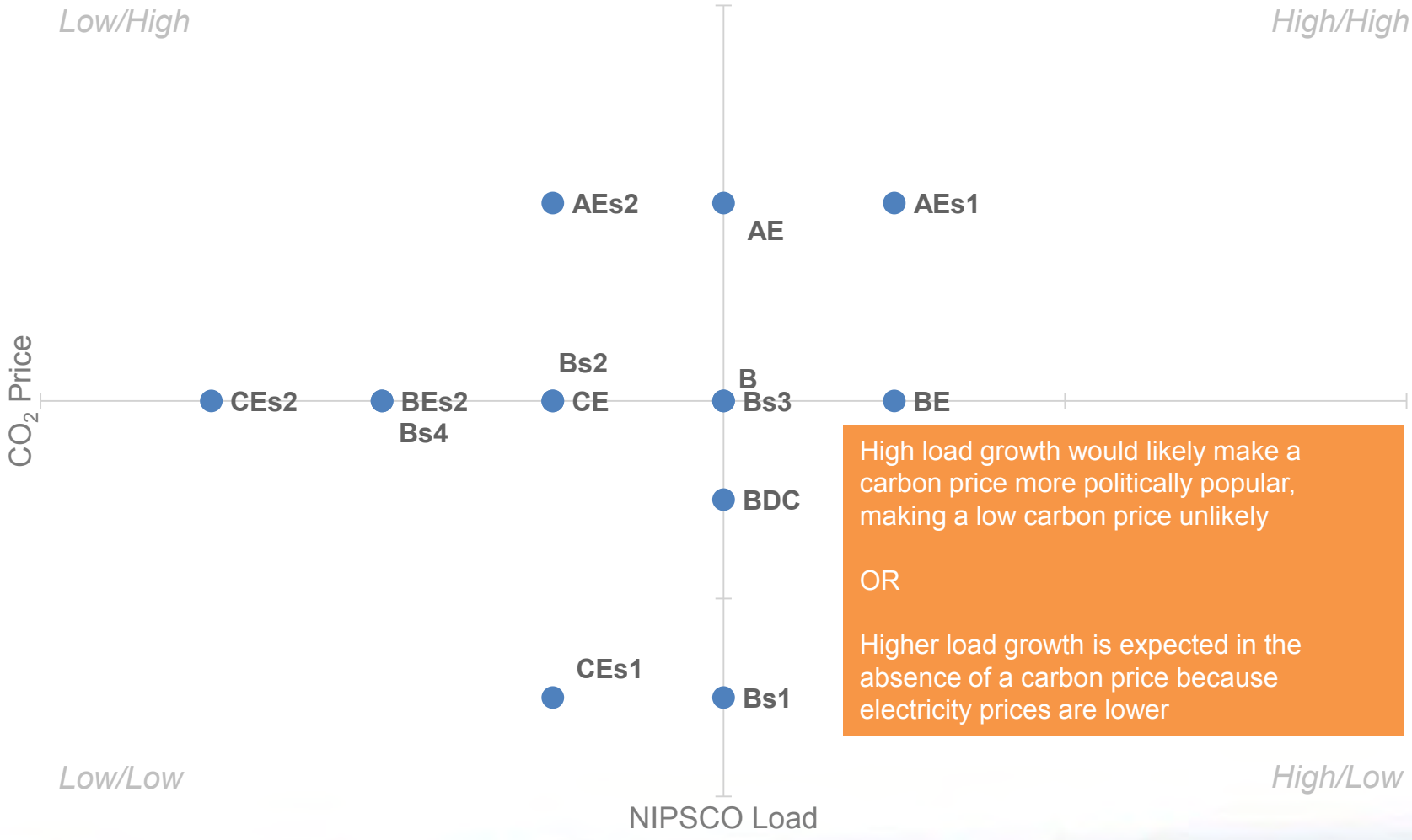
Sources and Notes: 1.) The Business As Usual scenario (BAU1) assumes no RPS in Indiana

NIPSCO Load / Natural Gas Price



Lower gas prices would suggest reduced gas demand nationally while load grew in Northwest Indiana
OR
Lower gas prices would mean lower electricity prices, encouraging a higher load

NIPSCO Load / CO_2 Price

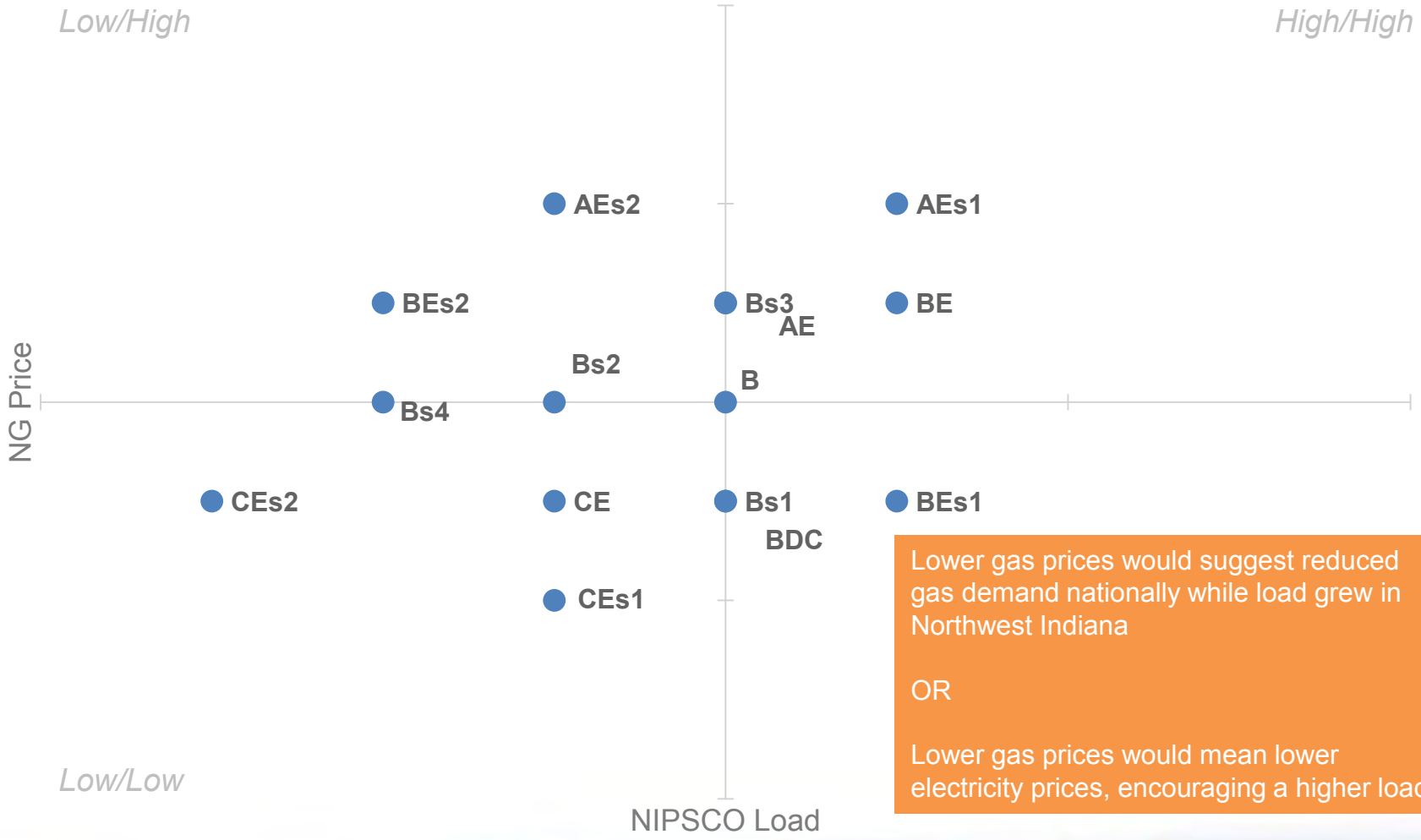


High load growth would likely make a carbon price more politically popular, making a low carbon price unlikely

OR

Higher load growth is expected in the absence of a carbon price because electricity prices are lower

NIPSCO Load / Electricity Price

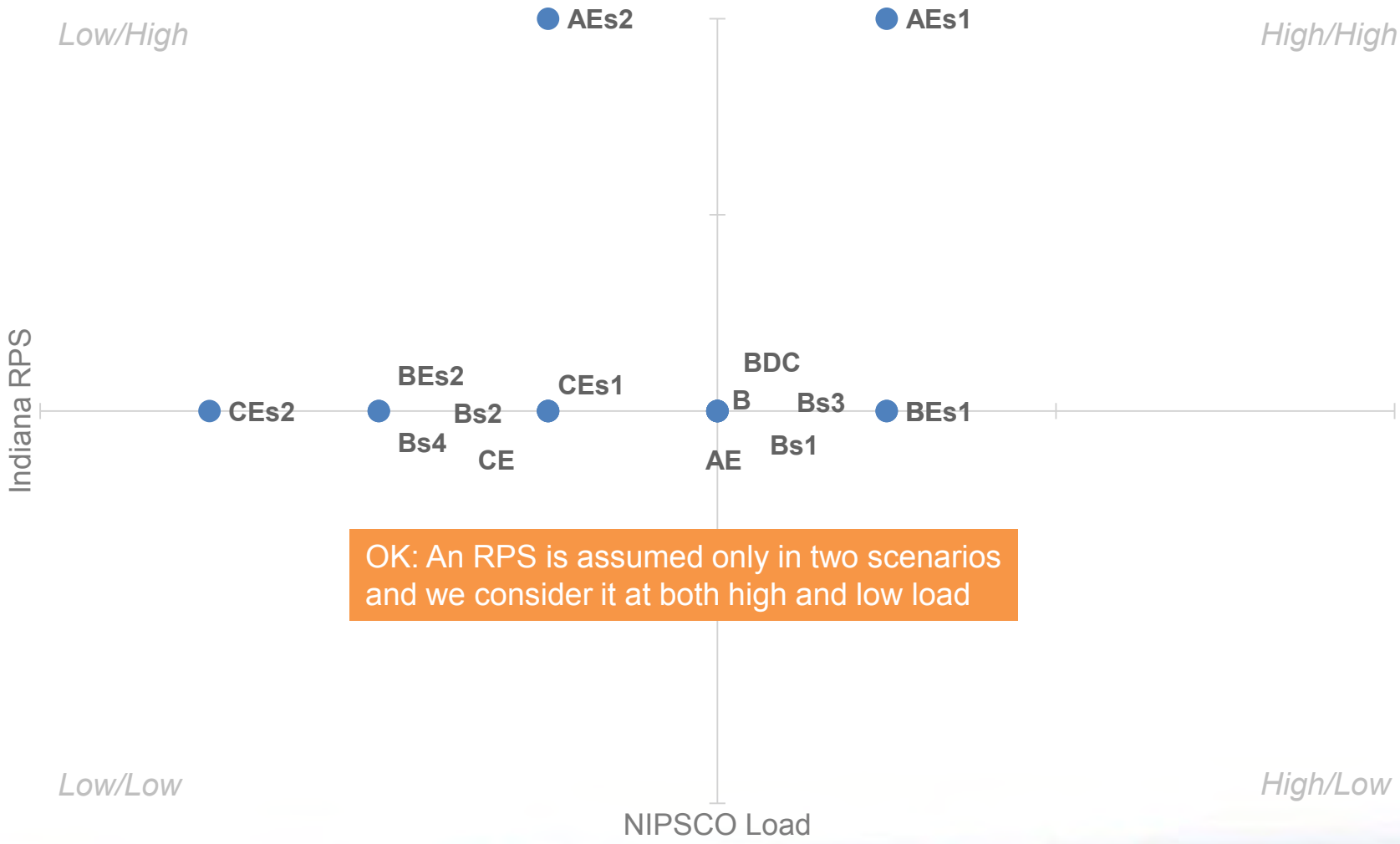


Lower gas prices would suggest reduced gas demand nationally while load grew in Northwest Indiana

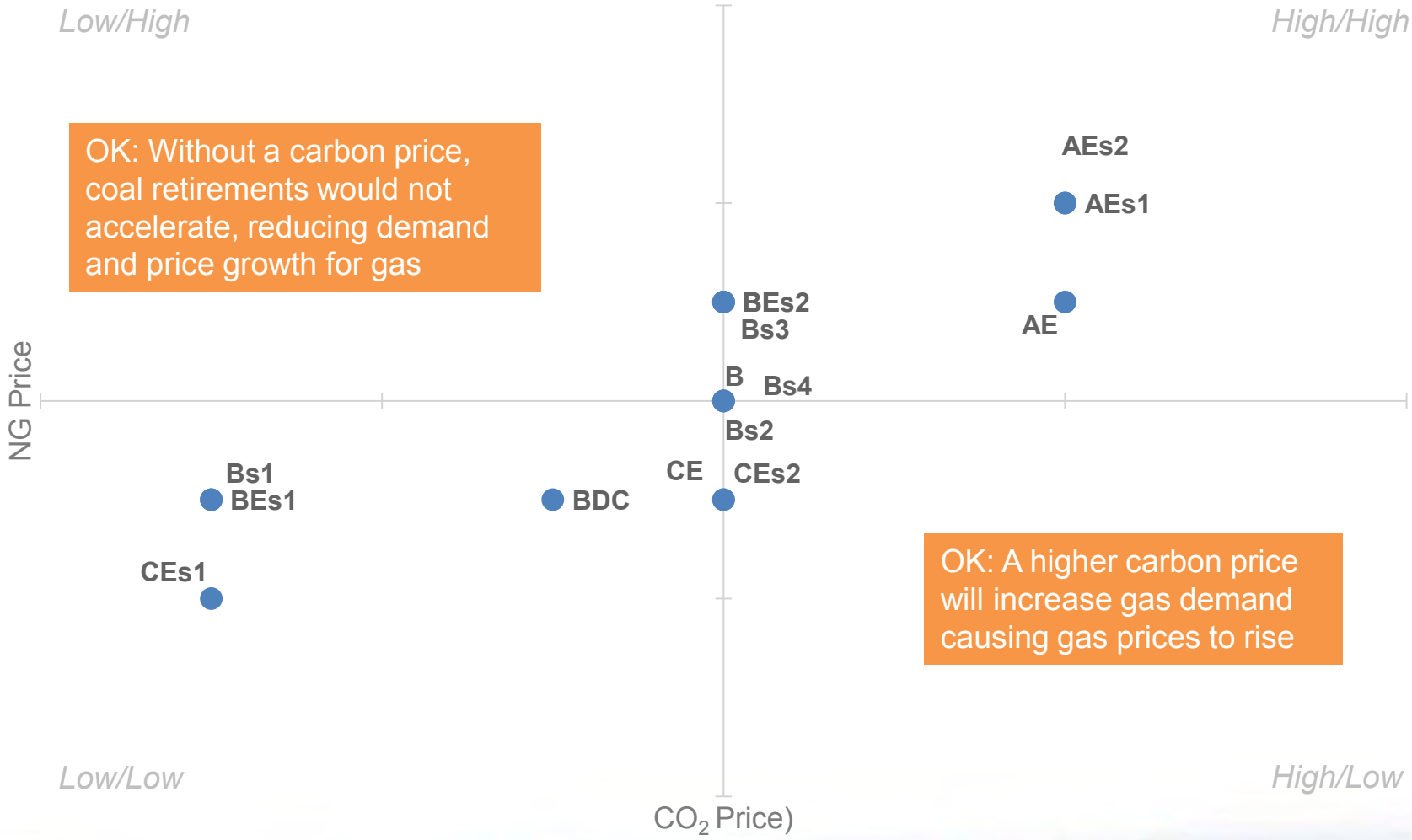
OR

Lower gas prices would mean lower electricity prices, encouraging a higher load

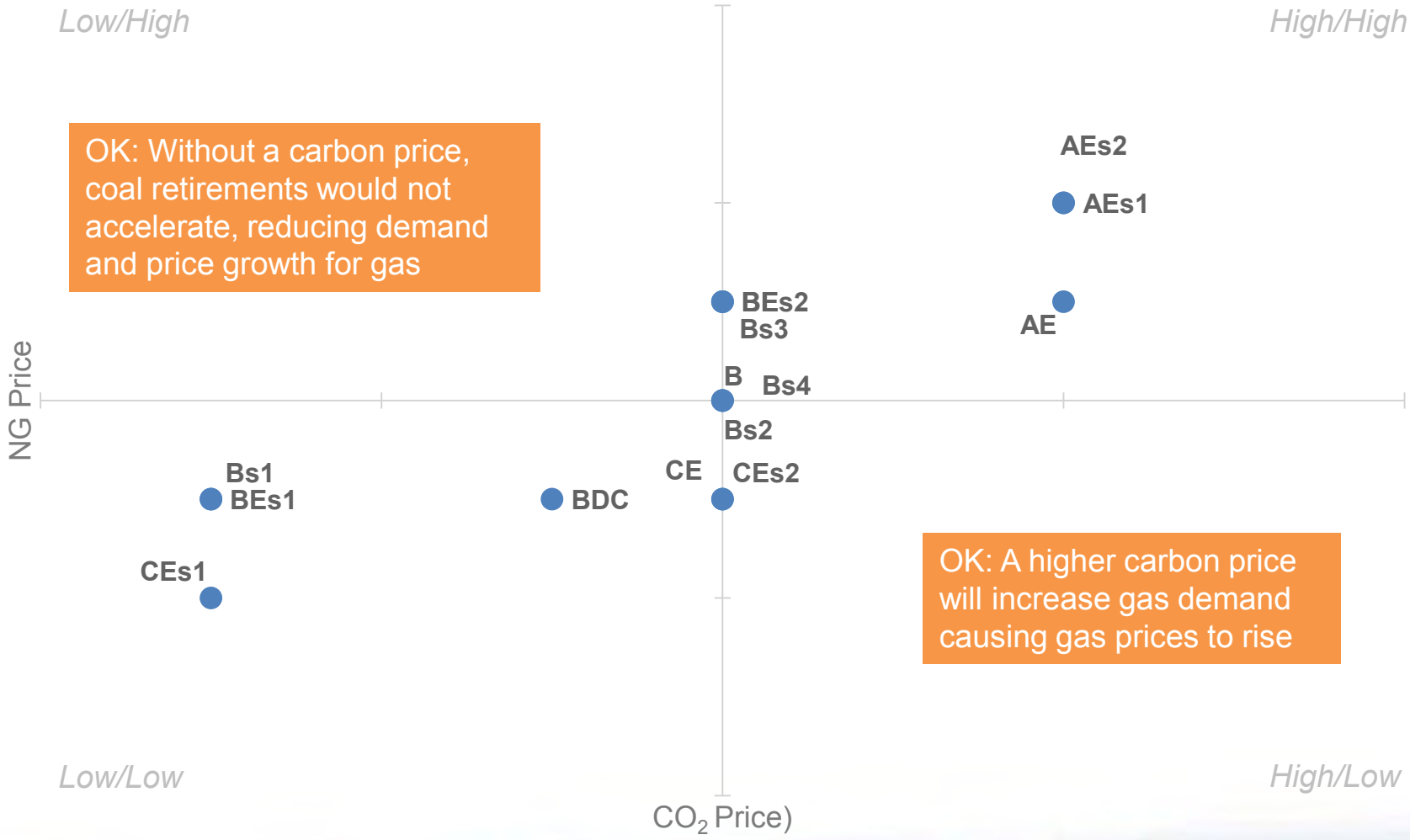
NIPSCO Load / Indiana RPS



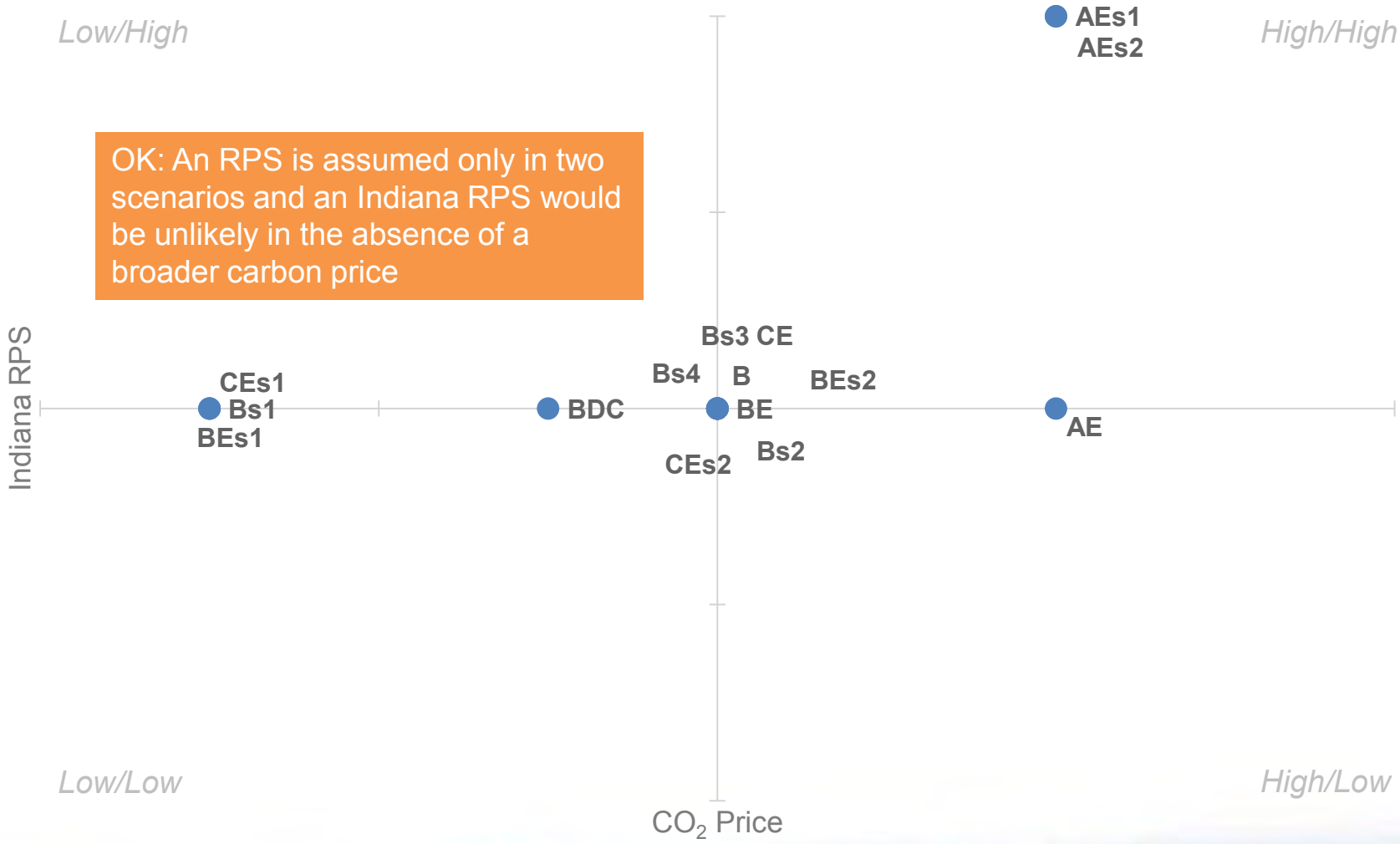
CO_2 Price / Natural Gas Price



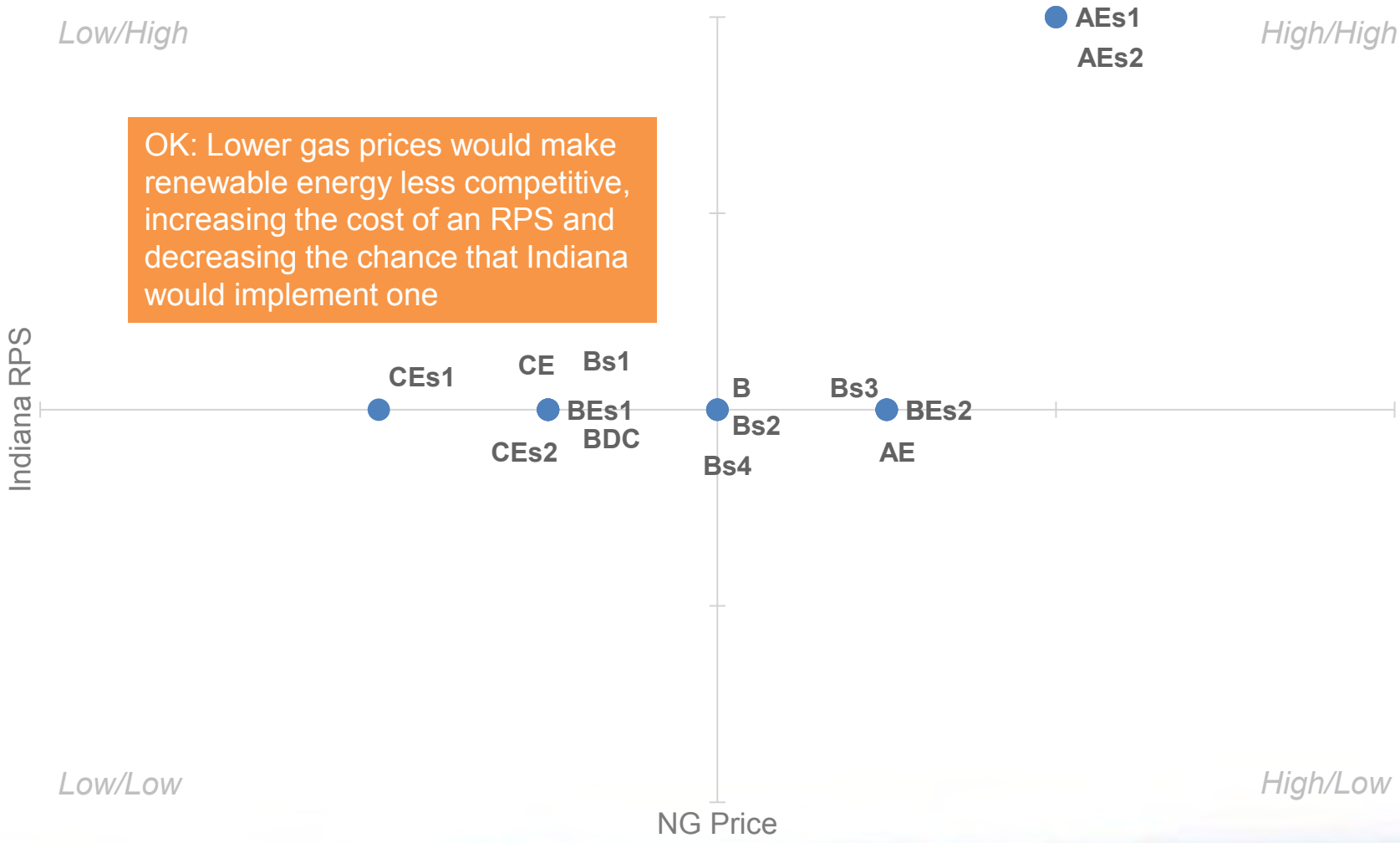
CO_2 Price / Electricity Price



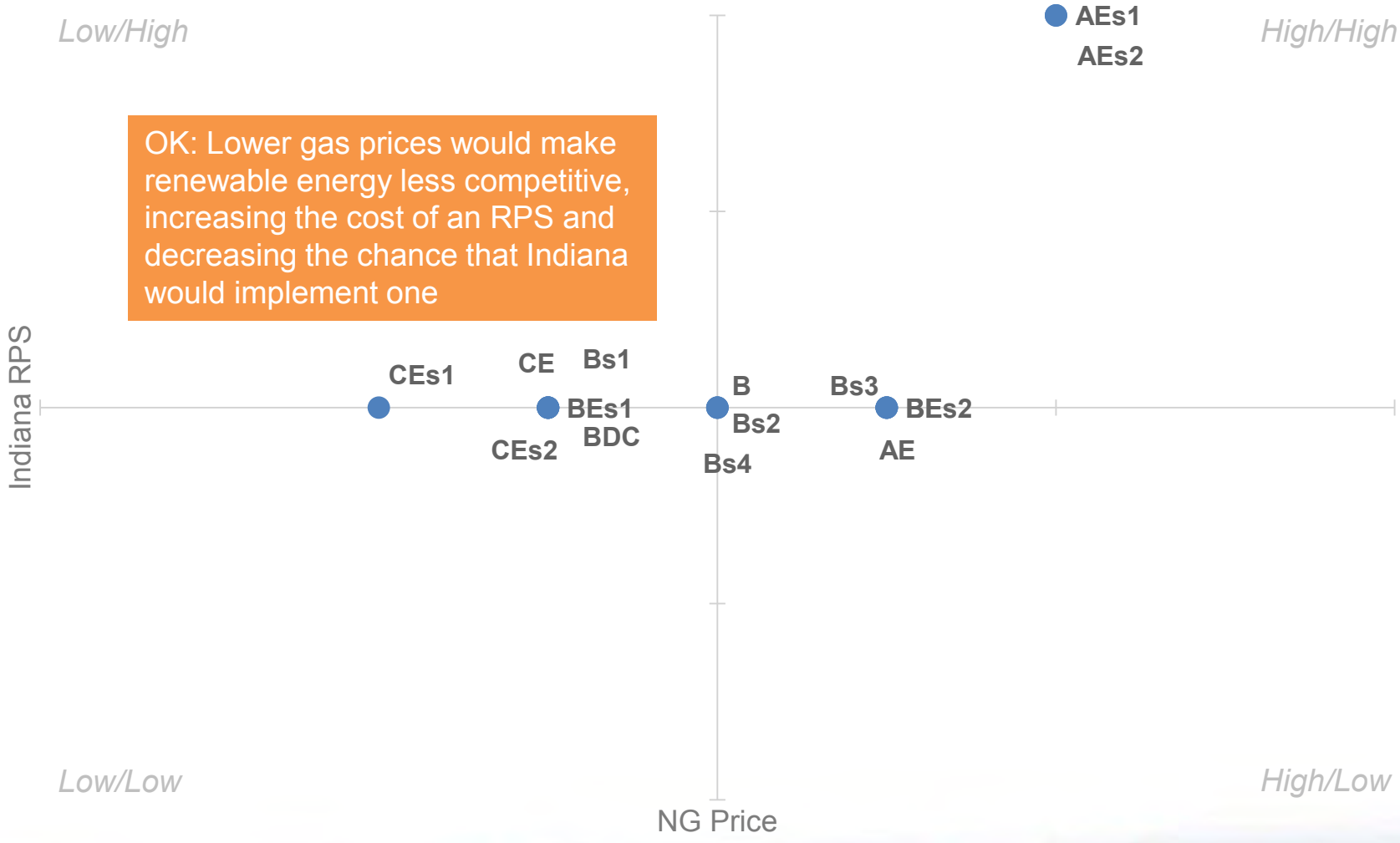
CO_2 Price / Indiana RPS



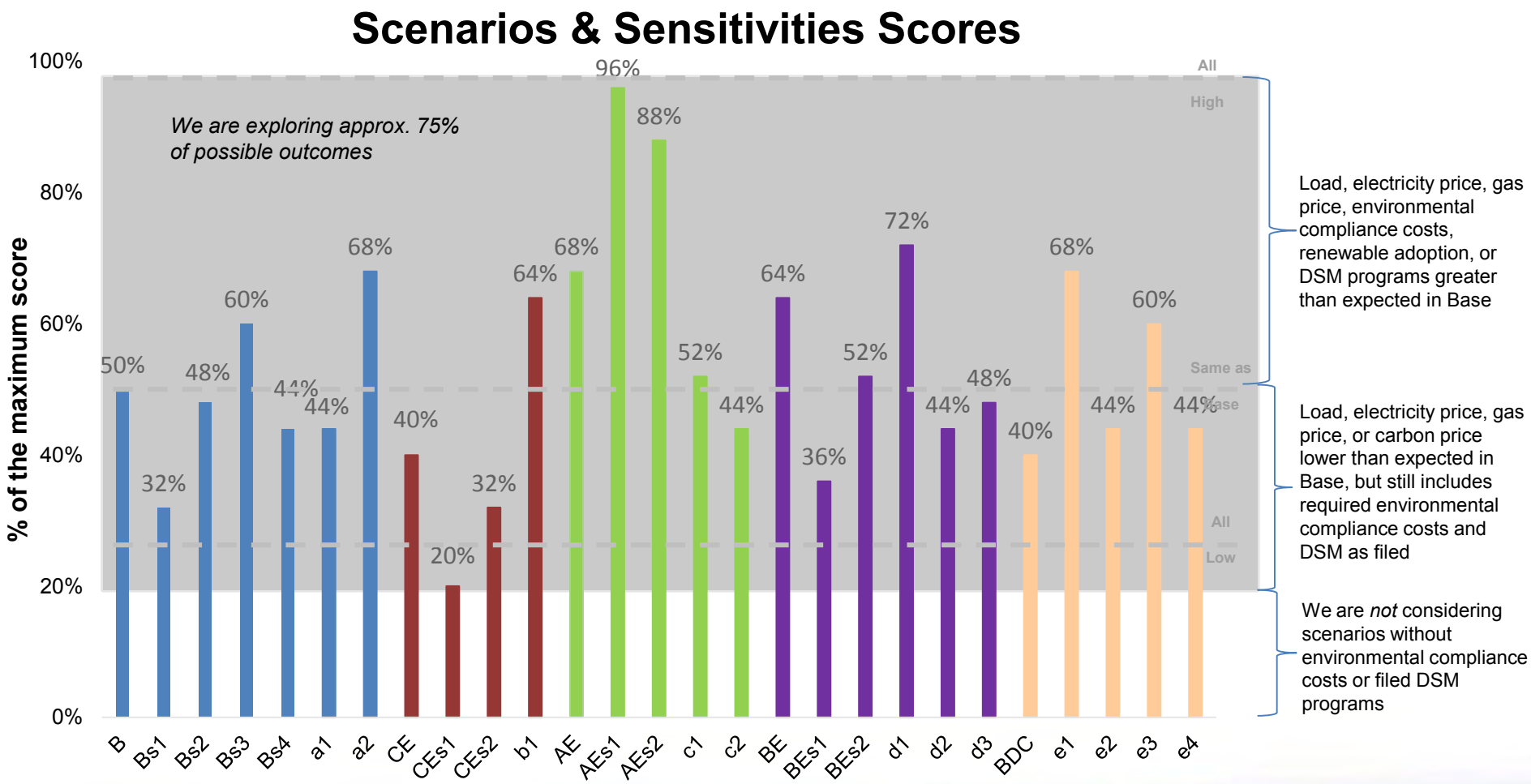
NG Price / Indiana RPS



Electricity Price / Indiana RPS



Scenario Variable Diversity Analysis with IURC Cases



Appendix F: Exhibit 2 – Sensitivity Modeling Results

The analysis of each of the sensitivity results in a mix of portfolio of supply-side and demand-side resources. The tables which follow show the incremental resources added throughout the planning period.

Base No CO_2 Price Sensitivity Results

Base No CO_2 Price Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Base No CO_2 Price Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Base No CO_2 Price Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	1,258	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$10.35
	DSM	529	530	531	532	533	534	535	536	537	538	539	540	541	542	542	543	543	543	543	543	544	542	
	Purchases	-	-	180	196	212	227	245	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	529	530	711	728	746	762	780	1,794	537	538	539	540	541	542	542	543	543	543	543	1,172	544	542	
Renewable Focus	Gas	-	-	-	-	-	-	-	822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$13.87
	Wind	-	-	-	-	-	-	-	8	8	16	16	16	16	16	16	8	16	16	16	79	8	16	
	Solar	-	-	-	-	-	-	-	128	13	-	-	-	-	-	-	-	-	-	-	370	-	-	
	Battery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
	CHP	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	DSM	529	530	531	532	533	534	535	536	537	538	539	540	541	542	542	543	543	543	543	543	544	542	
	Purchases	-	-	180	196	212	227	245	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	529	530	711	728	746	762	780	1,513	558	554	555	556	557	557	558	550	558	559	559	992	552	558	
Low Emission	Gas	-	-	-	-	-	-	-	822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$16.88
	Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	488	-	-	-	-	-	1,987	-	-	
	Biomass	-	-	-	-	-	-	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Recip	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	
	Wind	-	-	-	-	-	-	-	-	8	16	16	8	16	-	-	-	-	-	-	-	-	-	
	Solar	-	-	-	-	-	-	-	115	13	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Battery	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	
	DSM	529	530	531	532	533	534	535	536	537	538	539	540	541	542	542	543	543	543	543	543	544	542	
	Total	529	530	711	728	746	762	780	1,516	558	554	555	550	557	1,029	542	543	543	543	543	2,530	544	542	

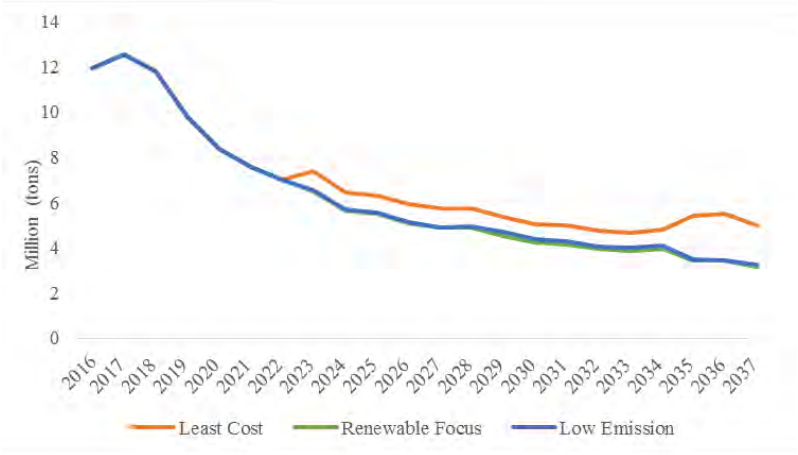
Base No CO_2 Price Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Base No CO_2 Price Sensitivity.

Base No CO_2 Price Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Reciprocating Engine	AP-1000	Small Module Reactor	Greenfield Biomass	Battery Storage (Lithium Ion)	Combined Heat and Power	Onshore Wind	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	1 MW	2,200 MW	540 MW	50 MW	1 MW	20 MW	100 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	.92 MW	1,987 MW	488 MW	43 MW	.97 MW	19 MW	7.9 MW	12.8 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Natural Gas/Methane	Nuclear	Nuclear	Biomass	N/A	Natural Gas	Wind	Solar	N/A
Least Cost	-	3	-	-	-	-	-	-	-	-	8
Renewable	1	1	-	-	-	-	1	1	34	40	8
Low Emission	1	1	1	1	1	1	1	-	8	10	8

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Base No CO_2 Price Sensitivity.

Annual Portfolio CO_2 Emission



Appendix F: Exhibit 2 – Sensitivity Modeling Results

Base Low Load Sensitivity Results

Base Low Load Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Base Low Load Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Base Low Load Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$11.16
	CHP	-	-	-	-	-	-	-	19	-	-	19	-	-	-	19	-	-	-	-	-	-	-	
	DSM	533	541	547	553	553	559	562	566	572	575	578	580	583	586	588	589	590	591	592	590	591	589	
	Total	533	541	547	553	553	559	562	1,214	572	575	597	580	583	586	607	589	590	591	592	1,219	591	589	
Renewable Focus	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	193	-	-	$11.35
	Solar	-	-	-	-	-	-	-	-	-	-	13	-	-	13	-	-	-	-	-	255	-	-	
	Battery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	
	CHP	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	DSM	533	541	547	553	553	559	562	566	572	575	578	580	583	586	588	589	590	591	592	590	591	589	
	Total	533	541	547	553	553	559	562	1,214	572	575	590	580	583	599	588	589	590	591	593	1,038	591	589	
Low Emission	Gas	-	-	-	-	-	-	-	822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$12.01
	Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	488	-	-	
	DSM	533	541	547	553	553	559	562	566	572	575	578	580	583	586	588	589	590	591	592	590	591	589	
	Total	533	541	547	553	553	559	562	1,388	572	575	578	580	583	586	588	589	590	591	592	1,078	591	589	

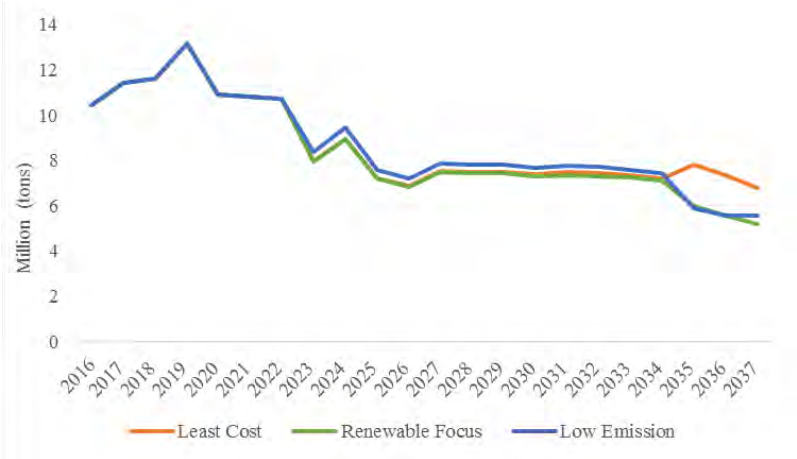
Base Low Load Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Base Low Load Sensitivity.

Base Low Load Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Small Module Reactor	Battery Storage (Lithium Ion)	Combined Heat and Power	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	540 MW	1 MW	20 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	488 MW	.97 MW	19 MW	12.8 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Nuclear	N/A	Natural Gas	Solar	N/A
Least Cost	-	2	-	-	3	-	16
Renewable	1	1	-	1	1	22	16
Low Emission	1	1	1	-	-	-	16

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Base Low Load Sensitivity.

Annual Portfolio CO_2 Emission



Appendix F: Exhibit 2 – Sensitivity Modeling Results

Base High Gas Price Sensitivity Results

Base High Gas Price Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Base High Gas Price Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Base High Gas Price Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	1,258	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$13.78
	DSM	533	538	543	548	546	549	553	556	562	565	567	570	572	575	577	578	580	580	581	579	580	588	
	Purchases	-	-	167	180	199	211	226	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	533	538	710	727	745	760	779	1,814	562	565	567	570	572	575	577	578	580	580	581	1,208	580	588	
Renewable Focus	Gas	-	-	-	-	-	-	-	822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$15.69
	Wind	-	-	-	-	-	-	-	-	0.01	16	-	16	16	16	8	8	16	16	16	79	8	8	
	Solar	-	-	-	-	-	-	-	115	13	-	13	-	-	-	-	-	-	-	-	370	-	-	
	Battery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	
	CHP	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	DSM	533	538	543	548	546	549	553	556	562	565	567	570	572	575	577	578	580	580	581	579	580	588	
	Purchases	-	-	167	180	199	211	226	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	533	538	710	727	745	760	779	1,512	575	581	580	586	588	591	585	587	596	596	597	1,028	588	595	
Low Emission	Gas	-	-	-	-	-	-	-	822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$17.93
	Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	488	-	-	1,987	-	
	Biomass	-	-	-	-	-	-	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Recip	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Wind	-	-	-	-	-	-	-	-	-	16	-	-	16	16	16	8	8	-	-	-	-	-	
	Solar	-	-	-	-	-	-	-	89	13	-	13	13	-	-	-	-	-	-	-	-	-	-	
	Battery	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
	DSM	533	538	543	548	546	549	553	556	562	565	567	570	572	575	577	578	580	580	581	579	580	588	
	Purchases	-	-	167	180	199	211	226	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	533	538	710	727	745	760	779	1,511	576	581	580	583	588	591	593	586	588	1,068	581	579	2,567	588	

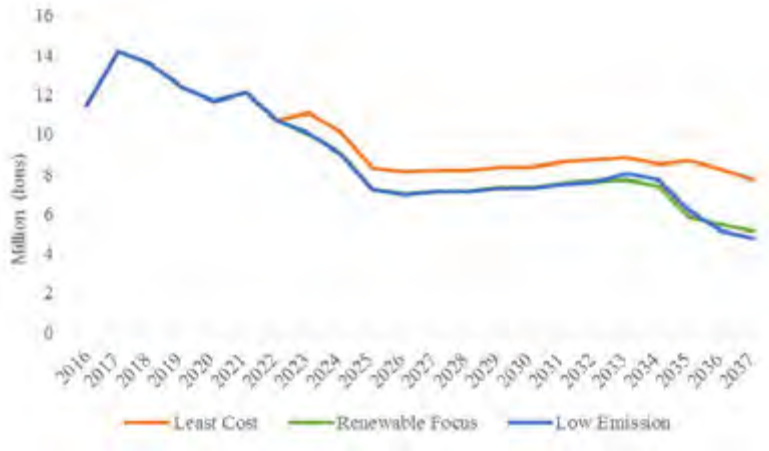
Base High Gas Price Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Base High Gas Price Sensitivity.

Base High Gas Price Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Reciprocating Engine	AP-1000	Small Module Reactor	Greenfield Biomass	Battery Storage (Lithium Ion)	Combined Heat and Power	Onshore Wind	Onshore Wind	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	1 MW	2,200 MW	540 MW	50 MW	1 MW	20 MW	100 MW	1.7 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	.92 MW	1,987 MW	488 MW	43 MW	.97 MW	19 MW	7.9 MW	.01 MW	12.8 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Natural Gas/Methane	Nuclear	Nuclear	Biomass	N/A	Natural Gas	Wind	Wind	Solar	N/A
Least Cost	-	3	-	-	-	-	-	-	-	-	-	13
Renewable	1	1	-	-	-	-	1	1	28	1	40	13
Low Emission	1	1	1	1	1	1	1	-	10	-	10	13

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the High Gas Price Sensitivity.

Annual Portfolio CO_2 Emission



Appendix F: Exhibit 2 – Sensitivity Modeling Results

Base Loss of Major Industrial Load Sensitivity Results

Base Loss of Major Industrial Load Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Base Loss of Major Industrial Load Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Base Loss of Major Industrial Load Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$7.93
	CHP	-	-	-	-	-	-	-	-	19	19	19	19	-	19	19	-	19	19	19	-	-	-	
	DSM	3	6	9	11	10	12	14	16	18	20	21	23	24	26	27	27	27	27	28	30	31	41	
	Total	3	6	9	11	10	12	14	645	37	39	40	42	24	45	46	27	46	46	47	659	31	41	
Renewable Focus	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$11.57
	Wind	-	-	-	-	-	-	-	-	14	14	14	14	14	14	14	5	5	3	0.1	-	-	-	
	Solar	-	-	-	-	-	-	-	-	-	3	1	-	1	-	-	6	7	14	12	-	-	-	
	DSM	3	6	9	11	10	12	14	16	18	20	21	23	24	26	27	27	27	27	28	30	31	41	
	Total	3	6	9	11	10	12	14	645	32	37	37	37	39	40	41	38	39	44	40	659	31	41	
Low Emission	Gas	-	-	-	-	-	-	-	629	193	-	-	-	-	-	-	-	-	-	-	-	-	-	$8.72
	Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	488	-	-	
	DSM	3	6	9	11	10	12	14	16	18	20	21	23	24	26	27	27	27	27	28	30	31	41	
	Total	3	6	9	11	10	12	14	645	212	20	21	23	24	26	27	27	27	27	28	518	31	41	

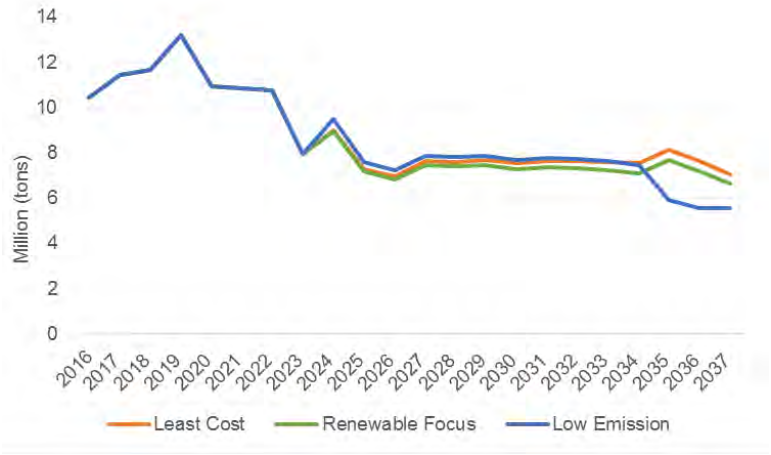
Base Loss of Major Industrial Load Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Base Loss of Major Industrial Load Sensitivity.

Base Loss of Major Industrial Load Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Small Module Reactor	Combined Heat and Power	Onshore Wind	Onshore Wind	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	540 MW	20 MW	100 MW	1.7 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	488 MW	19 MW	7.9 MW	.01 MW	1.4 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Nuclear	Natural Gas	Wind	Wind	Solar	N/A
Least Cost	-	2	-	9	-	-	-	13
Renewable	-	2	-	-	40	1	32	13
Low Emission	1	1	1	-	-	-	-	13

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Base Loss of Major Industrial Load Sensitivity.

Annual Portfolio CO_2 Emission



Appendix F: Exhibit 2 – Sensitivity Modeling Results

Challenged Economy No CO_2 Price Sensitivity Results

Challenged Economy No CO_2 Price Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Challenged Economy No CO_2 Price Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Challenged Economy No CO_2 Price Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$8.51
	CHP	-	-	-	-	-	-	-	-	-	-	19	-	-	-	19	-	-	-	-	-	-	-	
	DSM	530	552	559	566	574	581	584	587	591	593	596	599	601	604	607	608	608	609	610	610	611	571	
	Total	530	552	559	566	574	581	584	1,216	591	593	615	599	601	604	626	608	608	609	610	1,240	611	571	
Renewable Focus	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	193	-	-	$8.68
	Solar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-	242	-	38	
	CHP	-	-	-	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	
	DSM	530	552	559	566	574	581	584	587	591	593	596	599	601	604	607	608	608	609	610	610	611	571	
	Total	530	552	559	566	574	581	584	1,216	591	593	615	599	601	604	619	608	608	609	610	1,046	611	610	
Low Emission	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$9.18
	Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	488	-	-	
	Recip	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	
	Solar	-	-	-	-	-	-	-	-	-	-	13	-	-	13	-	-	-	-	-	-	-	-	
	DSM	530	552	559	566	574	581	584	587	591	593	596	599	601	604	607	608	608	609	610	610	611	571	
	Total	530	552	559	566	574	581	584	1,216	591	593	609	599	601	617	607	608	608	609	611	1,098	611	571	

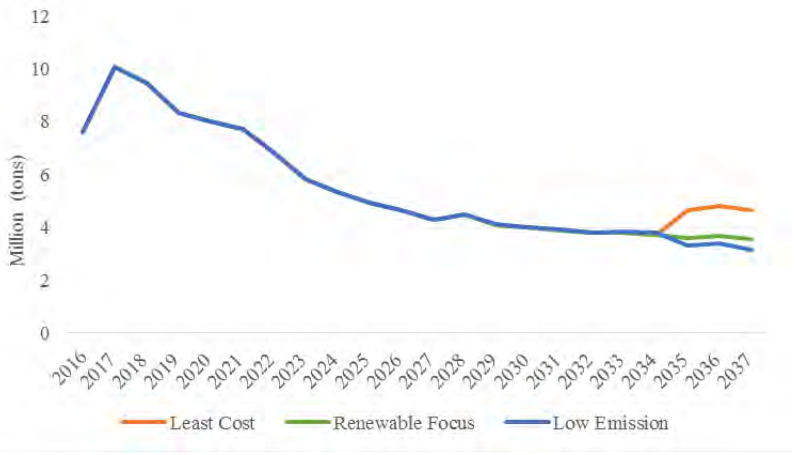
Challenged Economy No CO_2 Price Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Challenged Economy No CO_2 Price Sensitivity.

Challenged Economy No CO_2 Price Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Reciprocating Engine	Small Module Reactor	Combined Heat and Power	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	1 MW	540 MW	20 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	.92 MW	488 MW	19 MW	12.8 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Natural Gas/Methane	Nuclear	Natural Gas	Solar	N/A
Least Cost	-	2	-	-	2	-	10
Renewable	1	1	-	-	1	23	10
Low Emission	-	1	1	1	-	2	10

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Challenged Economy No CO_2 Price Sensitivity.

Annual Portfolio CO_2 Emission



Appendix F: Exhibit 2 – Sensitivity Modeling Results

Challenged Economy Loss of Major Industrial Load Sensitivity Results

Challenged Economy Loss of Major Industrial Load Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Challenged Economy Loss of Major Industrial Load Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Challenged Economy Loss of Major Industrial Load Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$7.00
	DSM	2	4	6	8	9	11	12	14	16	17	19	20	22	23	24	25	25	25	25	27	28	35	
	Total	2	4	6	8	9	11	12	643	16	17	19	20	22	23	24	25	25	25	25	656	28	35	
Renewable Focus	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	193	-	-	$8.30
	Wind	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	110	-	-	
	Solar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33	-	-	
	CHP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	-	-	
	DSM	2	4	6	8	9	11	12	14	16	17	19	20	22	23	24	25	25	25	25	27	28	35	
	Total	2	4	6	8	9	11	12	643	16	17	19	20	22	23	24	25	25	25	25	383	28	35	
Low Emission	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$7.61
	Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	488	-	-	
	DSM	2	4	6	8	9	11	12	14	16	17	19	20	22	23	24	25	25	25	25	27	28	35	
	Total	2	4	6	8	9	11	12	643	16	17	19	20	22	23	24	25	25	25	25	515	28	35	

Challenged Economy Loss of Major Industrial Load Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Challenged Economy Loss of Major Industrial Load Sensitivity.

Challenged Economy Loss of Major Industrial Load Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Small Module Reactor	Combined Heat and Power	Onshore Wind	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	540 MW	20 MW	100 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	488 MW	19 MW	7.9 MW	1.4 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Nuclear	Natural Gas	Wind	Solar	N/A
Least Cost	-	2	-	-	-	-	12
Renewable	1	1	-	1	40	24	12
Low Emission	-	1	1	-	-	-	12

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Challenged Economy Loss of Major Industrial Load Sensitivity.

Annual Portfolio CO_2 Emission

Appendix F: Exhibit 2 – Sensitivity Modeling Results

Aggressive Environmental High Renewables & Increasing Load Sensitivity Results

Aggressive Environmental High Renewables & Increasing Load Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Aggressive Environmental High Renewables & Increasing Load Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Aggressive Environmental High Renewables & Increasing Load Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	1,258	-	-	-	-	-	-	-	-	-	-	629	-	-	-	$18.36
	Wind	-	-	-	-	-	-	-	-	-	118	-	-	-	-	-	-	-	-	-	-	-	-	
	CHP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	19	19	19	-	-	-	-	
	DSM	550	560	568	577	579	587	594	602	612	619	625	631	637	644	650	655	662	667	671	672	675	656	
	Purchases	-	-	367	382	397	416	445	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	550	560	936	959	976	1,003	1,039	1,860	612	737	625	631	637	644	669	674	681	686	1,300	672	675	656	
Renewable Focus	Gas	-	-	-	-	-	-	-	822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$22.48
	Wind	-	-	-	-	-	-	-	355	39	39	-	39	39	-	39	39	-	39	39	316	39	39	
	Solar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	128	-	-	
	CHP	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	DSM	550	560	568	577	579	587	594	602	612	619	625	631	637	644	650	655	662	667	671	672	675	656	
	Purchases	-	-	367	382	397	416	445	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	550	560	936	959	976	1,003	1,039	1,798	651	658	625	670	677	644	690	695	662	707	711	1,115	715	696	
Low Emission	Gas	-	-	-	-	-	-	-	822	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$21.23
	Wind	-	-	-	-	-	-	-	118	39	39	-	39	39	-	39	39	-	39	-	-	-	-	
	Solar	-	-	-	-	-	-	-	255	-	-	-	-	-	-	-	-	-	-	128	383	-	128	
	Battery	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	
	DSM	550	560	568	577	579	587	594	602	612	619	625	631	637	644	650	655	662	667	671	672	675	656	
	Purchases	-	-	367	382	397	416	445	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	550	560	936	959	976	1,003	1,039	1,797	651	658	626	670	677	644	690	695	662	707	799	1,055	675	784	

Aggressive Environmental High Renewables & Increasing Load Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Aggressive Environmental High Renewables & Increasing Load Sensitivity.

Aggressive Environmental High Renewables & Increasing Load Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Battery Storage (Lithium Ion)	Combined Heat and Power	Onshore Wind	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	1 MW	20 MW	100 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	.97 MW	19 MW	7.9 MW	12.8 MW	N/A
Fuel Type	Natural Gas	Natural Gas	N/A	Natural Gas	Wind	Solar	N/A
Least Cost	-	3	-	4	15	-	19
Renewable	1	1	-	1	135	10	19
Low Emission	1	1	1	-	50	70	19

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Aggressive Environmental High Renewables & Increasing Load Sensitivity.

Annual Portfolio CO_2 Emission

Appendix F: Exhibit 2 – Sensitivity Modeling Results

Aggressive Environmental High Renewables & Decreasing Load Sensitivity Results

Aggressive Environmental High Renewables & Decreasing Load Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Aggressive Environmental High Renewables & Decreasing Load Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Aggressive Environmental High Renewables & Decreasing Load Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$14.21
	Wind	-	-	-	-	-	-	-	-	-	79	-	-	-	-	-	-	-	-	-	-	-	-	
	CHP	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	DSM	534	541	547	553	553	558	562	567	572	576	579	582	585	588	591	592	594	595	595	594	594	595	
	Total	534	541	547	553	553	558	562	1,215	572	655	579	582	585	588	591	592	594	595	595	1,223	594	595	
Renewable Focus	Wind	-	-	-	-	-	-	-	395	-	-	39	-	-	-	-	-	-	-	-	316	-	-	$18.52
	Solar	-	-	-	-	-	-	-	255	-	-	-	-	-	-	-	-	-	-	-	128	-	-	
	DSM	534	541	547	553	553	558	562	567	572	576	579	582	585	588	591	592	594	595	595	594	594	595	
	Total	534	541	547	553	553	558	562	1,216	572	576	619	582	585	588	591	592	594	595	595	1,037	594	595	
Low Emission	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	193	-	-	$14.76
	Wind	-	-	-	-	-	-	-	39	-	39	-	-	-	-	-	-	-	-	-	237	-	-	
	DSM	534	541	547	553	553	558	562	567	572	576	579	582	585	588	591	592	594	595	595	594	594	595	
	Total	534	541	547	553	553	558	562	1,235	572	616	579	582	585	588	591	592	594	595	595	1,024	594	595	

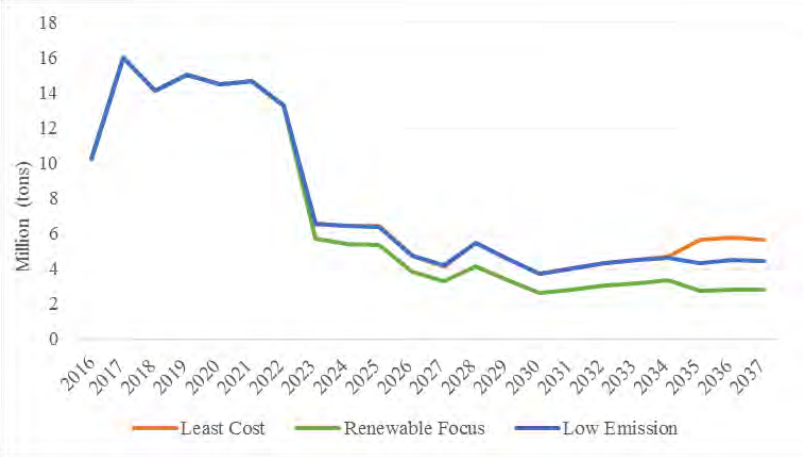
Aggressive Environmental High Renewables & Decreasing Load Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Aggressive Environmental High Renewables & Decreasing Load Sensitivity.

Aggressive Environmental High Renewables & Decreasing Load Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Combined Heat and Power	Onshore Wind	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	20 MW	100 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	19 MW	7.9 MW	12.8 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Natural Gas	Wind	Solar	N/A
Least Cost	-	2	1	10	-	17
Renewable	-	-	-	95	30	17
Low Emission	1	1	-	40	-	17

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Aggressive Environmental High Renewables & Decreasing Load Sensitivity.

Annual Portfolio CO_2 Emission



Appendix F: Exhibit 2 – Sensitivity Modeling Results

Booming Economy No CO_2 Price Sensitivity Results

Booming Economy No CO_2 Price Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Booming Economy No CO_2 Price Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Booming Economy No CO_2 Price Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	1,258	-	-	-	-	193	-	-	-	-	-	-	629	-	-	$11.37
	CHP	-	-	-	-	-	-	-	-	-	19	19	19	-	-	-	-	-	-	-	-	-	-	
	DSM	547	554	560	566	573	580	586	592	600	606	612	617	623	629	635	640	646	651	654	657	660	633	
	Purchases	-	-	376	393	403	423	454	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	547	554	936	959	976	1,003	1,040	1,850	600	625	631	636	816	629	635	640	646	651	654	1,286	660	633	
Renewable Focus	Gas	-	-	-	-	-	-	-	1,015	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$13.93
	Wind	-	-	-	-	-	-	-	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Solar	-	-	-	-	-	-	-	128	38	26	26	26	26	38	26	13	26	26	38	-	-	-	
	Battery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	
	CHP	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	DSM	547	554	560	566	573	580	586	592	600	606	612	617	623	629	635	640	646	651	654	657	660	633	
	Purchases	-	-	376	393	403	423	454	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	547	554	936	959	976	1,003	1,040	1,794	638	631	637	643	649	667	661	653	671	677	692	1,286	660	633	
Low Emission	Gas	-	-	-	-	-	-	-	1,015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$18.95
	Nuclear	-	-	-	-	-	-	-	-	-	488	-	-	-	-	-	-	-	-	-	1,987	-	-	
	Biomass	-	-	-	-	-	-	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Wind	-	-	-	-	-	-	-	16	32	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Solar	-	-	-	-	-	-	-	128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Battery	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
	DSM	547	554	560	566	573	580	586	592	600	606	612	617	623	629	635	640	646	651	654	657	660	633	
	Purchases	-	-	376	393	403	423	454	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	547	554	936	959	976	1,003	1,040	1,794	633	1,093	612	617	623	629	635	640	646	651	654	2,644	660	633	

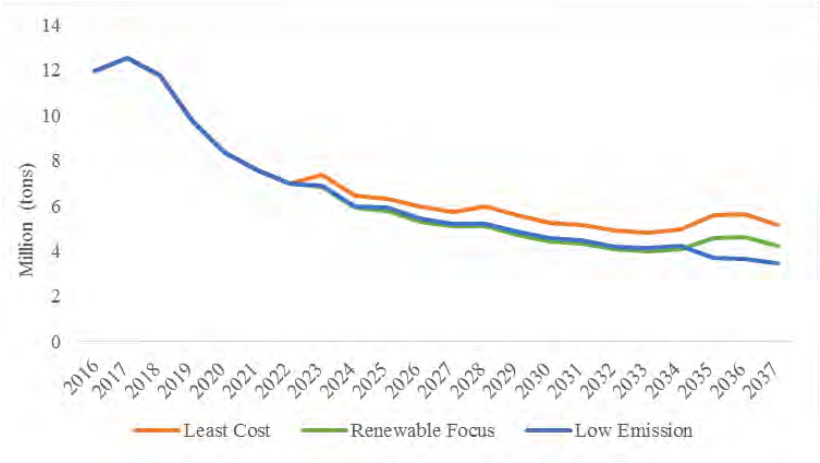
Booming Economy No CO_2 Price Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Booming Economy No CO_2 Price Sensitivity.

Booming Economy No CO_2 Price Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	AP-1000	Small Module Reactor	Greenfield Biomass	Battery Storage (Lithium Ion)	Combined Heat and Power	Onshore Wind	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	2,200 MW	540 MW	50 MW	1 MW	20 MW	100 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	1,987 MW	488 MW	43 MW	.97 MW	19 MW	7.9 MW	12.8 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Nuclear	Nuclear	Biomass	N/A	Natural Gas	Wind	Solar	N/A
Least Cost	1	3	-	-	-	-	3	-	-	12
Renewable	2	2	-	-	-	1	1	5	34	12
Low Emission	2	1	1	1	1	1	-	6	10	12

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Booming Economy No CO_2 Price Sensitivity.

Annual Portfolio CO_2 Emission



Appendix F: Exhibit 2 – Sensitivity Modeling Results

Booming Economy Loss of Major Industrial Load Sensitivity Results

Booming Economy Loss of Major Industrial Load Sensitivity Expansion Plan shows the resources selected as a result of the optimization of the Booming Economy Loss of Major Industrial Load Sensitivity and grouped by the three strategies or portfolios. The Net Present Value of Revenue Requirements (NPVRR) associated with each portfolio is also indicated.

Booming Economy Loss of Major Industrial Load Sensitivity Expansion Plan

Portfolio	Resources	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	NPVRR ($Billion)
Least Cost	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$8.15
	CHP	-	-	-	-	-	-	-	-	19	19	19	19	-	19	19	-	19	19	19	-	-	-	
	DSM	3	6	9	11	10	12	14	16	18	20	21	23	24	26	27	27	27	27	28	30	31	41	
	Total	3	6	9	11	10	12	14	645	37	39	40	42	24	45	46	27	46	46	47	659	31	41	
Renewable Focus	Gas	-	-	-	-	-	-	-	629	-	-	-	-	-	-	-	-	-	-	-	629	-	-	$11.25
	Wind	-	-	-	-	-	-	-	-	14	14	14	14	14	14	14	5	5	3	0.1	-	-	-	
	Solar	-	-	-	-	-	-	-	-	-	3	1	-	1	-	-	6	7	14	12	-	-	-	
	DSM	3	6	9	11	10	12	14	16	18	20	21	23	24	26	27	27	27	27	28	30	31	41	
	Total	3	6	9	11	10	12	14	645	32	37	37	37	39	40	41	38	39	44	40	659	31	41	
Low Emission	Gas	-	-	-	-	-	-	-	629	193	-	-	-	-	-	-	-	-	-	-	-	-	-	$8.94
	Nuclear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	488	-	-	
	DSM	3	6	9	11	10	12	14	16	18	20	21	23	24	26	27	27	27	27	28	30	31	41	
	Total	3	6	9	11	10	12	14	645	212	20	21	23	24	26	27	27	27	27	28	518	31	41	

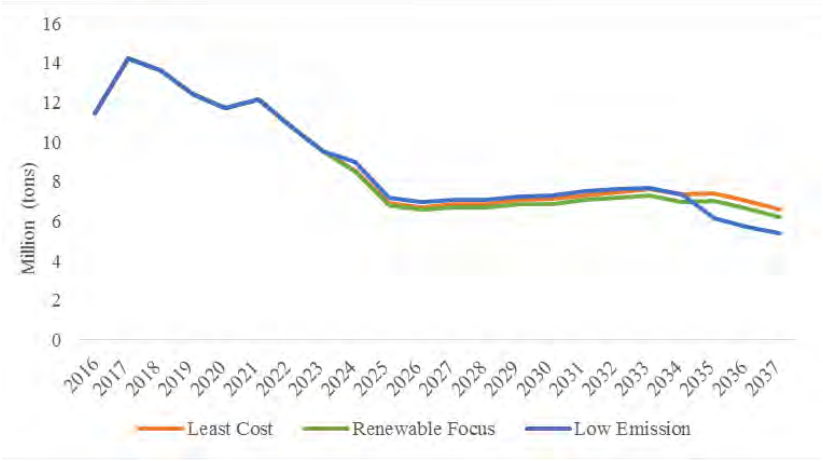
Booming Economy Loss of Major Industrial Load Sensitivity Number of Selected Resources by Portfolio shows the number of resources selected in the respective portfolios as a result of the optimization of the Booming Economy Loss of Major Industrial Load Sensitivity.

Booming Economy Loss of Major Industrial Load Sensitivity Number of Selected Resources by Portfolio

Alternative	Brownfield CT	Brownfield CCGT	Small Modular Reactor	Combined Heat and Power	Onshore Wind	Onshore Wind	Utility Solar	Incremental DSM
Nameplate Capacity	240 MW	700 MW	540 MW	20 MW	100 MW	1.7 MW	50 MW	N/A
Firm Capacity	193 MW	629 MW	488 MW	19 MW	7.9 MW	.01 MW	1.4 MW	N/A
Fuel Type	Natural Gas	Natural Gas	Nuclear	Natural Gas	Wind	Wind	Solar	N/A
Least Cost	-	2	-	9	-	-	-	13
Renewable	-	2	-	-	40	1	32	13
Low Emission	1	1	1	-	-	-	-	13

Annual CO_2 Emission shows the associated annual CO_2 emissions associated with each of the three portfolios associated with the Booming Economy Loss of Major Industrial Load Sensitivity.

Annual Portfolio CO_2 Emission



Appendix F: Exhibit 2 – Sensitivity Modeling Results

Summary Sensitivity Cumulative Energy Mix

Cumulative 2015-2037 Energy Mix shows what percent of total NIPSCO customer energy requirement is served by the various resource types over the 2015-2037 time frame for the three portfolios. The nest purchases represent total purchases minus total sales. A negative net purchases value represent a "long" position, where by NIPSCO is selling to the market and a positive value represent a "short" position, where by NIPSCO is buying from the market. Over the 2015-2037 planning horizon, NIPSCO is long and short throughout the year at different times.

Cumulative 2015-2037 Energy Mix Least Cost

Least Cost Portfolio								
Sensitivity	**Coal**	**Gas**	**Wind**	**CHP**	**Hydro**	**FIT**	**DSM**	**Net Purchases**
Base - No CO_2 Price	18.6%	37.0%	0.9%	-	0.3%	0.8%	1.9%	40.5%
Base - Low Load	28.5%	45.6%	1.1%	1.0%	0.3%	0.9%	3.2%	19.1%
Base - High Gas Price	28.6%	47.4%	0.9%	-	0.3%	0.8%	2.8%	19.2%
Base - Loss of Major Ind. Load	43.8%	64.1%	1.7%	0.7%	0.5%	1.4%	2.6%	-24.4%
Challenged Economy - No CO_2 Price	17.2%	35.2%	1.1%	0.1%	0.3%	0.9%	2.7%	42.4%
Challenged Economy - Loss of Major Ind. Load	39.5%	72.1%	1.8%	-	0.5%	1.5%	2.4%	-17.7%
Aggressive Environmental - High Renewables & Increasing Load	25.5%	29.3%	15.1%	0.5%	0.2%	0.7%	3.0%	22.3%
Aggressive Environmental - High Renewables & Decreasing Load	31.9%	29.0%	13.0%	0.4%	0.3%	0.9%	3.3%	21.2%
Booming Economy - No CO_2 Price	16.6%	33.7%	0.9%	0.1%	0.2%	0.7%	2.6%	44.3%
Booming Economy - Loss of Major Ind. Load	49.9%	55.6%	1.7%	0.7%	0.5%	1.4%	2.6%	-20.6%

Appendix F: Exhibit 2 – Sensitivity Modeling Results

Cumulative 2015-2037 Energy Mix Renewable Focus

Renewable Focus Portfolio									
Sensitivity	**Coal**	**Gas**	**Wind**	**CHP**	**Solar**	**Hydro**	**FIT**	**DSM**	**Net Purchases***
Base - No CO_2 Price	18.6%	27.3%	5.9%	0.2%	4.9%	0.3%	0.8%	1.9%	26.7%
Base - Low Load	28.4%	42.5%	1.1%	0.5%	1.5%	0.3%	0.9%	3.2%	21.2%
Base - High Gas Price	29.2%	33.0%	12.6%	0.4%	4.8%	0.3%	0.8%	2.8%	14.4%
Base - Loss of Major Ind. Load	43.7%	69.8%	10.7%	-	0.9%	0.5%	1.4%	2.6%	-85.0%
Challenged Economy - No CO_2 Price	17.1%	33.3%	1.1%	-	1.5%	0.3%	0.9%	2.7%	43.0%
Challenged Economy - Loss of Major Ind. Load	39.2%	67.6%	15.3%	-	2.7%	0.5%	1.5%	2.4%	-33.8%
Aggressive Environmental - High Renewables & Increasing Load	25.5%	21.6%	79.3%	0.3%	-	0.2%	0.7%	3.0%	-38.1%
Aggressive Environmental - High Renewables & Decreasing Load	31.9%	14.8%	85.2%	-	6.9%	0.3%	0.9%	3.3%	-45.4%
Booming Economy - No CO_2 Price	16.9%	27.1%	6.3%	0.2%	3.9%	0.2%	0.7%	2.6%	39.2%
Booming Economy - Loss of Major Ind. Load	49.9%	60.3%	10.7%	-	0.9%	0.5%	1.4%	2.6%	-81.6%

Cumulative 2015-2037 Energy Mix Low Emission

Low Emission Portfolio												
Sensitivity	**Coal**	**Gas**	**Wind**	**Battery**	**Biomass**	**Solar**	**Hydro**	**Nuclear**	**Recip**	**FIT**	**DSM**	**Net Purchases***
Base - No CO_2 Price	19.0%	26.9%	5.8%	-	0.1%	3.0%	0.3%	1.6%	-	0.8%	1.9%	37.3%
Base - Low Load	29.2%	43.6%	1.1%	-	-	-	0.3%	0.8%	-	0.9%	3.2%	21.0%
Base - High Gas Price	29.2%	32.9%	8.4%	0.006%	0.1%	2.9%	0.3%	-	0.0%	0.8%	2.8%	19.1%
Base - Loss of Major Ind. Load	44.7%	64.4%	1.7%	-	-	-	0.5%	1.2%	-	1.4%	2.6%	-18.6%
Challenged Economy - No CO_2 Price	17.2%	32.8%	1.1%	-	-	0.2%	0.3%	0.5%	-	0.9%	2.7%	44.1%
Challenged Economy - Loss of Major Ind. Load	39.1%	66.8%	1.8%	-	-	-	0.5%	2.2%	-	1.5%	2.4%	-14.3%
Aggressive Environmental - High Renewables & Increasing Load	25.6%	21.4%	26.4%	-	-	7.1%	0.2%	-	-	0.7%	3.0%	-1.1%
Aggressive Environmental - High Renewables & Decreasing Load	32.0%	26.4%	20.8%	-	-	-	0.3%	-	-	0.9%	3.3%	14.9%
Booming Economy - No CO_2 Price	17.3%	25.3%	6.1%	-	0.1%	2.7%	0.2%	1.4%	-	0.7%	2.6%	41.8%
Booming Economy - Loss of Major Ind. Load	51.4%	55.8%	1.7%	-	-	-	0.5%	0.7%	-	1.4%	2.6%	-15.6%

Confidential Appendix G (Redacted)

Unit Retirement Analysis

Exhibit A-1	Base Scenario
Exhibit A-2	Base Sensitivity - No CO2
Exhibit A-3	Base Sensitivity - Low Load
Exhibit A-4	Base Sensitivity - High Gas
Exhibit A-5	Base Sensitivity - No Major Industrial Load
Exhibit B-1	Challenged Economy Scenario
Exhibit B-2	Challenged Economy Sensitivity - No CO2
Exhibit B-3	Challenged Economy - No Major Industrial Load
Exhibit C-1	Aggressive Environmental Scenario
Exhibit C-2	Aggressive Environmental Sensitivity - High Renewables & Decreasing Load
Exhibit C-3	Aggressive Environmental Sensitivity - High Renewables & Increasing Load
Exhibit D-1	Booming Economy Scenario
Exhibit D-2	Booming Economy Sensitivity - No CO2
Exhibit D-3	Booming Economy - No Major Industrial Load
Exhibit E-1	Base Delayed Carbon Scenario

RECEIVED
November 1, 2016
INDIANA UTILITY
REGULATORY COMMISSION

Prepared by

Sargent & Lundy LLC
Consulting

55 East Monroe Street
Chicago, IL 60603-5780 USA

Integrated Resource Plan Engineering Study Technical Assessment

Prepared for
NIPSCO

Report SL-012949

Project 12749-842
November 2015

NIPSCO

F I N A L

Integrated Resource Plan Engineering Study Technical Assessment

Prepared for

NIPSCO

SL-012949
November 2015

55 East Monroe Street
Chicago, IL 60603-5780 USA

Project 12749-842

Integrated Resource Plan Engineering Study
Technical Assessment

Prepared by	Joseph Hudziak	Senior Consultant (Fossil Fuel & Biomass)
	Carl Jakubowski	Senior Consultant (Nuclear)
	Joe Capadona	Senior Consultant (Wind)
	David Jong	Senior Consultant (Distributed Generation & Energy Storage)
	Jose Mayen	Senior Consultant (Electric Grid Reliability)
	John Wroble	Senior Consultant (Capital & O&M)
	Dave Helm	Technical Consultant (Emissions)
	Ken Snell	Technical Consultant (Environmental Regulations)
	Jeffery Cobb	Technical Consultant (Natural Gas)
	Emile Jabre	Technical Consultant (Solar and Geothermal)
	Tony Song	Technical Consultant (Battery Storage)
	Ben Edgar	President, White Harvest Energy (CHP & Microgrids)

Reviewed by William D. Edgar
William D. Edgar
Senior Management
Consultant

Approved by Christopher D. Ungate November 20, 2015
Christopher Ungate Date
Senior Principal
Management Consultant

SL-012949
November 2015

55 East Monroe Street
Chicago, IL 60603-5780 USA

LEGAL NOTICE

This report was prepared by Sargent & Lundy, L.L.C. ("S&L"), expressly for the sole use of Northern Indiana Public Service Company ("NIPSCO") in accordance with the agreement between S&L and NIPSCO. This report was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances. The information and data contained in this report are time sensitive and changes in the data, applicable codes, standards, and acceptable engineering practices may invalidate the findings of this report. Any use or reliance upon this report by third parties shall be at their sole risk.

NIPSCO
Integrated Resource Plan Engineering Study
Technical Assessment

CONTENTS

Section Page

CONTENTS (cont.)

CONTENTS (cont.)

CONTENTS (cont.)

CONTENTS (cont.)

CONTENTS (cont.)

CONTENTS (cont.)

TABLES AND FIGURES

Table or Figure — Page

TABLES AND FIGURES (cont.)

TABLES AND FIGURES (cont.)

TABLES AND FIGURES (cont.)

TABLES AND FIGURES (cont.)

TABLES AND FIGURES (cont.)

TABLES AND FIGURES (cont.)

ACRONYMS AND ABBREVIATIONS

Term	Definition or Clarification
ACI	Activated Carbon Injection
AFUDC	Allowance for Funds Used During Construction
AMSL	Above mean sea level
APWR	Advanced pressurized water reactor
ASU	Air separator unit
BACT	Best available control technology
BLS	Bureau of Labor Statistics
BOP	Balance of plant
C&I	Commercial and industrial
CAA	Clean Air Act
CAES	Compressed air energy storage
CC	Combined cycle
CCHP	Combined Cooling, Heat and Power
CCS	Carbon capture and sequestration
CHP	Combined heat and power
CO	Carbon monoxide
CSP	Concentrated solar power
CT	Combustion turbine
CTG	Combustion turbine generator
CWA	Clean Water Act
DBB	Design-Bid-Build
DG	Distributed generation
DLN	Dry-low NOx combustion
DOE	Department of Energy
DSI	Dry sorbent injection
DSIRE	Database of State Incentives for Renewables & Efficiency®
EAF	Equivalent availability factor
EFOR	Equivalent forced outage rate
EGU	Electric generating unit

ACRONYMS AND ABBREVIATIONS (cont.)

Term	Definition or Clarification
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EPC	Engineer, procure, and construct
EPRI	Electric Power Research Institute
ERC	Emission reduction credits
ESP	Electrostatic precipitator
FERC	Federal Energy Regulatory Commission
FF	Fabric filter
FGD	Flue gas desulfurization
FICA	Federal Insurance Contributions Act
FIT	Feed-in tariff
FOH	Forced outage hours
FPM	Filterable particulate matter
GE	General Electric
GHG	Greenhouse gas
HAP	Hazardous air pollutant
HCl	Hydrogen chloride
Hg	Mercury
HHV	Higher heating value
hp	Horsepower
HRSG	Heat recovery steam generator
HVAC	Heating, Ventilation, & Air Conditioning
Hz	Hertz
IAC	Indiana Administrative Code
ICI	Industrial-Commercial-Institutional
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IGCC	Integrated gasification combined cycle
IRP	Integrated resource plan

ACRONYMS AND ABBREVIATIONS (cont.)

Term	Definition or Clarification
kW	kilowatt
LAER	Lowest achievable emissions rate
LAES	Liquefied air energy storage
LNB	Low NO_x burners
MACT	Maximum Achievable Control Technology
MATS	Mercury and Air Toxics Standards
MGD	Million gallons per day
mmBtu	Millions of Btu
MW	Megawatt
MWh	Megawatt-hour
MYRD&D	Multi-Year Research, Development, and Demonstration
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NNSR	Non-attainment New Source Review
NOWS	National Offshore Wind Strategy
NO_X	Nitric oxide (NO) and nitrogen dioxide (NO_2)
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NSCR	Non-selective catalytic reduction
NSPS	New Source Performance Standards
NSR	New Source Review
O&M	Operation and maintenance
O_2	Oxygen
OFA	Overfire air
OSWInD	Offshore Wind Innovation and Demonstration Initiative
PAS	Personnel Administration Services
Pb	Lead
PC	Pulverized coal

ACRONYMS AND ABBREVIATIONS (cont.)

Term	Definition or Clarification
PCB	Polychlorinated biphenyls
PH	Period hours
PILOT	Payments in lieu of taxes
PJFF	Pulse jet fabric filter
PM	Particulate matter
PM_{10}	Particulate matter less than 10 micrometers
$PM_{2.5}$	Particulate matter less than 2.5 micrometers
ppbvd	Parts per billion volume dry
ppmvd	Parts per million volume dry
PSD	Prevention of Significant Deterioration
PV	Photovoltaic
R&D	Research and development
RBLC	RACT/BACT/LAER Clearinghouse
RFP	Request for proposal
RH	Relative Humidity
rpm	Revolutions per minute
S&L	Sargent & Lundy LLC
SCR	Selective catalytic reduction
SGC	Syngas cleanup
SHP	Separate Heat and Power
SIP	State Implementation Plan
SMR	Small modular reactor
SNCR	Selective non-catalytic reduction
SO_2	Sulfur dioxide
SOH	Schedule outage hours
SPRINT	Spray inter-cooled
ST	Steam turbine
STG	Steam turbine generator
Syngas	Synthesis gas

ACRONYMS AND ABBREVIATIONS (cont.)

Term	Definition or Clarification
T&D	Transmission and distribution
TES	Thermal energy storage
tpy	Tons per year
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VOC	Volatile organic carbon
VOM	Variable O&M
WFGD	Wet Flue gas desulfurization
WTG	Wind-turbine generator

Last page of front matter.

1. EXECUTIVE SUMMARY

1.1 PROJECT INTRODUCTION

To support development of its 2016 IRP, The Northern Indiana Public Service Company (NIPSCO) engaged Sargent & Lundy LLC (S&L) to conduct a technical assessment of various generation technologies reflective of a Northern Indiana location. The list of technologies considered in the study was discussed during the project kick-off meeting and includes the technical options that might be considered feasible for the NIPSCO service territory and other options that are of interest to the utility, regulators, and stakeholders.

This technology assessment study includes an evaluation of the following technologies:

- Natural Gas Technologies – Section 4
  - Simple Cycle Aeroderivative Combustion Turbine (50 MW)
  - Simple Cycle Frame Combustion Turbine (240 MW)
  - Combined Cycle Frame Combustion Turbines (700 MW)
  - Combined Cycle Bailly Unit 7 Repowering (Coal to Combined Cycle Conversion)
  - Combined Cycle Schahfer 16A/B Conversion (2 Simple Cycle Frames to Combined Cycle)
  - Combined Cycle Generic Conversion (2 Simple Cycle Frames to Combined Cycle)
  - Black Start Retrofit at Schahfer Unit 16B
  - Coal to Natural Gas Boiler Conversion at Schahfer Unit 14
  - Coal to Natural Gas Boiler Conversion at Schahfer Unit 15
  - Coal to Natural Gas Boiler Conversion at Schahfer Unit 17 and 18
  - Coal to Natural Gas Boiler Conversion at Schahfer Unit 14, 15, 17, and 18 Collectively
- Coal and Nuclear Technologies – Section 5
  - Supercritical Pulverized Coal (750 MW gross)
  - Circulating Fluidized Bed Coal with Fuel Flexibility (400 MW gross)
  - Integrated Gasification Combined Cycle (600 MW gross)
  - Advanced Pressurized Water Reactor (2200 MW)
  - Small Modular Reactor (45 MW)
- Renewable Technologies – Section 6
  - Bubbling Fluidized Bed Biomass Boiler (50 MW)
  - Onshore Wind (100 MW)
  - Offshore Wind (50 MW)

  - Concentrated Solar Power (50 MW)
  - Utility Scale Solar Photovoltaic (50 MW)
  - Geothermal (5 MW)
- Energy Storage Technologies – Section 7
  - Pumped Storage
  - Thermal Storage
  - Compressed Air Storage
  - Liquefied Air Storage
  - Battery Storage
- Distributed Generation Technologies – Section 8
  - Reciprocating Engine Firing Biogas and/or Conventional Fuel Supply
  - Microturbines
  - Fuel Cells
  - Distributed Solar PV
  - Distributed Wind
  - Combined Heat and Power
  - Microgrids
- Grid Reliability Enhancements – Section 9
  - Interconnection Upgrades for Distributed Generation
  - Volt/VAR Optimization and Sensors

The assessment includes a review of the environmental requirements that apply to each generating technology to identify specific emission control technologies, for which cost, performance, and emissions data was developed. For the conventional technologies (i.e. natural gas, coal, and nuclear), the types of alternatives are well-known, and therefore, NIPSCO identified the specific configurations to consider. For renewable energy, energy storage, and distributed generation, a more extensive distributed generation screening analysis was performed to identify the commercially available technologies and the emerging technologies seen throughout the power industry. The complete distributed generation screening analysis is attached to this report as Appendix A. Throughout the remainder of this report, S&L presents the estimated cost, performance, and emissions data for both the conventional technologies and selected distributed generation technologies as well as the methodology and assumptions underlying these estimates.

NIPSCO

RECEIVED
November 1, 2016
INDIANA UTILITY
REGULATORY COMMISSION

Part 1. Identification and Certification

Transmitting Utility Name and Address:

Northern Indiana Public Service Company
801 East 86th Avenue
Merrillville, IN 46410

Contact Person:

Dawn Quick
Transmission Planning Engineer
Electric System Planning Department
Telephone Number: 219-647-4220
Facsimile Number: 219-647-5222
Email: dquick@nisource.com

Certification and signature by an authorized official of the Transmitting Utility regarding the accuracy of the information submitted:

Shaun Moran
Manager Electric System Planning

Part 2. Power Flow Base Cases

Northern Indiana Public Service Company submits the following base cases as part of the 2016 FERC FORM 715. These cases were developed under the 2015 Series of the Eastern Interconnection Reliability Assessment Group ("ERAG") Multiregional Modeling Working Group ("MMWG") process and are used as a starting point for transmission planning studies.

Case	Abbreviation
2016 Spring Light Load	2016SLL
2016 Summer	2016SUM
2016/17 Winter	2016WIN
2017 Spring Light Load	2017SLL
2017 Summer	2017SUM
2017 Summer Shoulder	2017SSH
2017/18 Winter	2017WIN
2021 Spring Light Load	2021SLL
2021 Summer	2021SUM
2021/22 Winter	2021WIN
2026 Summer	2026SUM
2026/27 Winter	2026WIN

NIPSCO's Transmission System

2016 Diagram and Drawings

5 Pages

THE FOLLOWING IS CONFIDENTIAL - NOT FOR PUBLIC DISCLOSURE

TRANSMISSION PLANNING ASSESSMENT METHODOLOGY AND CRITERIA

For Compliance with NERC Reliability Standard: TPL-001-4

1/10/2016
Version: 5.0

Table of Contents

1 REVISION AND APPROVAL HISTORY

The Annual Transmission System Assessment should be completed by Transmission Planning and approved by the Leader of Transmission Planning at least once per calendar year. Additionally, as the approved North American Electric Reliability Corporation (NERC) Standard requirements change, this document must be reviewed and revised as necessary to concur with the new requirement.

1.1 REVISION HISTORY

Version	Date	Author	Supervisor	Comments
1.0	10/14/2011	Dawn Quick	Robert Fox	Initial document load into the DMS.
2.0	12/31/2012	Dawn Quick	Robert Fox	Annual Review. Seasonal Ratings defined. Internal Communication additions.
3.0	07/18/2013	Dawn Quick	Robert Fox	Add Generator Interconnection Section.
3.1	10/15/2013	Dawn Quick	Robert Fox	Add language for Single Breaker Ratings.
3.2	12/26/2013	Dawn Quick	Robert Fox	Annual Review. No Changes
3.3	03/10/2014	Dawn Quick	Ganesh Velummylum	Annual Review. Section 4.5. Added footnote pertaining to Distribution Factor. Added Specification of NERC categories and Cases to study.
4.0	10/07/2015	Dawn Quick	Lynn Schmidt	Annual Review. Format and Content Changes to align with new TPL Standard
4.1	01/10/2016	Dawn Quick	Lynn Schmidt	Annual Review.

1.2 APPROVAL

Version	Supervisor	Title	Electronic Signature Date
1.0	Robert Fox	Leader Transmission Planning	9/28/2011
2.0	Robert Fox	Leader Transmission Planning	12/31/2012
3.0	Robert Fox	Leader Transmission Planning	7/18/2013
3.1	Robert Fox	Leader Transmission Planning	10/15/2013
3.2	Robert Fox	Leader Transmission Planning	12/26/2013
3.3	Ganesh Velummylum	Manager Electric System Planning	3/10/2014
4.0	Lynn Schmidt	Leader Transmission Planning	10/07/2015
4.1	Lynn Schmidt	Leader Transmission Planning	1/10/2016

2 ANNUAL PLANNING ASSESSMENT

Transmission Planning shall prepare an annual Planning Assessment of the performance of its portion of the BES. This Planning Assessment shall use current or qualified past studies (as indicated below), shall document assumptions, and shall document summarized results of the steady state analyses, short circuit analyses, and Stability analyses. This assessment shall be performed for both the Near-Term and the Long-Term Transmission Planning Horizons. [R2]

Past studies may be used to support the Planning Assessment if they meet the following requirements:

- For steady state, short circuit, or stability analysis: the study shall be five calendar years old or less, unless a technical rationale is provided to demonstrate that the results of an older study are still valid. [R2.6.1]
- For steady state, short circuit, or stability analysis: no material changes have occurred to the System represented in the study. Documentation to support the technical rationale for determining material changes shall be included in the written assessment. [R2.6.2]

For planning events shown in Table 1, when the analysis indicates an inability of the System to meet the required performance criteria, the Planning Assessment shall include Corrective Action Plan(s) addressing how the performance requirements will be met. Revisions to the Corrective Action Plan(s) are allowed in subsequent Planning Assessments but the planned System shall continue to meet the required performance criteria. Corrective Action Plan(s) do not need to be developed solely to meet the performance requirements for a single sensitivity case. For short circuit analysis, if the short circuit current interrupting duty on circuit breakers exceeds their Equipment Rating, the Planning Assessment shall include a Corrective Action Plan to address the Equipment Rating violations. [R2.7] [R2.8]

The Corrective Action Plan(s) shall:

- List System deficiencies and the associated actions needed to achieve required System performance. [R2.7.1] [R2.8.1]
- For Steady state and Stability Studies, include actions to resolve performance deficiencies identified in multiple sensitivity studies or provide a rationale for why actions were not necessary. [R2.7.2]
- Be reviewed in subsequent annual Planning Assessments for continued validity and implementation status of identified System Facilities and Operating Procedures. [R2.7.4] [R2.8.2]

When an entity's spare equipment strategy could result in the unavailability of major Transmission equipment that has a lead time of one year or more (such as a transformer), the impact of this possible unavailability on System performance shall be studied. The studies shall be performed for the P0, P1, and P2 categories identified in Table 1 with the conditions that the System is expected to experience during the possible unavailability of the long lead time equipment. NIPSCO Transmission Planning shall evaluate its current stock and procurement strategy annually. Conclusions of this evaluation shall be stated in the assessment report. [R2.1.5]

In accordance with TPL-001-4 R7, NIPSCO has executed a Coordination Agreement with MISO identifying individual and joint responsibilities for performing the required studies. NIPSCO has not delegated any of their TPL responsibilities to MISO. In addition to any data requests made by MISO required to fulfill their TPL requirements, NIPSCO will also provide results from its Short Circuit studies to MISO. [R7]

Transmission Planning shall distribute its Planning Assessment results to adjacent Planning Coordinators and adjacent Transmission Planners within 90 calendar days of completing its Planning Assessment, and to any functional entity that has a reliability related need and submits a written request for the information within 30 days of such a request. If a recipient of the Planning Assessment results provides documented comments on the results, the respective Planning Coordinator or Transmission Planner shall provide a documented response to that recipient within 90 calendar days of receipt of those comments. Recipients of the Planning Assessment include: MISO, PJM, METC, Duke, and Ameren. [R8] [R8.1]

2.1 MODEL DATA

NIPSCO Transmission Planning shall maintain System models within the NIPSCO area for performing the studies needed to complete its Planning Assessment. The models are consistent with provisions of the most recent Multiregional Modeling Working Group Procedure Manual and the most recent MOD-32 standard, supplemented by other sources as needed, including items represented in the Corrective Action Plan, and shall represent projected System conditions. This establishes Category P0 as the normal System condition in Table 1. [R1].

System Models Represent:

- Existing Facilities
- Known outage(s) of generation or Transmission Facility(ies) with a duration of at least six months.[R2.1.3]
- New planned Facilities and changes to existing Facilities
- Real and reactive Load forecasts
- Known commitments for Firm Transmission Service and Interchange
- Resources (supply or demand side) required for Load

A project is considered “planned” and is modeled in the base cases when a continuing need has been identified by recent and past study results. The planned project, in general, is needed in the near term and typically has budget approval for engineering or material costs.

A “proposed” project is typically not modeled in base cases. The “proposed” project is being studied for continuing need and timing when project lead time is sufficient. A “proposed” project may also be conceptual in nature. It has been identified as a possible solution in long term studies where violations may be marginal. It may also be identified as a possible solution to stressed or alternative dispatch cases. Alternative projects may be studied for best solution. Proposed projects are given a “planned” status after need has been proven, taking into consideration sufficient lead time.

2.2 *STEADY STATE*

In accordance with NERC Standard TPL-001-4, the following system conditions are required for study annually:

- System peak Load for either Year One or year two, and for year five. [R2.1.1]
- System Off-Peak Load for one of the five years [R2.1.2.]
- A current study assessing expected System peak Load conditions for one of the years in the Long-Term Transmission Planning Horizon and the rationale for why that year was selected. [R2.2.1]

For each of the Near-Term studies described above, sensitivity case(s) shall be utilized to demonstrate the impact of changes to the basic assumptions used in the model. To accomplish this, the sensitivity analysis in the Planning Assessment will vary one or more of the following conditions by a sufficient amount to stress the System within a range of credible conditions that demonstrate a measurable change in System response: [R2.1.4]

- Real and reactive forecasted Load.
- Expected transfers.
- Expected in service dates of new or modified Transmission Facilities.
- Reactive resource capability.
- Generation additions, retirements, or other dispatch scenarios.
- Controllable Loads and Demand Side Management.
- Duration or timing of known Transmission outages.

2.2.1 Contingency Analysis

For the steady state portion of the Planning Assessment, Transmission Planning shall perform studies for the Near-Term and Long-Term Transmission Planning Horizons mentioned above. The studies shall be based on computer simulation models using data provided in accordance with TPL-001-4 Requirement R1. [R3]

A list of those Contingencies to be evaluated for System Performance for Planning Events shall be created corresponding to the Planning Events P0-P7 listed in Table 1. For steady state, all planning events are simulated unless contingency outages duplicate the same elements as those of another contingency. Results of these simulations should be assessed to determine whether the BES meets the performance requirements in section 2.2.2. [R3.1][R3.4]

A list of Contingencies for those extreme events listed in Table 1 that are expected to produce more severe System impacts shall be identified and created. For Steady-State, all extreme events listed in Table 1, extreme events #1 and #2 shall be simulated. Wide-area events affecting the Transmission System, such as those described in Table 1, extreme events #3, may be evaluated. A description and rationale of these wide-area events, if included, will be documented in the assessment. If the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences and adverse impacts of the event(s) shall be conducted. [R3.2][R3.5]

Transmission Planning shall coordinate with adjacent Planning Coordinators and Transmission Planners to ensure that Contingencies on adjacent Systems which may impact their Systems are included in the Contingency list. [R3.4.1]

Contingency analysis shall simulate the removal of all elements that the Protection System and other automatic controls that are expected to normally clear or disconnect for each Contingency without operator intervention. [R3.3.1]

The analyses shall include the impact of subsequent:

- Tripping of generators where simulations show generator bus voltages or high side of the generation step up (GSU) voltages are less than known or assumed minimum generator steady state or ride through voltage limitations Generator terminal voltages will be monitored at *85%* for potential tripping. [R3.3.1.1]
- Tripping of Transmission elements where relay loadability limits are exceeded. A tripping proxy of 125% of Emergency Rating will be used for all lines and transformers. When exceeded, Transmission Planning will consult Protection Engineering to obtain actual trip values and determine if a corrective action plan is necessary. [R3.3.1.2]

Contingency analysis shall simulate the expected automatic operation of existing and planned devices designed to provide steady state control of electrical system quantities when such devices impact the study area. [R3.3.2]

2.2.2 Steady-State Performance Requirements and Criteria [R5]

- Voltages, post-contingency voltages, and post-contingency voltage deviations shall be within acceptable limits. See Steady-State Voltage Tables below.
- Applicable Facility Ratings shall not be exceeded. Transmission Planning establishes Normal and Emergency Facility Ratings for Summer and Winter seasonal periods based on its documented Facility Rating Methodology. Single Breaker Ratings are also established for use in studies where the contingency may cause a facility to have a more limited rating.
- The transmission system shall not experience uncontrolled cascading or islanding. Load loss shall not exceed 300 MWs, excluding consequential load. See section 2.5, Supplemental Performance Analysis. [R6]
- Generators are projected to trip when the terminal voltage is below 85%. [R4.3.1.2]
- Consequential Load Loss as well as generation loss is acceptable as a result of any event excluding category P0 No Contingency.
- The response of voltage sensitive Load that is disconnected from the System by end-user equipment associated with an event shall not be used to meet steady-state performance requirements.

Steady-State Voltage Tables

Location	Normal Condition		Post-Contingency Steady-State		
	Minimum	Maximum	Minimum	Maximum	Deviation
345 kV buses	92%	105%	90%	105%	+/- 10%
138 kV buses	92%	105%	90%	105%	+/- 10%
69 kV buses	94%	105%	92%	105%	+/- 10%
On-Line Generator Terminals [3.3.1.1]	95%	105%	85%	107%	+/- 10%

Location	Normal Condition		Post-Contingency Steady-State		
	Minimum	Maximum	Minimum	Maximum	Deviation
Customer Substation 138kV Buses	95%	105%	90%	110%	+/- 10%

2.3 STABILITY

In accordance with NERC Standard TPL-001-4, the following system conditions are required for study annually:

- System peak Load for one of the five years. System peak Load levels shall include a Load model which represents the expected dynamic behavior of Loads that could impact the study area, considering the behavior of induction motor Loads. An aggregate System Load model which represents the overall dynamic behavior of the Load is acceptable. [R2.4.1]
- System Off-Peak Load for one of the five years. [R2.4.2]

For each of the studies described above, sensitivity case(s) shall be utilized to demonstrate the impact of changes to the basic assumptions used in the model. To accomplish this, the sensitivity analysis in the Planning Assessment must vary one or more of the following conditions by a sufficient amount to stress the System within a range of credible conditions that demonstrate a measurable change in performance: [R2.4.3.]

- Load level, Load forecast, or dynamic Load model assumptions.
- Expected transfers.
- Expected in service dates of new or modified Transmission Facilities.
- Reactive resource capability
- Generation additions, retirements, or other dispatch scenarios.

For the Planning Assessment, the Long-Term Transmission Planning Horizon portion of the Stability analysis shall be assessed to address the impact of proposed material generation additions or changes in that timeframe and be supported by current or past studies and shall include documentation to support the technical rationale for determining material changes. [R2.5]

Loads shall be modeled by P (constant current) and Q (constant impedance) which represents the aggregate overall dynamic load behavior. For sensitivity analysis, loads may be modeled by a composite load model considering more detailed behavior of induction motor loads.

2.3.1 Contingency Events

For the Stability portion of the Planning Assessment, Transmission Planning shall perform the Contingency analyses for the Near-Term and Long-Term Planning Horizons mentioned above. The studies shall be based on computer simulation models using data provided in accordance with TPL-001-4 R1. [R4]

A list of those Contingencies to be evaluated for System Performance for Planning Events shall be created corresponding to the Planning Events P0-P7 listed in Table 1. For transient stability, Planning Events for transmission facilities directly associated to an individual power plant as well as Planning Events for other selected transmission facilities are simulated. [R4.4]

Those extreme events in Table 1 that are expected to produce more severe System impacts shall be identified and a list created of those events to be evaluated for impact to the BES. The rationale for those Contingencies selected for evaluation shall be available as supporting information. If the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences of the event(s) shall be conducted. [R4.2][R4.5]

Each Planning Coordinator and Transmission Planner shall coordinate with adjacent Planning Coordinators and Transmission Planners to ensure that Contingencies on adjacent Systems which may impact their Systems are included in the Contingency list. [R4.4.1]

Contingency analyses shall simulate the removal of all elements that the Protection System and other automatic controls are expected to disconnect for each Contingency without operator intervention. [R4.3] [R4.3.1]

The contingency analyses shall include the impact of subsequent:

- Successful high speed (less than one second) reclosing and unsuccessful high speed reclosing into a Fault where high speed reclosing is utilized. [R4.3.1.1]
- Tripping of generators where simulations show generator bus voltages or high side of the GSU voltages are less than known or assumed generator low voltage ride through capability. Include in the assessment any assumptions made. [R4.3.1.2]
- Tripping of Transmission lines and transformers where transient swings cause Protection System operation based on generic or actual relay models. [R4.3.1.3]

Contingency analyses shall simulate the expected automatic operation of existing and planned devices designed to provide dynamic control of electrical system quantities when such devices impact the study area. These devices may include equipment such as generation exciter control and power system stabilizers, static var compensators, power flow controllers, and DC Transmission controllers. [R4.3.2]

Studies shall be performed for planning events to determine whether the BES meets the following stability performance requirements and criteria: [R4.1] [R4.2]

2.3.2 Stability Performance Requirements And Criteria [R5]

The transmission system shall not experience uncontrolled cascading or islanding.

For planning event P1: No generating unit shall pull out of synchronism. A generator being disconnected from the System by fault clearing action or by a Special Protection System is not considered pulling out of synchronism. [R4.1.1]

For planning events P2 through P7: When a generator pulls out of synchronism in the simulations, the resulting apparent impedance swings shall not result in the tripping of any Transmission system elements other than the generating unit and its directly connected Facilities. [R4.1.2]

For planning events P1 through P7: Power oscillations shall exhibit acceptable damping. Observed damping ratio (ζ) shall be greater than 0.030. [R4.1.3]

Synchronous Generator Voltage: Voltages at the terminal bus of on-line synchronous generators shall return to the allowable steady-state contingency voltage within two seconds after fault clearing.

Wind Farm Voltage: Wind machines shall have low voltage ride-through capability down to 15% of the rated voltage for 0.625 seconds (37.5 cycles).

Load Bus Voltages: Voltages at load buses should return to the allowable steady-state contingency voltage within five seconds after fault clearing.

2.4 SHORT CIRCUIT

The short circuit analysis portion of the Planning Assessment shall be conducted annually addressing the Near-Term Transmission Planning Horizon and can be supported by current or qualified past. The analysis shall be used to determine whether circuit breakers have interrupting capability for Faults that they will be expected to interrupt using the System short circuit model with any planned generation and Transmission Facilities in service which could impact the study area. [R2.3]

2.5 SUPPLEMENTAL PERFORMANCE ANALYSIS

2.5.1 Cascading

Cascading potential shall be evaluated by sequentially removing those facilities with steady-state loading in excess of 125% of their emergency rating and those generating units with steady-state terminal voltage below their specified voltage criteria. [R6]

2.5.2 Uncontrolled Islanding

Uncontrolled islanding potential shall be evaluated by review of identified cascading outages that result in load being isolated with generation from the interconnected system. [R6]

2.5.3 Voltage Stability

Voltage stability analysis shall be performed for the Near-Term and Long-Term Planning Horizons mentioned above. Voltage stability shall be evaluated through the application of the Fast Voltage Stability Index (FVSI) and Voltage Stability Index Le. Analysis shall be performed for N-0 and N-1 contingency conditions. A voltage stability index value of 1.0 or greater is an indication of voltage instability. [R6]

3 FACILITY CONNECTION, TRANSMISSION SERVICE REQUEST ASSESSMENTS, AND GENERATOR RETIREMENTS

Transmission Reliability Planning Tests are performed on Facility Connection projects, Transmission Service Requests (TSR's), and Generation Retirements to evaluate any Thermal or Voltage criteria violations caused by projects originated through PJM, MISO and NIPSCO processes on NIPSCO's transmission system. These tests shall include NERC Contingency Categories P0, P1, and P2 (formerly A, B, C1, C2, and C5).

The Facility Connection Projects, TSR's, and Generation Retirements impacting NIPSCO's transmission shall be subject to two tests: the Individual Contribution Test and the Cumulative Impact Test.

The Facility Connections, TSR's, and Generation Retirements screened through the following two tests are studied for their impact on NIPSCO's transmission system. The RTEP and MTEP cases used by PJM and/or MISO will be used in the study process. Peak, off-peak, and high wind cases should be evaluated to determine worst-case impact. . Mitigations will be determined for all thermal and/or voltage violations.

3.1 INDIVIDUAL CONTRIBUTION TEST

The test is performed to identify individual Facility Connections, TSRs, and Generation Retirements affecting NIPSCO's transmission system. For a Facility Connection, TSR, or Generation Retirement to be considered to be impacting the NIPSCO transmission system, it should adhere to one of the two rules:

1. The contribution of the Distribution Factor of the Facility Connection, TSR, or Generation Retirement with magnitude of 3% or greater contributing to an overload on a NIPSCO facility.

2. The Contribution of a Facility Connection, TSR, or Generation Retirement on a NIPSCO facility is equal to or greater than 3% of the facility rating.

3.2 CUMULATIVE IMPACT TEST (CIT)

NIPSCO shall also perform a test to evaluate the cumulative impact of multiple Facility Connections, TSRs, and Generation Retirements when they are grouped together in the same study during the PJM and/or MISO process. The Facility Connections, TSRs, and Generation Retirements having a cumulative impact of at least 10% of the facility rating will be considered as impacting NIPSCO's transmission system.

TABLE 1. PLANNING AND EXTREME EVENTS

Category	Initial Condition	Event	Fault Type	Notes
P0	Normal System	None	N/A	Initial System Condition
P1 Single Contingency	Normal System	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device	3Ø	
P2 Single Contingency	Normal System	1. Opening of a line section w/o a fault	N/A	
		2. Bus Section Fault	SLG	
		3. Internal Breaker Fault (non-bus tie)	SLG	
		4. Internal Breaker Fault (Bus-tie Breaker)	SLG	
P3 Multiple Contingency	Loss of generator unit followed by System Adjustments	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device	3Ø	
P4 Multiple Contingency (Fault plus Stuck Breaker)	Normal System	Loss of Multiple Elements Caused by a stuck Breaker (non-bus tie) attempting to clear a fault on one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device 5. Bus Section 6. Loss of Multiple elements caused by a stuck Bus-tie	SLG	

		Breaker attempting to clear a fault on the associated bus.		
P5	Normal System	Delayed Fault Clearing due to the failure of a non-redundant relay protecting the Faulted element to operate as designed, for one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device 5. Bus section	SLG	
P6	Loss of one of the following followed by System adjustments. Loss of one of the following: 1. Transmission Circuit 2. Transformer 3. Shunt Device	Loss of one of the following: 1. Transmission Circuit 2. Transformer 3. Shunt Device	3Ø	Curtailment of Firm Transmission Service is allowed as a System adjustment as identified in the column entitled 'Initial Condition'.
P7	Normal System	The loss of: 1. Any two adjacent (vertically or horizontally) circuits on common structure.	SLG	Excludes circuits that share a common structure for 1 mile or less.
Extreme Event – Steady State 1	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device	Steady State Only	

Extreme Event – Steady State 2	Normal	Local Area events affecting the Transmission System such as: a. Loss of a tower line with three or more circuits. b. Loss of all Transmission lines on a common Right-of-Way. c. Loss of a switching Station or Substation (loss of one voltage level plus transformers) d. Loss of all generating Units a generating Station e. Loss of a large Load or major Load Center	Steady State Only	
Extreme Event -Steady State 3	Normal System	Wide area events affecting the transmission System based on System Topology such as: a. Loss of two generating Stations. b. Other events based upon operating experience that may result in wide area disturbances.	Steady State Only	
Extreme Event-Stability 1	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device	3Ø fault on one of the following: 1. Generator 2. Transmission Circuit 3. Transformer 4. Shunt Device	Stability Only -3Ø	
Extreme Event -Stability 2	Normal System	Local or wide area events affecting the Transmission System such as: a. 3Ø fault on generator with stuck breaker or a relay		

		failure resulting in Delayed Fault Clearing. b. 3Ø fault on Transmission Circuit with stuck breaker or a relay failure resulting in Delayed Fault Clearing. c. 3Ø fault on Transformer with stuck breaker or a relay failure resulting in Delayed Fault Clearing. d. 3Ø fault on bus section with stuck breaker or a relay failure resulting in Delayed Fault Clearing. e. 3Ø internal breaker fault f. Other events based upon operating experience, such as consideration of initiating evens that experience suggests may result in wide area disturbances.		

2016 FERC FORM 715 PART 6

SYSTEM EVALUATION

DATE: 03/03/2015

CONFIDENTIAL

NIPSCO Transmission Planning

CEII – Do Not Release