# Hoosier Energy
# 2023 Integrated Resource Plan
# Volume I: Main Report
# Cause No.

**April 2024**

*Prepared By:*

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HOOSIERENERGY

# 2023 Integrated Resource Plan

## Volume I: Main Report
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# 1 Introduction

This *2023 Integrated Resource Plan* (the Plan or the IRP) is submitted by Hoosier Energy Rural Electric Cooperative, Inc. ("Hoosier Energy") pursuant to the requirements of Rule 170 of the Indiana Administrative Code 4-7 (hereinafter referred to as the Rule). The Plan consists of two volumes. Volume I contains the executive summary, the peak demand and energy forecasts, a description of existing resources, the selection of resources, the resource portfolios and the short-term action plan as required by the Rule. Volume II contains the technical appendices with information required under the Rule.

The IRP contains four subsections. The first section (Section 1) provides an overview of Hoosier Energy and the Hoosier Energy member systems and an executive summary. The second subsection (Section 2) summarizes the energy and demand forecasts and the methodology used to develop the forecasts. The third subsection (Section 3) describes Hoosier Energy's existing resources, both supply-side and demand-side resources. The fourth subsection (Section 4) addresses the selection of potential new resources (both supply-side and demand-side) and the screening process used, along with the development of the modeling scenarios, the portfolio optimization modeling, and the resulting Preferred Plan.

## 1.1 Hoosier Energy Operational Description

### *1.1.1 Hoosier Energy Member Systems*

Hoosier Energy is comprised of seventeen member distribution cooperatives located in central and southern Indiana and one member distribution cooperative located in southeastern Illinois.
Table1 shows the member systems that comprise Hoosier Energy.

| **Rural Utilities Service Designation** | **Name of Cooperative** | **Location of Headquarters** |
|---|---|---|
| Indiana 1 | Utilities District of Western Indiana REMC | Bloomfield |
| Indiana 16 | Henry County REMC | New Castle |
| Indiana 21 | Bartholomew County REMC | Columbus |
| Indiana 26 | Daviess-Martin County REMC | Loogootee |
| Indiana 27 | Decatur County REMC | Greensburg |
| Indiana 38 | JCREMC | Franklin |
| Indiana 47 | Orange County REMC | Orleans |
| Indiana 52 | Southeastern Indiana REMC | Osgood |
| Indiana 60 | South Central Indiana REMC | Martinsville |
| Indiana 72 | Clark County REMC | Sellersburg |
| Indiana 83 | Dubois REC, Inc. | Jasper |
| Indiana 89 | Harrison REMC | Corydon |
| Indiana 92 | Jackson County REMC | Brownstown |
| Indiana 99 | Southern Indiana Power | Tell City |
| Indiana 109 | Whitewater Valley REMC | Liberty |
| Indiana 110 | WIN Energy REMC | Vincennes |
| Indiana 111 | RushShelby Energy | Manilla |
| Illinois 002 | Wayne-White Counties Electric Coop | Fairfield, IL |

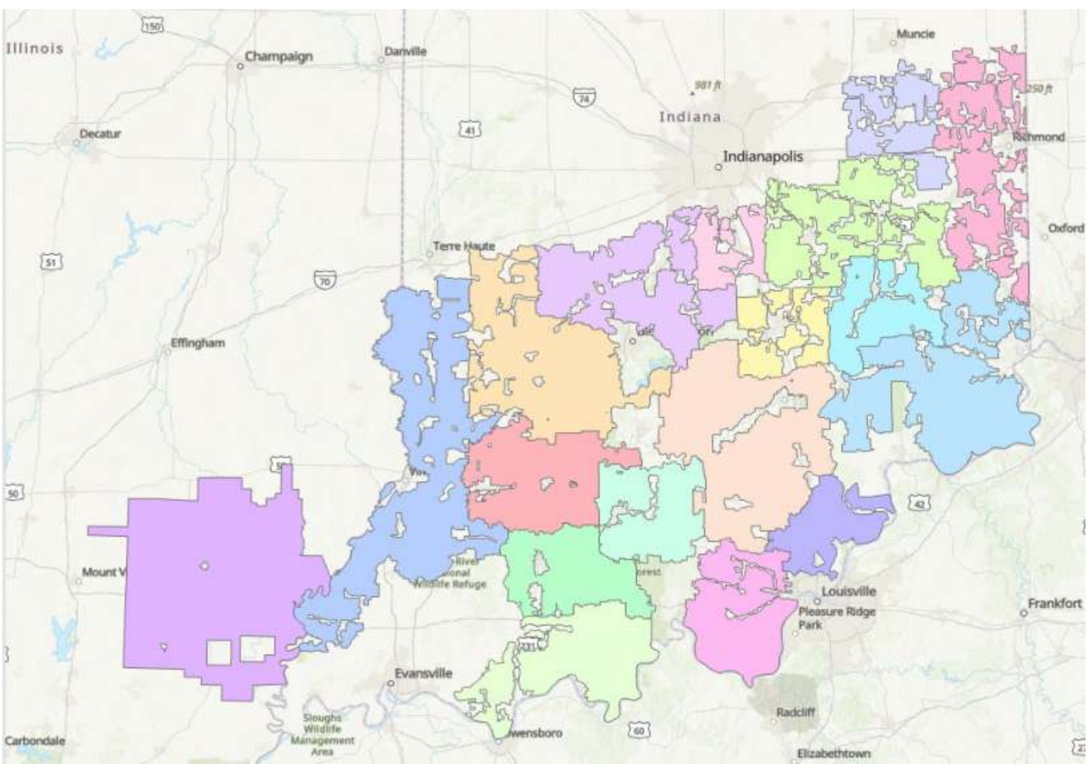
**Table 1: Hoosier Energy Member Systems**

### *1.1.2 Location and Service Territory Characteristics*

Hoosier Energy's headquarters facility is located at 2501 South Cooperative Way, on the south side of Bloomington, Indiana. Hoosier Energy operates power plants in Worthington and Lawrence County, Indiana and Beecher City and Pontiac, Illinois (detailed further in Section 3.1.1) and has transmission crews stationed in Spencer, Seymour, Rushville, Worthington, Petersburg, Poseyville, Napoleon, and English.

The approximate boundaries for Hoosier Energy's member service territory are shown in the map. The headquarters for Hoosier Energy is located on Interstate Highway 69, on the south side of Bloomington, Indiana. The approximate boundaries for the Hoosier Energy service area are as follows:

1. The east boundary – The Indiana and Ohio state line.
2. The south boundary – The Ohio River, which is the Indiana and Kentucky boundary.
3. The west boundary – The Wabash River, which is the Indiana and Illinois boundary. As of January 2011, portions of eleven counties in Southeastern Illinois, just across the Indiana-Illinois boundary are being served.
4. The north boundary – An east west horizontal line drawn across central Indiana through Indianapolis, Indiana.




This service area contains, or is adjacent to, the metropolitan areas of Indianapolis, Cincinnati, Louisville, Evansville, Terre Haute, Columbus, Bloomington and Vincennes. The major interstate highways serving this area are I-65, I-69, I-74, I-70 and I-64. The final section of I-69 connecting Martinsville and the southern section of Indianapolis will be complete in 2024. This will complete the I-69 project which began in 2008 connecting Evansville to Indianapolis. This new section extends through the Hoosier Energy and member distribution system service area. Eventually, this interstate would connect Canada to Mexico. The service area is served by a number of major airports. The largest of these is the Indianapolis International Airport, which is located on the northern boundary. There are also several railroads traversing the service area. The service area contains or is adjacent to several major cities, has major routes of transportation and covers the majority of southern and central Indiana and a portion of southeastern Illinois.

The terrain in Hoosier Energy's service area varies from flat to rolling farmland to heavily forested hills containing many deep ravines. This terrain is used in a variety of ways:

- Agriculture for the growing of corn, soybeans, wheat and tobacco.
- Animal husbandry for the raising of hogs, beef cattle, dairy cattle and poultry.
- Stone quarries.
- Coal mining (both strip and underground).
- Hardwood forests for logging.

Dozens of Indiana State parks, forests and fish and wildlife areas as well as portions of the Hoosier National Forest are found in Hoosier Energy's service territory. There are also three large, manmade reservoirs in the service territory, Patoka, Brookville and Monroe, which are used for recreation, water supply and flood control.

The climate in this service area is continental, with warm summers and moderately cold winters. There are four distinct seasons with an adequate growing and harvest season for most farm crops. On the northern perimeter of the service area, the monthly average temperatures range from about 28$^{O}$F to 76$^{O}$F, with record temperatures ranging from -27$^{O}$F to 105$^{O}$F.[1] The southernmost edge of the service area has monthly mean temperatures ranging from 33.0$^{O}$F to 78$^{O}$F, with extremes ranging from -23$^{O}$F to 111$^{O}$F.[2] The normal heating and cooling degree-days throughout the area vary as shown in Table 2.

| City | Heating Degree Days | Cooling Degree Days |
|---|---|---|
| Indianapolis, IN | 5,251 | 1,139 |
| Louisville, KY | 3,936 | 1,743 |
| Evansville, IN | 4,338 | 1,525 |
| Cincinnati, OH | 4,982 | 1,161 |

**Table 2: Normal Heating and Cooling Degree-Days[3]**

The normal annual precipitation for this area is approximately 44 inches per year.[4]

[1] Indianapolis Local Climatological Weather Station Reports (Midwest Regional Climate Center, average period 1991-2020, extreme period 1943-2021).
[2] Evansville Local Climatological Weather Station Reports (Midwest Regional Climate Center, average period 1981-2010, extreme period 1896-2021).
[3] Midwest Regional Climate Center (defined NOAA normal, period 1991-2020).
[4] Obtained from Midwest Regional Climate Center (Indianapolis Weather Station, period 1991-2020

### *1.1.3 Consumer Class Breakdown*[5]

The consumer mix on the Indiana portion of the Hoosier Energy system changed slightly over the 2010 - 2019 period. In 2010, 94.5 percent of the system's consumers were residential, while in 2019, 93.4 percent were residential. The number of residential consumers increased from 277,913 in 2010 to 286,480 in 2019. By the year 2040, the number of residential consumers is forecast to increase 9.8 percent to 314,217. The percentage of total residential consumers served is forecast to decline slightly by the year 2040 (93.0 percent).

In 2010, 4.7 percent were Commercial and Other consumers compared to 4.9 percent in 2019. The total number of consumers in this sector grew from 13,683 to 14,868 during this period, representing a growth of 8.7 percent. The percentage of Commercial and Other sector in the year 2040 is forecast to be 5.2 percent, slightly above the present mix. The number of consumers in this class is forecast to increase 18.0 percent to 17,542 in 2040.

The total number of consumers from the Industrial sector, which is defined as loads requiring transformation greater than 1,000 kVA, increased from 197 to 232 during the 2010 through 2019 period, for a net gain of 17.8 percent. The forecast number of 226 consumers in the year 2040 indicates an decrease of 2.6 percent.

The proportions of the aggregated member energy sales are different from the consumer mix. The residential class proportion of sales decreased from 62.9 percent in 2010 to 57.5 percent in 2019 due primarily to a large increase in sales to the Industrial and Other Sectors. The actual member system residential energy sales decreased 3.8 percent from 4,314 GWh in 2010 to 4,152 GWh in 2019. The year 2040 residential sales forecast is 4,686 GWh, which accounts for 54.9 percent of total sales.

Hoosier Energy experienced significant growth in sales to the Industrial classification between 2010 and 2019. Energy sales increased 28.4 percent from 1,612 GWh in 2010 to 2,069 GWh in 2019. The portion of total sales to this sector increased from 23.5 percent in 2010 to 28.6 percent in 2019. Total energy sales proportion is forecast to be 31.3 percent (2,672 GWh) for the year 2040.

The proportion of sales to the Commercial and Other sector increased slightly from 13.6 percent of total sales in 2010 to 13.9 percent in 2019. Actual sales increased from 930 GWh in 2010 to 1,005 GWh in 2019, for an overall increase of 8.1 percent. Total energy sales of this class are forecast to be 1,181 GWh in 2040, or 13.8 percent of total sales.

In aggregate, member-system energy sales increased 5.4 percent from 6,855 GWh in 2010 to 7,226 GWh in 2019. The member-system energy sales forecast of 8,540 GWh for 2040 represents an increase of 18.2 percent from the 2019 value.

## 1.2 Summary of the Planning Process

As described in 170 IAC 4-7, the objective of the integrated resource planning process is to give the Indiana Utility Regulatory Commission (IURC) a regulatory model to ensure that the resource initiatives considered by Hoosier Energy conform with the Indiana Legislature's policy goals. The rule requires that Hoosier Energy consider alternatives to supply-side resources when constructing its candidate resource portfolios.

[5] Historical statistics prior to 2011 do not include the addition of Wayne-White Counties Electric Cooperative.

In accordance with the Rule, the objective of the Hoosier Energy planning process was to develop a strategy for the planning period to afford Hoosier Energy flexibility and latitude in providing electric energy service to its customers. The first step in the IRP process was to prepare an analysis of the historical and forecast levels of peak demand and energy usage. Section 2 of the Plan presents Hoosier Energy's forecast of peak loads and energy consumption. The next step in the resource planning process was to assess the resources existing and potentially available to meet the energy and demand over the planning period. Section 3 details this resource assessment.

The final steps in the planning process were to eliminate nonviable resource alternatives through an initial screening of all future resources identified in the resource assessment and select the best combination of resources that is consistent with the objectives of the IRP. These processes are presented in Section 4.

### 1.3 Executive Summary of the Resource Plan

Based upon its current load forecast and existing and future resource assessment, Hoosier Energy's preferred course of action is to pursue a combination of owned and purchased power resources, including wind, solar, battery storage, natural-gas and nuclear to meet its requirements in upcoming years. The Preferred Plan is shown in Table 20 in Section 5.3. This Plan represents the portfolio that most economically serves members, while ensuring adequate reliability and minimizing risk.

Three criteria were established to guide the development of the IRP. These criteria were incorporated into a Scorecard to guide the resource planning process:

1. Affordability and Stability - Limit Wholesale rates and provide a level of rate certainty over the 20-year time horizon.
2. Environmental Sustainability - Limit environmental risk over the 20-year time horizon.
3. Risk and Opportunity – Evaluation of portfolios for the risk and opportunity associated with cost exposure ranges in shifting environments, market interaction & exposure, and generation diversity.

While not directly captured in the Scorecard, another important attribute that guided the IRP development was Reliability, or the ability of Hoosier Energy's resource portfolio to provide operational reliability and grid stability. This attribute was an important characterization in each of the portfolios and was addressed through the Quanta study.

The resource planning process resulted in a Plan that seeks to minimize member-system power supply costs and risks while maintaining a high degree of system reliability. In addition, the Plan seeks to maintain sufficient flexibility to react to changes in member system needs, load forecasts, legislative and regulatory mandates, new technologies and market price volatilities. This Plan will be reevaluated periodically to ensure that the recommended courses of action are having the desired effect and continue to be the best alternatives.

Hoosier Energy will continue to fulfill its resource requirements through a combination of company-owned resources, long-term power purchases and sales, and short-term purchases and sales. Hoosier Energy will continue to work with Member Systems to offer a menu of demand-side measures to promote the efficient use of resources. The wholesale tariff was most recently updated in 2021, with implementation in 2022, and provides incentives for both demand response program participation and load shifting.

### *1.3.1 Public Policy Considerations*

A major factor in the development of the Plan was the effect of potential CO2 legislation and/or regulatory changes. For example, additional environmental restrictions have the potential to further affect cost assumption tradeoffs between the type, quality and availability of fuel burned and the allowable emissions level at existing and future generating stations. The Plan considered future environmental legislation and was structured to be flexible enough to incorporate future restrictions.

This Plan contemplates no significant changes to the current integrated retail market, which could affect Hoosier Energy's Members. However, the plan does consider the relatively high-risk environment created by customer interest in self-generation and its impact on a utility's obligation to serve retail load.

### *1.3.2 Supply-Side Resource Considerations*

Hoosier Energy is required to adhere to specific standards regarding resource adequacy. The overall level of generation required to maintain system integrity and reliability is of paramount importance. In evaluating supply-side resources, the estimated capital cost and expected operating costs are two primary factors. However, a robust IRP must also consider additional factors, such as current and future environmental regulations, permit requirements, regulatory approvals and customer impacts. The Plan should also recognize the value of diversity – fuel, technology, resource type, ownership, location – to mitigate risks, such as operating, ownership and market risks.

### *1.3.3 Demand-Side Resource Considerations*

As a cooperative, Hoosier Energy interests are aligned with its Members and its Members' retail customers. Hoosier Energy is committed to serving Members reliably and at the lowest possible cost. This commitment is demonstrated as Hoosier Energy and Hoosier Energy's 18 Members offer an array of energy efficiency and demand-side management programs to member-consumers. Information pertaining to current program offerings are found at the following link: http://whyelectrify.com/ Descriptions of Hoosier Energy's DSM programs can be found in Section 3.

Further detail on the energy efficiency and demand response programs can be found in the 2022 Demand Side Management Report, which is included in this IRP as Appendix D. The DSM programs result from work with GDS Associates and Summit Blue Consulting to develop the Energy Efficiency & Demand Response Potential Report. The Potential Report, which was most recently updated in 2023 and attached as Appendix C, provides detailed descriptions and analysis of all demand-side programs considered and recommended for Hoosier Energy and remains an integral part of the Plan.

## 1.4 Hoosier Energy's Short-Term Action Plan

Section 9 of the Rule requires inclusion of a short-term action plan as part of its IRP. Hoosier Energy worked alongside ACES, Quanta Technology, GDS Associates and others to inform and execute an analysis of hypothetical portfolio performance under differing economic and regulatory scenarios. The analysis consisted of a 20-year forward assessment of the member load forecast and resources required to achieve an affordable and reliable portfolio profile. The preferred strategy is to bolster Hoosier's baseload capacity while diversifying energy sources to avoid fuel, development, and regulatory risk. Space should also be created to take advantage of an evolving technology landscape as new advancements are made in energy storage and grid management. As discussed in more detail within this integrated resource plan, based upon the current load forecast, power and gas market expectations, known environmental regulations and supply-side and demand-side resource mix, Hoosier Energy presents the following short-term action plan:

1. Add reliable intermediate load resources through the changing dynamics of MISO's generation mix.
2. Balance market opportunities to meet short-term needs.
3. Create a balance between affordability and stability in order to mitigate regulatory risk exposure.

### 1.5 Comparison to Prior Short-Term Action Plan

In the 2020 Integrated Resource Plan filing, Hoosier Energy submitted the following short-term action plan:

1. Expected retirement of Merom in 2023.
2. Issue an all-source Request for Proposal (RFP) in 2020.
3. Continue to monitor and analyze potential environmental regulations.
4. Continue to monitor market economies and the impact on existing and future resources.
5. Pursue economic short-term market transactions to manage risk.
6. Continue to identify and implement cost-effective DSM resources in conjunction with 18 Member systems.

In March 2020, Hoosier Energy issued an all-source RFP seeking up to 1,000 MW of capacity and energy resources to fill the need created by the prospective Merom retirement. This RFP received a broad range of responses from both a resource type and geographic perspective. The results of this RFP will be discussed in more detail in Section 3.

Hoosier Energy issued a follow-up all-source RFP in July 2022 to procure an unspecified amount of capacity and energy resources to meet its future requirements and inform supply-side resource assumptions in this IRP. Again, this RFP response received a broad range of resource types and locations

In 2022, Hoosier Energy reached agreement to sell the Merom plant to Hallador Energy Company rather than retire the facility. As part of the agreement, Hoosier Energy entered into a PPA with Hallador to purchase the full plant share of capacity and energy for MISO Planning Year 2022-23 and then 300 MW through calendar year 2025. In 2023, the parties amended the agreement to extend the term through MISO Planning Year 2027-28.

Hoosier Energy has continued to pursue the strategies described in its short-term action plan, including implementation of demand response and energy efficiency programs. The programs and their results are contained in the 2022 Demand Side Management Annual Report, which is attached as Appendix D to this IRP.

Hoosier Energy has continued to add cost-effective renewable resources to its resource portfolio. For example, Hoosier Energy added 200 MW of solar PPAs to its portfolio in 2022 and has Board approval to add a 150 MW solar resource during MISO Planning Year 2026-27. In addition, Hoosier Energy's Preferred Plan includes the addition of solar and battery storage resources during the next 10 years. The addition of these resources will add fixed price resources to the portfolio, thereby reducing market price risk.

# Section 2: Energy and Demand Forecasts

# Power Requirements Study 2020-2040

## July 2022

Hoosier Energy Rural Electric Cooperative, Inc.

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## Acknowledgments

A number of people have contributed to the development of this Power Requirements Study (PRS). The manager and PRS representative from each REMC/REC member system were keys to the success of this project and provided valuable data and input. The U.S. Department of Agriculture, Rural Utilities Service (RUS) provided valuable insights into interpreting the current demand for electricity. The Resource Planning and Forecasting Department of Hoosier Energy Rural Electric Cooperative, Inc. (Hoosier Energy) directed the research and was responsible for database updating. The group collaborated with Itron staff to develop the models utilizing their energy forecasting software to create the various forecast scenarios. Hoosier Energy staff compiled the final report.

## Executive Summary

This report documents the development of a modeling system for forecasting the growth in electric energy sales and demand through the year 2040 for Hoosier Energy, Indiana 106 and for each of its member REMC/REC systems. The forecast meets three specific needs:

- provides a basis for determining distribution system modifications and capital investments;
- develops a consistent framework for Hoosier Energy to plan and project system wide requirements and improvements; and
- satisfies the requirement made by the Rural Utilities Service (RUS) that Generation and Transmission (G&T) cooperatives provide empirical studies of each distribution cooperative which are consistent with system projections and which reflect an understanding of the system, its loads, its members and its power supply.

This Power Requirements Study (PRS) was prepared by the Hoosier Energy Resource Planning and Forecasting Department with assistance, input, and review by the member system managers and/or PRS representatives and by the RUS representatives. The Hoosier Energy forecast is the result of aggregating the individual member system energy forecasts. Hoosier Energy forecasted generation requirements were obtained by combining the aggregated member results with the transmission losses due to the member load and non member energy sales.

As stated in Hoosier Energy Board Policy No. 5-3, "In partnership with members, Hoosier Energy will develop and offer efficiency and demand response programs that strengthen the ability of consumers to better manage electric consumption in an era of rising costs." Collectively, these energy efficiency and demand response (i.e., load control) programs are referred to as Demand Side Management (DSM) programs. The Hoosier Energy DSM impacts are determined through the aggregation of member system DSM program impacts across all user classifications (residential, commercial and industrial) and then adjusted to generation levels. In support of this policy, a DSM adjusted forecast is provided and should be used for all planning purposes.

Econometrics was the methodology chosen to develop models for each of the member system's residential and commercial energy use, peaks, and consumers. These Residential Energy Models were Statistically Adjusted End-Use Models and were specified to include these factors: average use, real average price, service area real per capita income, heating and cooling degree days, energy efficiency codes and standards, and service area population and households. Future values for these variables were developed based upon various governmental sources, consulting firms as well as local area knowledge provided by the REMC's representatives.

The Commercial Energy Model was specified to include average use and consumer growth. Commercial consumer growth was directed by economic drivers (examples: total employment, non-manufacturing employment, GDP, etc.) that best align with past growth patterns. Future values for these variables were developed based upon various governmental sources, consulting firms as well as local area knowledge provided by the REMC's representatives. Results from the Residential Energy Model and Commercial Energy Model were combined with projections for growth in the Industrial and Other sectors to provide a forecast for total energy sales for each member. Aggregation of the members total energy sales, along with incorporation of distribution losses yield the total member system energy purchases.

Five energy forecast scenarios were developed to examine each of the members' requirements and their sensitivity to weather variances and economic conditions. These five scenarios are identified as Base-Normal case, Base-Severe case, Base-Mild case, High-Normal case and Low-Normal case. All cases are presented with DSM impacts included. The Base-Severe and Base-Mild are the energy extreme weather sensitivity cases, while the High-Normal and Low-Normal cases represent varying economic conditions. Economic variation in the models was simulated via variation of the member specific economic drivers for the Residential and Commercial classes. The results of each scenario were aggregated to provide different scenarios for Hoosier Energy as a whole.

The Base-Normal case scenario results for the Hoosier Energy system reflect a forecasted average annual growth in the number of total consumers of 0.46% over the 20-year forecast period which is about the same as the 0.47% average annual growth observed over the past 10 years, and less than the previously forecasted 20-year growth rate of 0.6% found in the July 2020 PRS. The Hoosier Energy total electric energy sales to the member systems (energy purchased by member systems) has an average annual growth rate of 1.01% for the forecast period. This growth is higher than the 0.72% average annual growth experienced by the system covering the past ten-year period. The previous 20 year energy purchase forecast growth rate found in the July 2020 PRS was 0.58%. The five-year incremental average annual growth rates for the July 2022 PRS over the forecast period are 3.01% (2020-2025), 0.33% (2025-2030), 0.26% (2030-2035) and 0.46% (2035-2040).

A summary of the Base-Normal Compound Average Growth can be found in Table 3 and is also below:

**AVERAGE ANNUAL PERCENT GROWTH TABLES**

Base-Normal Case

| Time Period | Total Consumers | HE Sales | Winter Peak | Summer Peak |
|---|---|---|---|---|
| 2010-2015 | 0.30% | 0.33% | 3.94% | -0.32% |
| 2015-2019 | 0.68% | 1.21% | 0.63% | 1.15% |
| 2010-2019 | 0.47% | 0.72% | 2.45% | 0.33% |
| 2020-2025 | 0.60% | 3.01% | 1.84% | 2.18% |
| 2025-2030 | 0.49% | 0.33% | 0.12% | 0.25% |
| 2030-2035 | 0.40% | 0.26% | 0.02% | 0.25% |
| 2035-2040 | 0.34% | 0.46% | 0.23% | 0.48% |
| 2020-2040 | 0.46% | 1.01% | 0.55% | 0.79% |

It is important to note that the historical percentages, as reported, cover time periods in which the number of Hoosier Energy member systems served has fluctuated. Hoosier Energy membership expanded to 18 as of January 1, 2008, when Wayne-White Counties Electric Cooperative joined. Power service to Wayne-White Counties Electric Cooperative began on January 1, 2011. Table 1 illustrates forecasted consumer and energy values with graphics being presented in Figures 1, 4, and 6. Table 3 illustrates the average annual percent growth rates by consumer class.

To obtain the maximum Hoosier Energy system generation energy requirements, the Base-Normal case scenario member energy requirements (excluding the special "pass-through" contractual sales) are combined with the energy requirements involving non member sales during this forecast period. There are no non-member energy sales forecasted at this time.

The method used in developing the Hoosier Energy demand forecast was developed by aggregating the individual member 60-minute coincident system demand forecasts. The total generation demand requirements for the Hoosier Energy system were developed by combining the Hoosier Energy 60-minute demand results (excluding the special "pass-through" contractual peak), and transmission losses.

The individual member system peak demands forecast coincident and non-coincident peaks are developed using a statistical model driven by the electric energy forecast and peak producing weather.

Four additional scenarios were developed according to RUS standards. These scenarios are defined as Base-Severe, Base-Mild, Low-Normal, and High-Normal. These reflect Base, High, and Low economic conditions and Normal, Severe and Mild weather conditions. Normal weather is a 30-year average, Severe and Mild weather are based on a one in ten scenario. Base economics utilized Woods and Poole's long-term forecast, generated in 2021, and the High and Low economic forecasts capture faster and slower than anticipated economic growth. The energy and demand values for these scenarios are in Table 4, with graphics in Figures 4 and 6.

To develop an upper bound on peak demand requirements, an additional case was examined. The Base-Extreme case reflects the third coldest day in the last 30 years for the peak winter month. Similarly, the third hottest day in the last 30 years for the peak summer month. All scenarios were adjusted for DSM impacts.

In the Base-Normal case, the Hoosier Energy member system is winter peaking for the entire forecast period of 2020 through 2040. Upon review of the two forecasts, all but one of the member systems peak in the same season they peaked in the previous forecast. The Hoosier Energy system is a relatively balanced system between the winter and summer peaks. It is important to note that due to system characteristics extreme weather can easily cause the systems' peak season to swing.

The 2040 Hoosier Energy member system winter coincident demand requirement is estimated to be 1,728 megawatts (MW), with transmission losses included (excluding the "pass-through" contractual demand). This illustrates an average annual increase of 0.55% and an overall demand change of 180 MW for the forecasted period. The forecasted 2040 summer peak demand requirement is estimated to be 1,647 MW, with an average annual increase of 0.78% during the forecast period, representing an overall increase of 238 MW. The comparable demand growth rates in the July 2020 PRS were 0.78% for summer and 0.65% for winter, overall increases of 249 MW and 214 MW, respectively.

The Hoosier Energy member system updated coincident demand values with losses for the 2040 Base-Normal Extreme summer and winter cases are 1,886 MW and 1,960 MW, respectively. Table 2 illustrates the Base-Normal and Base-Normal Extreme demand values along with the expected annual load factors.

To obtain the maximum seasonal Hoosier Energy system generation demand requirements, the Base-Normal 60-minute coincident winter and summer peaks due to the member system demands (transmission losses included and "pass-through" contractual sales excluded) are combined with winter and summer demands due to non member sales. As with the non member energy sales requirements, there are no non member demand sales requirements included in this forecast.

The results, based upon the stated assumptions, indicate that the winter seasonal peak demand requirements will be the dominating factor driving the peak generation requirement needs from 2020 through 2040.

The PRS is part of a continuous process of performance evaluation and forecasting. The modeling process, as well as the continuous database updating, model validation and forecast error analysis involved in the preparation of this study, will be expanded and adapted as additional information becomes available.

# SECTION 1.
# Power Requirements Study Overview

## Introduction

The electric utility industry faces changes in load patterns and the rate of load growth due to ever-changing economic, demographic, technological and regulatory conditions. The relationship between economic variables and electricity usage became evident in the early seventies when electric utilities experienced sudden and unexpected fluctuations in load patterns and demand magnitudes due to economic factors. The volatility of these economic factors necessitated the development and usage of more sophisticated load forecasting methods to accurately reflect their impacts. No longer could the traditional method of trending the historical growth in electric use provide an accurate estimate of the future.

In consideration of this, the Rural Utilities Service (RUS) has established the procedures to be followed by their RUS borrowers in the development of load forecasts. These procedures and requirements are stated in RUS Rule[1] 1710, Subpart E, sections 1710.200 through 1710.210. This rule requires that the Generation & Transmission Power Supply (G&T) borrower and its member distribution cooperatives develop models which take into consideration all relevant factors and reflect an in-depth understanding of the system, its loads, its members and its power supply situation. The specific method chosen by the cooperative depends on its needs and resources and must be both an empirical and judgmental process and capable of producing credible and defensible load forecasts. For the G&T borrowers, the Power Requirements Study (PRS) must be coordinated between the power supply organization and its members, include input from consumer surveys coordinated by the power supplier and be approved by the member system's Board of Directors. Hoosier Energy coordinates the PRS development through representatives from Hoosier Energy and PRS Representatives from each member distribution cooperative.

### OBJECTIVES

The PRS provides an empirical basis for capacity, transmission and distribution facilities planning. It formalizes the analysis of the need for electric energy and demand in the territory served by the electric cooperative over the next twenty years. The PRS provides for a systematic investigation of the history of the cooperative's growth and an understanding of the unique features of the cooperative's service area. It allows not only for a better background for forecasting electricity load growth, but also for a more accurate perspective on the current status of the system. In the end, this study allows for the development of a forecast which meets three specific needs:

1. provides a basis for determining distribution system modifications and capital investments;
2. develops a consistent framework for Hoosier Energy to plan and project system wide requirements and improvements;
3. satisfies the requirement made by RUS that G&T cooperatives provide empirical studies of each distribution cooperative, which are consistent with system projections, and which reflect an understanding of the system, its loads, its members and its power supply.

The current PRS follows the procedures and requirements as established by RUS Rule 1710, subpart E, sections 1710.200 through 1710.210. In general, these rules require the G&T borrowers and their member distribution cooperatives to develop models which will take into consideration all relevant factors and reflect an in depth understanding of the system, its loads, its members and its power supply situation. Examples of relevant factors to be used would be the economic, demographic, technological, regulatory and meteorological factors which affect electricity consumption in the cooperative's service area.

[1] RUS uses the term "Load Forecast" in reference to these forecasts in their rule but recognizes that "Power Requirements Study (PRS)" is a synonymous term. Therefore, Hoosier Energy REC, Inc. (Hoosier Energy) has elected, for continuity, to use the PRS terminology throughout the remainder of this document and in conjunction with the "Load Forecast" terminology within the titles of both the work plan and forecast documents.

## Methodology and Resources

### MEMBER BACKGROUND AND MODEL SELECTION

Before a model can be formulated, the analyst must have a clear understanding of the system. This understanding requires an investigation of the economic, demographic, technological and regulatory conditions influencing and affecting the demand for electricity by the system. Each of Hoosier Energy's member systems is analyzed to identify the important factors affecting their load and energy usage.

Beginning with information from previous Power Requirements Studies and drawing upon the experience and knowledge of the managers and staff, cooperative records and historical consumer survey databases, a preliminary list of factors influencing electricity demand in each cooperative is identified. A model sensitive to these factors is then formulated.

Factors which may be important include:

1. The levels of and changes in economic factors such as income and unemployment.
2. The levels of and changes in demographic variables such as population and housing.
3. The levels of and changes in electricity prices.
4. The levels of and changes in the price and availability of alternate fuels.
5. The effects of conservation and DSM programs, which would include both demand response and energy efficiency programs.
6. Appliance mix, saturations, new home penetrations and efficiencies.
7. Weather.
8. Taxes or other government-imposed measures.

The models having the desired forecasting characteristics and manageable constraints are then examined for their consistency with RUS requirements. The models must provide credible, defensible and replicable short-term and long-range forecasts.

### MEMBER SYSTEM DATA COLLECTION

The data needed to model future electric power use includes both electricity consumption patterns and the factors affecting electricity consumption. Once models providing credible forecasts are identified, the data needs for these models are evaluated. The data needs of each model, the availability, quality, validity, costs and relevance of the data are considered.

Statistical data such as income, population, alternate fuel costs, unemployment and housing may be disaggregated to a level consistent with the cooperatives' service areas. Possible sources for this information are governmental agencies such as the U.S. Department of Commerce and the U.S. Department of Labor, private consulting firms and appropriate state agencies. Other information, such as energy usage, electric costs, consumers per system, consumers served per county, and DSM program participation and impacts are collected on a per system basis. The main sources for this information are RUS Form 7, CFC Form 7, RUS Form 345 and the Hoosier Energy's "Consumers Served per County" form. This information is gathered annually. All consumer specific data is coded for confidentiality purposes.

The information gathered from the Form 7 consists of operational cost data from "Part A"; miles of energized line from "Part B"; and the detailed monthly consumer sales and revenue information on a per class and total system basis as illustrated in the RUS Form 7 "Part R" (REV 12/99). The monthly per class information from "Part R" assists in the validation and analysis of the collected data and is required by RUS to maintain a complete PRS database. The data collected from the Form 345 in the years between formal forecasting is simply the updating of actual monthly load information, while in the formal forecast years consists of historical monthly information updates and future consumer specific planned growth activities and/or forecast values. The numbers annually collected on the "Consumers Served per County" form consists of residential and total consumers served per county on a year-ending basis. This information is used in the establishment of weights to allow for the conversion of county level information to "service area" specific values.

Through 2015, the DSM program activity levels were compiled annually on a per member system, per DSM program basis through collaboration between Hoosier Energy and the member distribution system staff. Beginning in 2016, aggregate data is collected automatically as member systems enter participant information using an Energy Efficiency Collaborative Platform (EECP). Using customized residential and commercial/industrial sector-level potential assessment computer models, along with the collection and the tracking of actual program participation, an estimation of DSM impact is examined. This information provides support for review of current and future DSM impacts on each system.

Additional data specific to each member distribution system is acquired from the residential survey database. Currently this database consists of the 18 sampling years of 1979, 1985, 1987, 1990, 1993, 1996, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019 and 2021. The residential surveys are developed and performed biennially by professional data gathering firms with assistance received from the Hoosier Energy staff and the member distribution systems.

These surveys are always conducted with sampling numbers such that results are truly representative of each individual member distribution system. The accuracy of these surveys allows Hoosier Energy and the member systems to continue to develop and maintain a valuable understanding of their end consumers and supports the Residential class statistically adjusted end use (SAE) model.

Hoosier Energy utilizes a SQL server database as a storage location for the majority of the data collected including SAE, weather, meter, member and economic data. The SQL server database is Itron's Forecast Manager software. Per Itron's website: "Itron's Forecast Manager™ brings together sales forecasting, data management and reporting into a single integrated application. Forecast Manager automates the input of key data for forecasting and analyzing sales trends linking directly with MetrixND™ forecast and weather impact models." Additionally, some economic data is stored within the provided spreadsheets from private firms on local network servers.

### DEVELOPMENT OF LOAD FORECASTING MODELS, FORECASTS AND DOCUMENTATION

Once the above items are completed, the important relationships between kilowatt-hour (kWh) sales and the factors affecting sales by the consumer class are explored. Hoosier Energy staff performs the forecast model development, using consultants as necessary.

The forecast models for each class consist of a consumer model and an average energy use model. The consumer models for the Residential and Commercial/Small Industrial classes are based on econometric modeling. The Residential average use model is an SAE model. The Commercial/Small Industrial average use model is based simply on historical average use.

Each forecast model is developed via the input of projected values for the driving variables, as discussed above, used within the econometric models. These projected values are obtained from a consultant's or a government agency's forecast of these variables or determined based on historical and projected member data. To validate the estimated relationships, Hoosier Energy examines:

1. The Consistency of the Model's Results – Based on the experience and knowledge of the cooperatives, do the factors identified have the expected impact on electricity consumption?
2. The Accuracy of Predicting Past Movements or "Backcasting" – Do the models track the historical pattern of energy consumption, price, and consumers when historical data is inputted?

3. The Energy Forecasts Results – Do the short-term and long-range forecasts seem reasonable?

Both the modeling and forecasting processes are iterative until an adequate econometric model and reasonable forecast results for each individual member system cooperative are obtained.

Next, the Other and Large Industrial classes are examined. Energy usage and consumer growth forecasts are developed on a per class basis. The Other forecast is handled through a simple trend/judgment review process. Industrial sector forecasts are customized for each consumer based on the knowledge and direction provided by each member system.

Once the energy forecast for each classification is completed, these values are aggregated and seasonal demand forecasts are produced for each member system. Forecast demand peaks are developed using a statistical model driven by the electric energy forecast and peak producing weather. Peak producing weather is determined by modeling historical peak demand and weather data.

The baseline energy forecast established represents the scenario identified as the "Most-probable economic assumptions, with normal weather." RUS requires four alternative scenarios involving economic and weather fluctuations. The four energy alternative scenarios are (i) Most-probable economic assumptions, with severe weather causing higher loads; (ii) Most-probable economic assumptions, with mild weather causing lower loads; (iii) Normal weather with more pessimistic macroeconomic assumptions causing lower loads; and (iv) Normal weather with more optimistic macroeconomic assumptions causing higher loads. The driving variables are adjusted to reflect the desired economic conditions, while all other variables remain at their baseline magnitudes. For the scenarios in which the weather conditions vary from extreme to mild, the heating and cooling degree days representing cooperative's service area are altered while all other variable values remain at baseline levels. To develop an upper bound on peak demand requirements, an additional demand scenario representing an "Extreme Single-Temperature" (Extreme) condition for the winter and summer season is also developed.

The results of the derived forecasts from each model are documented and reported. The cooperatives provide knowledge to the Hoosier Energy staff assisting in the development of the forecast models so that any shortcomings in the process are remedied before the models are finalized and reports prepared. Hoosier Energy staff, having worked with consultants, RUS and others in this field to perform these studies in the past, have the in-house capabilities to perform updates and revisions as needed and to assist the members in using these forecasting modules for their systems.

The Hoosier Energy system forecast is the final step in the forecasting process. This forecast is developed on a per class basis for energy and a total system basis for demand; however, Hoosier Energy's forecast does not involve actual forecast model development. Hoosier Energy's forecast is developed via the aggregation of all the individual member distribution system forecasts. As with the member system forecasts, the results of a baseline along with the four required alternative energy and demand scenarios are presented at the Hoosier Energy system level. An additional Extreme demand scenario for summer and winter is also developed. Each time a member cooperative system is updated, an update to the Hoosier Energy total system forecast is required.

In conjunction with using Itron's Forecast Manager database, Hoosier Energy develops the forecast models for each cooperative by utilizing Itron's MetrixND software. Per Itron's website: "Itron's industry-leading forecasting engine allows rapid development of accurate forecasts. Its intuitive Windows®-based interface and drag-and-drop architecture streamline the development of forecasting variables and models. MetrixND™ puts the power of the most advanced forecasting tools at your fingertips, enabling you to develop accurate load forecasts with confidence. Itron has developed, tested, and refined MetrixND for more than 10 years, providing a proven track record in the real world of energy forecasting."

## Work Assignments

Hoosier Energy and its member systems coordinate activities through member PRS Representatives. Responsibilities of member representatives may include annual data coordination and collection, data review and analysis, Hoosier Energy-member meeting scheduling, forecast review and PRS approval coordination. Consultant support is used in the areas of consumer survey, economic analysis, model development and DSM analysis when necessary.

### INVESTIGATION/ANALYSIS OF EACH COOPERATIVE'S & HOOSIER ENERGY'S SYSTEMS

Hoosier Energy, with cooperatives' assistance, drawing on cooperatives' records, consumer survey data and cooperatives' knowledge of their systems, evaluate and analyze available data to develop an understanding of each system and Hoosier Energy as a whole.

### LOAD FORECASTING METHODOLOGY ANALYSIS

Hoosier Energy, through communication and support from expert forecasting consultants, feedback from the utility marketplace, experiences by other G&T, and advice from RUS, evaluates the present methods of forecasting against other methodologies. Findings from this on-going research establish what methodologies are available and which best fit the present needs.

### MEMBER SYSTEM DATA COLLECTION AND ANALYSIS

Hoosier Energy, with cooperatives and consultants' assistance as needed, collect the necessary data. Cooperatives' records along with the surveys are sources of some data. Hoosier Energy has established links and subscriptions to economic, weather and energy information databases to support forecast and model development. This information is obtained from sources such as governmental statistical data collection agencies, state university sources, private organizations, NOAA databases and other utility databases.

### DEVELOPMENT OF LOAD FORECASTING MODELS, FORECASTS AND DOCUMENTATION

Hoosier Energy develops forecast models for each cooperative and for Hoosier Energy by consumer class. Forecasts and documentation are provided with cooperatives' input regarding any significant changes that may impact future electricity usage.

Meetings of Hoosier Energy and cooperative representatives are held as needed to solve any problems that may arise, review the results of the tasks, and provide direction if tasks must be revised. RUS consultation and input are requested, as necessary. Once the preliminary forecast for each system is developed, a copy is provided to each PRS Representative and their respective member manager for review and finalization. Each member system may request a meeting at their discretion to review the results of the forecast.

RUS has stated that an individual member system PRS meeting is not necessary if the member system, following review of their preliminary forecast, finds the numbers to be representative of what they believe will be happening on their system in the future. Sign-off from each individual member system manager is obtained as a record indicating review meeting option selected and final approval of the system's forecast.

## Schedule

The schedule for the Hoosier Energy and Member Systems PRS development and update is broken down into three specific periods. These three periods are defined as the “Annual Data Collection Period,” “Non-Forecast Period,” and “Forecast Period.” Tasks and times in the Annual Data Collection Period are events which occur every calendar year from December of one year to April of the next year. The tasks and events in the Non-Forecast Period occur from July of one year to April of the next year. Finally, the Forecast Period tasks and events occur from May of one year to June of the next year. The breakdown of these tasks and events within their appropriate periods are as shown below.

**I. ANNUAL DATA COLLECTION PERIOD**

December through June

1. Member System operational and statistical data collection and analysis (December-April).
2. Exogenous variable data collection (February-June).
3. Collect DSM actual data and analyze (February-April).

**II. NON-FORECAST PERIOD**

July through December

1. Finalize all Residential End-Use Survey (EUS) databases and preliminary preparations (July-August).
2. EUS in field (September-October).
3. EUS data processing and analysis (November-December)
4. Database collection preparation for forecast year (October-November).

January through April

1. EUS report structure and preliminary results review (January-February).
2. EUS reports completed and then distributed in May (April).

**III. FORECAST PERIOD**

May through December

1. Updating of operational database file structures and populating database (May-June).
2. Finalizing all exogenous data collection and populating database (May-June).
3. Complete DSM review (May).
4. Individual system model development and analysis (July-August).
5. Development and analysis of preliminary baseline and four required and two optional scenario forecasts for all classes per member distribution system (September-November).
6. Finalize Member system forecasts and complete Hoosier Energy iteration and forecast (October-December).
7. Preliminary review of the Hoosier Energy PRS (November-December).
8. Draft report development active (October-December).

January through June

1. Deliver member system forecast and receive member system CEO/Manager sign-off (January).
2. Final report development and review of each member system PRS (January-April).
3. Present to the member systems’ Board of Directors for approval (March-April).
4. Final documentation, report development, and review of the Hoosier Energy PRS (February-May).
5. Present to Hoosier Energy’s Board of Directors for board approval (June).

# SECTION 2.
# Hoosier Energy System

## Characteristics of Hoosier Energy's Service Territory

This section describes some of the important characteristics of Hoosier Energy's service territory. The location of the territory and the current pattern of residential electricity use are examined. A discussion of the member system's consumer classes and energy sales mix follows.

### LOCATION

The headquarters for Hoosier Energy is located on Interstate Highway 69, on the south side of Bloomington, Indiana. The approximate boundaries for the Hoosier Energy service area are as follows:

1. The east boundary – The Indiana and Ohio state line.
2. The south boundary – The Ohio River, which is the Indiana and Kentucky boundary.
3. The west boundary – The Wabash River, which is the Indiana and Illinois boundary. As of January 2011, portions of eleven counties in Southeastern Illinois, just across the Indiana-Illinois boundary are being served.
4. The north boundary – An east west horizontal line drawn across central Indiana through Indianapolis, Indiana.

This service area contains, or is adjacent to, the metropolitan areas of Indianapolis, Cincinnati, Louisville, Evansville, Terre Haute, Columbus, Bloomington and Vincennes. The major interstate highways serving this area are I-65, I-69, I-74, I-70 and I-64. The final section of I-69 connecting Martinsville and the southern section of Indianapolis will be complete in 2024. This will complete the I-69 project which began in 2008 connecting Evansville to Indianapolis. This new section extends through the Hoosier Energy and member distribution system service area. Eventually, this interstate would connect Canada to Mexico. The service area is served by a number of major airports. The largest of these is the Indianapolis International Airport, which is located on the northern boundary. There are also several railroads traversing the service area. The service area contains or is adjacent to several major cities, has major routes of transportation and covers the majority of southern and central Indiana and a portion of southeastern Illinois.

### CONSUMER CLASS BREAKDOWN

Figure 3 displays a stacked bar chart of the historical and forecasted number of consumers by class and the corresponding percentage each class represents. The Residential class represents over 93% of the total consumers. The Commercial class makes up almost 5% of consumers. The Irrigation, Street & Highway and Public Authority consumer classes are combined and reported as "Other". For Hoosier Energy the Other consumer class makes up less than 2% of total consumers. Industrial class makes up less than 1% of total consumers. Figure 3 displays the percentage of consumers by class. Overall consumer Compound Average Growth Rate (CAGR) from 2010-2019 was 0.47%. Refer to Table 3 for a summary of compound average growth rate by consumer class.

From 2010 to 2019 Hoosier Energy kWh member sales increased by a CAGR of 0.59%. Refer to Table 3 for compound average growth rates for each of the energy sales by consumer class. Figure 7 shows the percentage of sales for each consumer class. In 2019, the percent breakdown was: Residential (57%), Industrial class (29%), Commercial (13%) and Other (1%).

## RESIDENTIAL CONSUMER AND END USE PROFILE

The profile of members shows they are slightly older, better educated and have higher income than in prior measures. The average respondent is 57 years old, with the top two dominant occupations being classified as retired and professional. More than half have an education level of college graduate or higher. The average household income level has increased to more than $88,000 per year. The dominant dwelling structure remains a single family traditionally built home, with an average square footage of over 2,000 square feet and an average age of 32 years.

In review of the study results pertaining to heating fuels, systems, and appliances, here are some of the key findings:

- The primary heating fuel has the greatest impact on overall electric usage, and for the past several measures electricity has continued to record a gain in share. Electric penetration, with a 43% share, continues to exceed propane at 28% and natural gas at 22%. Wood heat continues to decline, now showing 6%.
- For electric heating systems, as related to electric heat customers only, heat pumps continue to be the primary area of growth. Electric heat pumps have the single largest share at 40%. Electric furnaces have the next largest share at 32%, followed by geothermal at 17%, resulting in more than half of electric systems including heat pumps of some form.
- Air conditioning saturation remains essentially unchanged at 94%. Air conditioning systems are composed of 22% heat pump systems and 69% traditional central air units. Window units are experiencing a decline.
- Electric remains the dominant primary fuel used in water heating, although electric penetration fell slightly (70%). Natural gas rose slightly (17%), with propane at 12%.

## COMMUNICATION AND NEW TECHNOLOGIES

The levels of Internet-connected devices all continued sizable growth, with smart phone technology now reaching 96%. Landlines as a primary home phone service continues to decline and has fallen to 11% from over 55% 10 years ago.

The usage of satellite and cable boxes in households continues to decrease and is under 50%.

Social media growth has continued, with only 11% of members not using it. The fastest growth platform is TikTok. The measure of electric vehicles has grown but is still small at 1%. However, nearly 19% plan to acquire an EV in the next 10 years. Similarly, only 2% have renewable power generation resources currently, and nearly 8% plan to in the next five years.

# SECTION 3.
# Results

## Base-Normal Forecast Assumptions and Results

The Hoosier Energy forecast is an aggregation of the member forecast results. The Base-Normal forecast scenario for Hoosier Energy uses recent normal weather (2007-2019) and most probable economic conditions. The annual forecasted energy results for each class can be found in the RUS Form 341 Base-Normal Scenario. Refer to Figure 7 for forecast energy sales by consumer class and a trend of percent of energy sales by class. Table 3 provides a summary for CAGR historically and for various intervals in the current forecast.

Hoosier Energy is forecasted to see a 1.01% CAGR in energy sales over the forecast period (2020-2040). The growth is expected to be at its highest rate in the first 5 years (3.03% CAGR). Overall demand is expected to increase by 0.55% during the forecast period.

All classes are modeled for both consumers and energy. The residential consumer models for each member are econometric models and driven by economic drivers for population or number of households within the service territory. The residential energy model for each member is a Statistically Adjusted End-Use model, with one or more of the following drivers: baseload technologies, income, employment and RPI. The residential forecasted energy CAGR is 0.65% over the forecast period. Residential energy is about 59% of total energy sales at the beginning of the forecast 2020 and will decrease to 55% by 2040.

The Commercial class consumer model is an econometric model and the economic driver for each member varies. The economic drivers that best aligned with the members commercial consumers growth in this study are: total employment, manufacturing employment, mining employment, and non-farm employment. The Commercial class energy model is an Average Use model based on historical usage per consumer. The Commercial class forecasted energy CAGR is 0.82% over the forecast period. Commercial class energy sales make up 14% of total energy sales in 2020 and will decrease slightly to 13% by 2040.

The Industrial class forecast was customized for each consumer based on historical data and knowledge from Hoosier Energy Key Accounts and representative personnel from each of the members. The Industrial class is forecasted to see an 8.69% increase in the first 5 years of the forecast with a 1.83% CAGR over the 20-year forecast period. In 2020 industrial energy sales make up 27% of total energy sales and will increase to 31% by the end of the forecast.

The “Other” forecasted consumers and energy per consumer components are based on empirical and historical usage data. This consumer class is expected to grow by a CAGR of 0.02% during this forecast. The Other class contributes less than 1% of total energy sales in 2020 and this will stay the same throughout the forecast.

Once the energy forecast is complete, the forecasted demand peaks are developed using a statistical model driven by the energy forecast and peak producing weather. Historically, Hoosier Energy has been a winter peaking system. The forecast shows that this will not change through 2040. Seasonal demand is expected to increase by 0.55% CAGR for winter and increase 0.78% for summer. See Tables 2 and 3 for details of the seasonal forecast for demand.

## Forecast Alternatives

Four alternative energy scenarios and an additional demand scenario were also developed. A summary of the results for annual energy and demand for each forecast scenario can be found in Table 4 and Figures 4 and 6. Two economic scenarios-High-Normal and Low-Normal-are developed by correspondingly adjusting the economic drivers correlated with the residential and commercial classes. Each of these scenarios uses Normal weather, as in the Base-Normal scenario.

Two additional weather-related scenarios were also developed. The Base-Mild scenario is based on the warmest average monthly temperature for the winter months and coolest average monthly temperature for the summer months. The Base-Severe scenario was created based on coolest average monthly temperature in the winter months and warmest average monthly temperature in the summer months. The weather was based on historical average monthly temperatures from 2007 to 2019. The economic variables use a most probable economic outlook as in the Base-Normal scenario.

Lastly, an additional demand scenario was developed. The Base-Extreme scenario is based on the third coldest day in the last 30 years for winter demand and third hottest day in the last 30 years for the summer demand. The economic variables use a most probable economic outlook.  The Base-Extreme demand forecast is located in Table 2 and Figures 8 and 9.

Future uncertainties include Electric Vehicle (EV) adoption and distributed generation installations such as solar and battery storage. Current EV adoption rates are low and have no clear trend based on the information collected at this time. Therefore, impacts on the short-term range of this forecast expect to fall well within the alternative scenarios presented. Future studies will provide more insight into long term EV adoption rates and forecast impacts. Current distributed generation technologies are tracked within the service territory and are considered in the residential energy model. Current levels do not have a statistically significant impact on the energy model. However, future studies will provide more insight into long term distribution generation adoption and forecast impacts.

# Figures & Tables

**TABLE 1**

## Forecasted Consumers, Energy Sales and Energy Generation

| Forecasted Consumers, Energy Sales and Energy Generation Requirements (MWh) | | | | |
|---|---|---|---|---|
| **Year** | **Consumers Total** | **MEMBER SALES BASE-NORMAL** | **HE SALES BASE-NORMAL** | **HE GENERATION BASE-NORMAL** |
| 2020 | 308,248 | 6,981,774 | 7,294,837 | 7,574,958 |
| 2021 | 310,034 | 7,203,433 | 7,525,007 | 7,813,967 |
| 2022 | 311,814 | 7,373,506 | 7,701,530 | 7,997,269 |
| 2023 | 313,726 | 7,741,175 | 8,082,921 | 8,393,306 |
| 2024 | 315,646 | 8,066,747 | 8,421,474 | 8,744,858 |
| 2025 | 317,586 | 8,104,412 | 8,461,209 | 8,786,119 |
| 2026 | 319,439 | 8,147,885 | 8,506,574 | 8,833,226 |
| 2027 | 321,070 | 8,189,502 | 8,549,963 | 8,878,282 |
| 2028 | 322,548 | 8,200,136 | 8,560,949 | 8,889,689 |
| 2029 | 323,993 | 8,229,735 | 8,592,252 | 8,922,195 |
| 2030 | 325,406 | 8,236,751 | 8,599,751 | 8,929,981 |
| 2031 | 326,785 | 8,267,225 | 8,631,624 | 8,963,078 |
| 2032 | 328,130 | 8,316,971 | 8,683,158 | 9,016,591 |
| 2033 | 329,441 | 8,280,931 | 8,646,542 | 8,978,569 |
| 2034 | 330,718 | 8,303,364 | 8,670,160 | 9,003,094 |
| 2035 | 331,963 | 8,343,732 | 8,712,371 | 9,046,926 |
| 2036 | 333,171 | 8,383,542 | 8,753,658 | 9,089,798 |
| 2037 | 334,348 | 8,405,868 | 8,777,550 | 9,114,608 |
| 2038 | 335,494 | 8,446,924 | 8,820,484 | 9,159,191 |
| 2039 | 336,612 | 8,487,277 | 8,862,686 | 9,203,014 |
| 2040 | 337,711 | 8,539,517 | 8,916,812 | 9,259,217 |

**TABLE 2**

## 60-Minute Peak Demand and Annual System Load Factor

Hoosier Energy Generation 60-Minute Peak Demand Forecast (MW)
Annual System Load Factor

| Year | HE Generation Winter Peak Base-Normal | HE Generation Summer Peak Base-Normal | Load Factor | HE Generation Winter Peak Extreme | HE Generation Summer Peak Extreme | Load Factor Extreme |
|---|---|---|---|---|---|---|
| **2020** | 1,548 | 1,408 | 55.8% | 1,774 | 1,620 | 50.3% |
| **2021** | 1,542 | 1,421 | 57.8% | 1,772 | 1,632 | 51.9% |
| **2022** | 1,561 | 1,444 | 58.5% | 1,789 | 1,657 | 52.6% |
| **2023** | 1,585 | 1,486 | 60.5% | 1,813 | 1,697 | 54.4% |
| **2024** | 1,638 | 1,544 | 60.9% | 1,866 | 1,755 | 55.0% |
| **2025** | 1,696 | 1,568 | 59.1% | 1,926 | 1,785 | 53.5% |
| **2026** | 1,698 | 1,574 | 59.4% | 1,927 | 1,792 | 53.8% |
| **2027** | 1,702 | 1,580 | 59.5% | 1,932 | 1,799 | 53.9% |
| **2028** | 1,706 | 1,582 | 59.5% | 1,936 | 1,802 | 53.9% |
| **2029** | 1,707 | 1,586 | 59.7% | 1,938 | 1,807 | 54.0% |
| **2030** | 1,707 | 1,588 | 59.7% | 1,937 | 1,811 | 54.1% |
| **2031** | 1,706 | 1,592 | 60.0% | 1,936 | 1,816 | 54.3% |
| **2032** | 1,709 | 1,599 | 60.2% | 1,940 | 1,824 | 54.5% |
| **2033** | 1,716 | 1,600 | 59.7% | 1,948 | 1,827 | 54.1% |
| **2034** | 1,707 | 1,601 | 60.2% | 1,937 | 1,829 | 54.5% |
| **2035** | 1,708 | 1,608 | 60.4% | 1,939 | 1,838 | 54.7% |
| **2036** | 1,713 | 1,615 | 60.6% | 1,944 | 1,847 | 54.9% |
| **2037** | 1,719 | 1,622 | 60.5% | 1,951 | 1,855 | 54.8% |
| **2038** | 1,719 | 1,629 | 60.8% | 1,950 | 1,865 | 55.1% |
| **2039** | 1,724 | 1,638 | 61.0% | 1,955 | 1,875 | 55.2% |
| **2040** | 1,728 | 1,647 | 61.2% | 1,960 | 1,886 | 55.4% |

**TABLE 3**

## Compound Average Growth Rate Forecast Scenarios

| | | | Base-Mild | | Low-Normal | | Base-Normal | | High-Normal | | Base-Severe | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Consumer | Energy | Consumer | Energy | Consumer | Energy | Consumer | Energy | Consumer | Energy |
| **Residential** | | | | | | | | | | | | |
| 2010 | 2019 | Historical | 0.34% | -0.42% | 0.34% | -0.42% | 0.34% | -0.42% | 0.34% | -0.42% | 0.34% | -0.42% |
| 2020 | 2025 | First 5 Years | 0.56% | 0.54% | 0.22% | 0.17% | 0.56% | 0.53% | 0.68% | 0.77% | 0.56% | 0.51% |
| 2020 | 2030 | First 10 Years of Forecast | 0.52% | 0.60% | 0.20% | 0.20% | 0.52% | 0.58% | 0.66% | 0.84% | 0.52% | 0.56% |
| 2030 | 2040 | Second 10 Years of Forecast | 0.36% | 0.75% | 0.15% | 0.35% | 0.36% | 0.73% | 0.61% | 0.99% | 0.36% | 0.72% |
| 2020 | 2040 | Forecast Period | 0.44% | 0.67% | 0.18% | 0.28% | 0.44% | 0.65% | 0.64% | 0.92% | 0.44% | 0.64% |
| **Commercial** | | | | | | | | | | | | |
| 2010 | 2019 | Historical | 0.93% | 0.75% | 0.93% | 0.75% | 0.93% | 0.75% | 0.93% | 0.75% | 0.93% | 0.75% |
| 2020 | 2025 | First 5 Years | 1.26% | 1.07% | 0.51% | 0.25% | 1.26% | 1.07% | 1.57% | 1.44% | 1.26% | 1.07% |
| 2020 | 2030 | First 10 Years of Forecast | 1.00% | 0.95% | 0.33% | 0.20% | 1.00% | 0.95% | 1.38% | 1.39% | 1.00% | 0.95% |
| 2030 | 2040 | Second 10 Years of Forecast | 0.61% | 0.69% | 0.13% | 0.14% | 0.61% | 0.69% | 1.20% | 1.33% | 0.61% | 0.69% |
| 2020 | 2040 | Forecast Period | 0.81% | 0.82% | 0.23% | 0.17% | 0.81% | 0.82% | 1.29% | 1.36% | 0.81% | 0.82% |
| **Industrial** | | | | | | | | | | | | |
| 2010 | 2019 | Historical | 1.87% | 2.81% | 1.87% | 2.81% | 1.87% | 2.81% | 1.87% | 2.81% | 1.87% | 2.81% |
| 2020 | 2025 | First 5 Years | -0.26% | 8.69% | -0.26% | 8.69% | -0.26% | 8.69% | -0.26% | 8.69% | -0.26% | 8.69% |
| 2020 | 2030 | First 10 Years of Forecast | -0.13% | 4.09% | -0.13% | 4.09% | -0.13% | 4.09% | -0.13% | 4.09% | -0.13% | 4.09% |
| 2030 | 2040 | Second 10 Years of Forecast | -0.18% | -0.37% | -0.18% | -0.37% | -0.18% | -0.37% | -0.18% | -0.37% | -0.18% | -0.37% |
| 2020 | 2040 | Forecast Period | -0.15% | 1.83% | -0.15% | 1.83% | -0.15% | 1.83% | -0.15% | 1.83% | -0.15% | 1.83% |
| **Total** | | | | | | | | | | | | |
| 2010 | 2019 | Historical | 0.47% | 0.59% | 0.47% | 0.59% | 0.47% | 0.59% | 0.47% | 0.59% | 0.47% | 0.59% |
| 2020 | 2025 | First 5 Years | 0.60% | 3.12% | 0.24% | 2.74% | 0.60% | 3.03% | 0.73% | 3.20% | 0.60% | 2.93% |
| 2020 | 2030 | First 10 Years of Forecast | 0.54% | 1.71% | 0.21% | 1.37% | 0.54% | 1.67% | 0.69% | 1.86% | 0.54% | 1.62% |
| 2030 | 2040 | Second 10 Years of Forecast | 0.37% | 0.36% | 0.16% | 0.08% | 0.37% | 0.36% | 0.65% | 0.60% | 0.37% | 0.37% |
| 2020 | 2040 | Forecast Period | 0.46% | 1.03% | 0.19% | 0.72% | 0.46% | 1.01% | 0.67% | 1.23% | 0.46% | 0.99% |

| | | | Winter Peak | Summer Peak | Annual Demand |
|---|---|---|---|---|---|
| **Demand** | | | NCP | NCP | NCP |
| 2010 | 2019 | Historical | 2.11% | 0.33% | 2.03% |
| 2020 | 2025 | First 5 Years | 0.00% | 2.18% | 1.84% |
| 2020 | 2030 | First 10 Years of Forecast | 0.00% | 1.21% | 0.98% |
| 2030 | 2040 | Second 10 Years of Forecast | 0.00% | 0.36% | 0.13% |
| 2020 | 2040 | Forecast Period | 0.00% | 0.78% | 0.55% |

**TABLE 4**

## Forecasted Energy and Demand Scenarios

| | Forecast Scenarios | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | | Base-Normal | | High-Normal | | Low-Normal | | Base-Mild | | Base-Severe | |
| Year | ENERGY GENERATED (MWH) | NCP DEMAND (MW) | ENERGY GENERATED (MWH) | NCP DEMAND (MW) | ENERGY GENERATED (MWH) | NCP DEMAND (MW) | ENERGY GENERATED (MWH) | NCP DEMAND (MW) | ENERGY GENERATED (MWH) | NCP DEMAND (MW) | ENERGY GENERATED (MWH) | NCP DEMAND (MW) |
| 2010 | 7,169,555 | 1,366 | | | | | | | | | | |
| 2011 | 7,261,250 | 1,418 | | | | | | | | | | |
| 2012 | 7,193,545 | 1,457 | | | | | | | | | | |
| 2013 | 7,335,037 | 1,363 | | | | | | | | | | |
| 2014 | 7,639,069 | 1,645 | | | | | | | | | | |
| 2015 | 7,481,099 | 1,584 | | | | | | | | | | |
| 2016 | 7,564,387 | 1,423 | | | | | | | | | | |
| 2017 | 7,476,942 | 1,356 | | | | | | | | | | |
| 2018 | 8,063,654 | 1,587 | | | | | | | | | | |
| 2019 | 7,859,968 | 1,624 | | | | | | | | | | |
| 2020 | | | 7,574,958 | 1,480 | 7,582,125 | 1,480 | 7,565,050 | 1,480 | 7,314,558 | 1,262 | 7,859,565 | 1,628 |
| 2021 | | | 7,813,967 | 1,474 | 7,832,996 | 1,475 | 7,780,912 | 1,472 | 7,550,296 | 1,273 | 8,101,824 | 1,625 |
| 2022 | | | 7,997,269 | 1,492 | 8,029,313 | 1,495 | 7,938,142 | 1,486 | 7,732,920 | 1,295 | 8,285,999 | 1,642 |
| 2023 | | | 8,393,306 | 1,515 | 8,440,849 | 1,520 | 8,308,851 | 1,504 | 8,129,449 | 1,335 | 8,681,512 | 1,665 |
| 2024 | | | 8,744,858 | 1,565 | 8,809,828 | 1,574 | 8,635,142 | 1,551 | 8,479,996 | 1,390 | 9,034,120 | 1,716 |
| 2025 | | | 8,786,119 | 1,621 | 8,869,150 | 1,632 | 8,650,815 | 1,602 | 8,521,679 | 1,413 | 9,075,148 | 1,773 |
| 2026 | | | 8,833,226 | 1,623 | 8,935,009 | 1,636 | 8,671,320 | 1,599 | 8,568,364 | 1,418 | 9,122,823 | 1,773 |
| 2027 | | | 8,878,282 | 1,627 | 8,999,913 | 1,644 | 8,689,610 | 1,599 | 8,612,950 | 1,423 | 9,168,517 | 1,778 |
| 2028 | | | 8,889,689 | 1,631 | 9,032,961 | 1,650 | 8,673,983 | 1,599 | 8,623,006 | 1,425 | 9,181,400 | 1,782 |
| 2029 | | | 8,922,195 | 1,631 | 9,086,624 | 1,655 | 8,680,279 | 1,595 | 8,655,521 | 1,428 | 9,214,157 | 1,783 |
| 2030 | | | 8,929,981 | 1,631 | 9,114,156 | 1,658 | 8,661,476 | 1,591 | 8,662,579 | 1,429 | 9,222,868 | 1,782 |
| 2031 | | | 8,963,078 | 1,630 | 9,166,490 | 1,660 | 8,667,802 | 1,586 | 8,694,766 | 1,432 | 9,257,101 | 1,781 |
| 2032 | | | 9,016,591 | 1,634 | 9,240,408 | 1,667 | 8,693,813 | 1,585 | 8,746,526 | 1,439 | 9,312,553 | 1,785 |
| 2033 | | | 8,978,569 | 1,640 | 9,222,661 | 1,676 | 8,629,700 | 1,587 | 8,708,231 | 1,438 | 9,275,127 | 1,792 |
| 2034 | | | 9,003,094 | 1,631 | 9,268,817 | 1,671 | 8,627,631 | 1,574 | 8,731,703 | 1,439 | 9,300,982 | 1,783 |
| 2035 | | | 9,046,926 | 1,633 | 9,335,283 | 1,676 | 8,645,106 | 1,572 | 8,774,402 | 1,444 | 9,346,237 | 1,784 |
| 2036 | | | 9,089,798 | 1,637 | 9,402,528 | 1,684 | 8,661,019 | 1,572 | 8,815,303 | 1,450 | 9,391,324 | 1,789 |
| 2037 | | | 9,114,608 | 1,643 | 9,451,542 | 1,693 | 8,661,047 | 1,574 | 8,839,541 | 1,455 | 9,417,093 | 1,795 |
| 2038 | | | 9,159,191 | 1,643 | 9,522,076 | 1,697 | 8,680,356 | 1,570 | 8,882,840 | 1,462 | 9,463,283 | 1,794 |
| 2039 | | | 9,203,014 | 1,647 | 9,592,976 | 1,706 | 8,699,363 | 1,570 | 8,925,402 | 1,469 | 9,508,689 | 1,799 |
| 2040 | | | 9,259,217 | 1,652 | 9,678,179 | 1,715 | 8,730,237 | 1,571 | 8,979,614 | 1,476 | 9,567,134 | 1,804 |

**FIGURE 1**

## Consumer Forecast Scenarios

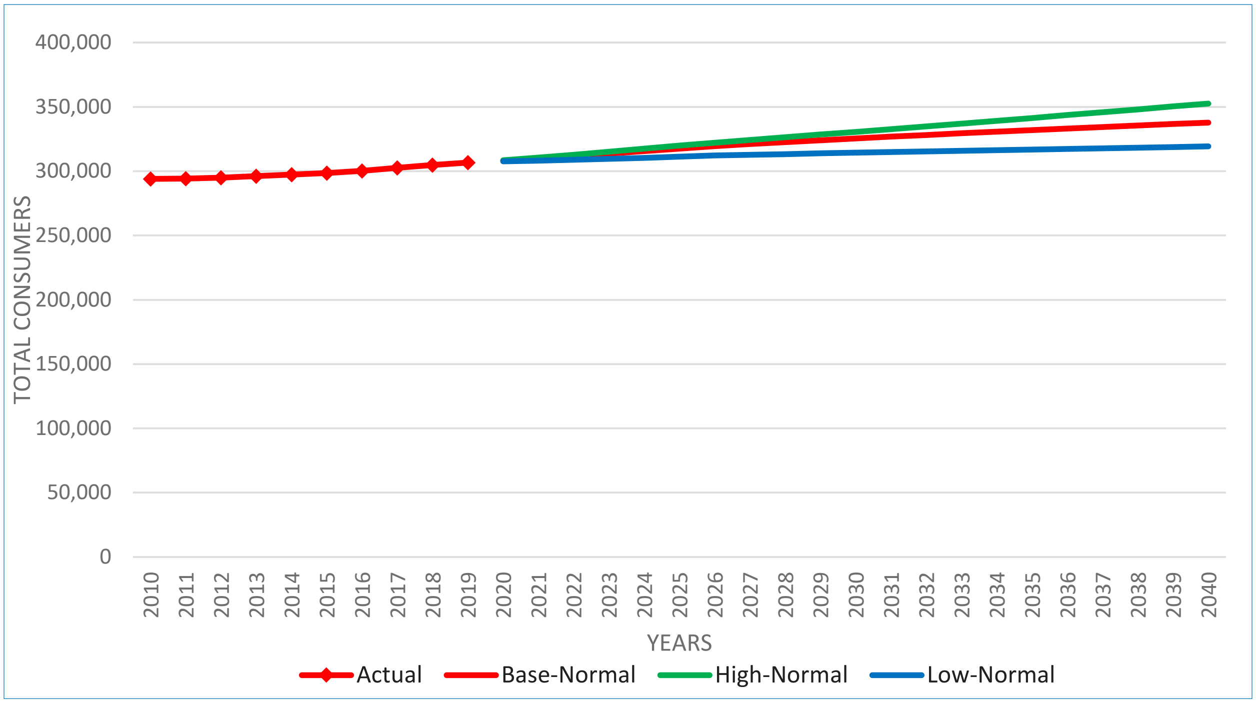



**FIGURE 2**

## Residential Consumer Forecast Scenarios

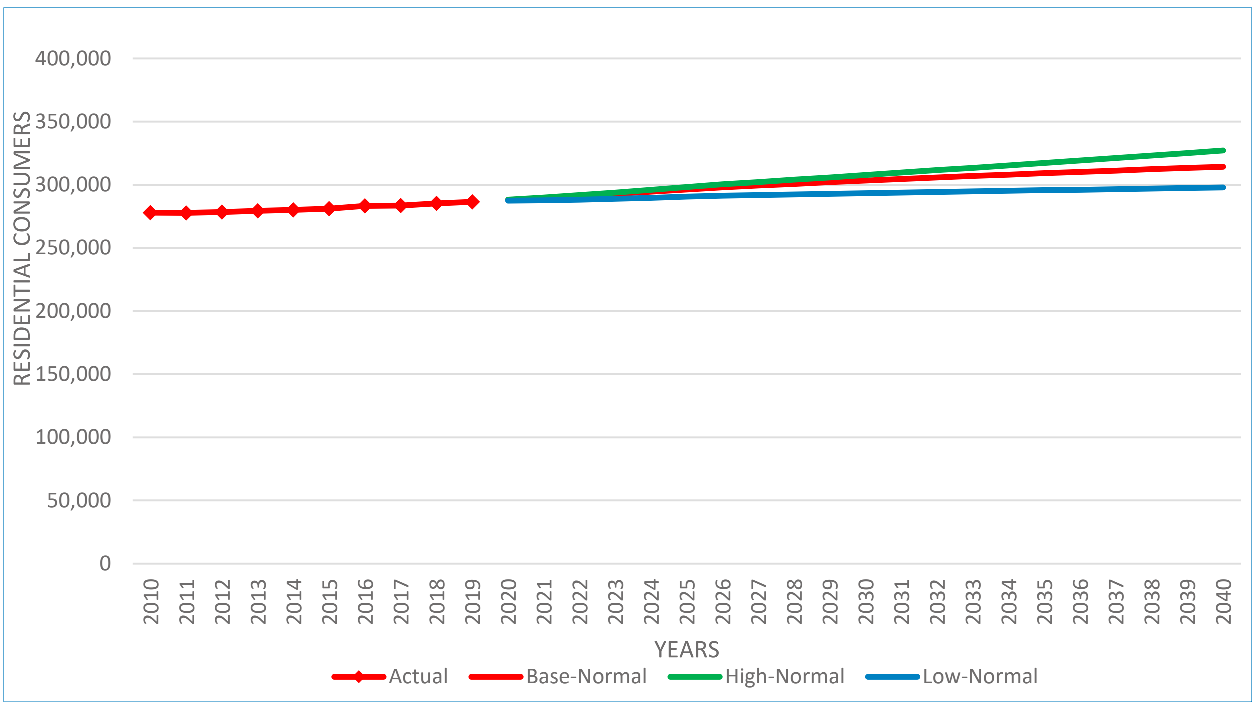
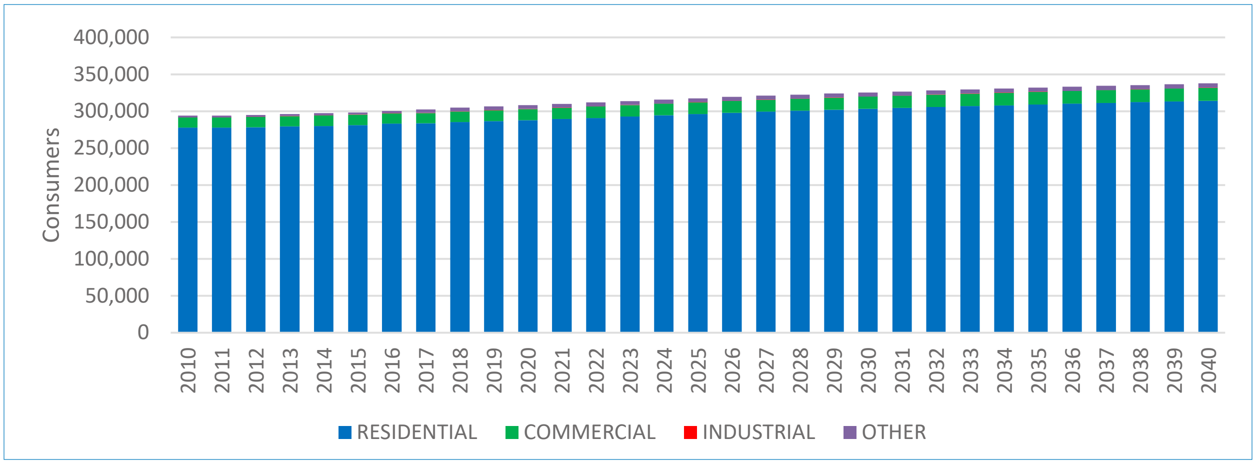


**FIGURE 3**

## Consumers by Class




## Percent of Consumers by Class

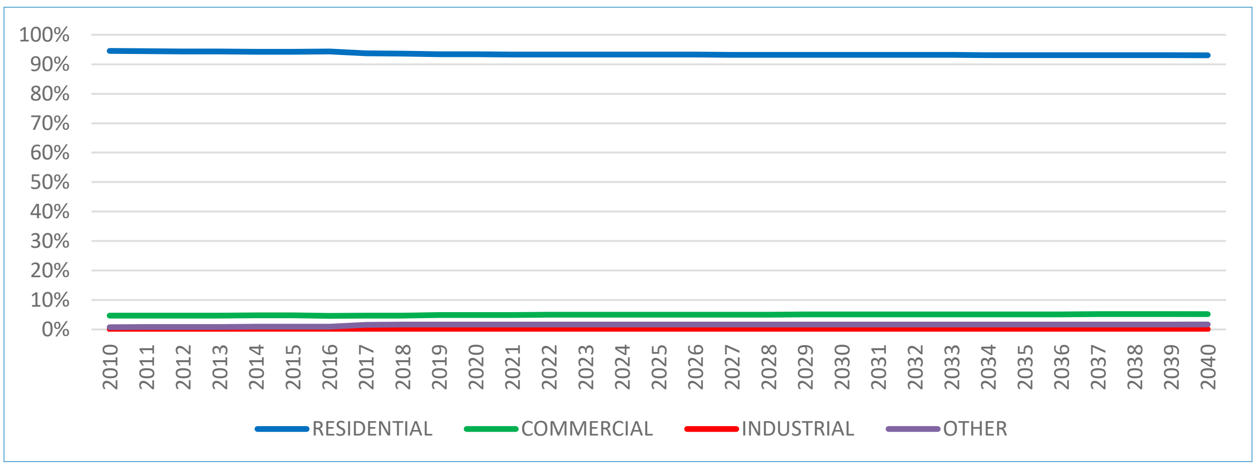


**FIGURE 4**

## Member Energy Sales Forecast Scenarios


**FIGURE 5**

## Residential Energy Sales Forecast Scenarios

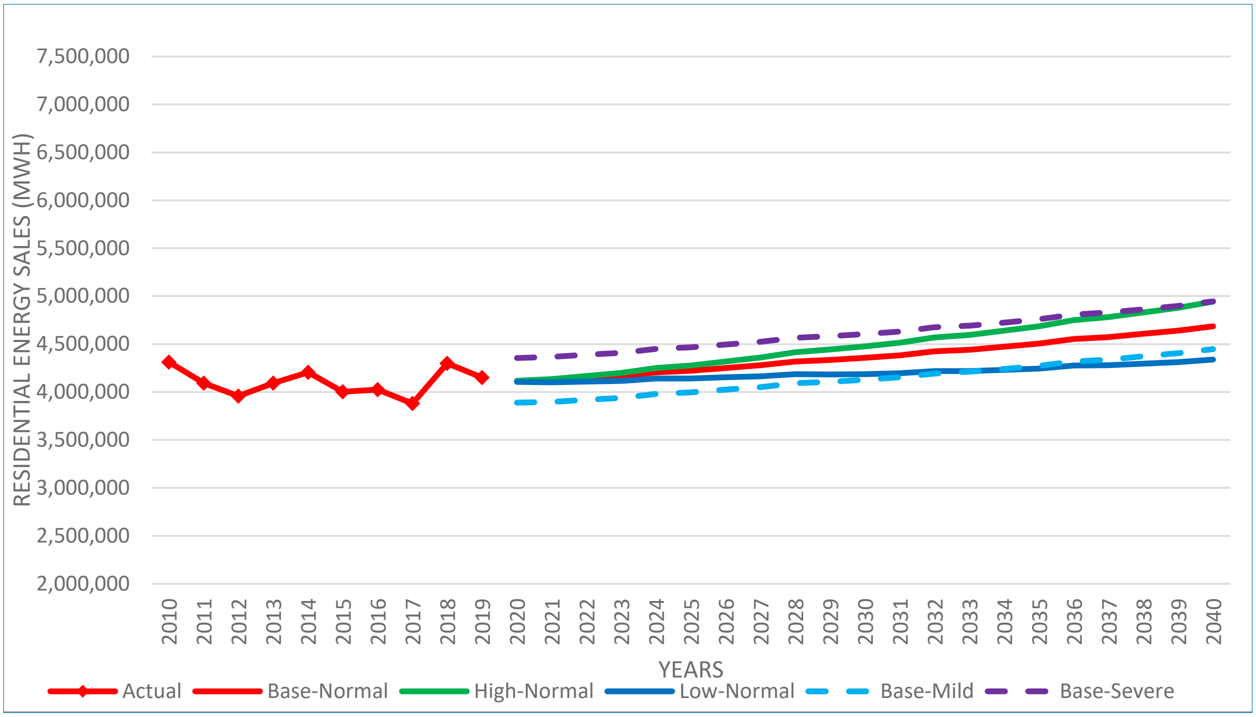


**FIGURE 6**

## Hoosier Energy Sales Scenarios

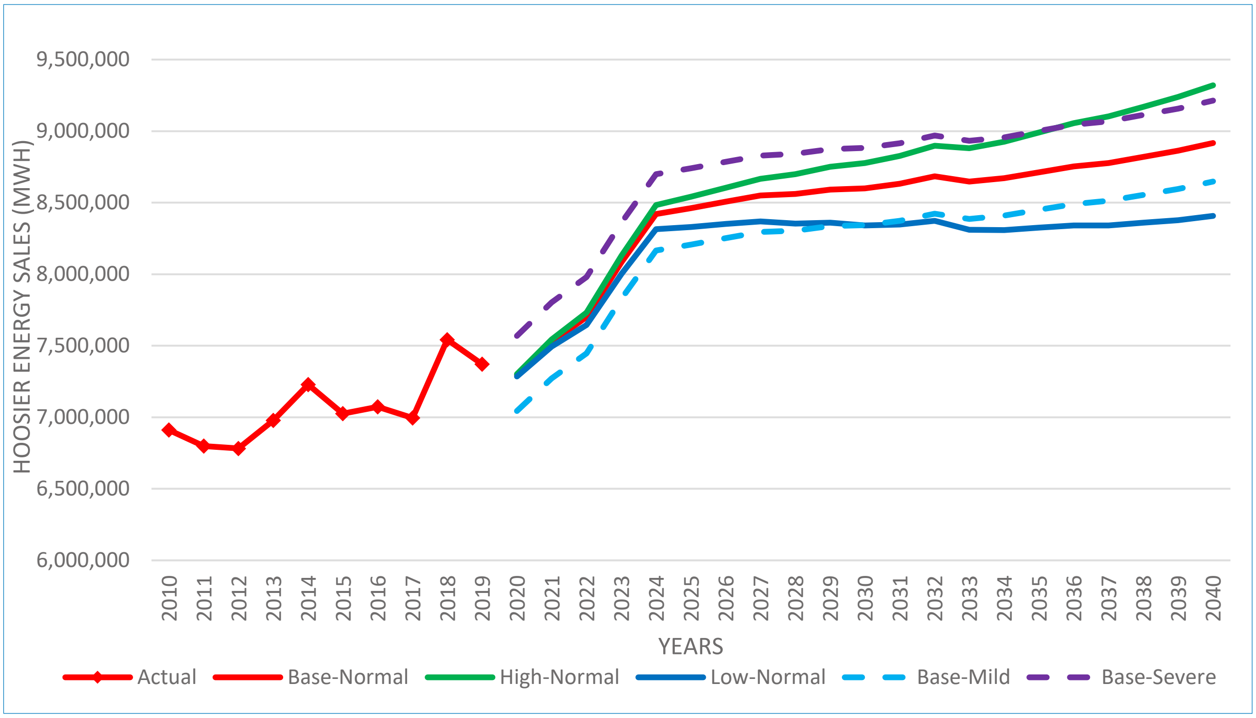
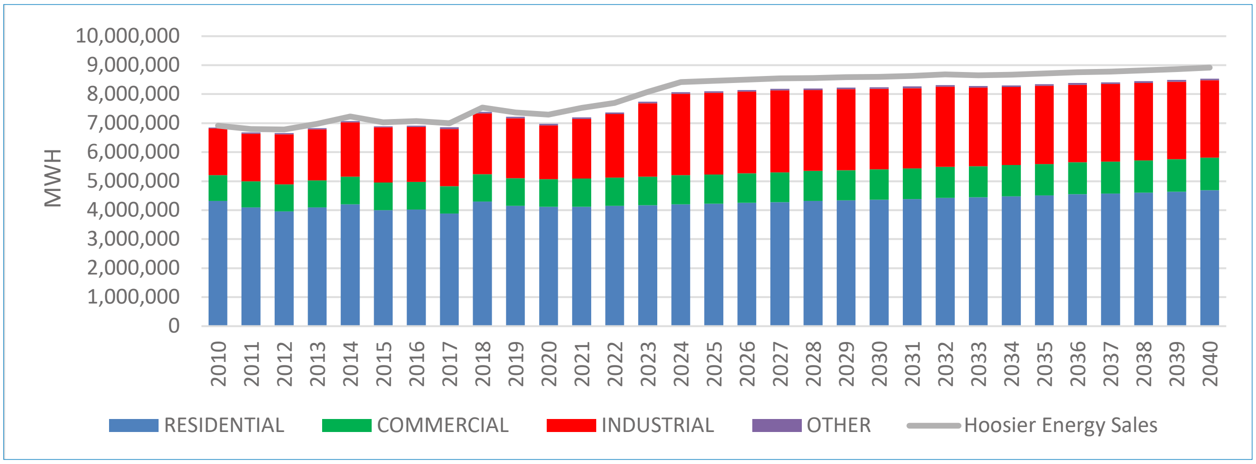


**FIGURE 7**

## Energy Sales by Class




## Percent of Energy Sales by Class

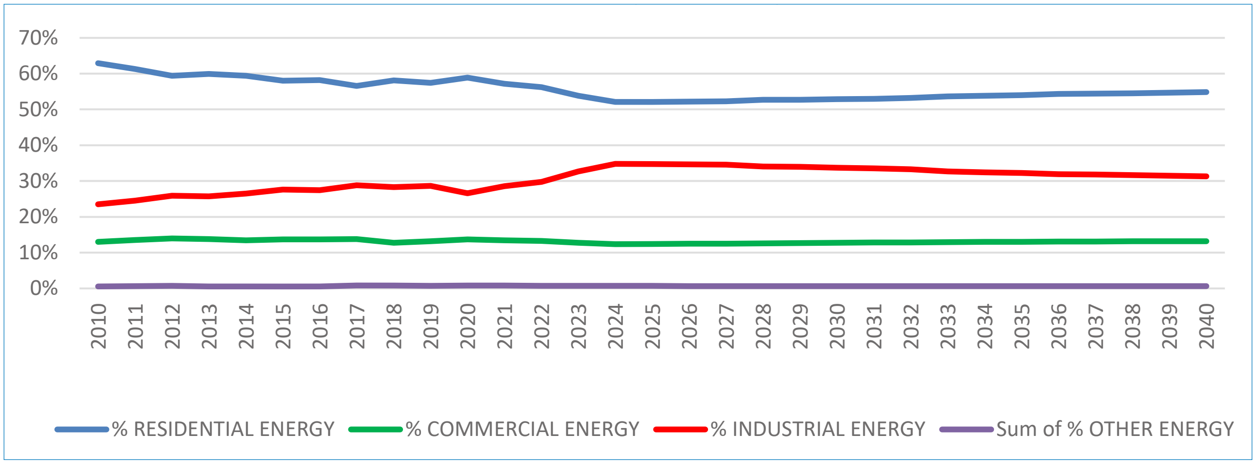


**FIGURE 8**

## Winter Peak Demand

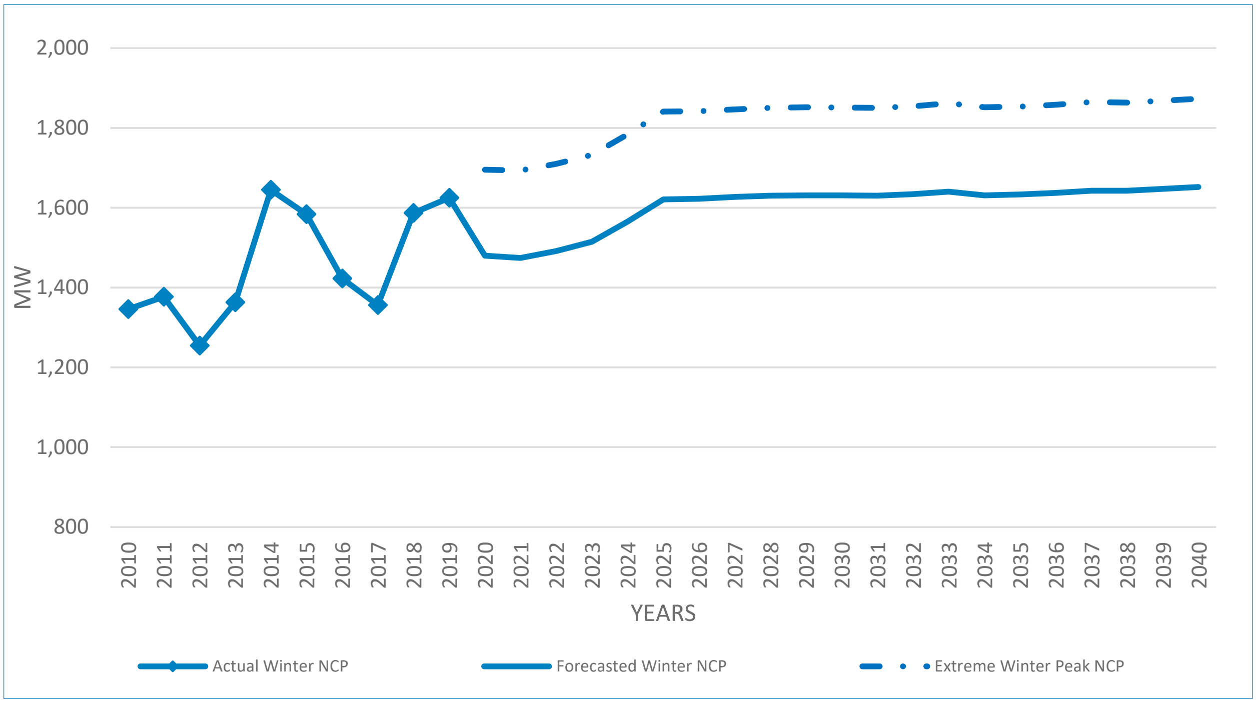
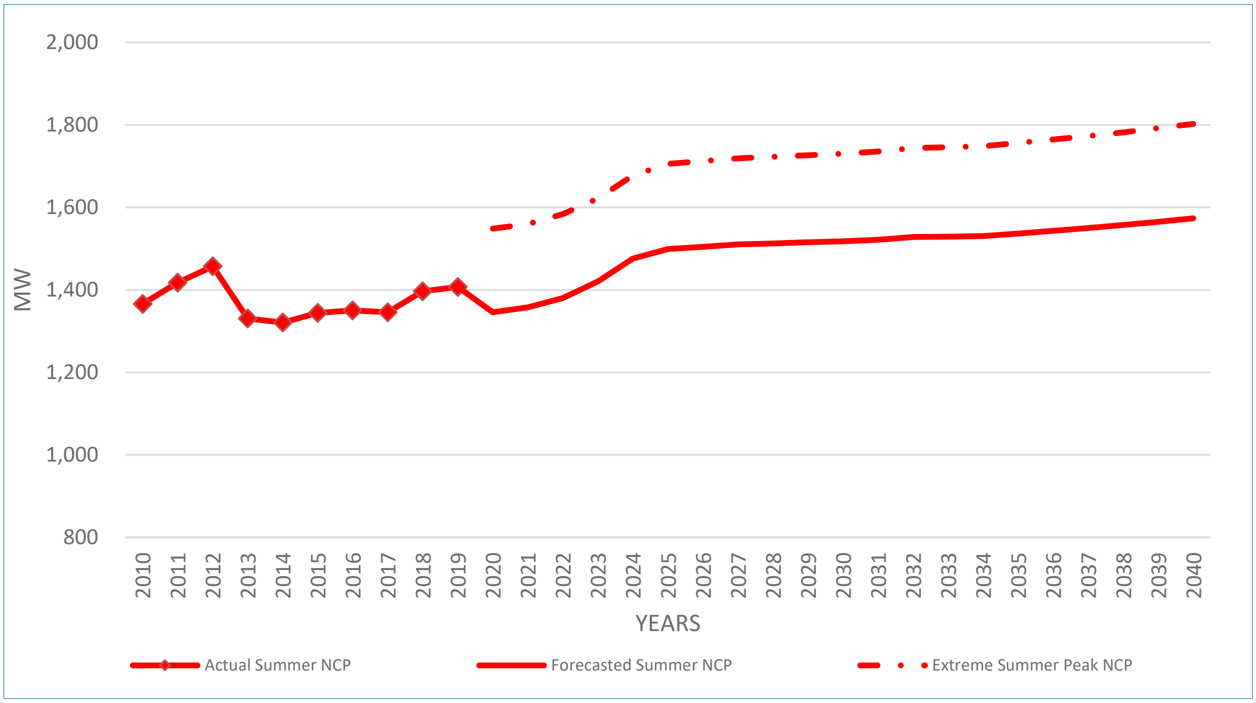


**FIGURE 9**

## Summer Peak Demand



# RUS Form 341

**RUS FORM 341**

## Base-Normal Scenario

| | Year | RESIDENTIAL NUMBER OF CONSUMERS | RESIDENTIAL CONSUMERS % CHANGE | RESIDENTIAL ENERGY SALES (MWH) | RESIDENTIAL ENERGY SALES % CHANGE | RESIDENTIAL KWH/CONSUMER PER MONTH | RESIDENTIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 277,913 | | 4,313,612 | | 1293 | |
| **Actual** | **2011** | 277,751 | -0.1% | 4,093,234 | -5.1% | 1228 | -5.0% |
| **Actual** | **2012** | 278,372 | 0.2% | 3,958,457 | -3.3% | 1185 | -3.5% |
| **Actual** | **2013** | 279,338 | 0.3% | 4,091,996 | 3.4% | 1221 | 3.0% |
| **Actual** | **2014** | 280,061 | 0.3% | 4,204,582 | 2.8% | 1251 | 2.5% |
| **Actual** | **2015** | 281,173 | 0.4% | 4,002,896 | -4.8% | 1186 | -5.2% |
| **Actual** | **2016** | 283,258 | 0.7% | 4,024,894 | 0.5% | 1184 | -0.2% |
| **Actual** | **2017** | 283,540 | 0.1% | 3,880,889 | -3.6% | 1141 | -3.6% |
| **Actual** | **2018** | 285,314 | 0.6% | 4,298,011 | 10.7% | 1255 | 10.0% |
| **Actual** | **2019** | 286,480 | 0.4% | 4,151,582 | -3.4% | 1208 | -3.7% |
| | | | | | | | |
| **Base-Normal** | **2020** | 288,002 | | 4,112,682 | | 1190 | |
| **Base-Normal** | **2021** | 289,373 | 0.5% | 4,121,163 | 0.2% | 1187 | -0.3% |
| **Base-Normal** | **2022** | 290,969 | 0.6% | 4,143,849 | 0.6% | 1187 | 0.0% |
| **Base-Normal** | **2023** | 292,701 | 0.6% | 4,165,560 | 0.5% | 1186 | -0.1% |
| **Base-Normal** | **2024** | 294,446 | 0.6% | 4,206,476 | 1.0% | 1191 | 0.4% |
| **Base-Normal** | **2025** | 296,210 | 0.6% | 4,222,169 | 0.4% | 1188 | -0.3% |
| **Base-Normal** | **2026** | 297,892 | 0.6% | 4,251,351 | 0.7% | 1189 | 0.1% |
| **Base-Normal** | **2027** | 299,366 | 0.5% | 4,278,806 | 0.6% | 1191 | 0.2% |
| **Base-Normal** | **2028** | 300,695 | 0.4% | 4,319,780 | 1.0% | 1197 | 0.5% |
| **Base-Normal** | **2029** | 301,994 | 0.4% | 4,334,443 | 0.3% | 1196 | -0.1% |
| **Base-Normal** | **2030** | 303,261 | 0.4% | 4,356,352 | 0.5% | 1197 | 0.1% |
| **Base-Normal** | **2031** | 304,496 | 0.4% | 4,381,724 | 0.6% | 1199 | 0.2% |
| **Base-Normal** | **2032** | 305,700 | 0.4% | 4,424,199 | 1.0% | 1206 | 0.6% |
| **Base-Normal** | **2033** | 306,873 | 0.4% | 4,440,936 | 0.4% | 1206 | 0.0% |
| **Base-Normal** | **2034** | 308,014 | 0.4% | 4,472,564 | 0.7% | 1210 | 0.3% |
| **Base-Normal** | **2035** | 309,123 | 0.4% | 4,505,415 | 0.7% | 1215 | 0.4% |
| **Base-Normal** | **2036** | 310,197 | 0.3% | 4,553,569 | 1.1% | 1223 | 0.7% |
| **Base-Normal** | **2037** | 311,241 | 0.3% | 4,573,320 | 0.4% | 1224 | 0.1% |
| **Base-Normal** | **2038** | 312,256 | 0.3% | 4,607,115 | 0.7% | 1230 | 0.5% |
| **Base-Normal** | **2039** | 313,244 | 0.3% | 4,640,281 | 0.7% | 1234 | 0.3% |
| **Base-Normal** | **2040** | 314,214 | 0.3% | 4,685,825 | 1.0% | 1243 | 0.7% |

**Equivalent Compound Growth Rates**

| Time Period | | Residential Consumers % Change | Residential Sales to End Consumers % Change | Residential kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.23% | -1.48% | -1.71% |
| **2015** | **2019** | 0.47% | 0.92% | 0.46% |
| **2020** | **2025** | 0.56% | 0.53% | -0.03% |
| **2025** | **2030** | 0.47% | 0.63% | 0.15% |
| **2030** | **2035** | 0.38% | 0.68% | 0.30% |
| **2035** | **2040** | 0.33% | 0.79% | 0.46% |
| **2020** | **2030** | 0.52% | 0.58% | 0.06% |
| **2030** | **2040** | 0.36% | 0.73% | 0.38% |
| **2010** | **2019** | 0.34% | -0.42% | -0.75% |
| **2020** | **2040** | 0.44% | 0.65% | 0.22% |

RUS FORM 341

## Base-Normal Scenario

| | Year | COMMERCIAL NUMBER OF CONSUMERS | COMMERCIAL CONSUMERS % CHANGE | COMMERCIAL ENERGY SALES (MWH) | COMMERCIAL ENERGY SALES % CHANGE | COMMERCIAL KWH/CONSUMER PER MONTH | COMMERCIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 13683 | | 889,903 | | 5420 | |
| **Actual** | **2011** | 13764 | 0.6% | 901,707 | 1.3% | 5459 | 0.7% |
| **Actual** | **2012** | 13890 | 0.9% | 930,499 | 3.2% | 5583 | 2.3% |
| **Actual** | **2013** | 14029 | 1.0% | 938,826 | 0.9% | 5577 | -0.1% |
| **Actual** | **2014** | 14289 | 1.9% | 952,690 | 1.5% | 5556 | -0.4% |
| **Actual** | **2015** | 14255 | -0.2% | 946,635 | -0.6% | 5534 | -0.4% |
| **Actual** | **2016** | 13827 | -3.0% | 949,179 | 0.3% | 5720 | 3.4% |
| **Actual** | **2017** | 14030 | 1.5% | 944,810 | -0.5% | 5612 | -1.9% |
| **Actual** | **2018** | 14215 | 1.3% | 940,218 | -0.5% | 5512 | -1.8% |
| **Actual** | **2019** | 14868 | 4.6% | 951,542 | 1.2% | 5333 | -3.2% |
| | | | | | | | |
| **Base-Normal** | **2020** | 14939 | | 955,451 | | 5330 | |
| **Base-Normal** | **2021** | 15330 | 2.6% | 967,173 | 1.2% | 5258 | -1.4% |
| **Base-Normal** | **2022** | 15477 | 1.0% | 977,469 | 1.1% | 5263 | 0.1% |
| **Base-Normal** | **2023** | 15621 | 0.9% | 987,736 | 1.1% | 5269 | 0.1% |
| **Base-Normal** | **2024** | 15761 | 0.9% | 997,687 | 1.0% | 5275 | 0.1% |
| **Base-Normal** | **2025** | 15904 | 0.9% | 1,007,753 | 1.0% | 5280 | 0.1% |
| **Base-Normal** | **2026** | 16042 | 0.9% | 1,017,395 | 1.0% | 5285 | 0.1% |
| **Base-Normal** | **2027** | 16166 | 0.8% | 1,026,235 | 0.9% | 5290 | 0.1% |
| **Base-Normal** | **2028** | 16281 | 0.7% | 1,034,507 | 0.8% | 5295 | 0.1% |
| **Base-Normal** | **2029** | 16394 | 0.7% | 1,042,648 | 0.8% | 5300 | 0.1% |
| **Base-Normal** | **2030** | 16506 | 0.7% | 1,050,675 | 0.8% | 5305 | 0.1% |
| **Base-Normal** | **2031** | 16617 | 0.7% | 1,058,629 | 0.8% | 5309 | 0.1% |
| **Base-Normal** | **2032** | 16725 | 0.6% | 1,066,399 | 0.7% | 5314 | 0.1% |
| **Base-Normal** | **2033** | 16830 | 0.6% | 1,074,026 | 0.7% | 5318 | 0.1% |
| **Base-Normal** | **2034** | 16936 | 0.6% | 1,081,661 | 0.7% | 5322 | 0.1% |
| **Base-Normal** | **2035** | 17039 | 0.6% | 1,089,166 | 0.7% | 5327 | 0.1% |
| **Base-Normal** | **2036** | 17142 | 0.6% | 1,096,577 | 0.7% | 5331 | 0.1% |
| **Base-Normal** | **2037** | 17244 | 0.6% | 1,103,942 | 0.7% | 5335 | 0.1% |
| **Base-Normal** | **2038** | 17344 | 0.6% | 1,111,199 | 0.7% | 5339 | 0.1% |
| **Base-Normal** | **2039** | 17443 | 0.6% | 1,118,376 | 0.6% | 5343 | 0.1% |
| **Base-Normal** | **2040** | 17542 | 0.6% | 1,125,481 | 0.6% | 5347 | 0.1% |

**Equivalent Compound Growth Rates**

| Time Period | | Commercial Consumers % Change | Commercial Sales to End Consumers % Change | Commercial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.82% | 1.24% | 0.42% |
| **2015** | **2019** | 1.06% | 0.13% | -0.92% |
| **2020** | **2025** | 1.26% | 1.07% | -0.19% |
| **2025** | **2030** | 0.75% | 0.84% | 0.09% |
| **2030** | **2035** | 0.64% | 0.72% | 0.08% |
| **2035** | **2040** | 0.58% | 0.66% | 0.07% |
| **2020** | **2030** | 1.00% | 0.95% | -0.05% |
| **2030** | **2040** | 0.61% | 0.69% | 0.08% |
| **2010** | **2019** | 0.93% | 0.75% | -0.18% |
| **2020** | **2040** | 0.81% | 0.82% | 0.02% |

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## Base-Normal Scenario

| | Year | INDUSTRIAL NUMBER OF CONSUMERS | INDUSTRIAL CONSUMERS % CHANGE | INDUSTRIAL ENERGY SALES (MWH) | INDUSTRIAL ENERGY SALES % CHANGE | INDUSTRIAL KWH/CONSUMER PER MONTH | INDUSTRIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 197 | | 1,611,671 | | 682,911 | |
| **Actual** | **2011** | 201 | 1.9% | 1,640,012 | 1.8% | 681,634 | -0.2% |
| **Actual** | **2012** | 194 | -3.2% | 1,725,290 | 5.2% | 741,104 | 8.7% |
| **Actual** | **2013** | 197 | 1.8% | 1,756,666 | 1.8% | 741,522 | 0.1% |
| **Actual** | **2014** | 202 | 2.3% | 1,878,298 | 6.9% | 775,195 | 4.5% |
| **Actual** | **2015** | 201 | -0.5% | 1,906,729 | 1.5% | 791,174 | 2.1% |
| **Actual** | **2016** | 205 | 1.8% | 1,898,538 | -0.4% | 773,650 | -2.2% |
| **Actual** | **2017** | 211 | 3.1% | 1,976,447 | 4.1% | 780,896 | 0.9% |
| **Actual** | **2018** | 233 | 10.3% | 2,095,080 | 6.0% | 750,656 | -3.9% |
| **Actual** | **2019** | 232 | -0.1% | 2,068,766 | -1.3% | 741,759 | -1.2% |
| **Base-Normal** | **2020** | 233 | | 1,858,055 | | 664,540 | |
| **Base-Normal** | **2021** | 225 | -3.4% | 2,059,493 | 10.8% | 762,775 | 14.8% |
| **Base-Normal** | **2022** | 228 | 1.3% | 2,196,571 | 6.7% | 802,840 | 5.3% |
| **Base-Normal** | **2023** | 230 | 0.9% | 2,532,250 | 15.3% | 917,482 | 14.3% |
| **Base-Normal** | **2024** | 231 | 0.4% | 2,806,942 | 10.8% | 1,012,605 | 10.4% |
| **Base-Normal** | **2025** | 230 | -0.4% | 2,818,835 | 0.4% | 1,021,317 | 0.9% |
| **Base-Normal** | **2026** | 230 | 0.0% | 2,823,471 | 0.2% | 1,022,997 | 0.2% |
| **Base-Normal** | **2027** | 230 | 0.0% | 2,828,781 | 0.2% | 1,024,921 | 0.2% |
| **Base-Normal** | **2028** | 230 | 0.0% | 2,790,157 | -1.4% | 1,010,926 | -1.4% |
| **Base-Normal** | **2029** | 230 | 0.0% | 2,796,938 | 0.2% | 1,013,383 | 0.2% |
| **Base-Normal** | **2030** | 230 | 0.0% | 2,774,005 | -0.8% | 1,005,074 | -0.8% |
| **Base-Normal** | **2031** | 230 | 0.0% | 2,771,141 | -0.1% | 1,004,037 | -0.1% |
| **Base-Normal** | **2032** | 230 | 0.0% | 2,770,629 | 0.0% | 1,003,851 | 0.0% |
| **Base-Normal** | **2033** | 230 | 0.0% | 2,710,213 | -2.2% | 981,961 | -2.2% |
| **Base-Normal** | **2034** | 228 | -0.9% | 2,693,370 | -0.6% | 984,419 | 0.3% |
| **Base-Normal** | **2035** | 228 | 0.0% | 2,693,370 | 0.0% | 984,419 | 0.0% |
| **Base-Normal** | **2036** | 228 | 0.0% | 2,677,603 | -0.6% | 978,656 | -0.6% |
| **Base-Normal** | **2037** | 227 | -0.4% | 2,672,801 | -0.2% | 981,204 | 0.3% |
| **Base-Normal** | **2038** | 227 | 0.0% | 2,672,793 | 0.0% | 981,202 | 0.0% |
| **Base-Normal** | **2039** | 226 | -0.4% | 2,672,790 | 0.0% | 985,542 | 0.4% |
| **Base-Normal** | **2040** | 226 | 0.0% | 2,672,371 | 0.0% | 985,388 | 0.0% |

**Equivalent Compound Growth Rates**

| Time Period | | Industrial Consumers % Change | Industrial Sales to End Consumers % Change | Industrial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.42% | 3.42% | 2.99% |
| **2015** | **2019** | 3.72% | 2.06% | -1.60% |
| **2020** | **2025** | -0.26% | 8.69% | 8.98% |
| **2025** | **2030** | 0.00% | -0.32% | -0.32% |
| **2030** | **2035** | -0.17% | -0.59% | -0.41% |
| **2035** | **2040** | -0.18% | -0.16% | 0.02% |
| **2020** | **2030** | -0.13% | 4.09% | 4.22% |
| **2030** | **2040** | -0.18% | -0.37% | -0.20% |
| **2010** | **2019** | 1.87% | 2.81% | 0.92% |
| **2020** | **2040** | -0.15% | 1.83% | 1.99% |

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## Base-Normal Scenario

| | Year | OTHER NUMBER OF CONSUMERS | OTHER CONSUMERS % CHANGE | OTHER ENERGY SALES (MWH) | OTHER ENERGY SALES % CHANGE | OTHER KWH/CONSUMER PER MONTH | OTHER KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 2200 | | 40029 | | 1516 | |
| **Actual** | **2011** | 2418 | 9.9% | 40873 | 2.1% | 1409 | -7% |
| **Actual** | **2012** | 2509 | 3.8% | 46874 | 14.7% | 1557 | 11% |
| **Actual** | **2013** | 2610 | 4.0% | 40415 | -13.8% | 1291 | -17% |
| **Actual** | **2014** | 2742 | 5.1% | 41305 | 2.2% | 1255 | -3% |
| **Actual** | **2015** | 2825 | 3.0% | 37584 | -9.0% | 1109 | -12% |
| **Actual** | **2016** | 2920 | 3.4% | 39012 | 3.8% | 1113 | 0% |
| **Actual** | **2017** | 4850 | 66.1% | 56774 | 45.5% | 976 | -12% |
| **Actual** | **2018** | 4975 | 2.6% | 57912 | 2.0% | 970 | -1% |
| **Actual** | **2019** | 5063 | 1.8% | 53754 | -7.2% | 885 | -9% |
| **Base-Normal** | **2020** | 5073 | | 55587 | | 913 | |
| **Base-Normal** | **2021** | 5107 | 0.7% | 55604 | 0.0% | 907 | -1% |
| **Base-Normal** | **2022** | 5141 | 0.7% | 55617 | 0.0% | 902 | -1% |
| **Base-Normal** | **2023** | 5174 | 0.6% | 55629 | 0.0% | 896 | -1% |
| **Base-Normal** | **2024** | 5208 | 0.6% | 55642 | 0.0% | 890 | -1% |
| **Base-Normal** | **2025** | 5241 | 0.6% | 55655 | 0.0% | 885 | -1% |
| **Base-Normal** | **2026** | 5275 | 0.6% | 55668 | 0.0% | 879 | -1% |
| **Base-Normal** | **2027** | 5309 | 0.6% | 55681 | 0.0% | 874 | -1% |
| **Base-Normal** | **2028** | 5342 | 0.6% | 55693 | 0.0% | 869 | -1% |
| **Base-Normal** | **2029** | 5376 | 0.6% | 55706 | 0.0% | 864 | -1% |
| **Base-Normal** | **2030** | 5409 | 0.6% | 55719 | 0.0% | 858 | -1% |
| **Base-Normal** | **2031** | 5442 | 0.6% | 55731 | 0.0% | 853 | -1% |
| **Base-Normal** | **2032** | 5475 | 0.6% | 55744 | 0.0% | 848 | -1% |
| **Base-Normal** | **2033** | 5508 | 0.6% | 55756 | 0.0% | 844 | 0% |
| **Base-Normal** | **2034** | 5540 | 0.6% | 55769 | 0.0% | 839 | -1% |
| **Base-Normal** | **2035** | 5573 | 0.6% | 55781 | 0.0% | 834 | -1% |
| **Base-Normal** | **2036** | 5604 | 0.6% | 55793 | 0.0% | 830 | 0% |
| **Base-Normal** | **2037** | 5636 | 0.6% | 55805 | 0.0% | 825 | -1% |
| **Base-Normal** | **2038** | 5667 | 0.6% | 55817 | 0.0% | 821 | 0% |
| **Base-Normal** | **2039** | 5698 | 0.5% | 55829 | 0.0% | 816 | -1% |
| **Base-Normal** | **2040** | 5729 | 0.5% | 55840 | 0.0% | 812 | 0% |

**Equivalent Compound Growth Rates**

| Time Period | | Other Consumers % Change | Other Sales to End Consumers % Change | Other kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 5.13% | -1.25% | -6.06% |
| **2015** | **2019** | 15.70% | 9.36% | -5.48% |
| **2020** | **2025** | 0.65% | 0.02% | -0.62% |
| **2025** | **2030** | 0.63% | 0.02% | -0.62% |
| **2030** | **2035** | 0.60% | 0.02% | -0.57% |
| **2035** | **2040** | 0.56% | 0.02% | -0.53% |
| **2020** | **2030** | 0.64% | 0.02% | -0.62% |
| **2030** | **2040** | 0.58% | 0.02% | -0.55% |
| **2010** | **2019** | 9.70% | 3.33% | -5.81% |
| **2020** | **2040** | 0.61% | 0.02% | -0.58% |

**RUS FORM 341**

## Base-Normal Scenario

| | Year | CONSUMERS TOTAL | CONSUMERS % CHANGE | MEMBER SALES BASE-NORMAL | HE SALES BASE-NORMAL | HE SALES 60-MIN DEMAND | ANNUAL LOAD FACTOR (%) |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 293,992 | | 6,855,216 | 6,911,304 | 1366 | 58% |
| **Actual** | **2011** | 294,132 | 0.0% | 6,675,825 | 6,799,323 | 1418 | 55% |
| **Actual** | **2012** | 294,965 | 0.3% | 6,661,120 | 6,782,533 | 1457 | 53% |
| **Actual** | **2013** | 296,174 | 0.4% | 6,827,902 | 6,977,821 | 1363 | 58% |
| **Actual** | **2014** | 297,293 | 0.4% | 7,076,875 | 7,229,477 | 1645 | 50% |
| **Actual** | **2015** | 298,453 | 0.4% | 6,893,844 | 7,025,479 | 1584 | 50% |
| **Actual** | **2016** | 300,210 | 0.6% | 6,911,623 | 7,072,483 | 1423 | 57% |
| **Actual** | **2017** | 302,631 | 0.8% | 6,858,920 | 6,994,237 | 1356 | 59% |
| **Actual** | **2018** | 304,737 | 0.7% | 7,391,221 | 7,542,577 | 1587 | 54% |
| **Actual** | **2019** | 306,644 | 0.6% | 7,225,644 | 7,371,844 | 1624 | 52% |
| | | | | | | | |
| **Base-Normal** | **2020** | 308,248 | | 6,981,774 | 7,294,837 | 1480 | 58% |
| **Base-Normal** | **2021** | 310,034 | 0.6% | 7,203,433 | 7,525,007 | 1474 | 59% |
| **Base-Normal** | **2022** | 311,814 | 0.6% | 7,373,506 | 7,701,530 | 1492 | 61% |
| **Base-Normal** | **2023** | 313,726 | 0.6% | 7,741,175 | 8,082,921 | 1515 | 61% |
| **Base-Normal** | **2024** | 315,646 | 0.6% | 8,066,747 | 8,421,474 | 1565 | 60% |
| **Base-Normal** | **2025** | 317,586 | 0.6% | 8,104,412 | 8,461,209 | 1621 | 60% |
| **Base-Normal** | **2026** | 319,439 | 0.6% | 8,147,885 | 8,506,574 | 1623 | 60% |
| **Base-Normal** | **2027** | 321,070 | 0.5% | 8,189,502 | 8,549,963 | 1627 | 60% |
| **Base-Normal** | **2028** | 322,548 | 0.5% | 8,200,136 | 8,560,949 | 1631 | 60% |
| **Base-Normal** | **2029** | 323,993 | 0.4% | 8,229,735 | 8,592,252 | 1631 | 60% |
| **Base-Normal** | **2030** | 325,406 | 0.4% | 8,236,751 | 8,599,751 | 1631 | 60% |
| **Base-Normal** | **2031** | 326,785 | 0.4% | 8,267,225 | 8,631,624 | 1630 | 61% |
| **Base-Normal** | **2032** | 328,130 | 0.4% | 8,316,971 | 8,683,158 | 1634 | 60% |
| **Base-Normal** | **2033** | 329,441 | 0.4% | 8,280,931 | 8,646,542 | 1640 | 61% |
| **Base-Normal** | **2034** | 330,718 | 0.4% | 8,303,364 | 8,670,160 | 1631 | 61% |
| **Base-Normal** | **2035** | 331,963 | 0.4% | 8,343,732 | 8,712,371 | 1633 | 61% |
| **Base-Normal** | **2036** | 333,171 | 0.4% | 8,383,542 | 8,753,658 | 1637 | 61% |
| **Base-Normal** | **2037** | 334,348 | 0.4% | 8,405,868 | 8,777,550 | 1643 | 61% |
| **Base-Normal** | **2038** | 335,494 | 0.3% | 8,446,924 | 8,820,484 | 1643 | 61% |
| **Base-Normal** | **2039** | 336,612 | 0.3% | 8,487,277 | 8,862,686 | 1647 | 61% |
| **Base-Normal** | **2040** | 337,711 | 0.3% | 8,539,517 | 8,916,812 | 1652 | 56% |

**Equivalent Compound Growth Rates**

| Time Period | | Total Consumers % Change | Member Sales % Change | HE Sales % Change | HE Sales Demand % Change | Load Factor % Change |
|---|---|---|---|---|---|---|
| **2010** | **2015** | 0.30% | 0.11% | 0.33% | 3.00% | -2.60% |
| **2015** | **2019** | 0.68% | 1.18% | 1.21% | 0.63% | 0.58% |
| **2020** | **2025** | 0.60% | 3.03% | 3.01% | 1.84% | 0.54% |
| **2025** | **2030** | 0.49% | 0.32% | 0.33% | 0.13% | 0.20% |
| **2030** | **2035** | 0.40% | 0.26% | 0.26% | 0.02% | 0.14% |
| **2035** | **2040** | 0.34% | 0.46% | 0.46% | 0.23% | -1.59% |
| **2020** | **2030** | 0.54% | 1.67% | 1.66% | 0.98% | 0.37% |
| **2030** | **2040** | 0.37% | 0.36% | 0.36% | 0.13% | -0.73% |
| **2010** | **2019** | 0.47% | 0.59% | 0.72% | 1.94% | -1.20% |
| **2020** | **2040** | 0.46% | 1.01% | 1.01% | 0.55% | -0.18% |

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## Base-Normal Scenario

| | Year | HE GENERATION BASE-NORMAL | GENERATION % CHANGE | HE GENERATION 60-MIN DEMAND | GENERATION DEMAND % CHANGE | ANNUAL PEAK SEASON |
|---|---|---|---|---|---|---|
| **Actual** | **2010** | 7,169,555 | | 1431 | | SUMMER |
| **Actual** | **2011** | 7,261,250 | 1.3% | 1478 | 3.3% | SUMMER |
| **Actual** | **2012** | 7,193,545 | -0.9% | 1537 | 4.0% | SUMMER |
| **Actual** | **2013** | 7,335,037 | 2.0% | 1409 | -8.3% | WINTER |
| **Actual** | **2014** | 7,639,069 | 4.1% | 1698 | 20.5% | WINTER |
| **Actual** | **2015** | 7,481,099 | -2.1% | 1643 | -3.2% | WINTER |
| **Actual** | **2016** | 7,564,387 | 1.1% | 1498 | -8.8% | WINTER |
| **Actual** | **2017** | 7,476,942 | -1.2% | 1425 | -4.8% | WINTER |
| **Actual** | **2018** | 8,063,654 | 7.8% | 1668 | 17.0% | WINTER |
| **Actual** | **2019** | 7,859,968 | -2.5% | 1714 | 2.8% | WINTER |
| **Base-Normal** | **2020** | 7,574,958 | | 1548 | 0.0% | WINTER |
| **Base-Normal** | **2021** | 7,813,967 | 3.2% | 1542 | -0.4% | WINTER |
| **Base-Normal** | **2022** | 7,997,269 | 2.3% | 1561 | 1.2% | WINTER |
| **Base-Normal** | **2023** | 8,393,306 | 5.0% | 1585 | 1.5% | WINTER |
| **Base-Normal** | **2024** | 8,744,858 | 4.2% | 1638 | 3.4% | WINTER |
| **Base-Normal** | **2025** | 8,786,119 | 0.5% | 1696 | 3.5% | WINTER |
| **Base-Normal** | **2026** | 8,833,226 | 0.5% | 1698 | 0.1% | WINTER |
| **Base-Normal** | **2027** | 8,878,282 | 0.5% | 1702 | 0.3% | WINTER |
| **Base-Normal** | **2028** | 8,889,689 | 0.1% | 1706 | 0.2% | WINTER |
| **Base-Normal** | **2029** | 8,922,195 | 0.4% | 1707 | 0.0% | WINTER |
| **Base-Normal** | **2030** | 8,929,981 | 0.1% | 1707 | 0.0% | WINTER |
| **Base-Normal** | **2031** | 8,963,078 | 0.4% | 1706 | -0.1% | WINTER |
| **Base-Normal** | **2032** | 9,016,591 | 0.6% | 1709 | 0.2% | WINTER |
| **Base-Normal** | **2033** | 8,978,569 | -0.4% | 1716 | 0.4% | WINTER |
| **Base-Normal** | **2034** | 9,003,094 | 0.3% | 1707 | -0.5% | WINTER |
| **Base-Normal** | **2035** | 9,046,926 | 0.5% | 1708 | 0.1% | WINTER |
| **Base-Normal** | **2036** | 9,089,798 | 0.5% | 1713 | 0.3% | WINTER |
| **Base-Normal** | **2037** | 9,114,608 | 0.3% | 1719 | 0.3% | WINTER |
| **Base-Normal** | **2038** | 9,159,191 | 0.5% | 1719 | 0.0% | WINTER |
| **Base-Normal** | **2039** | 9,203,014 | 0.5% | 1724 | 0.3% | WINTER |
| **Base-Normal** | **2040** | 9,259,217 | 0.6% | 1728 | 0.3% | WINTER |

### Equivalent Compound Growth Rates

| Time Period | | HE Generation % Change | HE Generation Demand % Change |
|---|---|---|---|
| **2010** | **2015** | 0.85% | 2.80% |
| **2015** | **2019** | 1.24% | 1.06% |
| **2020** | **2025** | 3.01% | 1.84% |
| **2025** | **2030** | 0.33% | 0.13% |
| **2030** | **2035** | 0.26% | 0.02% |
| **2035** | **2040** | 0.46% | 0.23% |
| **2020** | **2030** | 1.66% | 0.98% |
| **2030** | **2040** | 0.36% | 0.13% |
| **2010** | **2019** | 1.03% | 2.03% |
| **2020** | **2040** | 1.01% | 0.55% |

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## Low-Normal Scenario

| | Year | RESIDENTIAL NUMBER OF CONSUMERS | RESIDENTIAL CONSUMERS % CHANGE | RESIDENTIAL ENERGY SALES (MWH) | RESIDENTIAL ENERGY SALES % CHANGE | RESIDENTIAL KWH/CONSUMER PER MONTH | RESIDENTIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 277913 | | 4,313,612 | | 1293 | |
| **Actual** | **2011** | 277751 | -0.1% | 4,093,234 | -5.1% | 1228 | -5.0% |
| **Actual** | **2012** | 278372 | 0.2% | 3,958,457 | -3.3% | 1185 | -3.5% |
| **Actual** | **2013** | 279338 | 0.3% | 4,091,996 | 3.4% | 1221 | 3.0% |
| **Actual** | **2014** | 280061 | 0.3% | 4,204,582 | 2.8% | 1251 | 2.5% |
| **Actual** | **2015** | 281173 | 0.4% | 4,002,896 | -4.8% | 1186 | -5.2% |
| **Actual** | **2016** | 283258 | 0.7% | 4,024,894 | 0.5% | 1184 | -0.2% |
| **Actual** | **2017** | 283540 | 0.1% | 3,880,889 | -3.6% | 1141 | -3.6% |
| **Actual** | **2018** | 285314 | 0.6% | 4,298,011 | 10.7% | 1255 | 10.0% |
| **Actual** | **2019** | 286480 | 0.4% | 4,151,582 | -3.4% | 1208 | -3.7% |
| | | | | | | | |
| **Low-Normal** | **2020** | 287412 | | 4,106,419 | | 1191 | |
| **Low-Normal** | **2021** | 287685 | 0.1% | 4,101,347 | -0.1% | 1188 | -0.3% |
| **Low-Normal** | **2022** | 288225 | 0.2% | 4,109,775 | 0.2% | 1188 | 0.0% |
| **Low-Normal** | **2023** | 288966 | 0.3% | 4,116,661 | 0.2% | 1187 | -0.1% |
| **Low-Normal** | **2024** | 289747 | 0.3% | 4,141,572 | 0.6% | 1191 | 0.3% |
| **Low-Normal** | **2025** | 290572 | 0.3% | 4,140,970 | 0.0% | 1188 | -0.3% |
| **Low-Normal** | **2026** | 291344 | 0.3% | 4,153,215 | 0.3% | 1188 | 0.0% |
| **Low-Normal** | **2027** | 291933 | 0.2% | 4,163,445 | 0.2% | 1188 | 0.0% |
| **Low-Normal** | **2028** | 292404 | 0.2% | 4,186,514 | 0.6% | 1193 | 0.4% |
| **Low-Normal** | **2029** | 292873 | 0.2% | 4,183,830 | -0.1% | 1190 | -0.3% |
| **Low-Normal** | **2030** | 293340 | 0.2% | 4,187,967 | 0.1% | 1190 | 0.0% |
| **Low-Normal** | **2031** | 293805 | 0.2% | 4,195,336 | 0.2% | 1190 | 0.0% |
| **Low-Normal** | **2032** | 294267 | 0.2% | 4,218,970 | 0.6% | 1195 | 0.4% |
| **Low-Normal** | **2033** | 294726 | 0.2% | 4,218,055 | 0.0% | 1193 | -0.2% |
| **Low-Normal** | **2034** | 295184 | 0.2% | 4,231,445 | 0.3% | 1195 | 0.2% |
| **Low-Normal** | **2035** | 295638 | 0.2% | 4,246,168 | 0.3% | 1197 | 0.2% |
| **Low-Normal** | **2036** | 296089 | 0.2% | 4,275,524 | 0.7% | 1203 | 0.5% |
| **Low-Normal** | **2037** | 296537 | 0.2% | 4,278,480 | 0.1% | 1202 | -0.1% |
| **Low-Normal** | **2038** | 296982 | 0.2% | 4,294,899 | 0.4% | 1205 | 0.2% |
| **Low-Normal** | **2039** | 297424 | 0.1% | 4,311,016 | 0.4% | 1208 | 0.2% |
| **Low-Normal** | **2040** | 297866 | 0.1% | 4,338,920 | 0.6% | 1214 | 0.5% |

**Equivalent Compound Growth Rates**

| Time Period | | Residential Consumers % Change | Residential Sales to End Consumers % Change | Residential kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.23% | -1.48% | -1.71% |
| **2015** | **2019** | 0.47% | 0.92% | 0.46% |
| **2020** | **2025** | 0.22% | 0.17% | -0.05% |
| **2025** | **2030** | 0.19% | 0.23% | 0.03% |
| **2030** | **2035** | 0.16% | 0.28% | 0.12% |
| **2035** | **2040** | 0.15% | 0.43% | 0.28% |
| **2020** | **2030** | 0.20% | 0.20% | -0.01% |
| **2030** | **2040** | 0.15% | 0.35% | 0.20% |
| **2010** | **2019** | 0.34% | -0.42% | -0.75% |
| **2020** | **2040** | 0.18% | 0.28% | 0.10% |

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## Low-Normal Scenario

| | Year | COMMERCIAL NUMBER OF CONSUMERS | COMMERCIAL CONSUMERS % CHANGE | COMMERCIAL ENERGY SALES (MWH) | COMMERCIAL ENERGY SALES % CHANGE | COMMERCIAL KWH/CONSUMER PER MONTH | COMMERCIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 13683 | | 889,903 | | 5420 | |
| **Actual** | **2011** | 13764 | 0.6% | 901,707 | 1.3% | 5459 | 0.7% |
| **Actual** | **2012** | 13890 | 0.9% | 930,499 | 3.2% | 5583 | 2.3% |
| **Actual** | **2013** | 14029 | 1.0% | 938,826 | 0.9% | 5577 | -0.1% |
| **Actual** | **2014** | 14289 | 1.9% | 952,690 | 1.5% | 5556 | -0.4% |
| **Actual** | **2015** | 14255 | -0.2% | 946,635 | -0.6% | 5534 | -0.4% |
| **Actual** | **2016** | 13827 | -3.0% | 949,179 | 0.3% | 5720 | 3.4% |
| **Actual** | **2017** | 14030 | 1.5% | 944,810 | -0.5% | 5612 | -1.9% |
| **Actual** | **2018** | 14215 | 1.3% | 940,218 | -0.5% | 5512 | -1.8% |
| **Actual** | **2019** | 14868 | 4.6% | 951,542 | 1.2% | 5333 | -3.2% |
| | | | | | | | |
| **Low-Normal** | **2020** | 14907 | | 952,629 | | 5325 | |
| **Low-Normal** | **2021** | 15191 | 1.9% | 956,597 | 0.4% | 5248 | -1.4% |
| **Low-Normal** | **2022** | 15188 | 0.0% | 957,140 | 0.1% | 5252 | 0.1% |
| **Low-Normal** | **2023** | 15207 | 0.1% | 958,910 | 0.2% | 5255 | 0.1% |
| **Low-Normal** | **2024** | 15249 | 0.3% | 961,607 | 0.3% | 5255 | 0.0% |
| **Low-Normal** | **2025** | 15294 | 0.3% | 964,424 | 0.3% | 5255 | 0.0% |
| **Low-Normal** | **2026** | 15324 | 0.2% | 966,514 | 0.2% | 5256 | 0.0% |
| **Low-Normal** | **2027** | 15343 | 0.1% | 967,941 | 0.1% | 5257 | 0.0% |
| **Low-Normal** | **2028** | 15360 | 0.1% | 969,217 | 0.1% | 5258 | 0.0% |
| **Low-Normal** | **2029** | 15380 | 0.1% | 970,600 | 0.1% | 5259 | 0.0% |
| **Low-Normal** | **2030** | 15399 | 0.1% | 971,925 | 0.1% | 5260 | 0.0% |
| **Low-Normal** | **2031** | 15418 | 0.1% | 973,241 | 0.1% | 5260 | 0.0% |
| **Low-Normal** | **2032** | 15436 | 0.1% | 974,516 | 0.1% | 5261 | 0.0% |
| **Low-Normal** | **2033** | 15454 | 0.1% | 975,807 | 0.1% | 5262 | 0.0% |
| **Low-Normal** | **2034** | 15474 | 0.1% | 977,203 | 0.1% | 5263 | 0.0% |
| **Low-Normal** | **2035** | 15494 | 0.1% | 978,580 | 0.1% | 5263 | 0.0% |
| **Low-Normal** | **2036** | 15514 | 0.1% | 979,943 | 0.1% | 5264 | 0.0% |
| **Low-Normal** | **2037** | 15534 | 0.1% | 981,330 | 0.1% | 5264 | 0.0% |
| **Low-Normal** | **2038** | 15554 | 0.1% | 982,703 | 0.1% | 5265 | 0.0% |
| **Low-Normal** | **2039** | 15574 | 0.1% | 984,092 | 0.1% | 5266 | 0.0% |
| **Low-Normal** | **2040** | 15595 | 0.1% | 985,482 | 0.1% | 5266 | 0.0% |

### Equivalent Compound Growth Rates

| Time Period | | Commercial Consumers % Change | Commercial Sales to End Consumers % Change | Commercial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.82% | 1.24% | 0.42% |
| **2015** | **2019** | 1.06% | 0.13% | -0.92% |
| **2020** | **2025** | 0.51% | 0.25% | -0.26% |
| **2025** | **2030** | 0.14% | 0.16% | 0.02% |
| **2030** | **2035** | 0.12% | 0.14% | 0.01% |
| **2035** | **2040** | 0.13% | 0.14% | 0.01% |
| **2020** | **2030** | 0.33% | 0.20% | -0.12% |
| **2030** | **2040** | 0.13% | 0.14% | 0.01% |
| **2010** | **2019** | 0.93% | 0.75% | -0.18% |
| **2020** | **2040** | 0.23% | 0.17% | -0.06% |

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## Low-Normal Scenario

| | Year | INDUSTRIAL NUMBER OF CONSUMERS | INDUSTRIAL CONSUMERS % CHANGE | INDUSTRIAL ENERGY SALES (MWH) | INDUSTRIAL ENERGY SALES % CHANGE | INDUSTRIAL KWH/CONSUMER PER MONTH | INDUSTRIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 197 | | 1,611,671 | | 682,911 | |
| **Actual** | **2011** | 201 | 1.9% | 1,640,012 | 1.8% | 681,634 | -0.2% |
| **Actual** | **2012** | 194 | -3.2% | 1,725,290 | 5.2% | 741,104 | 8.7% |
| **Actual** | **2013** | 197 | 1.8% | 1,756,666 | 1.8% | 741,522 | 0.1% |
| **Actual** | **2014** | 202 | 2.3% | 1,878,298 | 6.9% | 775,195 | 4.5% |
| **Actual** | **2015** | 201 | -0.5% | 1,906,729 | 1.5% | 791,174 | 2.1% |
| **Actual** | **2016** | 205 | 1.8% | 1,898,538 | -0.4% | 773,650 | -2.2% |
| **Actual** | **2017** | 211 | 3.1% | 1,976,447 | 4.1% | 780,896 | 0.9% |
| **Actual** | **2018** | 233 | 10.3% | 2,095,080 | 6.0% | 750,656 | -3.9% |
| **Actual** | **2019** | 232 | -0.1% | 2,068,766 | -1.3% | 741,759 | -1.2% |
| **Low-Normal** | **2020** | 233 | | 1,858,055 | | 664,540 | |
| **Low-Normal** | **2021** | 225 | -3.4% | 2,059,493 | 10.8% | 762,775 | 14.8% |
| **Low-Normal** | **2022** | 228 | 1.3% | 2,196,571 | 6.7% | 802,840 | 5.3% |
| **Low-Normal** | **2023** | 230 | 0.9% | 2,532,250 | 15.3% | 917,482 | 14.3% |
| **Low-Normal** | **2024** | 231 | 0.4% | 2,806,942 | 10.8% | 1,012,605 | 10.4% |
| **Low-Normal** | **2025** | 230 | -0.4% | 2,818,835 | 0.4% | 1,021,317 | 0.9% |
| **Low-Normal** | **2026** | 230 | 0.0% | 2,823,471 | 0.2% | 1,022,997 | 0.2% |
| **Low-Normal** | **2027** | 230 | 0.0% | 2,828,781 | 0.2% | 1,024,921 | 0.2% |
| **Low-Normal** | **2028** | 230 | 0.0% | 2,790,157 | -1.4% | 1,010,926 | -1.4% |
| **Low-Normal** | **2029** | 230 | 0.0% | 2,796,938 | 0.2% | 1,013,383 | 0.2% |
| **Low-Normal** | **2030** | 230 | 0.0% | 2,774,005 | -0.8% | 1,005,074 | -0.8% |
| **Low-Normal** | **2031** | 230 | 0.0% | 2,771,141 | -0.1% | 1,004,037 | -0.1% |
| **Low-Normal** | **2032** | 230 | 0.0% | 2,770,629 | 0.0% | 1,003,851 | 0.0% |
| **Low-Normal** | **2033** | 230 | 0.0% | 2,710,213 | -2.2% | 981,961 | -2.2% |
| **Low-Normal** | **2034** | 228 | -0.9% | 2,693,370 | -0.6% | 984,419 | 0.3% |
| **Low-Normal** | **2035** | 228 | 0.0% | 2,693,370 | 0.0% | 984,419 | 0.0% |
| **Low-Normal** | **2036** | 228 | 0.0% | 2,677,603 | -0.6% | 978,656 | -0.6% |
| **Low-Normal** | **2037** | 227 | -0.4% | 2,672,801 | -0.2% | 981,204 | 0.3% |
| **Low-Normal** | **2038** | 227 | 0.0% | 2,672,793 | 0.0% | 981,202 | 0.0% |
| **Low-Normal** | **2039** | 226 | -0.4% | 2,672,790 | 0.0% | 985,542 | 0.4% |
| **Low-Normal** | **2040** | 226 | 0.0% | 2,672,371 | 0.0% | 985,388 | 0.0% |

**Equivalent Compound Growth Rates**

| Time Period | | Industrial Consumers % Change | Industrial Sales to End Consumers % Change | Industrial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.42% | 3.42% | 2.99% |
| **2015** | **2019** | 3.72% | 2.06% | -1.60% |
| **2020** | **2025** | -0.26% | 8.69% | 8.98% |
| **2025** | **2030** | 0.00% | -0.32% | -0.32% |
| **2030** | **2035** | -0.17% | -0.59% | -0.41% |
| **2035** | **2040** | -0.18% | -0.16% | 0.02% |
| **2020** | **2030** | -0.13% | 4.09% | 4.22% |
| **2030** | **2040** | -0.18% | -0.37% | -0.20% |
| **2010** | **2019** | 1.87% | 2.81% | 0.92% |
| **2020** | **2040** | -0.15% | 1.83% | 1.99% |

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## Low-Normal Scenario

| | Year | OTHER NUMBER OF CONSUMERS | OTHER CONSUMERS % CHANGE | OTHER ENERGY SALES (MWH) | OTHER ENERGY SALES % CHANGE | OTHER KWH/CONSUMER PER MONTH | OTHER KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 2200 | | 40029 | | 1516 | |
| **Actual** | **2011** | 2418 | 9.9% | 40873 | 2.1% | 1409 | -7% |
| **Actual** | **2012** | 2509 | 3.8% | 46874 | 14.7% | 1557 | 11% |
| **Actual** | **2013** | 2610 | 4.0% | 40415 | -13.8% | 1291 | -17% |
| **Actual** | **2014** | 2742 | 5.1% | 41305 | 2.2% | 1255 | -3% |
| **Actual** | **2015** | 2825 | 3.0% | 37584 | -9.0% | 1109 | -12% |
| **Actual** | **2016** | 2920 | 3.4% | 39012 | 3.8% | 1113 | 0% |
| **Actual** | **2017** | 4850 | 66.1% | 56774 | 45.5% | 976 | -12% |
| **Actual** | **2018** | 4975 | 2.6% | 57912 | 2.0% | 970 | -1% |
| **Actual** | **2019** | 5063 | 1.8% | 53754 | -7.2% | 885 | -9% |
| **Low-Normal** | **2020** | 5069 | | 55584 | | 914 | |
| **Low-Normal** | **2021** | 5095 | 0.5% | 55596 | 0.0% | 909 | -1% |
| **Low-Normal** | **2022** | 5122 | 0.5% | 55604 | 0.0% | 905 | 0% |
| **Low-Normal** | **2023** | 5147 | 0.5% | 55612 | 0.0% | 900 | -1% |
| **Low-Normal** | **2024** | 5173 | 0.5% | 55620 | 0.0% | 896 | 0% |
| **Low-Normal** | **2025** | 5200 | 0.5% | 55628 | 0.0% | 892 | 0% |
| **Low-Normal** | **2026** | 5226 | 0.5% | 55636 | 0.0% | 887 | -1% |
| **Low-Normal** | **2027** | 5252 | 0.5% | 55645 | 0.0% | 883 | 0% |
| **Low-Normal** | **2028** | 5278 | 0.5% | 55653 | 0.0% | 879 | 0% |
| **Low-Normal** | **2029** | 5304 | 0.5% | 55661 | 0.0% | 875 | 0% |
| **Low-Normal** | **2030** | 5330 | 0.5% | 55669 | 0.0% | 870 | -1% |
| **Low-Normal** | **2031** | 5356 | 0.5% | 55678 | 0.0% | 866 | 0% |
| **Low-Normal** | **2032** | 5382 | 0.5% | 55686 | 0.0% | 862 | 0% |
| **Low-Normal** | **2033** | 5407 | 0.5% | 55694 | 0.0% | 858 | 0% |
| **Low-Normal** | **2034** | 5433 | 0.5% | 55703 | 0.0% | 854 | 0% |
| **Low-Normal** | **2035** | 5459 | 0.5% | 55711 | 0.0% | 850 | 0% |
| **Low-Normal** | **2036** | 5484 | 0.5% | 55720 | 0.0% | 847 | 0% |
| **Low-Normal** | **2037** | 5510 | 0.5% | 55728 | 0.0% | 843 | 0% |
| **Low-Normal** | **2038** | 5535 | 0.5% | 55737 | 0.0% | 839 | 0% |
| **Low-Normal** | **2039** | 5560 | 0.5% | 55745 | 0.0% | 835 | 0% |
| **Low-Normal** | **2040** | 5585 | 0.5% | 55754 | 0.0% | 832 | 0% |

**Equivalent Compound Growth Rates**

| Time Period | | Other Consumers % Change | Other Sales to End Consumers % Change | Other kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 5.13% | -1.25% | -6.06% |
| **2015** | **2019** | 15.70% | 9.36% | -5.48% |
| **2020** | **2025** | 0.51% | 0.02% | -0.49% |
| **2025** | **2030** | 0.50% | 0.01% | -0.50% |
| **2030** | **2035** | 0.48% | 0.02% | -0.46% |
| **2035** | **2040** | 0.46% | 0.02% | -0.43% |
| **2020** | **2030** | 0.50% | 0.02% | -0.49% |
| **2030** | **2040** | 0.47% | 0.02% | -0.45% |
| **2010** | **2019** | 9.70% | 3.33% | -5.81% |
| **2020** | **2040** | 0.49% | 0.02% | -0.47% |

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## Low-Normal Scenario

| | Year | TOTAL CONSUMERS | CONSUMERS % CHANGE | MEMBER SALES LOW-NORMAL | HE SALES LOW-NORMAL | HE SALES 60-MIN DEMAND | ANNUAL LOAD FACTOR (%) |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 293,992 | | 6,855,216 | 6,911,304 | 1366 | 58% |
| **Actual** | **2011** | 294,132 | 0.0% | 6,675,825 | 6,799,323 | 1418 | 55% |
| **Actual** | **2012** | 294,965 | 0.3% | 6,661,120 | 6,782,533 | 1457 | 53% |
| **Actual** | **2013** | 296,174 | 0.4% | 6,827,902 | 6,977,821 | 1363 | 58% |
| **Actual** | **2014** | 297,293 | 0.4% | 7,076,875 | 7,229,477 | 1645 | 50% |
| **Actual** | **2015** | 298,453 | 0.4% | 6,893,844 | 7,025,479 | 1584 | 50% |
| **Actual** | **2016** | 300,210 | 0.6% | 6,911,623 | 7,072,483 | 1423 | 57% |
| **Actual** | **2017** | 302,631 | 0.8% | 6,858,920 | 6,994,237 | 1356 | 59% |
| **Actual** | **2018** | 304,737 | 0.7% | 7,391,221 | 7,542,577 | 1587 | 54% |
| **Actual** | **2019** | 306,644 | 0.6% | 7,225,644 | 7,371,844 | 1624 | 52% |
| **Low-Normal** | **2020** | 307,622 | | 6,972,686 | 7,285,295 | 1480 | 56% |
| **Low-Normal** | **2021** | 308,196 | 0.2% | 7,173,033 | 7,493,175 | 1472 | 58% |
| **Low-Normal** | **2022** | 308,763 | 0.2% | 7,319,090 | 7,644,589 | 1486 | 59% |
| **Low-Normal** | **2023** | 309,551 | 0.3% | 7,663,433 | 8,001,590 | 1504 | 61% |
| **Low-Normal** | **2024** | 310,400 | 0.3% | 7,965,741 | 8,315,815 | 1551 | 61% |
| **Low-Normal** | **2025** | 311,295 | 0.3% | 7,979,857 | 8,330,909 | 1602 | 59% |
| **Low-Normal** | **2026** | 312,123 | 0.3% | 7,998,837 | 8,350,655 | 1599 | 60% |
| **Low-Normal** | **2027** | 312,757 | 0.2% | 8,015,812 | 8,368,268 | 1599 | 60% |
| **Low-Normal** | **2028** | 313,272 | 0.2% | 8,001,541 | 8,353,219 | 1599 | 59% |
| **Low-Normal** | **2029** | 313,787 | 0.2% | 8,007,029 | 8,359,283 | 1595 | 60% |
| **Low-Normal** | **2030** | 314,299 | 0.2% | 7,989,567 | 8,341,175 | 1591 | 60% |
| **Low-Normal** | **2031** | 314,809 | 0.2% | 7,995,396 | 8,347,267 | 1586 | 60% |
| **Low-Normal** | **2032** | 315,314 | 0.2% | 8,019,801 | 8,372,316 | 1585 | 60% |
| **Low-Normal** | **2033** | 315,818 | 0.2% | 7,959,770 | 8,310,574 | 1587 | 60% |
| **Low-Normal** | **2034** | 316,319 | 0.2% | 7,957,722 | 8,308,581 | 1574 | 60% |
| **Low-Normal** | **2035** | 316,819 | 0.2% | 7,973,830 | 8,325,411 | 1572 | 60% |
| **Low-Normal** | **2036** | 317,315 | 0.2% | 7,988,790 | 8,340,734 | 1572 | 60% |
| **Low-Normal** | **2037** | 317,807 | 0.2% | 7,988,339 | 8,340,762 | 1574 | 61% |
| **Low-Normal** | **2038** | 318,298 | 0.2% | 8,006,132 | 8,359,357 | 1570 | 61% |
| **Low-Normal** | **2039** | 318,785 | 0.2% | 8,023,644 | 8,377,661 | 1570 | 61% |
| **Low-Normal** | **2040** | 319,272 | 0.2% | 8,052,527 | 8,407,393 | 1571 | 61% |

**Equivalent Compound Growth Rates**

| Time Period | | Total Consumers % Change | Member Sales % Change | HE Sales % Change | HE Sales Demand % Change | Load Factor % Change |
|---|---|---|---|---|---|---|
| **2010** | **2015** | 0.30% | 0.11% | 0.33% | 3.00% | -2.60% |
| **2015** | **2019** | 0.68% | 1.18% | 1.21% | 0.63% | 0.58% |
| **2020** | **2025** | 0.24% | 2.74% | 2.72% | 1.60% | 1.16% |
| **2025** | **2030** | 0.19% | 0.02% | 0.02% | -0.14% | 0.16% |
| **2030** | **2035** | 0.16% | -0.04% | -0.04% | -0.24% | 0.21% |
| **2035** | **2040** | 0.15% | 0.20% | 0.20% | -0.01% | 0.15% |
| **2020** | **2030** | 0.21% | 1.37% | 1.36% | 0.73% | 0.66% |
| **2030** | **2040** | 0.16% | 0.08% | 0.08% | -0.12% | 0.18% |
| **2010** | **2019** | 0.47% | 0.59% | 0.72% | 1.94% | -1.20% |
| **2020** | **2040** | 0.19% | 0.72% | 0.72% | 0.30% | 0.42% |

**RUS FORM 341**

## Low-Normal Scenario

| | Year | HE GENERATION LOW-NORMAL | HE GENERATION % CHANGE | HE GENERATION 60-MIN DEMAND | GENERATION DEMAND % CHANGE | ANNUAL PEAK SEASON |
|---|---|---|---|---|---|---|
| **Actual** | **2010** | 7,169,555 | | 1431 | | SUMMER |
| **Actual** | **2011** | 7,261,250 | 3.8% | 1478 | 3.3% | SUMMER |
| **Actual** | **2012** | 7,193,545 | 2.8% | 1537 | 4.0% | SUMMER |
| **Actual** | **2013** | 7,335,037 | -6.4% | 1409 | -8.3% | WINTER |
| **Actual** | **2014** | 7,639,069 | 20.6% | 1698 | 20.5% | WINTER |
| **Actual** | **2015** | 7,481,099 | -3.7% | 1643 | -3.2% | WINTER |
| **Actual** | **2016** | 7,564,387 | -10.2% | 1498 | -8.8% | WINTER |
| **Actual** | **2017** | 7,476,942 | -4.7% | 1425 | -4.8% | WINTER |
| **Actual** | **2018** | 8,063,654 | 17.1% | 1668 | 17.0% | WINTER |
| **Actual** | **2019** | 7,859,968 | 2.4% | 1714 | 2.8% | WINTER |
| **Low-Normal** | **2020** | 7,565,050 | | 1548 | | WINTER |
| **Low-Normal** | **2021** | 7,780,912 | 2.9% | 1540 | -0.5% | WINTER |
| **Low-Normal** | **2022** | 7,938,142 | 2.0% | 1554 | 0.9% | WINTER |
| **Low-Normal** | **2023** | 8,308,851 | 4.7% | 1574 | 1.2% | WINTER |
| **Low-Normal** | **2024** | 8,635,142 | 3.9% | 1623 | 3.1% | WINTER |
| **Low-Normal** | **2025** | 8,650,815 | 0.2% | 1676 | 3.3% | WINTER |
| **Low-Normal** | **2026** | 8,671,320 | 0.2% | 1673 | -0.2% | WINTER |
| **Low-Normal** | **2027** | 8,689,610 | 0.2% | 1673 | 0.0% | WINTER |
| **Low-Normal** | **2028** | 8,673,983 | -0.2% | 1673 | 0.0% | WINTER |
| **Low-Normal** | **2029** | 8,680,279 | 0.1% | 1669 | -0.2% | WINTER |
| **Low-Normal** | **2030** | 8,661,476 | -0.2% | 1665 | -0.3% | WINTER |
| **Low-Normal** | **2031** | 8,667,802 | 0.1% | 1659 | -0.3% | WINTER |
| **Low-Normal** | **2032** | 8,693,813 | 0.3% | 1658 | 0.0% | WINTER |
| **Low-Normal** | **2033** | 8,629,700 | -0.7% | 1661 | 0.1% | WINTER |
| **Low-Normal** | **2034** | 8,627,631 | 0.0% | 1647 | -0.8% | WINTER |
| **Low-Normal** | **2035** | 8,645,106 | 0.2% | 1645 | -0.2% | WINTER |
| **Low-Normal** | **2036** | 8,661,019 | 0.2% | 1645 | 0.0% | WINTER |
| **Low-Normal** | **2037** | 8,661,047 | 0.0% | 1646 | 0.1% | WINTER |
| **Low-Normal** | **2038** | 8,680,356 | 0.2% | 1643 | -0.2% | WINTER |
| **Low-Normal** | **2039** | 8,699,363 | 0.2% | 1643 | 0.0% | WINTER |
| **Low-Normal** | **2040** | 8,730,237 | 0.4% | 1644 | 0.1% | WINTER |

**Equivalent Compound Growth Rates**

| Time Period | | HE Generation % Change | HE Generation Demand % Change |
|---|---|---|---|
| **2010** | **2015** | 0.85% | 2.80% |
| **2015** | **2019** | 1.24% | 1.06% |
| **2020** | **2025** | 2.72% | 1.60% |
| **2025** | **2030** | 0.02% | -0.14% |
| **2030** | **2035** | -0.04% | -0.24% |
| **2035** | **2040** | 0.20% | -0.01% |
| **2020** | **2030** | 1.36% | 0.73% |
| **2030** | **2040** | 0.08% | -0.12% |
| **2010** | **2019** | 1.03% | 2.03% |
| **2020** | **2040** | 0.72% | 0.30% |

## RUS FORM 341

# High-Normal Scenario

| | Year | RESIDENTIAL NUMBER OF CONSUMERS | RESIDENTIAL CONSUMERS % CHANGE | RESIDENTIAL ENERGY SALES (MWH) | RESIDENTIAL ENERGY SALES % CHANGE | RESIDENTIAL KWH/CONSUMER PER MONTH | RESIDENTIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 277913 | | 4,313,612 | | 1293 | |
| **Actual** | **2011** | 277751 | -0.1% | 4,093,234 | -5.1% | 1228 | -5.0% |
| **Actual** | **2012** | 278372 | 0.2% | 3,958,457 | -3.3% | 1185 | -3.5% |
| **Actual** | **2013** | 279338 | 0.3% | 4,091,996 | 3.4% | 1221 | 3.0% |
| **Actual** | **2014** | 280061 | 0.3% | 4,204,582 | 2.8% | 1251 | 2.5% |
| **Actual** | **2015** | 281173 | 0.4% | 4,002,896 | -4.8% | 1186 | -5.2% |
| **Actual** | **2016** | 283258 | 0.7% | 4,024,894 | 0.5% | 1184 | -0.2% |
| **Actual** | **2017** | 283540 | 0.1% | 3,880,889 | -3.6% | 1141 | -3.6% |
| **Actual** | **2018** | 285314 | 0.6% | 4,298,011 | 10.7% | 1255 | 10.0% |
| **Actual** | **2019** | 286480 | 0.4% | 4,151,582 | -3.4% | 1208 | -3.7% |
| | | | | | | | |
| **High-Normal** | **2020** | 288186 | | 4,117,654 | | 1191 | |
| **High-Normal** | **2021** | 289851 | 0.6% | 4,134,305 | 0.4% | 1189 | -0.2% |
| **High-Normal** | **2022** | 291755 | 0.7% | 4,166,258 | 0.8% | 1190 | 0.1% |
| **High-Normal** | **2023** | 293856 | 0.7% | 4,198,684 | 0.8% | 1191 | 0.1% |
| **High-Normal** | **2024** | 295986 | 0.7% | 4,250,978 | 1.2% | 1197 | 0.5% |
| **High-Normal** | **2025** | 298156 | 0.7% | 4,278,375 | 0.6% | 1196 | -0.1% |
| **High-Normal** | **2026** | 300270 | 0.7% | 4,320,076 | 1.0% | 1199 | 0.3% |
| **High-Normal** | **2027** | 302202 | 0.6% | 4,360,781 | 0.9% | 1203 | 0.3% |
| **High-Normal** | **2028** | 304017 | 0.6% | 4,416,076 | 1.3% | 1210 | 0.6% |
| **High-Normal** | **2029** | 305849 | 0.6% | 4,444,151 | 0.6% | 1211 | 0.1% |
| **High-Normal** | **2030** | 307720 | 0.6% | 4,477,885 | 0.8% | 1213 | 0.2% |
| **High-Normal** | **2031** | 309618 | 0.6% | 4,514,325 | 0.8% | 1215 | 0.2% |
| **High-Normal** | **2032** | 311524 | 0.6% | 4,568,636 | 1.2% | 1222 | 0.6% |
| **High-Normal** | **2033** | 313441 | 0.6% | 4,596,700 | 0.6% | 1222 | 0.0% |
| **High-Normal** | **2034** | 315368 | 0.6% | 4,640,608 | 1.0% | 1226 | 0.3% |
| **High-Normal** | **2035** | 317304 | 0.6% | 4,686,354 | 1.0% | 1231 | 0.4% |
| **High-Normal** | **2036** | 319250 | 0.6% | 4,748,745 | 1.3% | 1240 | 0.7% |
| **High-Normal** | **2037** | 321206 | 0.6% | 4,782,252 | 0.7% | 1241 | 0.1% |
| **High-Normal** | **2038** | 323172 | 0.6% | 4,831,130 | 1.0% | 1246 | 0.4% |
| **High-Normal** | **2039** | 325149 | 0.6% | 4,880,105 | 1.0% | 1251 | 0.4% |
| **High-Normal** | **2040** | 327139 | 0.6% | 4,942,969 | 1.3% | 1259 | 0.6% |

**Equivalent Compound Growth Rates**

| Time Period | | Residential Consumers % Change | Residential Sales to End Consumers % Change | Residential kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.23% | -1.48% | -1.71% |
| **2015** | **2019** | 0.47% | 0.92% | 0.46% |
| **2020** | **2025** | 0.68% | 0.77% | 0.08% |
| **2025** | **2030** | 0.63% | 0.92% | 0.28% |
| **2030** | **2035** | 0.62% | 0.91% | 0.30% |
| **2035** | **2040** | 0.61% | 1.07% | 0.45% |
| **2020** | **2030** | 0.66% | 0.84% | 0.18% |
| **2030** | **2040** | 0.61% | 0.99% | 0.37% |
| **2010** | **2019** | 0.34% | -0.42% | -0.75% |
| **2020** | **2040** | 0.64% | 0.92% | 0.28% |

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## High-Normal Scenario

| | Year | COMMERCIAL NUMBER OF CONSUMERS | COMMERCIAL CONSUMERS % CHANGE | COMMERCIAL ENERGY SALES (MWH) | COMMERCIAL ENERGY SALES % CHANGE | COMMERCIAL KWH/CONSUMER PER MONTH | COMMERCIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 13683 | | 889,903 | | 5420 | |
| **Actual** | **2011** | 13764 | 0.6% | 901,707 | 1.3% | 5459 | 0.7% |
| **Actual** | **2012** | 13890 | 0.9% | 930,499 | 3.2% | 5583 | 2.3% |
| **Actual** | **2013** | 14029 | 1.0% | 938,826 | 0.9% | 5577 | -0.1% |
| **Actual** | **2014** | 14289 | 1.9% | 952,690 | 1.5% | 5556 | -0.4% |
| **Actual** | **2015** | 14255 | -0.2% | 946,635 | -0.6% | 5534 | -0.4% |
| **Actual** | **2016** | 13827 | -3.0% | 949,179 | 0.3% | 5720 | 3.4% |
| **Actual** | **2017** | 14030 | 1.5% | 944,810 | -0.5% | 5612 | -1.9% |
| **Actual** | **2018** | 14215 | 1.3% | 940,218 | -0.5% | 5512 | -1.8% |
| **Actual** | **2019** | 14868 | 4.6% | 951,542 | 1.2% | 5333 | -3.2% |
| **High-Normal** | **2020** | 14961 | | 957,077 | | 5331 | |
| **High-Normal** | **2021** | 15389 | 2.9% | 971,541 | 1.5% | 5261 | -1.3% |
| **High-Normal** | **2022** | 15568 | 1.2% | 984,541 | 1.3% | 5270 | 0.2% |
| **High-Normal** | **2023** | 15757 | 1.2% | 998,350 | 1.4% | 5280 | 0.2% |
| **High-Normal** | **2024** | 15964 | 1.3% | 1,012,966 | 1.5% | 5288 | 0.2% |
| **High-Normal** | **2025** | 16176 | 1.3% | 1,027,945 | 1.5% | 5296 | 0.2% |
| **High-Normal** | **2026** | 16376 | 1.2% | 1,042,321 | 1.4% | 5304 | 0.2% |
| **High-Normal** | **2027** | 16565 | 1.2% | 1,056,176 | 1.3% | 5313 | 0.2% |
| **High-Normal** | **2028** | 16756 | 1.2% | 1,070,051 | 1.3% | 5322 | 0.2% |
| **High-Normal** | **2029** | 16952 | 1.2% | 1,084,245 | 1.3% | 5330 | 0.2% |
| **High-Normal** | **2030** | 17152 | 1.2% | 1,098,627 | 1.3% | 5338 | 0.2% |
| **High-Normal** | **2031** | 17356 | 1.2% | 1,113,222 | 1.3% | 5345 | 0.1% |
| **High-Normal** | **2032** | 17561 | 1.2% | 1,127,959 | 1.3% | 5353 | 0.1% |
| **High-Normal** | **2033** | 17769 | 1.2% | 1,142,909 | 1.3% | 5360 | 0.1% |
| **High-Normal** | **2034** | 17983 | 1.2% | 1,158,179 | 1.3% | 5367 | 0.1% |
| **High-Normal** | **2035** | 18199 | 1.2% | 1,173,628 | 1.3% | 5374 | 0.1% |
| **High-Normal** | **2036** | 18417 | 1.2% | 1,189,264 | 1.3% | 5381 | 0.1% |
| **High-Normal** | **2037** | 18640 | 1.2% | 1,205,136 | 1.3% | 5388 | 0.1% |
| **High-Normal** | **2038** | 18864 | 1.2% | 1,221,201 | 1.3% | 5395 | 0.1% |
| **High-Normal** | **2039** | 19093 | 1.2% | 1,237,500 | 1.3% | 5401 | 0.1% |
| **High-Normal** | **2040** | 19325 | 1.2% | 1,254,013 | 1.3% | 5408 | 0.1% |

**Equivalent Compound Growth Rates**

| Time Period | | Commercial Consumers % Change | Commercial Sales to End Consumers % Change | Commercial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.82% | 1.24% | 0.42% |
| **2015** | **2019** | 1.06% | 0.13% | -0.92% |
| **2020** | **2025** | 1.57% | 1.44% | -0.13% |
| **2025** | **2030** | 1.18% | 1.34% | 0.16% |
| **2030** | **2035** | 1.19% | 1.33% | 0.13% |
| **2035** | **2040** | 1.21% | 1.33% | 0.13% |
| **2020** | **2030** | 1.38% | 1.39% | 0.01% |
| **2030** | **2040** | 1.20% | 1.33% | 0.13% |
| **2010** | **2019** | 0.93% | 0.75% | -0.18% |
| **2020** | **2040** | 1.29% | 1.36% | 0.07% |

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## High-Normal Scenario

| | Year | INDUSTRIAL NUMBER OF CONSUMERS | INDUSTRIAL CONSUMERS % CHANGE | INDUSTRIAL ENERGY SALES (MWH) | INDUSTRIAL ENERGY SALES % CHANGE | INDUSTRIAL KWH/CONSUMER PER MONTH | INDUSTRIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 197 | | 1,611,671 | | 682,911 | |
| **Actual** | **2011** | 201 | 1.9% | 1,640,012 | 1.8% | 681,634 | -0.2% |
| **Actual** | **2012** | 194 | -3.2% | 1,725,290 | 5.2% | 741,104 | 8.7% |
| **Actual** | **2013** | 197 | 1.8% | 1,756,666 | 1.8% | 741,522 | 0.1% |
| **Actual** | **2014** | 202 | 2.3% | 1,878,298 | 6.9% | 775,195 | 4.5% |
| **Actual** | **2015** | 201 | -0.5% | 1,906,729 | 1.5% | 791,174 | 2.1% |
| **Actual** | **2016** | 205 | 1.8% | 1,898,538 | -0.4% | 773,650 | -2.2% |
| **Actual** | **2017** | 211 | 3.1% | 1,976,447 | 4.1% | 780,896 | 0.9% |
| **Actual** | **2018** | 233 | 10.3% | 2,095,080 | 6.0% | 750,656 | -3.9% |
| **Actual** | **2019** | 232 | -0.1% | 2,068,766 | -1.3% | 741,759 | -1.2% |
| **High-Normal** | **2020** | 233 | | 1,858,055 | | 664,540 | |
| **High-Normal** | **2021** | 225 | -3.4% | 2,059,493 | 10.8% | 762,775 | 14.8% |
| **High-Normal** | **2022** | 228 | 1.3% | 2,196,571 | 6.7% | 802,840 | 5.3% |
| **High-Normal** | **2023** | 230 | 0.9% | 2,532,250 | 15.3% | 917,482 | 14.3% |
| **High-Normal** | **2024** | 231 | 0.4% | 2,806,942 | 10.8% | 1,012,605 | 10.4% |
| **High-Normal** | **2025** | 230 | -0.4% | 2,818,835 | 0.4% | 1,021,317 | 0.9% |
| **High-Normal** | **2026** | 230 | 0.0% | 2,823,471 | 0.2% | 1,022,997 | 0.2% |
| **High-Normal** | **2027** | 230 | 0.0% | 2,828,781 | 0.2% | 1,024,921 | 0.2% |
| **High-Normal** | **2028** | 230 | 0.0% | 2,790,157 | -1.4% | 1,010,926 | -1.4% |
| **High-Normal** | **2029** | 230 | 0.0% | 2,796,938 | 0.2% | 1,013,383 | 0.2% |
| **High-Normal** | **2030** | 230 | 0.0% | 2,774,005 | -0.8% | 1,005,074 | -0.8% |
| **High-Normal** | **2031** | 230 | 0.0% | 2,771,141 | -0.1% | 1,004,037 | -0.1% |
| **High-Normal** | **2032** | 230 | 0.0% | 2,770,629 | 0.0% | 1,003,851 | 0.0% |
| **High-Normal** | **2033** | 230 | 0.0% | 2,710,213 | -2.2% | 981,961 | -2.2% |
| **High-Normal** | **2034** | 228 | -0.9% | 2,693,370 | -0.6% | 984,419 | 0.3% |
| **High-Normal** | **2035** | 228 | 0.0% | 2,693,370 | 0.0% | 984,419 | 0.0% |
| **High-Normal** | **2036** | 228 | 0.0% | 2,677,603 | -0.6% | 978,656 | -0.6% |
| **High-Normal** | **2037** | 227 | -0.4% | 2,672,801 | -0.2% | 981,204 | 0.3% |
| **High-Normal** | **2038** | 227 | 0.0% | 2,672,793 | 0.0% | 981,202 | 0.0% |
| **High-Normal** | **2039** | 226 | -0.4% | 2,672,790 | 0.0% | 985,542 | 0.4% |
| **High-Normal** | **2040** | 226 | 0.0% | 2,672,371 | 0.0% | 985,388 | 0.0% |

### Equivalent Compound Growth Rates

| Time Period | | Industrial Consumers % Change | Industrial Sales to End Consumers % Change | Industrial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.42% | 3.42% | 2.99% |
| **2015** | **2019** | 3.72% | 2.06% | -1.60% |
| **2020** | **2025** | -0.26% | 8.69% | 8.98% |
| **2025** | **2030** | 0.00% | -0.32% | -0.32% |
| **2030** | **2035** | -0.17% | -0.59% | -0.41% |
| **2035** | **2040** | -0.18% | -0.16% | 0.02% |
| **2020** | **2030** | -0.13% | 4.09% | 4.22% |
| **2030** | **2040** | -0.18% | -0.37% | -0.20% |
| **2010** | **2019** | 1.87% | 2.81% | 0.92% |
| **2020** | **2040** | -0.15% | 1.83% | 1.99% |

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## High-Normal Scenario

| | Year | OTHER NUMBER OF CONSUMERS | OTHER CONSUMERS % CHANGE | OTHER ENERGY SALES (MWH) | OTHER ENERGY SALES % CHANGE | OTHER KWH/CONSUMER PER MONTH | OTHER KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 2200 | | 40,029 | | 1516 | |
| **Actual** | **2011** | 2418 | 9.9% | 40,873 | 2.1% | 1409 | -7% |
| **Actual** | **2012** | 2509 | 3.8% | 46,874 | 14.7% | 1557 | 11% |
| **Actual** | **2013** | 2610 | 4.0% | 40,415 | -13.8% | 1291 | -17% |
| **Actual** | **2014** | 2742 | 5.1% | 41,305 | 2.2% | 1255 | -3% |
| **Actual** | **2015** | 2825 | 3.0% | 37,584 | -9.0% | 1109 | -12% |
| **Actual** | **2016** | 2920 | 3.4% | 39,012 | 3.8% | 1113 | 0% |
| **Actual** | **2017** | 4850 | 66.1% | 56,774 | 45.5% | 976 | -12% |
| **Actual** | **2018** | 4975 | 2.6% | 57,912 | 2.0% | 970 | -1% |
| **Actual** | **2019** | 5063 | 1.8% | 53,754 | -7.2% | 885 | -9% |
| | | | | | | | |
| **High-Normal** | **2020** | 5075 | | 55,588 | | 913 | |
| **High-Normal** | **2021** | 5111 | 0.7% | 55,607 | 0.0% | 907 | -1% |
| **High-Normal** | **2022** | 5148 | 0.7% | 55,621 | 0.0% | 900 | -1% |
| **High-Normal** | **2023** | 5184 | 0.7% | 55,636 | 0.0% | 894 | -1% |
| **High-Normal** | **2024** | 5221 | 0.7% | 55,651 | 0.0% | 888 | -1% |
| **High-Normal** | **2025** | 5258 | 0.7% | 55,666 | 0.0% | 882 | -1% |
| **High-Normal** | **2026** | 5295 | 0.7% | 55,681 | 0.0% | 876 | -1% |
| **High-Normal** | **2027** | 5333 | 0.7% | 55,696 | 0.0% | 870 | -1% |
| **High-Normal** | **2028** | 5371 | 0.7% | 55,711 | 0.0% | 864 | -1% |
| **High-Normal** | **2029** | 5409 | 0.7% | 55,727 | 0.0% | 859 | -1% |
| **High-Normal** | **2030** | 5447 | 0.7% | 55,742 | 0.0% | 853 | -1% |
| **High-Normal** | **2031** | 5485 | 0.7% | 55,758 | 0.0% | 847 | -1% |
| **High-Normal** | **2032** | 5524 | 0.7% | 55,774 | 0.0% | 841 | -1% |
| **High-Normal** | **2033** | 5562 | 0.7% | 55,790 | 0.0% | 836 | -1% |
| **High-Normal** | **2034** | 5601 | 0.7% | 55,806 | 0.0% | 830 | -1% |
| **High-Normal** | **2035** | 5640 | 0.7% | 55,822 | 0.0% | 825 | -1% |
| **High-Normal** | **2036** | 5679 | 0.7% | 55,838 | 0.0% | 819 | -1% |
| **High-Normal** | **2037** | 5718 | 0.7% | 55,855 | 0.0% | 814 | -1% |
| **High-Normal** | **2038** | 5757 | 0.7% | 55,871 | 0.0% | 809 | -1% |
| **High-Normal** | **2039** | 5797 | 0.7% | 55,888 | 0.0% | 803 | -1% |
| **High-Normal** | **2040** | 5836 | 0.7% | 55,905 | 0.0% | 798 | -1% |

### Equivalent Compound Growth Rates

| Time Period | | Other Consumers % Change | Other Sales to End Consumers % Change | Other kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 5.13% | -1.25% | -6.06% |
| **2015** | **2019** | 15.70% | 9.36% | -5.48% |
| **2020** | **2025** | 0.71% | 0.03% | -0.69% |
| **2025** | **2030** | 0.71% | 0.03% | -0.67% |
| **2030** | **2035** | 0.70% | 0.03% | -0.67% |
| **2035** | **2040** | 0.69% | 0.03% | -0.66% |
| **2020** | **2030** | 0.71% | 0.03% | -0.68% |
| **2030** | **2040** | 0.69% | 0.03% | -0.66% |
| **2010** | **2019** | 9.70% | 3.33% | -5.81% |
| **2020** | **2040** | 0.70% | 0.03% | -0.67% |

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## High-Normal Scenario

| | Year | TOTAL CONSUMERS | CONSUMERS % CHANGE | MEMBER SALES HIGH-NORMAL | HE SALES HIGH-NORMAL | HE SALES 60-MIN DEMAND | ANNUAL LOAD FACTOR (%) |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 293,992 | | 6,855,216 | 6,911,304 | 1366 | 58% |
| **Actual** | **2011** | 294,132 | 0.0% | 6,675,825 | 6,799,323 | 1418 | 55% |
| **Actual** | **2012** | 294,965 | 0.3% | 6,661,120 | 6,782,533 | 1457 | 53% |
| **Actual** | **2013** | 296,174 | 0.4% | 6,827,902 | 6,977,821 | 1363 | 58% |
| **Actual** | **2014** | 297,293 | 0.4% | 7,076,875 | 7,229,477 | 1645 | 50% |
| **Actual** | **2015** | 298,453 | 0.4% | 6,893,844 | 7,025,479 | 1584 | 50% |
| **Actual** | **2016** | 300,210 | 0.6% | 6,911,623 | 7,072,483 | 1423 | 57% |
| **Actual** | **2017** | 302,631 | 0.8% | 6,858,920 | 6,994,237 | 1356 | 59% |
| **Actual** | **2018** | 304,737 | 0.7% | 7,391,221 | 7,542,577 | 1587 | 54% |
| **Actual** | **2019** | 306,644 | 0.6% | 7,225,644 | 7,371,844 | 1624 | 52% |
| | | | | | | | |
| **High-Normal** | **2020** | 308,455 | | 6,988,374 | 7,301,739 | 1480 | 56% |
| **High-Normal** | **2021** | 310,576 | 0.7% | 7,220,946 | 7,543,332 | 1475 | 58% |
| **High-Normal** | **2022** | 312,699 | 0.7% | 7,402,991 | 7,732,389 | 1495 | 59% |
| **High-Normal** | **2023** | 315,027 | 0.7% | 7,784,920 | 8,128,707 | 1520 | 61% |
| **High-Normal** | **2024** | 317,402 | 0.8% | 8,126,537 | 8,484,041 | 1574 | 61% |
| **High-Normal** | **2025** | 319,821 | 0.8% | 8,180,820 | 8,541,169 | 1632 | 60% |
| **High-Normal** | **2026** | 322,171 | 0.7% | 8,241,549 | 8,604,592 | 1636 | 60% |
| **High-Normal** | **2027** | 324,330 | 0.7% | 8,301,434 | 8,667,097 | 1644 | 60% |
| **High-Normal** | **2028** | 326,373 | 0.6% | 8,331,995 | 8,698,922 | 1650 | 60% |
| **High-Normal** | **2029** | 328,440 | 0.6% | 8,381,061 | 8,750,601 | 1655 | 60% |
| **High-Normal** | **2030** | 330,550 | 0.6% | 8,406,259 | 8,777,114 | 1658 | 60% |
| **High-Normal** | **2031** | 332,688 | 0.6% | 8,454,446 | 8,827,513 | 1660 | 61% |
| **High-Normal** | **2032** | 334,838 | 0.6% | 8,522,997 | 8,898,698 | 1667 | 61% |
| **High-Normal** | **2033** | 337,002 | 0.6% | 8,505,612 | 8,881,608 | 1676 | 60% |
| **High-Normal** | **2034** | 339,179 | 0.6% | 8,547,963 | 8,926,057 | 1671 | 61% |
| **High-Normal** | **2035** | 341,371 | 0.6% | 8,609,174 | 8,990,065 | 1676 | 61% |
| **High-Normal** | **2036** | 343,574 | 0.6% | 8,671,450 | 9,054,823 | 1684 | 61% |
| **High-Normal** | **2037** | 345,791 | 0.6% | 8,716,043 | 9,102,025 | 1693 | 61% |
| **High-Normal** | **2038** | 348,021 | 0.6% | 8,780,996 | 9,169,950 | 1697 | 62% |
| **High-Normal** | **2039** | 350,265 | 0.6% | 8,846,284 | 9,238,228 | 1706 | 62% |
| **High-Normal** | **2040** | 352,526 | 0.6% | 8,925,258 | 9,320,280 | 1715 | 62% |

**Equivalent Compound Growth Rates**

| Time Period | | Total Consumers % Change | Member Sales % Change | HE Sales % Change | HE Sales Demand % Change | Load Factor % Change |
|---|---|---|---|---|---|---|
| **2010** | **2015** | 0.30% | 0.11% | 0.33% | 3.00% | -2.60% |
| **2015** | **2019** | 0.68% | 1.18% | 1.21% | 0.63% | 0.58% |
| **2020** | **2025** | 0.73% | 3.20% | 3.19% | 1.97% | 1.25% |
| **2025** | **2030** | 0.66% | 0.55% | 0.55% | 0.32% | 0.23% |
| **2030** | **2035** | 0.65% | 0.48% | 0.48% | 0.21% | 0.27% |
| **2035** | **2040** | 0.65% | 0.72% | 0.72% | 0.46% | 0.21% |
| **2020** | **2030** | 0.69% | 1.86% | 1.86% | 1.14% | 0.74% |
| **2030** | **2040** | 0.65% | 0.60% | 0.60% | 0.34% | 0.24% |
| **2010** | **2019** | 0.47% | 0.59% | 0.72% | 1.94% | -1.20% |
| **2020** | **2040** | 0.67% | 1.23% | 1.23% | 0.74% | 0.49% |

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## High-Normal Scenario

| | Year | HE GENERATION HIGH-NORMAL | HE GENERATION % CHANGE | HE GENERATION 60-MIN DEMAND | GENERATION DEMAND % CHANGE | ANNUAL PEAK SEASON |
|---|---|---|---|---|---|---|
| **Actual** | **2010** | 7,169,555 | | 1431 | | SUMMER |
| **Actual** | **2011** | 7,261,250 | 1.3% | 1478 | 3.3% | SUMMER |
| **Actual** | **2012** | 7,193,545 | -0.9% | 1537 | 4.0% | SUMMER |
| **Actual** | **2013** | 7,335,037 | 2.0% | 1409 | -8.3% | WINTER |
| **Actual** | **2014** | 7,639,069 | 4.1% | 1698 | 20.5% | WINTER |
| **Actual** | **2015** | 7,481,099 | -2.1% | 1643 | -3.2% | WINTER |
| **Actual** | **2016** | 7,564,387 | 1.1% | 1498 | -8.8% | WINTER |
| **Actual** | **2017** | 7,476,942 | -1.2% | 1425 | -4.8% | WINTER |
| **Actual** | **2018** | 8,063,654 | 7.8% | 1668 | 17.0% | WINTER |
| **Actual** | **2019** | 7,859,968 | -2.5% | 1714 | 2.8% | WINTER |
| **High-Normal** | **2020** | 7,582,125 | | 1549 | | WINTER |
| **High-Normal** | **2021** | 7,832,996 | 3.3% | 1544 | -0.3% | WINTER |
| **High-Normal** | **2022** | 8,029,313 | 2.5% | 1564 | 1.3% | WINTER |
| **High-Normal** | **2023** | 8,440,849 | 5.1% | 1590 | 1.7% | WINTER |
| **High-Normal** | **2024** | 8,809,828 | 4.4% | 1646 | 3.5% | WINTER |
| **High-Normal** | **2025** | 8,869,150 | 0.7% | 1707 | 3.7% | WINTER |
| **High-Normal** | **2026** | 8,935,009 | 0.7% | 1712 | 0.3% | WINTER |
| **High-Normal** | **2027** | 8,999,913 | 0.7% | 1720 | 0.4% | WINTER |
| **High-Normal** | **2028** | 9,032,961 | 0.4% | 1727 | 0.4% | WINTER |
| **High-Normal** | **2029** | 9,086,624 | 0.6% | 1731 | 0.3% | WINTER |
| **High-Normal** | **2030** | 9,114,156 | 0.3% | 1735 | 0.2% | WINTER |
| **High-Normal** | **2031** | 9,166,490 | 0.6% | 1737 | 0.1% | WINTER |
| **High-Normal** | **2032** | 9,240,408 | 0.8% | 1744 | 0.4% | WINTER |
| **High-Normal** | **2033** | 9,222,661 | -0.2% | 1754 | 0.6% | WINTER |
| **High-Normal** | **2034** | 9,268,817 | 0.5% | 1748 | -0.3% | WINTER |
| **High-Normal** | **2035** | 9,335,283 | 0.7% | 1753 | 0.3% | WINTER |
| **High-Normal** | **2036** | 9,402,528 | 0.7% | 1762 | 0.5% | WINTER |
| **High-Normal** | **2037** | 9,451,542 | 0.5% | 1772 | 0.6% | WINTER |
| **High-Normal** | **2038** | 9,522,076 | 0.7% | 1776 | 0.2% | WINTER |
| **High-Normal** | **2039** | 9,592,976 | 0.7% | 1785 | 0.5% | WINTER |
| **High-Normal** | **2040** | 9,678,179 | 0.9% | 1794 | 0.5% | WINTER |

**Equivalent Compound Growth Rates**

| Time Period | | HE Generation % Change | HE Generation Demand % Change |
|---|---|---|---|
| **2010** | **2015** | 0.85% | 2.80% |
| **2015** | **2019** | 1.24% | 1.06% |
| **2020** | **2025** | 3.19% | 1.97% |
| **2025** | **2030** | 0.55% | 0.32% |
| **2030** | **2035** | 0.48% | 0.21% |
| **2035** | **2040** | 0.72% | 0.46% |
| **2020** | **2030** | 1.86% | 1.14% |
| **2030** | **2040** | 0.60% | 0.34% |
| **2010** | **2019** | 1.03% | 2.03% |
| **2020** | **2040** | 1.23% | 0.74% |

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## Base-Mild Scenario

| | Year | RESIDENTIAL NUMBER OF CONSUMERS | RESIDENTIAL CONSUMERS % CHANGE | RESIDENTIAL ENERGY SALES (MWH) | RESIDENTIAL ENERGY SALES % CHANGE | RESIDENTIAL KWH/CONSUMER PER MONTH | RESIDENTIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 277,913 | | 4,313,612 | | 1293 | |
| **Actual** | **2011** | 277,751 | -0.1% | 4,093,234 | -5.1% | 1228 | -5.0% |
| **Actual** | **2012** | 278,372 | 0.2% | 3,958,457 | -3.3% | 1185 | -3.5% |
| **Actual** | **2013** | 279,338 | 0.3% | 4,091,996 | 3.4% | 1221 | 3.0% |
| **Actual** | **2014** | 280,061 | 0.3% | 4,204,582 | 2.8% | 1251 | 2.5% |
| **Actual** | **2015** | 281,173 | 0.4% | 4,002,896 | -4.8% | 1186 | -5.2% |
| **Actual** | **2016** | 283,258 | 0.7% | 4,024,894 | 0.5% | 1184 | -0.2% |
| **Actual** | **2017** | 283,540 | 0.1% | 3,880,889 | -3.6% | 1141 | -3.6% |
| **Actual** | **2018** | 285,314 | 0.6% | 4,298,011 | 10.7% | 1255 | 10.0% |
| **Actual** | **2019** | 286,480 | 0.4% | 4,151,582 | -3.4% | 1208 | -3.7% |
| **Base-Mild** | **2020** | 288,002 | | 3,889,763 | | 1126 | |
| **Base-Mild** | **2021** | 289,373 | 0.5% | 3,895,708 | 0.2% | 1122 | -0.4% |
| **Base-Mild** | **2022** | 290,969 | 0.6% | 3,917,932 | 0.6% | 1122 | 0.0% |
| **Base-Mild** | **2023** | 292,701 | 0.6% | 3,940,244 | 0.6% | 1122 | 0.0% |
| **Base-Mild** | **2024** | 294,446 | 0.6% | 3,980,353 | 1.0% | 1127 | 0.4% |
| **Base-Mild** | **2025** | 296,210 | 0.6% | 3,996,598 | 0.4% | 1124 | -0.3% |
| **Base-Mild** | **2026** | 297,892 | 0.6% | 4,025,528 | 0.7% | 1126 | 0.2% |
| **Base-Mild** | **2027** | 299,366 | 0.5% | 4,052,686 | 0.7% | 1128 | 0.2% |
| **Base-Mild** | **2028** | 300,695 | 0.4% | 4,092,521 | 1.0% | 1134 | 0.5% |
| **Base-Mild** | **2029** | 301,994 | 0.4% | 4,107,350 | 0.4% | 1133 | -0.1% |
| **Base-Mild** | **2030** | 303,261 | 0.4% | 4,128,716 | 0.5% | 1135 | 0.2% |
| **Base-Mild** | **2031** | 304,496 | 0.4% | 4,153,376 | 0.6% | 1137 | 0.2% |
| **Base-Mild** | **2032** | 305,700 | 0.4% | 4,194,337 | 1.0% | 1143 | 0.5% |
| **Base-Mild** | **2033** | 306,873 | 0.4% | 4,210,970 | 0.4% | 1144 | 0.1% |
| **Base-Mild** | **2034** | 308,014 | 0.4% | 4,241,749 | 0.7% | 1148 | 0.3% |
| **Base-Mild** | **2035** | 309,123 | 0.4% | 4,273,678 | 0.8% | 1152 | 0.3% |
| **Base-Mild** | **2036** | 310,197 | 0.3% | 4,320,111 | 1.1% | 1161 | 0.8% |
| **Base-Mild** | **2037** | 311,241 | 0.3% | 4,339,478 | 0.4% | 1162 | 0.1% |
| **Base-Mild** | **2038** | 312,256 | 0.3% | 4,372,207 | 0.8% | 1167 | 0.4% |
| **Base-Mild** | **2039** | 313,244 | 0.3% | 4,404,328 | 0.7% | 1172 | 0.4% |
| **Base-Mild** | **2040** | 314,214 | 0.3% | 4,448,128 | 1.0% | 1180 | 0.7% |

**Equivalent Compound Growth Rates**

| Time Period | | Residential Consumers % Change | Residential Sales to End Consumers % Change | Residential kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.23% | -1.48% | -1.71% |
| **2015** | **2019** | 0.47% | 0.92% | 0.46% |
| **2020** | **2025** | 0.56% | 0.54% | -0.04% |
| **2025** | **2030** | 0.47% | 0.65% | 0.19% |
| **2030** | **2035** | 0.38% | 0.69% | 0.30% |
| **2035** | **2040** | 0.33% | 0.80% | 0.48% |
| **2020** | **2030** | 0.52% | 0.60% | 0.08% |
| **2030** | **2040** | 0.36% | 0.75% | 0.39% |
| **2010** | **2019** | 0.34% | -0.42% | -0.75% |
| **2020** | **2040** | 0.44% | 0.67% | 0.23% |

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## Base-Mild Scenario

| | Year | COMMERCIAL NUMBER OF CONSUMERS | COMMERCIAL CONSUMERS % CHANGE | COMMERCIAL ENERGY SALES (MWH) | COMMERCIAL ENERGY SALES % CHANGE | COMMERCIAL KWH/CONSUMER PER MONTH | COMMERCIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 13683 | | 889,903 | | 5420 | |
| **Actual** | **2011** | 13764 | 0.6% | 901,707 | 1.3% | 5459 | 0.7% |
| **Actual** | **2012** | 13890 | 0.9% | 930,499 | 3.2% | 5583 | 2.3% |
| **Actual** | **2013** | 14029 | 1.0% | 938,826 | 0.9% | 5577 | -0.1% |
| **Actual** | **2014** | 14289 | 1.9% | 952,690 | 1.5% | 5556 | -0.4% |
| **Actual** | **2015** | 14255 | -0.2% | 946,635 | -0.6% | 5534 | -0.4% |
| **Actual** | **2016** | 13827 | -3.0% | 949,179 | 0.3% | 5720 | 3.4% |
| **Actual** | **2017** | 14030 | 1.5% | 944,810 | -0.5% | 5612 | -1.9% |
| **Actual** | **2018** | 14215 | 1.3% | 940,218 | -0.5% | 5512 | -1.8% |
| **Actual** | **2019** | 14868 | 4.6% | 951,542 | 1.2% | 5333 | -3.2% |
| **Base-Mild** | **2020** | 14939 | | 939,725 | | 5242 | |
| **Base-Mild** | **2021** | 15330 | 2.6% | 951,118 | 1.2% | 5170 | -1.4% |
| **Base-Mild** | **2022** | 15477 | 1.0% | 961,250 | 1.1% | 5176 | 0.1% |
| **Base-Mild** | **2023** | 15621 | 0.9% | 971,362 | 1.1% | 5182 | 0.1% |
| **Base-Mild** | **2024** | 15761 | 0.9% | 981,166 | 1.0% | 5188 | 0.1% |
| **Base-Mild** | **2025** | 15904 | 0.9% | 991,089 | 1.0% | 5193 | 0.1% |
| **Base-Mild** | **2026** | 16042 | 0.9% | 1,000,591 | 1.0% | 5198 | 0.1% |
| **Base-Mild** | **2027** | 16166 | 0.8% | 1,009,292 | 0.9% | 5203 | 0.1% |
| **Base-Mild** | **2028** | 16281 | 0.7% | 1,017,428 | 0.8% | 5208 | 0.1% |
| **Base-Mild** | **2029** | 16394 | 0.7% | 1,025,436 | 0.8% | 5212 | 0.1% |
| **Base-Mild** | **2030** | 16506 | 0.7% | 1,033,330 | 0.8% | 5217 | 0.1% |
| **Base-Mild** | **2031** | 16617 | 0.7% | 1,041,155 | 0.8% | 5221 | 0.1% |
| **Base-Mild** | **2032** | 16725 | 0.6% | 1,048,797 | 0.7% | 5226 | 0.1% |
| **Base-Mild** | **2033** | 16830 | 0.6% | 1,056,298 | 0.7% | 5230 | 0.1% |
| **Base-Mild** | **2034** | 16936 | 0.6% | 1,063,808 | 0.7% | 5235 | 0.1% |
| **Base-Mild** | **2035** | 17039 | 0.6% | 1,071,190 | 0.7% | 5239 | 0.1% |
| **Base-Mild** | **2036** | 17142 | 0.6% | 1,078,479 | 0.7% | 5243 | 0.1% |
| **Base-Mild** | **2037** | 17244 | 0.6% | 1,085,722 | 0.7% | 5247 | 0.1% |
| **Base-Mild** | **2038** | 17344 | 0.6% | 1,092,860 | 0.7% | 5251 | 0.1% |
| **Base-Mild** | **2039** | 17443 | 0.6% | 1,099,919 | 0.6% | 5255 | 0.1% |
| **Base-Mild** | **2040** | 17542 | 0.6% | 1,106,906 | 0.6% | 5258 | 0.1% |

**Equivalent Compound Growth Rates**

| Time Period | | Commercial Consumers % Change | Commercial Sales to End Consumers % Change | Commercial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.82% | 1.24% | 0.42% |
| **2015** | **2019** | 1.06% | 0.13% | -0.92% |
| **2020** | **2025** | 1.26% | 1.07% | -0.19% |
| **2025** | **2030** | 0.75% | 0.84% | 0.09% |
| **2030** | **2035** | 0.64% | 0.72% | 0.08% |
| **2035** | **2040** | 0.58% | 0.66% | 0.07% |
| **2020** | **2030** | 1.00% | 0.95% | -0.05% |
| **2030** | **2040** | 0.61% | 0.69% | 0.08% |
| **2010** | **2019** | 0.93% | 0.75% | -0.18% |
| **2020** | **2040** | 0.81% | 0.82% | 0.02% |

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## Base-Mild Scenario

| | Year | INDUSTRIAL NUMBER OF CONSUMERS | INDUSTRIAL CONSUMERS % CHANGE | INDUSTRIAL ENERGY SALES (MWH) | INDUSTRIAL ENERGY SALES % CHANGE | INDUSTRIAL KWH/CONSUMER PER MONTH | INDUSTRIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| Actual | 2010 | 197 | | 1,611,671 | | 682,911 | |
| Actual | 2011 | 201 | 1.9% | 1,640,012 | 1.8% | 681,634 | -0.2% |
| Actual | 2012 | 194 | -3.2% | 1,725,290 | 5.2% | 741,104 | 8.7% |
| Actual | 2013 | 197 | 1.8% | 1,756,666 | 1.8% | 741,522 | 0.1% |
| Actual | 2014 | 202 | 2.3% | 1,878,298 | 6.9% | 775,195 | 4.5% |
| Actual | 2015 | 201 | -0.5% | 1,906,729 | 1.5% | 791,174 | 2.1% |
| Actual | 2016 | 205 | 1.8% | 1,898,538 | -0.4% | 773,650 | -2.2% |
| Actual | 2017 | 211 | 3.1% | 1,976,447 | 4.1% | 780,896 | 0.9% |
| Actual | 2018 | 233 | 10.3% | 2,095,080 | 6.0% | 750,656 | -3.9% |
| Actual | 2019 | 232 | -0.1% | 2,068,766 | -1.3% | 741,759 | -1.2% |
| Base-Mild | 2020 | 233 | | 1,858,055 | | 664,540 | |
| Base-Mild | 2021 | 225 | -3.4% | 2,059,493 | 10.8% | 762,775 | 14.8% |
| Base-Mild | 2022 | 228 | 1.3% | 2,196,571 | 6.7% | 802,840 | 5.3% |
| Base-Mild | 2023 | 230 | 0.9% | 2,532,250 | 15.3% | 917,482 | 14.3% |
| Base-Mild | 2024 | 231 | 0.4% | 2,806,942 | 10.8% | 1,012,605 | 10.4% |
| Base-Mild | 2025 | 230 | -0.4% | 2,818,835 | 0.4% | 1,021,317 | 0.9% |
| Base-Mild | 2026 | 230 | 0.0% | 2,823,471 | 0.2% | 1,022,997 | 0.2% |
| Base-Mild | 2027 | 230 | 0.0% | 2,828,781 | 0.2% | 1,024,921 | 0.2% |
| Base-Mild | 2028 | 230 | 0.0% | 2,790,157 | -1.4% | 1,010,926 | -1.4% |
| Base-Mild | 2029 | 230 | 0.0% | 2,796,938 | 0.2% | 1,013,383 | 0.2% |
| Base-Mild | 2030 | 230 | 0.0% | 2,774,005 | -0.8% | 1,005,074 | -0.8% |
| Base-Mild | 2031 | 230 | 0.0% | 2,771,141 | -0.1% | 1,004,037 | -0.1% |
| Base-Mild | 2032 | 230 | 0.0% | 2,770,629 | 0.0% | 1,003,851 | 0.0% |
| Base-Mild | 2033 | 230 | 0.0% | 2,710,213 | -2.2% | 981,961 | -2.2% |
| Base-Mild | 2034 | 228 | -0.9% | 2,693,370 | -0.6% | 984,419 | 0.3% |
| Base-Mild | 2035 | 228 | 0.0% | 2,693,370 | 0.0% | 984,419 | 0.0% |
| Base-Mild | 2036 | 228 | 0.0% | 2,677,603 | -0.6% | 978,656 | -0.6% |
| Base-Mild | 2037 | 227 | -0.4% | 2,672,801 | -0.2% | 981,204 | 0.3% |
| Base-Mild | 2038 | 227 | 0.0% | 2,672,793 | 0.0% | 981,202 | 0.0% |
| Base-Mild | 2039 | 226 | -0.4% | 2,672,790 | 0.0% | 985,542 | 0.4% |
| Base-Mild | 2040 | 226 | 0.0% | 2,672,371 | 0.0% | 985,388 | 0.0% |

**Equivalent Compound Growth Rates**

| Time Period | | Industrial Consumers % Change | Industrial Sales to End Consumers % Change | Industrial kWh/Consumer % Change |
|---|---|---|---|---|
| 2010 | 2015 | 0.42% | 3.42% | 2.99% |
| 2015 | 2019 | 3.72% | 2.06% | -1.60% |
| 2020 | 2025 | -0.26% | 8.69% | 8.98% |
| 2025 | 2030 | 0.00% | -0.32% | -0.32% |
| 2030 | 2035 | -0.17% | -0.59% | -0.41% |
| 2035 | 2040 | -0.18% | -0.16% | 0.02% |
| 2020 | 2030 | -0.13% | 4.09% | 4.22% |
| 2030 | 2040 | -0.18% | -0.37% | -0.20% |
| 2010 | 2019 | 1.87% | 2.81% | 0.92% |
| 2020 | 2040 | -0.15% | 1.83% | 1.99% |

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## Base-Mild Scenario

| | Year | OTHER NUMBER OF CONSUMERS | OTHER CONSUMERS % CHANGE | OTHER ENERGY SALES (MWH) | OTHER ENERGY SALES % CHANGE | OTHER KWH/CONSUMER PER MONTH | OTHER KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 2200 | | 40029 | | 1516 | |
| **Actual** | **2011** | 2418 | 9.9% | 40873 | 2.1% | 1409 | -7% |
| **Actual** | **2012** | 2509 | 3.8% | 46874 | 14.7% | 1557 | 11% |
| **Actual** | **2013** | 2610 | 4.0% | 40415 | -13.8% | 1291 | -17% |
| **Actual** | **2014** | 2742 | 5.1% | 41305 | 2.2% | 1255 | -3% |
| **Actual** | **2015** | 2825 | 3.0% | 37584 | -9.0% | 1109 | -12% |
| **Actual** | **2016** | 2920 | 3.4% | 39012 | 3.8% | 1113 | 0% |
| **Actual** | **2017** | 4850 | 66.1% | 56774 | 45.5% | 976 | -12% |
| **Actual** | **2018** | 4975 | 2.6% | 57912 | 2.0% | 970 | -1% |
| **Actual** | **2019** | 5063 | 1.8% | 53754 | -7.2% | 885 | -9% |
| **Base-Mild** | **2020** | 5073 | | 54756 | | 899 | |
| **Base-Mild** | **2021** | 5107 | 0.7% | 54771 | 0.0% | 894 | -1% |
| **Base-Mild** | **2022** | 5141 | 0.7% | 54784 | 0.0% | 888 | -1% |
| **Base-Mild** | **2023** | 5174 | 0.6% | 54797 | 0.0% | 883 | -1% |
| **Base-Mild** | **2024** | 5208 | 0.6% | 54809 | 0.0% | 877 | -1% |
| **Base-Mild** | **2025** | 5241 | 0.6% | 54822 | 0.0% | 872 | -1% |
| **Base-Mild** | **2026** | 5275 | 0.6% | 54835 | 0.0% | 866 | -1% |
| **Base-Mild** | **2027** | 5309 | 0.6% | 54848 | 0.0% | 861 | -1% |
| **Base-Mild** | **2028** | 5342 | 0.6% | 54861 | 0.0% | 856 | -1% |
| **Base-Mild** | **2029** | 5376 | 0.6% | 54874 | 0.0% | 851 | -1% |
| **Base-Mild** | **2030** | 5409 | 0.6% | 54886 | 0.0% | 846 | -1% |
| **Base-Mild** | **2031** | 5442 | 0.6% | 54899 | 0.0% | 841 | -1% |
| **Base-Mild** | **2032** | 5475 | 0.6% | 54911 | 0.0% | 836 | -1% |
| **Base-Mild** | **2033** | 5508 | 0.6% | 54924 | 0.0% | 831 | -1% |
| **Base-Mild** | **2034** | 5540 | 0.6% | 54936 | 0.0% | 826 | -1% |
| **Base-Mild** | **2035** | 5573 | 0.6% | 54949 | 0.0% | 822 | 0% |
| **Base-Mild** | **2036** | 5604 | 0.6% | 54961 | 0.0% | 817 | -1% |
| **Base-Mild** | **2037** | 5636 | 0.6% | 54973 | 0.0% | 813 | 0% |
| **Base-Mild** | **2038** | 5667 | 0.6% | 54985 | 0.0% | 809 | 0% |
| **Base-Mild** | **2039** | 5698 | 0.5% | 54997 | 0.0% | 804 | -1% |
| **Base-Mild** | **2040** | 5729 | 0.5% | 55008 | 0.0% | 800 | 0% |

**Equivalent Compound Growth Rates**

| Time Period | | Other Consumers % Change | Other Sales to End Consumers % Change | Other kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 5.13% | -1.25% | -6.06% |
| **2015** | **2019** | 15.70% | 9.36% | -5.48% |
| **2020** | **2025** | 0.65% | 0.02% | -0.61% |
| **2025** | **2030** | 0.63% | 0.02% | -0.60% |
| **2030** | **2035** | 0.60% | 0.02% | -0.57% |
| **2035** | **2040** | 0.56% | 0.02% | -0.54% |
| **2020** | **2030** | 0.64% | 0.02% | -0.61% |
| **2030** | **2040** | 0.58% | 0.02% | -0.56% |
| **2010** | **2019** | 9.70% | 3.33% | -5.81% |
| **2020** | **2040** | 0.61% | 0.02% | -0.58% |

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## Base-Mild Scenario

| | Year | TOTAL CONSUMERS | CONSUMERS % CHANGE | MEMBER SALES BASE-MILD | HE SALES BASE-MILD | HE SALES 60-MIN DEMAND | ANNUAL LOAD FACTOR (%) |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 293,992 | | 6,855,216 | 6,911,304 | 1366 | 58% |
| **Actual** | **2011** | 294,132 | 0.0% | 6,675,825 | 6,799,323 | 1418 | 55% |
| **Actual** | **2012** | 294,965 | 0.3% | 6,661,120 | 6,782,533 | 1457 | 53% |
| **Actual** | **2013** | 296,174 | 0.4% | 6,827,902 | 6,977,821 | 1363 | 58% |
| **Actual** | **2014** | 297,293 | 0.4% | 7,076,875 | 7,229,477 | 1645 | 50% |
| **Actual** | **2015** | 298,453 | 0.4% | 6,893,844 | 7,025,479 | 1584 | 50% |
| **Actual** | **2016** | 300,210 | 0.6% | 6,911,623 | 7,072,483 | 1423 | 57% |
| **Actual** | **2017** | 302,631 | 0.8% | 6,858,920 | 6,994,237 | 1356 | 59% |
| **Actual** | **2018** | 304,737 | 0.7% | 7,391,221 | 7,542,577 | 1587 | 54% |
| **Actual** | **2019** | 306,644 | 0.6% | 7,225,644 | 7,371,844 | 1624 | 52% |
| | | | | | | | |
| **Base-Mild** | **2020** | 308,248 | | 6,742,298 | 7,044,066 | 1262 | 64% |
| **Base-Mild** | **2021** | 310,034 | 0.6% | 6,961,090 | 7,271,086 | 1273 | 65% |
| **Base-Mild** | **2022** | 311,814 | 0.6% | 7,130,537 | 7,446,957 | 1295 | 66% |
| **Base-Mild** | **2023** | 313,726 | 0.6% | 7,498,653 | 7,828,822 | 1335 | 67% |
| **Base-Mild** | **2024** | 315,646 | 0.6% | 7,823,270 | 8,166,406 | 1390 | 67% |
| **Base-Mild** | **2025** | 317,586 | 0.6% | 7,861,345 | 8,206,548 | 1413 | 66% |
| **Base-Mild** | **2026** | 319,439 | 0.6% | 7,904,425 | 8,251,506 | 1418 | 66% |
| **Base-Mild** | **2027** | 321,070 | 0.5% | 7,945,607 | 8,294,444 | 1423 | 67% |
| **Base-Mild** | **2028** | 322,548 | 0.5% | 7,954,967 | 8,304,127 | 1425 | 66% |
| **Base-Mild** | **2029** | 323,993 | 0.4% | 7,984,597 | 8,335,440 | 1428 | 67% |
| **Base-Mild** | **2030** | 325,406 | 0.4% | 7,990,938 | 8,342,237 | 1429 | 67% |
| **Base-Mild** | **2031** | 326,785 | 0.4% | 8,020,570 | 8,373,234 | 1432 | 67% |
| **Base-Mild** | **2032** | 328,130 | 0.4% | 8,068,674 | 8,423,080 | 1439 | 67% |
| **Base-Mild** | **2033** | 329,441 | 0.4% | 8,032,405 | 8,386,201 | 1438 | 67% |
| **Base-Mild** | **2034** | 330,718 | 0.4% | 8,053,864 | 8,408,804 | 1439 | 67% |
| **Base-Mild** | **2035** | 331,963 | 0.4% | 8,093,186 | 8,449,925 | 1444 | 67% |
| **Base-Mild** | **2036** | 333,171 | 0.4% | 8,131,153 | 8,489,314 | 1450 | 67% |
| **Base-Mild** | **2037** | 334,348 | 0.4% | 8,152,974 | 8,512,655 | 1455 | 67% |
| **Base-Mild** | **2038** | 335,494 | 0.3% | 8,192,845 | 8,554,353 | 1462 | 67% |
| **Base-Mild** | **2039** | 336,612 | 0.3% | 8,232,034 | 8,595,341 | 1469 | 67% |
| **Base-Mild** | **2040** | 337,711 | 0.3% | 8,282,413 | 8,647,548 | 1476 | 67% |

**Equivalent Compound Growth Rates**

| Time Period | | Total Consumers % Change | Member Sales % Change | HE Sales % Change | HE Sales Demand % Change | Load Factor % Change |
|---|---|---|---|---|---|---|
| **2010** | **2015** | 0.30% | 0.11% | 0.33% | 3.00% | -2.60% |
| **2015** | **2019** | 0.68% | 1.18% | 1.21% | 0.63% | 0.58% |
| **2020** | **2025** | 0.60% | 3.12% | 3.10% | 2.29% | 0.85% |
| **2025** | **2030** | 0.49% | 0.33% | 0.33% | 0.23% | 0.10% |
| **2030** | **2035** | 0.40% | 0.25% | 0.26% | 0.21% | 0.05% |
| **2035** | **2040** | 0.34% | 0.46% | 0.46% | 0.44% | -0.03% |
| **2020** | **2030** | 0.54% | 1.71% | 1.71% | 1.25% | 0.47% |
| **2030** | **2040** | 0.37% | 0.36% | 0.36% | 0.32% | 0.01% |
| **2010** | **2019** | 0.47% | 0.59% | 0.72% | 1.94% | -1.20% |
| **2020** | **2040** | 0.46% | 1.03% | 1.03% | 0.79% | 0.24% |

**RUS FORM 341**

## Base-Mild Scenario

| | Year | HE GENERATION BASE-MILD | HE GENERATION % CHANGE | HE GENERATION 60-MIN DEMAND | GENERATION DEMAND % CHANGE | ANNUAL PEAK SEASON |
|---|---|---|---|---|---|---|
| **Actual** | **2010** | 7,169,555 | | 1431 | | SUMMER |
| **Actual** | **2011** | 7,261,250 | 1.3% | 1478 | 3.3% | SUMMER |
| **Actual** | **2012** | 7,193,545 | -0.9% | 1537 | 4.0% | SUMMER |
| **Actual** | **2013** | 7,335,037 | 2.0% | 1409 | -8.3% | WINTER |
| **Actual** | **2014** | 7,639,069 | 4.1% | 1698 | 20.5% | WINTER |
| **Actual** | **2015** | 7,481,099 | -2.1% | 1643 | -3.2% | WINTER |
| **Actual** | **2016** | 7,564,387 | 1.1% | 1498 | -8.8% | WINTER |
| **Actual** | **2017** | 7,476,942 | -1.2% | 1425 | -4.8% | WINTER |
| **Actual** | **2018** | 8,063,654 | 7.8% | 1668 | 17.0% | WINTER |
| **Actual** | **2019** | 7,859,968 | -2.5% | 1714 | 2.8% | WINTER |
| **Base-Mild** | **2020** | 7,314,558 | | 1320 | | SUMMER |
| **Base-Mild** | **2021** | 7,550,296 | 3.2% | 1332 | -0.3% | SUMMER |
| **Base-Mild** | **2022** | 7,732,920 | 2.4% | 1355 | 1.3% | SUMMER |
| **Base-Mild** | **2023** | 8,129,449 | 5.1% | 1397 | 1.7% | SUMMER |
| **Base-Mild** | **2024** | 8,479,996 | 4.3% | 1455 | 3.5% | SUMMER |
| **Base-Mild** | **2025** | 8,521,679 | 0.5% | 1478 | 3.7% | SUMMER |
| **Base-Mild** | **2026** | 8,568,364 | 0.5% | 1484 | 0.3% | SUMMER |
| **Base-Mild** | **2027** | 8,612,950 | 0.5% | 1489 | 0.4% | SUMMER |
| **Base-Mild** | **2028** | 8,623,006 | 0.1% | 1491 | 0.4% | SUMMER |
| **Base-Mild** | **2029** | 8,655,521 | 0.4% | 1494 | 0.3% | SUMMER |
| **Base-Mild** | **2030** | 8,662,579 | 0.1% | 1495 | 0.2% | SUMMER |
| **Base-Mild** | **2031** | 8,694,766 | 0.4% | 1499 | 0.1% | SUMMER |
| **Base-Mild** | **2032** | 8,746,526 | 0.6% | 1505 | 0.4% | SUMMER |
| **Base-Mild** | **2033** | 8,708,231 | -0.4% | 1504 | 0.6% | SUMMER |
| **Base-Mild** | **2034** | 8,731,703 | 0.3% | 1505 | -0.3% | SUMMER |
| **Base-Mild** | **2035** | 8,774,402 | 0.5% | 1511 | 0.3% | SUMMER |
| **Base-Mild** | **2036** | 8,815,303 | 0.5% | 1517 | 0.5% | SUMMER |
| **Base-Mild** | **2037** | 8,839,541 | 0.3% | 1523 | 0.6% | SUMMER |
| **Base-Mild** | **2038** | 8,882,840 | 0.5% | 1529 | 0.2% | SUMMER |
| **Base-Mild** | **2039** | 8,925,402 | 0.5% | 1537 | 0.5% | SUMMER |
| **Base-Mild** | **2040** | 8,979,614 | 0.6% | 1545 | 0.5% | SUMMER |

### Equivalent Compound Growth Rates

| Time Period | | HE Generation % Change | HE Generation Demand % Change |
|---|---|---|---|
| **2010** | **2015** | 0.85% | 2.80% |
| **2015** | **2019** | 1.24% | 1.06% |
| **2020** | **2025** | 3.10% | 2.29% |
| **2025** | **2030** | 0.33% | 0.23% |
| **2030** | **2035** | 0.26% | 0.21% |
| **2035** | **2040** | 0.46% | 0.44% |
| **2020** | **2030** | 1.71% | 1.25% |
| **2030** | **2040** | 0.36% | 0.32% |
| **2010** | **2019** | 1.03% | 2.03% |
| **2020** | **2040** | 1.03% | 0.79% |

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## Base-Severe Scenario

| | Year | RESIDENTIAL NUMBER OF CONSUMERS | RESIDENTIAL CONSUMERS % CHANGE | RESIDENTIAL ENERGY SALES (MWH) | RESIDENTIAL ENERGY SALES % CHANGE | RESIDENTIAL KWH/CONSUMER PER MONTH | RESIDENTIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 277,913 | | 4,313,612 | | 1293 | |
| **Actual** | **2011** | 277,751 | -0.1% | 4,093,234 | -5.1% | 1228 | -5.0% |
| **Actual** | **2012** | 278,372 | 0.2% | 3,958,457 | -3.3% | 1185 | -3.5% |
| **Actual** | **2013** | 279,338 | 0.3% | 4,091,996 | 3.4% | 1221 | 3.0% |
| **Actual** | **2014** | 280,061 | 0.3% | 4,204,582 | 2.8% | 1251 | 2.5% |
| **Actual** | **2015** | 281,173 | 0.4% | 4,002,896 | -4.8% | 1186 | -5.2% |
| **Actual** | **2016** | 283,258 | 0.7% | 4,024,894 | 0.5% | 1184 | -0.2% |
| **Actual** | **2017** | 283,540 | 0.1% | 3,880,889 | -3.6% | 1141 | -3.6% |
| **Actual** | **2018** | 285,314 | 0.6% | 4,298,011 | 10.7% | 1255 | 10.0% |
| **Actual** | **2019** | 286,480 | 0.4% | 4,151,582 | -3.4% | 1208 | -3.7% |
| **Base-Severe** | **2020** | 288,002 | | 4,355,102 | | 1260 | |
| **Base-Severe** | **2021** | 289,373 | 0.5% | 4,366,091 | 0.3% | 1257 | -0.2% |
| **Base-Severe** | **2022** | 290,969 | 0.6% | 4,389,395 | 0.5% | 1257 | 0.0% |
| **Base-Severe** | **2023** | 292,701 | 0.6% | 4,410,449 | 0.5% | 1256 | -0.1% |
| **Base-Severe** | **2024** | 294,446 | 0.6% | 4,452,192 | 0.9% | 1260 | 0.3% |
| **Base-Severe** | **2025** | 296,210 | 0.6% | 4,467,487 | 0.3% | 1257 | -0.2% |
| **Base-Severe** | **2026** | 297,892 | 0.6% | 4,497,032 | 0.7% | 1258 | 0.1% |
| **Base-Severe** | **2027** | 299,366 | 0.5% | 4,524,918 | 0.6% | 1260 | 0.2% |
| **Base-Severe** | **2028** | 300,695 | 0.4% | 4,567,119 | 0.9% | 1266 | 0.5% |
| **Base-Severe** | **2029** | 301,994 | 0.4% | 4,581,838 | 0.3% | 1264 | -0.2% |
| **Base-Severe** | **2030** | 303,261 | 0.4% | 4,604,448 | 0.5% | 1265 | 0.1% |
| **Base-Severe** | **2031** | 304,496 | 0.4% | 4,630,718 | 0.6% | 1267 | 0.2% |
| **Base-Severe** | **2032** | 305,700 | 0.4% | 4,674,855 | 1.0% | 1274 | 0.6% |
| **Base-Severe** | **2033** | 306,873 | 0.4% | 4,691,975 | 0.4% | 1274 | 0.0% |
| **Base-Severe** | **2034** | 308,014 | 0.4% | 4,724,685 | 0.7% | 1278 | 0.3% |
| **Base-Severe** | **2035** | 309,123 | 0.4% | 4,758,705 | 0.7% | 1283 | 0.4% |
| **Base-Severe** | **2036** | 310,197 | 0.3% | 4,808,782 | 1.1% | 1292 | 0.7% |
| **Base-Severe** | **2037** | 311,241 | 0.3% | 4,829,255 | 0.4% | 1293 | 0.1% |
| **Base-Severe** | **2038** | 312,256 | 0.3% | 4,864,391 | 0.7% | 1298 | 0.4% |
| **Base-Severe** | **2039** | 313,244 | 0.3% | 4,898,879 | 0.7% | 1303 | 0.4% |
| **Base-Severe** | **2040** | 314,214 | 0.3% | 4,946,375 | 1.0% | 1312 | 0.7% |

**Equivalent Compound Growth Rates**

| Time Period | | Residential Consumers % Change | Residential Sales to End Consumers % Change | Residential kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.23% | -1.48% | -1.71% |
| **2015** | **2019** | 0.47% | 0.92% | 0.46% |
| **2020** | **2025** | 0.56% | 0.51% | -0.05% |
| **2025** | **2030** | 0.47% | 0.61% | 0.13% |
| **2030** | **2035** | 0.38% | 0.66% | 0.28% |
| **2035** | **2040** | 0.33% | 0.78% | 0.45% |
| **2020** | **2030** | 0.52% | 0.56% | 0.04% |
| **2030** | **2040** | 0.36% | 0.72% | 0.37% |
| **2010** | **2019** | 0.34% | -0.42% | -0.75% |
| **2020** | **2040** | 0.44% | 0.64% | 0.20% |

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## Base-Severe Scenario

| | Year | COMMERCIAL NUMBER OF CONSUMERS | COMMERCIAL CONSUMERS % CHANGE | COMMERCIAL ENERGY SALES (MWH) | COMMERCIAL ENERGY SALES % CHANGE | COMMERCIAL KWH/CONSUMER PER MONTH | COMMERCIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 13683 | | 889,903 | | 5420 | |
| **Actual** | **2011** | 13764 | 0.6% | 901,707 | 1.3% | 5459 | 0.7% |
| **Actual** | **2012** | 13890 | 0.9% | 930,499 | 3.2% | 5583 | 2.3% |
| **Actual** | **2013** | 14029 | 1.0% | 938,826 | 0.9% | 5577 | -0.1% |
| **Actual** | **2014** | 14289 | 1.9% | 952,690 | 1.5% | 5556 | -0.4% |
| **Actual** | **2015** | 14255 | -0.2% | 946,635 | -0.6% | 5534 | -0.4% |
| **Actual** | **2016** | 13827 | -3.0% | 949,179 | 0.3% | 5720 | 3.4% |
| **Actual** | **2017** | 14030 | 1.5% | 944,810 | -0.5% | 5612 | -1.9% |
| **Actual** | **2018** | 14215 | 1.3% | 940,218 | -0.5% | 5512 | -1.8% |
| **Actual** | **2019** | 14868 | 4.6% | 951,542 | 1.2% | 5333 | -3.2% |
| | | | | | | | |
| **Base-Severe** | **2020** | 14939 | | 973,825 | | 5432 | |
| **Base-Severe** | **2021** | 15330 | 2.6% | 985,895 | 1.2% | 5359 | -1.3% |
| **Base-Severe** | **2022** | 15477 | 1.0% | 996,382 | 1.1% | 5365 | 0.1% |
| **Base-Severe** | **2023** | 15621 | 0.9% | 1,006,827 | 1.0% | 5371 | 0.1% |
| **Base-Severe** | **2024** | 15761 | 0.9% | 1,016,950 | 1.0% | 5377 | 0.1% |
| **Base-Severe** | **2025** | 15904 | 0.9% | 1,027,181 | 1.0% | 5382 | 0.1% |
| **Base-Severe** | **2026** | 16042 | 0.9% | 1,036,987 | 1.0% | 5387 | 0.1% |
| **Base-Severe** | **2027** | 16166 | 0.8% | 1,045,987 | 0.9% | 5392 | 0.1% |
| **Base-Severe** | **2028** | 16281 | 0.7% | 1,054,418 | 0.8% | 5397 | 0.1% |
| **Base-Severe** | **2029** | 16394 | 0.7% | 1,062,715 | 0.8% | 5402 | 0.1% |
| **Base-Severe** | **2030** | 16506 | 0.7% | 1,070,896 | 0.8% | 5407 | 0.1% |
| **Base-Severe** | **2031** | 16617 | 0.7% | 1,079,002 | 0.8% | 5411 | 0.1% |
| **Base-Severe** | **2032** | 16725 | 0.6% | 1,086,921 | 0.7% | 5416 | 0.1% |
| **Base-Severe** | **2033** | 16830 | 0.6% | 1,094,696 | 0.7% | 5420 | 0.1% |
| **Base-Severe** | **2034** | 16936 | 0.6% | 1,102,477 | 0.7% | 5425 | 0.1% |
| **Base-Severe** | **2035** | 17039 | 0.6% | 1,110,126 | 0.7% | 5429 | 0.1% |
| **Base-Severe** | **2036** | 17142 | 0.6% | 1,117,681 | 0.7% | 5433 | 0.1% |
| **Base-Severe** | **2037** | 17244 | 0.6% | 1,125,188 | 0.7% | 5438 | 0.1% |
| **Base-Severe** | **2038** | 17344 | 0.6% | 1,132,585 | 0.7% | 5442 | 0.1% |
| **Base-Severe** | **2039** | 17443 | 0.6% | 1,139,902 | 0.6% | 5446 | 0.1% |
| **Base-Severe** | **2040** | 17542 | 0.6% | 1,147,144 | 0.6% | 5449 | 0.1% |

### Equivalent Compound Growth Rates

| Time Period | | Commercial Consumers % Change | Commercial Sales to End Consumers % Change | Commercial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.82% | 1.24% | 0.42% |
| **2015** | **2019** | 1.06% | 0.13% | -0.92% |
| **2020** | **2025** | 1.26% | 1.07% | -0.18% |
| **2025** | **2030** | 0.75% | 0.84% | 0.09% |
| **2030** | **2035** | 0.64% | 0.72% | 0.08% |
| **2035** | **2040** | 0.58% | 0.66% | 0.07% |
| **2020** | **2030** | 1.00% | 0.95% | -0.05% |
| **2030** | **2040** | 0.61% | 0.69% | 0.08% |
| **2010** | **2019** | 0.93% | 0.75% | -0.18% |
| **2020** | **2040** | 0.81% | 0.82% | 0.02% |

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## Base-Severe Scenario

| | Year | INDUSTRIAL NUMBER OF CONSUMERS | INDUSTRIAL CONSUMERS % CHANGE | INDUSTRIAL ENERGY SALES (MWH) | INDUSTRIAL ENERGY SALES % CHANGE | INDUSTRIAL KWH/CONSUMER PER MONTH | INDUSTRIAL KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 197 | | 1,611,671 | | 682,911 | |
| **Actual** | **2011** | 201 | 1.9% | 1,640,012 | 1.8% | 681,634 | -0.2% |
| **Actual** | **2012** | 194 | -3.2% | 1,725,290 | 5.2% | 741,104 | 8.7% |
| **Actual** | **2013** | 197 | 1.8% | 1,756,666 | 1.8% | 741,522 | 0.1% |
| **Actual** | **2014** | 202 | 2.3% | 1,878,298 | 6.9% | 775,195 | 4.5% |
| **Actual** | **2015** | 201 | -0.5% | 1,906,729 | 1.5% | 791,174 | 2.1% |
| **Actual** | **2016** | 205 | 1.8% | 1,898,538 | -0.4% | 773,650 | -2.2% |
| **Actual** | **2017** | 211 | 3.1% | 1,976,447 | 4.1% | 780,896 | 0.9% |
| **Actual** | **2018** | 233 | 10.3% | 2,095,080 | 6.0% | 750,656 | -3.9% |
| **Actual** | **2019** | 232 | -0.1% | 2,068,766 | -1.3% | 741,759 | -1.2% |
| **Base-Severe** | **2020** | 233 | | 1,858,055 | | 664,540 | |
| **Base-Severe** | **2021** | 225 | -3.4% | 2,059,493 | 10.8% | 762,775 | 14.8% |
| **Base-Severe** | **2022** | 228 | 1.3% | 2,196,571 | 6.7% | 802,840 | 5.3% |
| **Base-Severe** | **2023** | 230 | 0.9% | 2,532,250 | 15.3% | 917,482 | 14.3% |
| **Base-Severe** | **2024** | 231 | 0.4% | 2,806,942 | 10.8% | 1,012,605 | 10.4% |
| **Base-Severe** | **2025** | 230 | -0.4% | 2,818,835 | 0.4% | 1,021,317 | 0.9% |
| **Base-Severe** | **2026** | 230 | 0.0% | 2,823,471 | 0.2% | 1,022,997 | 0.2% |
| **Base-Severe** | **2027** | 230 | 0.0% | 2,828,781 | 0.2% | 1,024,921 | 0.2% |
| **Base-Severe** | **2028** | 230 | 0.0% | 2,790,157 | -1.4% | 1,010,926 | -1.4% |
| **Base-Severe** | **2029** | 230 | 0.0% | 2,796,938 | 0.2% | 1,013,383 | 0.2% |
| **Base-Severe** | **2030** | 230 | 0.0% | 2,774,005 | -0.8% | 1,005,074 | -0.8% |
| **Base-Severe** | **2031** | 230 | 0.0% | 2,771,141 | -0.1% | 1,004,037 | -0.1% |
| **Base-Severe** | **2032** | 230 | 0.0% | 2,770,629 | 0.0% | 1,003,851 | 0.0% |
| **Base-Severe** | **2033** | 230 | 0.0% | 2,710,213 | -2.2% | 981,961 | -2.2% |
| **Base-Severe** | **2034** | 228 | -0.9% | 2,693,370 | -0.6% | 984,419 | 0.3% |
| **Base-Severe** | **2035** | 228 | 0.0% | 2,693,370 | 0.0% | 984,419 | 0.0% |
| **Base-Severe** | **2036** | 228 | 0.0% | 2,677,603 | -0.6% | 978,656 | -0.6% |
| **Base-Severe** | **2037** | 227 | -0.4% | 2,672,801 | -0.2% | 981,204 | 0.3% |
| **Base-Severe** | **2038** | 227 | 0.0% | 2,672,793 | 0.0% | 981,202 | 0.0% |
| **Base-Severe** | **2039** | 226 | -0.4% | 2,672,790 | 0.0% | 985,542 | 0.4% |
| **Base-Severe** | **2040** | 226 | 0.0% | 2,672,371 | 0.0% | 985,388 | 0.0% |

**Equivalent Compound Growth Rates**

| Time Period | | Industrial Consumers % Change | Industrial Sales to End Consumers % Change | Industrial kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 0.42% | 3.42% | 2.99% |
| **2015** | **2019** | 3.72% | 2.06% | -1.60% |
| **2020** | **2025** | -0.26% | 8.69% | 8.98% |
| **2025** | **2030** | 0.00% | -0.32% | -0.32% |
| **2030** | **2035** | -0.17% | -0.59% | -0.41% |
| **2035** | **2040** | -0.18% | -0.16% | 0.02% |
| **2020** | **2030** | -0.13% | 4.09% | 4.22% |
| **2030** | **2040** | -0.18% | -0.37% | -0.20% |
| **2010** | **2019** | 1.87% | 2.81% | 0.92% |
| **2020** | **2040** | -0.15% | 1.83% | 1.99% |

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## Base-Severe Scenario

| | Year | OTHER NUMBER OF CONSUMERS | OTHER CONSUMERS % CHANGE | OTHER ENERGY SALES (MWH) | OTHER ENERGY SALES % CHANGE | OTHER KWH/CONSUMER PER MONTH | OTHER KWH/CONSUMER % CHANGE |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 2200 | | 40029 | | 1516 | |
| **Actual** | **2011** | 2418 | 9.9% | 40873 | 2.1% | 1409 | -7% |
| **Actual** | **2012** | 2509 | 3.8% | 46874 | 14.7% | 1557 | 11% |
| **Actual** | **2013** | 2610 | 4.0% | 40415 | -13.8% | 1291 | -17% |
| **Actual** | **2014** | 2742 | 5.1% | 41305 | 2.2% | 1255 | -3% |
| **Actual** | **2015** | 2825 | 3.0% | 37584 | -9.0% | 1109 | -12% |
| **Actual** | **2016** | 2920 | 3.4% | 39012 | 3.8% | 1113 | 0% |
| **Actual** | **2017** | 4850 | 66.1% | 56774 | 45.5% | 976 | -12% |
| **Actual** | **2018** | 4975 | 2.6% | 57912 | 2.0% | 970 | -1% |
| **Actual** | **2019** | 5063 | 1.8% | 53754 | -7.2% | 885 | -9% |
| | | | | | | | |
| **Base-Severe** | **2020** | 5073 | | 56605 | | 930 | |
| **Base-Severe** | **2021** | 5107 | 0.7% | 56624 | 0.0% | 924 | -1% |
| **Base-Severe** | **2022** | 5141 | 0.7% | 56637 | 0.0% | 918 | -1% |
| **Base-Severe** | **2023** | 5174 | 0.6% | 56649 | 0.0% | 912 | -1% |
| **Base-Severe** | **2024** | 5208 | 0.6% | 56662 | 0.0% | 907 | -1% |
| **Base-Severe** | **2025** | 5241 | 0.6% | 56675 | 0.0% | 901 | -1% |
| **Base-Severe** | **2026** | 5275 | 0.6% | 56688 | 0.0% | 896 | -1% |
| **Base-Severe** | **2027** | 5309 | 0.6% | 56700 | 0.0% | 890 | -1% |
| **Base-Severe** | **2028** | 5342 | 0.6% | 56713 | 0.0% | 885 | -1% |
| **Base-Severe** | **2029** | 5376 | 0.6% | 56726 | 0.0% | 879 | -1% |
| **Base-Severe** | **2030** | 5409 | 0.6% | 56738 | 0.0% | 874 | -1% |
| **Base-Severe** | **2031** | 5442 | 0.6% | 56751 | 0.0% | 869 | -1% |
| **Base-Severe** | **2032** | 5475 | 0.6% | 56763 | 0.0% | 864 | -1% |
| **Base-Severe** | **2033** | 5508 | 0.6% | 56776 | 0.0% | 859 | -1% |
| **Base-Severe** | **2034** | 5540 | 0.6% | 56788 | 0.0% | 854 | -1% |
| **Base-Severe** | **2035** | 5573 | 0.6% | 56800 | 0.0% | 849 | -1% |
| **Base-Severe** | **2036** | 5604 | 0.6% | 56812 | 0.0% | 845 | 0% |
| **Base-Severe** | **2037** | 5636 | 0.6% | 56824 | 0.0% | 840 | -1% |
| **Base-Severe** | **2038** | 5667 | 0.6% | 56836 | 0.0% | 836 | 0% |
| **Base-Severe** | **2039** | 5698 | 0.5% | 56847 | 0.0% | 831 | -1% |
| **Base-Severe** | **2040** | 5729 | 0.5% | 56859 | 0.0% | 827 | 0% |

**Equivalent Compound Growth Rates**

| Time Period | | Other Consumers % Change | Other Sales to End Consumers % Change | Other kWh/Consumer % Change |
|---|---|---|---|---|
| **2010** | **2015** | 5.13% | -1.25% | -6.06% |
| **2015** | **2019** | 15.70% | 9.36% | -5.48% |
| **2020** | **2025** | 0.65% | 0.02% | -0.63% |
| **2025** | **2030** | 0.63% | 0.02% | -0.61% |
| **2030** | **2035** | 0.60% | 0.02% | -0.58% |
| **2035** | **2040** | 0.56% | 0.02% | -0.52% |
| **2020** | **2030** | 0.64% | 0.02% | -0.62% |
| **2030** | **2040** | 0.58% | 0.02% | -0.55% |
| **2010** | **2019** | 9.70% | 3.33% | -5.81% |
| **2020** | **2040** | 0.61% | 0.02% | -0.59% |

RUS FORM 341

## Base-Severe Scenario

| | Year | TOTAL CONSUMERS | CONSUMERS % CHANGE | MEMBER SALES BASE-SEVERE | HE SALES BASE-SEVERE | HE SALES 60-MIN DEMAND | ANNUAL LOAD FACTOR (%) |
|---|---|---|---|---|---|---|---|
| **Actual** | **2010** | 293,992 | | 6,855,216 | 6,911,304 | 1366 | 58% |
| **Actual** | **2011** | 294,132 | 0.0% | 6,675,825 | 6,799,323 | 1418 | 55% |
| **Actual** | **2012** | 294,965 | 0.3% | 6,661,120 | 6,782,533 | 1457 | 53% |
| **Actual** | **2013** | 296,174 | 0.4% | 6,827,902 | 6,977,821 | 1363 | 58% |
| **Actual** | **2014** | 297,293 | 0.4% | 7,076,875 | 7,229,477 | 1645 | 50% |
| **Actual** | **2015** | 298,453 | 0.4% | 6,893,844 | 7,025,479 | 1584 | 50% |
| **Actual** | **2016** | 300,210 | 0.6% | 6,911,623 | 7,072,483 | 1423 | 57% |
| **Actual** | **2017** | 302,631 | 0.8% | 6,858,920 | 6,994,237 | 1356 | 59% |
| **Actual** | **2018** | 304,737 | 0.7% | 7,391,221 | 7,542,577 | 1587 | 54% |
| **Actual** | **2019** | 306,644 | 0.6% | 7,225,644 | 7,371,844 | 1624 | 52% |
| **Base-Severe** | **2020** | 308,248 | | 7,243,587 | 7,568,919 | 1628 | 53% |
| **Base-Severe** | **2021** | 310,034 | 0.6% | 7,468,103 | 7,802,219 | 1625 | 55% |
| **Base-Severe** | **2022** | 311,814 | 0.6% | 7,638,985 | 7,979,583 | 1642 | 55% |
| **Base-Severe** | **2023** | 313,726 | 0.6% | 8,006,175 | 8,360,470 | 1665 | 57% |
| **Base-Severe** | **2024** | 315,646 | 0.6% | 8,332,745 | 8,700,038 | 1716 | 58% |
| **Base-Severe** | **2025** | 317,586 | 0.6% | 8,370,178 | 8,739,549 | 1773 | 56% |
| **Base-Severe** | **2026** | 319,439 | 0.6% | 8,414,178 | 8,785,462 | 1773 | 57% |
| **Base-Severe** | **2027** | 321,070 | 0.5% | 8,456,387 | 8,829,465 | 1778 | 57% |
| **Base-Severe** | **2028** | 322,548 | 0.5% | 8,468,406 | 8,841,872 | 1782 | 56% |
| **Base-Severe** | **2029** | 323,993 | 0.4% | 8,498,217 | 8,873,417 | 1783 | 57% |
| **Base-Severe** | **2030** | 325,406 | 0.4% | 8,506,088 | 8,881,806 | 1782 | 57% |
| **Base-Severe** | **2031** | 326,785 | 0.4% | 8,537,612 | 8,914,774 | 1781 | 57% |
| **Base-Severe** | **2032** | 328,130 | 0.4% | 8,589,169 | 8,968,175 | 1785 | 57% |
| **Base-Severe** | **2033** | 329,441 | 0.4% | 8,553,659 | 8,932,133 | 1792 | 57% |
| **Base-Severe** | **2034** | 330,718 | 0.4% | 8,577,320 | 8,957,032 | 1783 | 57% |
| **Base-Severe** | **2035** | 331,963 | 0.4% | 8,619,002 | 9,000,613 | 1784 | 58% |
| **Base-Severe** | **2036** | 333,171 | 0.4% | 8,660,878 | 9,044,033 | 1789 | 58% |
| **Base-Severe** | **2037** | 334,348 | 0.4% | 8,684,067 | 9,068,850 | 1795 | 58% |
| **Base-Severe** | **2038** | 335,494 | 0.3% | 8,726,605 | 9,113,331 | 1794 | 58% |
| **Base-Severe** | **2039** | 336,612 | 0.3% | 8,768,418 | 9,157,058 | 1799 | 58% |
| **Base-Severe** | **2040** | 337,711 | 0.3% | 8,822,749 | 9,213,342 | 1804 | 58% |

| Time Period | | Equivalent Compound Growth Rates<br>Total Consumers % Change | Member Sales % Change | Equivalent Compound Growth Rates<br>HE Sales % Change | HE Sales Demand % Change | Load Factor % Change |
|---|---|---|---|---|---|---|
| **2010** | **2015** | 0.30% | 0.11% | 0.33% | 3.00% | -2.60% |
| **2015** | **2019** | 0.68% | 1.18% | 1.21% | 0.63% | 0.58% |
| **2020** | **2025** | 0.60% | 2.93% | 2.92% | 1.71% | 1.24% |
| **2025** | **2030** | 0.49% | 0.32% | 0.32% | 0.11% | 0.21% |
| **2030** | **2035** | 0.40% | 0.26% | 0.27% | 0.02% | 0.24% |
| **2035** | **2040** | 0.34% | 0.47% | 0.47% | 0.22% | 0.20% |
| **2020** | **2030** | 0.54% | 1.62% | 1.61% | 0.91% | 0.73% |
| **2030** | **2040** | 0.37% | 0.37% | 0.37% | 0.12% | 0.22% |
| **2010** | **2019** | 0.47% | 0.59% | 0.72% | 1.94% | -1.20% |
| **2020** | **2040** | 0.46% | 0.99% | 0.99% | 0.51% | 0.47% |

**RUS FORM 341**

## Base-Severe Scenario

| | Year | HE GENERATION BASE-SEVERE | HE GENERATION % CHANGE | HE GENERATION 60-MIN DEMAND | GENERATION DEMAND % CHANGE | ANNUAL PEAK SEASON |
|---|---|---|---|---|---|---|
| **Actual** | **2010** | 7,169,555 | | 1431 | | SUMMER |
| **Actual** | **2011** | 7,261,250 | 1.3% | 1478 | 3.3% | SUMMER |
| **Actual** | **2012** | 7,193,545 | -0.9% | 1537 | 4.0% | SUMMER |
| **Actual** | **2013** | 7,335,037 | 2.0% | 1409 | -8.3% | WINTER |
| **Actual** | **2014** | 7,639,069 | 4.1% | 1698 | 20.5% | WINTER |
| **Actual** | **2015** | 7,481,099 | -2.1% | 1643 | -3.2% | WINTER |
| **Actual** | **2016** | 7,564,387 | 1.1% | 1498 | -8.8% | WINTER |
| **Actual** | **2017** | 7,476,942 | -1.2% | 1425 | -4.8% | WINTER |
| **Actual** | **2018** | 8,063,654 | 7.8% | 1668 | 17.0% | WINTER |
| **Actual** | **2019** | 7,859,968 | -2.5% | 1714 | 2.8% | WINTER |
| **Base-Severe** | **2020** | 7,859,565 | | 1704 | | WINTER |
| **Base-Severe** | **2021** | 8,101,824 | 3.1% | 1701 | -0.2% | WINTER |
| **Base-Severe** | **2022** | 8,285,999 | 2.3% | 1718 | 1.0% | WINTER |
| **Base-Severe** | **2023** | 8,681,512 | 4.8% | 1742 | 1.4% | WINTER |
| **Base-Severe** | **2024** | 9,034,120 | 4.1% | 1795 | 3.1% | WINTER |
| **Base-Severe** | **2025** | 9,075,148 | 0.5% | 1855 | 3.3% | WINTER |
| **Base-Severe** | **2026** | 9,122,823 | 0.5% | 1856 | 0.0% | WINTER |
| **Base-Severe** | **2027** | 9,168,517 | 0.5% | 1860 | 0.3% | WINTER |
| **Base-Severe** | **2028** | 9,181,400 | 0.1% | 1864 | 0.2% | WINTER |
| **Base-Severe** | **2029** | 9,214,157 | 0.4% | 1866 | 0.1% | WINTER |
| **Base-Severe** | **2030** | 9,222,868 | 0.1% | 1865 | 0.0% | WINTER |
| **Base-Severe** | **2031** | 9,257,101 | 0.4% | 1864 | -0.1% | WINTER |
| **Base-Severe** | **2032** | 9,312,553 | 0.6% | 1868 | 0.2% | WINTER |
| **Base-Severe** | **2033** | 9,275,127 | -0.4% | 1875 | 0.4% | WINTER |
| **Base-Severe** | **2034** | 9,300,982 | 0.3% | 1865 | -0.5% | WINTER |
| **Base-Severe** | **2035** | 9,346,237 | 0.5% | 1867 | 0.1% | WINTER |
| **Base-Severe** | **2036** | 9,391,324 | 0.5% | 1872 | 0.3% | WINTER |
| **Base-Severe** | **2037** | 9,417,093 | 0.3% | 1878 | 0.4% | WINTER |
| **Base-Severe** | **2038** | 9,463,283 | 0.5% | 1877 | 0.0% | WINTER |
| **Base-Severe** | **2039** | 9,508,689 | 0.5% | 1882 | 0.3% | WINTER |
| **Base-Severe** | **2040** | 9,567,134 | 0.6% | 1887 | 0.3% | WINTER |

| Time Period | | HE Generation % Change | HE Generation Demand % Change |
|---|---|---|---|
| **2010** | **2015** | 0.85% | 2.80% |
| **2015** | **2019** | 1.24% | 1.06% |
| **2020** | **2025** | 2.92% | 1.71% |
| **2025** | **2030** | 0.32% | 0.11% |
| **2030** | **2035** | 0.27% | 0.02% |
| **2035** | **2040** | 0.47% | 0.22% |
| **2020** | **2030** | 1.61% | 0.91% |
| **2030** | **2040** | 0.37% | 0.12% |
| **2010** | **2019** | 1.03% | 2.03% |
| **2020** | **2040** | 0.99% | 0.51% |

# APPENDIX A
# 2019 Residential End-Use Survey

HOOSIER ENERGY
A Touchstone Energy® Cooperative

# 2019 Residential End-Use Survey

## Overall System Report

Hoosier Energy & Member Distribution Systems

April 2019

insights
Strategic Marketing and Research

# Table of Contents

# Executive Summary

## Introduction

Business planning demands an understanding of the existing market as well as the ability to project future trends. For utility planning, this means understanding changes and trends in end-product usage. Because most customers purchase only the energy from electric utilities and not the end products, the way to gain a thorough understanding of these trends is through regularly conducted residential appliance saturation studies.

The 2019 Residential End-Use Survey is designed to profile end-use by customers and classification characteristics, such as their housing and demographics. This research was conducted to support Hoosier Energy and its 18 member distribution cooperatives in better understanding their consumers' makeup and electricity use, as well as their power requirements studies.

As recommended by the Rural Utilities Service, surveying similar to this has been completed typically over a two- to three-year cycle since 1979. To assure representativeness, 2,667 telephone and 4,634 online surveys were completed. The detailed methodology used, sampling, and survey instrument are located in later sections. This report presents Hoosier Energy Power Network (HEPN) results for the past five sampling years.

## End-Use Profile

In review of the study results pertaining to heating fuels, systems, and appliances, here are some of the key findings:

- The primary heating fuel has the greatest impact on overall electric usage, and despite small shifts the fuel mix has remained fairly stable over the last three sample periods. Electric penetration, with a 39% share, continues to exceed propane at 30% and natural gas at 20%. Wood heat has been stable at about a 9% level since 2009.
- For electric heating systems, as related to electric heat customers only, there has been a decline in the less efficient systems including electric furnaces and baseboard heat and a corresponding increase in both air to air and geothermal heat pumps. Traditional electric furnaces have the single largest share at 36%. Heat pumps have the next largest share at 35%, followed by geothermal at 14%, resulting in nearly half of electric systems including heat pumps of some form.
- Air conditioning saturation remains essentially unchanged at 95%. Air conditioning systems are composed of 18% heat pump systems and 69% traditional central air units.

- Electric remains the dominant primary fuel used in water heating, although electric penetration fell slightly (72%). Natural gas rose slightly (from 14% to 15%), and propane remained 12%.

- Lighting technologies continue to shift, particularly LED adoption, which currently reaches three-fourths of member households.

**Communication and New Technologies**

The explosion of smart phone technology continues, with 8 out of 10 members having these devices and Internet connectivity at home nearing 90%.

Social media growth has plateaued, with only 23% of members not using it. The fastest growth platform is Instagram.

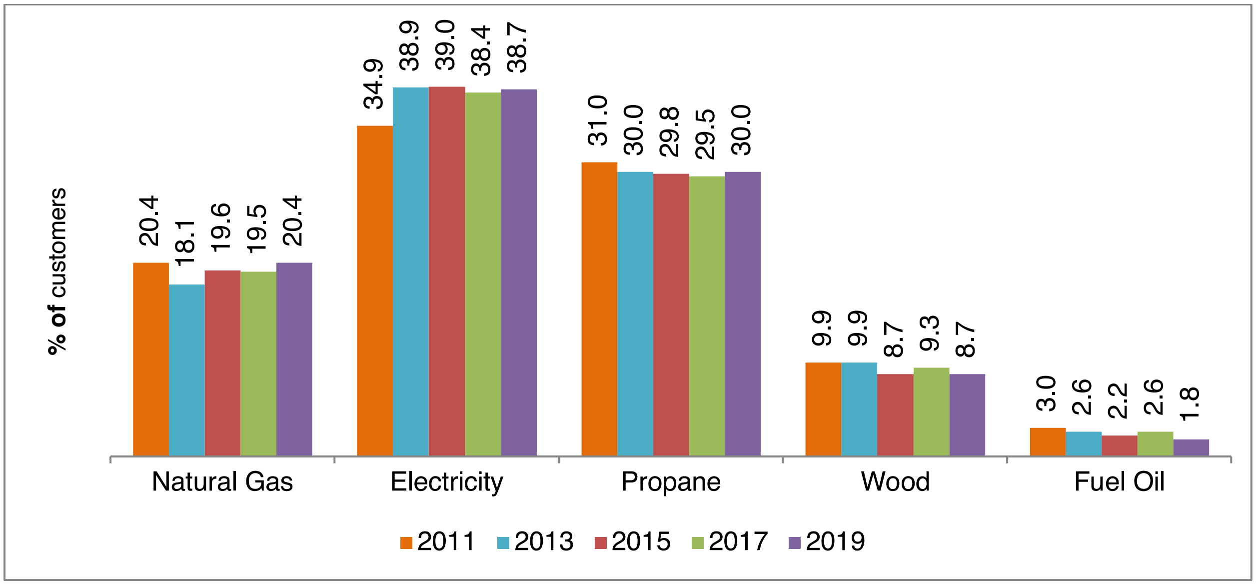
An enhanced review of significant future technologies such as plug-in vehicles explores the nascent stage of this equipment, which while still small is seeing some initial growth. Assessments of charging methods and times will eventually have significant impacts, as will the growing use of renewables.

**Customer Profile**

The profile of members shows a population that is slightly younger, better educated and higher income than in prior measures. The average respondent is 58 years old, with the top two dominant occupations being classified as retired and professional. Almost half have an education level of college graduate or higher. The average household income level has increased to more than $74,000 per year. The dominant dwelling structure remains a single family traditionally built home, with the average square footage resting just over 2,000 square feet and an average age of 32 years.

# Heating Shares

Primary Heating Fuel (Figure 1)

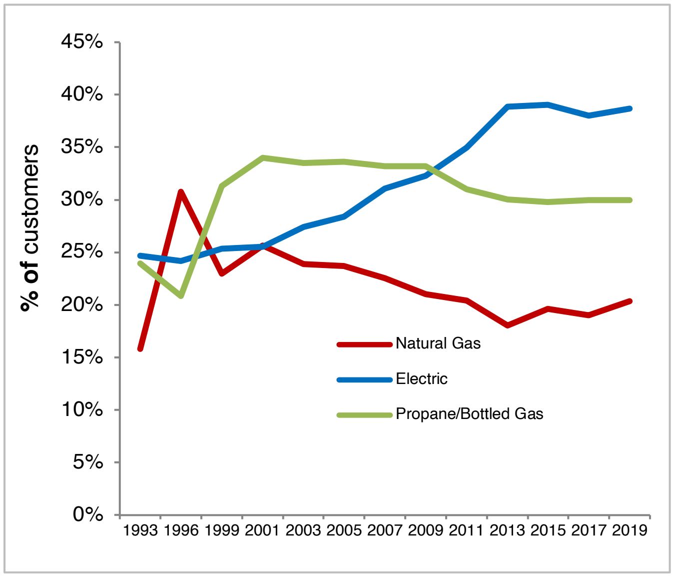



- While heating fuel shares are slow to change, when viewed over time electric heat had shown a trend of continuous growth. However, since 2013 the shares of the top heating fuels have remained essentially flat (Figure 1a).

- Over that period, natural gas has reported a modest growth, with both wood and fuel oil exhibiting small declines (Figure 1).

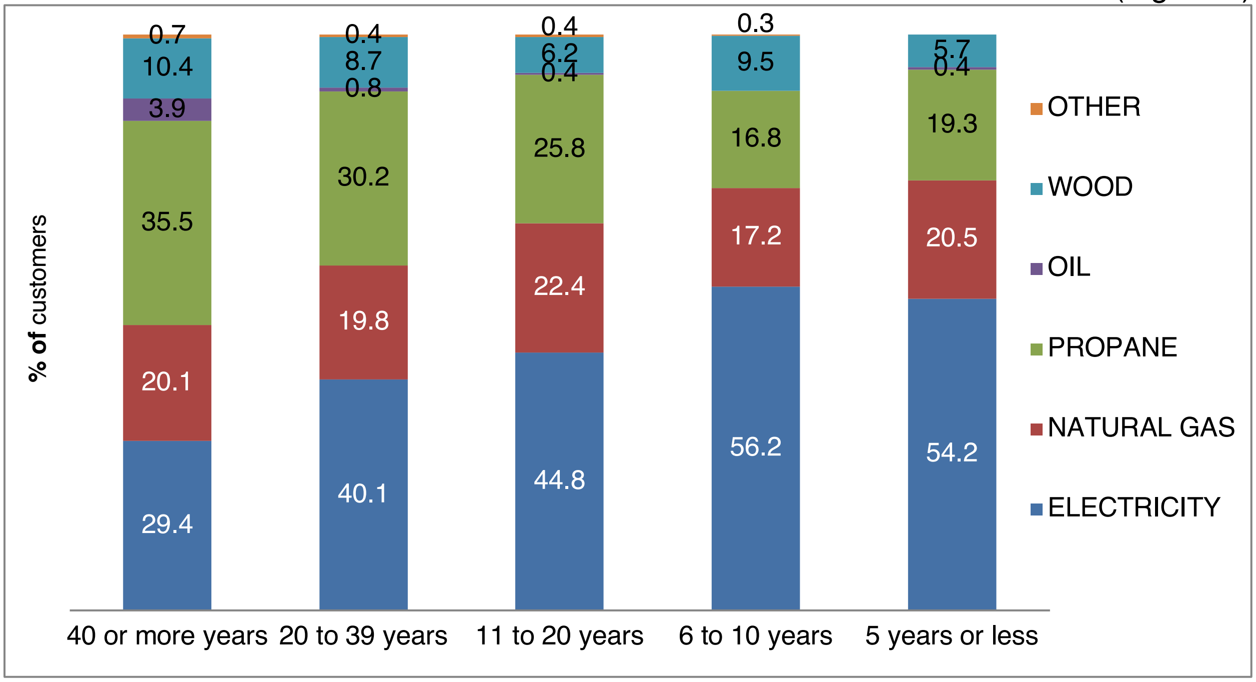
- Heating shares across the member systems showed wide ranges within each of the fuel types. Penetration ranged from 6%-61% for natural gas, 27%-56% for electricity, 10%-54% for propane, and 1%-14% for wood.

Historical Gas & Electric (Figure 1a)



# Heating Share & Home Age

Heating Share by Age of Home (Figure 2)

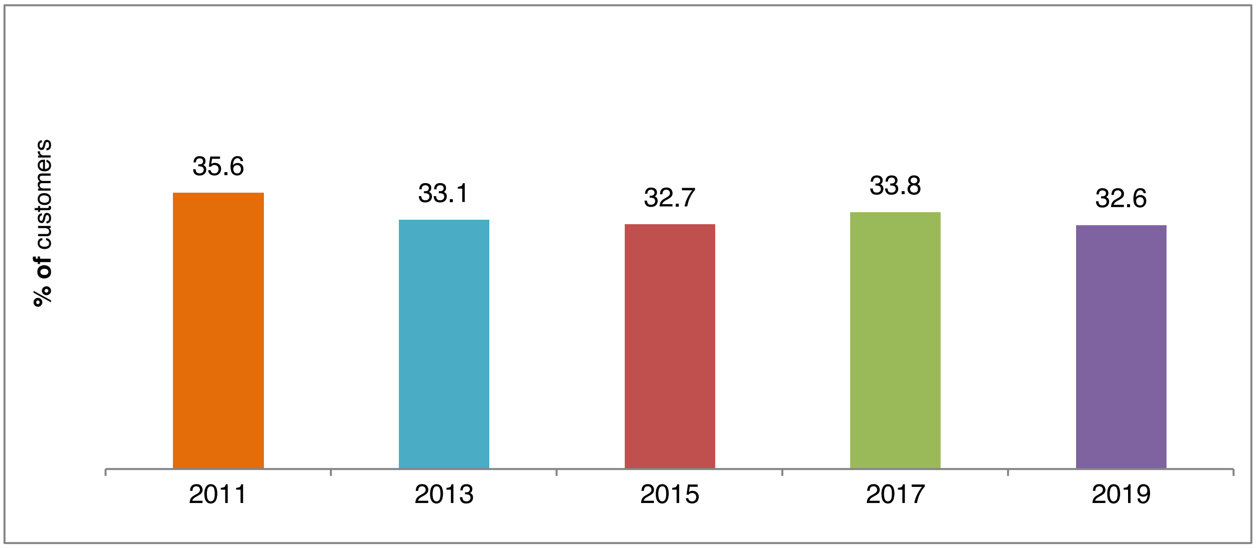



- Changes in heating fuel share are most often a function of fuel penetration in new homes. Fuel share by home age can help explain overall fuel trends.
- Historically, the growth of electric share has been a function of a growing share of electric heat installation in newer homes. The number of electrically heated homes built in the last 10 years is nearly twice as high as it is in homes more than 40 years of age.
- The slow pace of change is a function of limited new construction, with only 11% of homes being 10 years of age or less compared to 40% being 40 years or more (See Frequencies & Trends Tables FT 36).
- The primary electric heat gains have come from a declining share of propane and wood heat and the elimination of fuel oil heat in homes built in the last 20 years.
- Interestingly, natural gas use has remained essentially constant across different ages of homes.

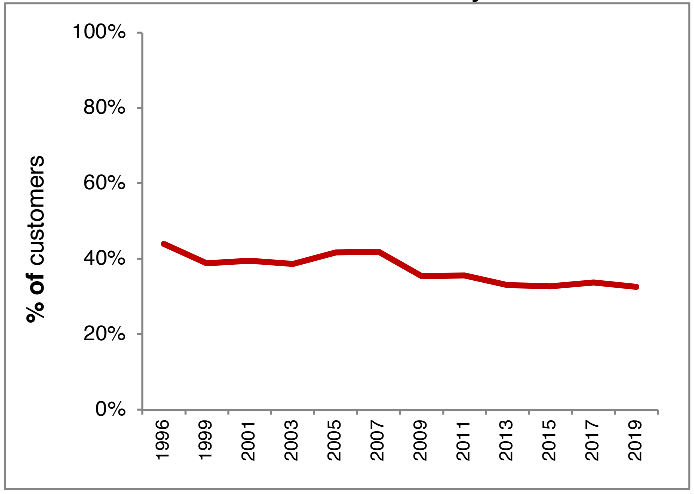
# Natural Gas Availability

(Figure 3)

Natural Gas Availability



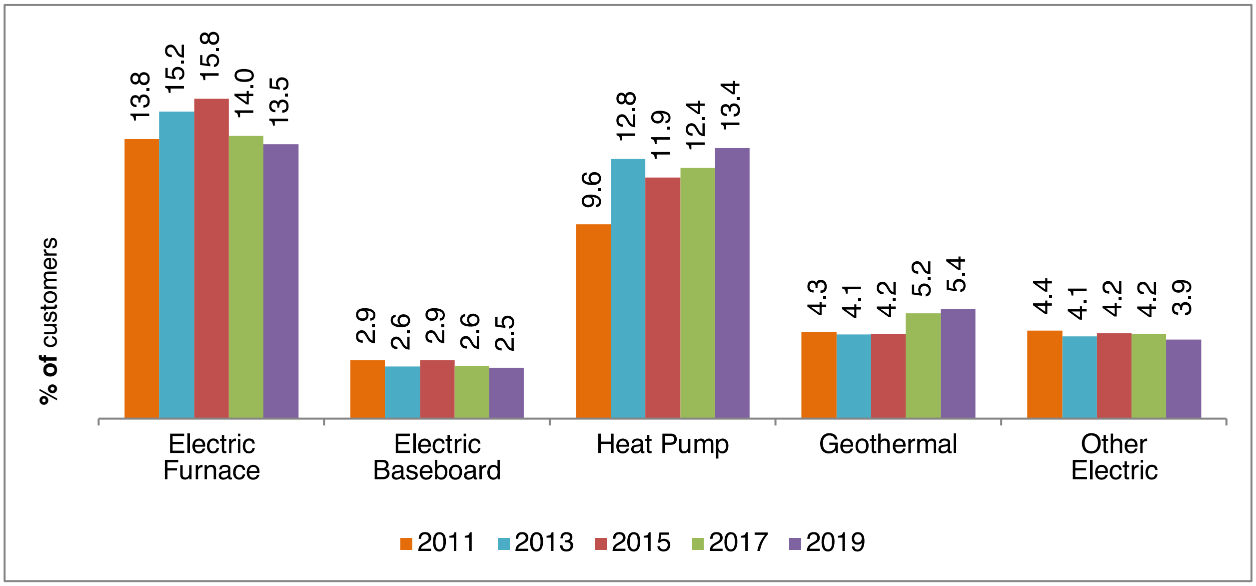

Historical Natural Gas Availability (Figure 3a)




- There has been a continual but gradual decline in the availability of natural gas as a percentage of customers.
- Despite this slow decline there has in recent years been a slight increase in penetration of natural gas heating share. In fact, this year gas is used in nearly 65% of the homes in which it is available.
- This suggests a growing appeal among consumers for gas as a heating fuel and may require active promotion of electric heating alternatives to prevent continual gains.

# Electric Heating Systems

Primary Electric Heating System (as a % of all primary heating systems) (Figure 4)




- As with fuel shares, heating system shares are typically slow to change. While system share seems generally stable, this year there has been an increase in both air to air and geothermal heat pumps and a corresponding decline in the less efficient systems, including electric furnaces, baseboard heat, and other electric systems such as wall units, ceiling cable, and room heaters.

- When considering customers with only electric heating systems, traditional electric furnaces have the single largest share at 36%. Heat pumps have the next largest share at 35% followed by geothermal at 14%, resulting in nearly half of electric systems including heat pumps of some form (see Frequencies & Trends Table FT 4).

  An additional 3% of cooperative members report a heat pump as a supplemental heating system (see Frequencies & Trends Table FT 6). The predominant auxiliary fuel used by both types of heat pumps is electricity at nearly 80%, with the next highest share at 10% for propane (see Frequencies & Trends Table FT 5).

# Electric Equipment Use

(Figure 5)

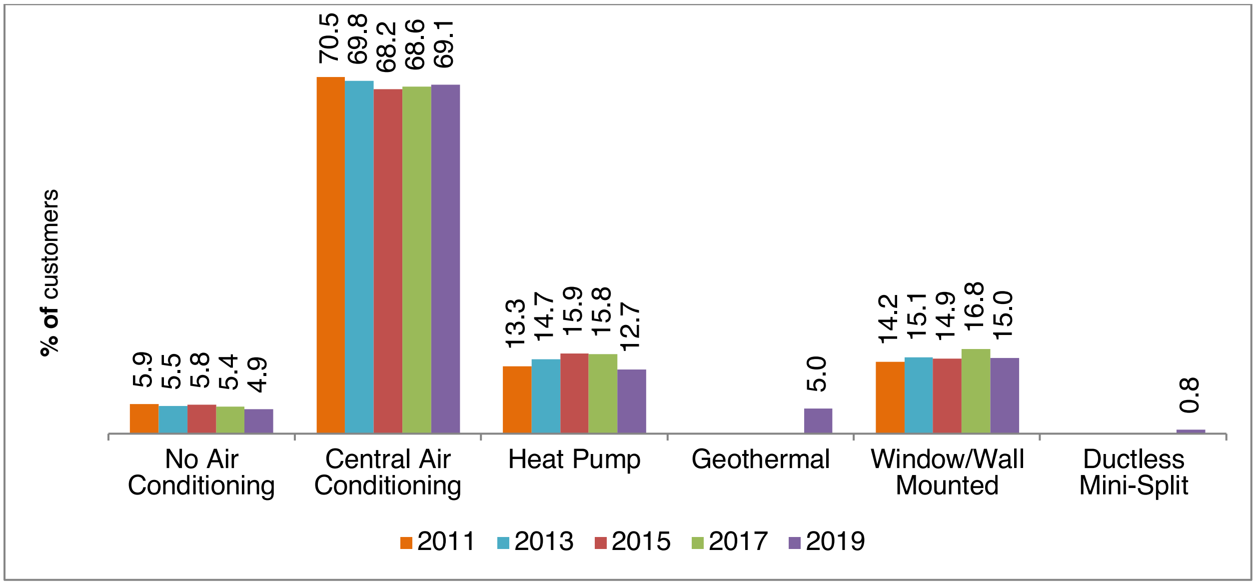
| Electric Equipment Usage in Home | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|
| Cooking[1] | 74.7% | 77.5% | 78.0% | 76.7% | 77.9% |
| Clothes Dryer | 89.6% | 89.6% | 90.0% | 90.7% | 90.0% |
| Dishwasher | 64.5% | 64.6% | 65.2% | 66.6% | 70.6% |
| Single Refrigerator | 65.6% | 66.4% | 65.4% | 63.5% | 59.6% |
| Multiple Refrigerators | 34.2% | 33.4% | 34.4% | 36.0% | 39.9% |
| Stand-alone Freezers | 66.4% | 67.4% | 66.5% | 69.4% | 66.5% |
| # of Televisions | 2.4 | 2.5 | 2.5 | 2.5 | 2.5 |
| Smart phones[2] | NA | 47.3% | 61.4% | 69.3% | 81.1% |
| Tablets, iPads, Readers, etc.[2] | NA | 34.4% | 47.5% | 60.0% | 63.2% |
| Personal Computers | 72.7% | 73.0% | 72.3% | 71.2% | 79.3% |
| Swimming Pool Heating[3] | 1.1% | 1.0% | 0.5% | 0.3% | 0.8% |
| Swimming Pool Pump | NA | NA | 9.3% | 9.8% | 10.2% |
| Hot Tub Heating System | 4.6% | 5.1% | 5.0% | 5.7% | 5.8% |

[1] 2013 Structure change to cooking fuel question – electric now includes electric/gas combinations
[1] 2019 Structure change to cooking fuel question – now asks about specific type of fuel
[2] 2013 Structure change to appliance/device usage question
[3] 2015 Structure change to electric swimming pool heating – now asks type of fuel

- As with heating, stability in penetration is the norm for cooking and clothes drying. Dishwashers and multiple refrigerators represent the growing appliance categories.
- More than a quarter of households have both multiple refrigerators and at least one stand-alone freezer (see Cross-Tabulations Table CT 11).
- The substantial growth of Internet-connected devices including tablets and smart phones continues along with a rebounding of personal computers in this measure. Smart phones are currently used by more than four-fifths of members.

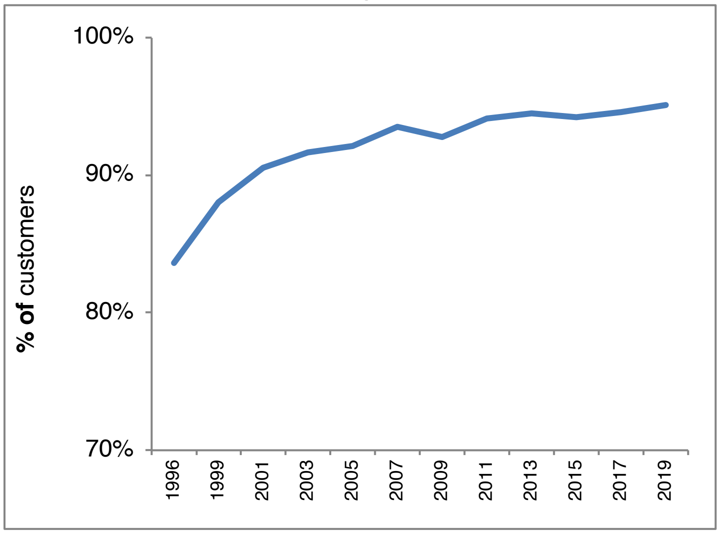
# Air Conditioning

Air Conditioning Type (Figure 6)




*Totals above are greater than 100% due to multiple air conditioning sources

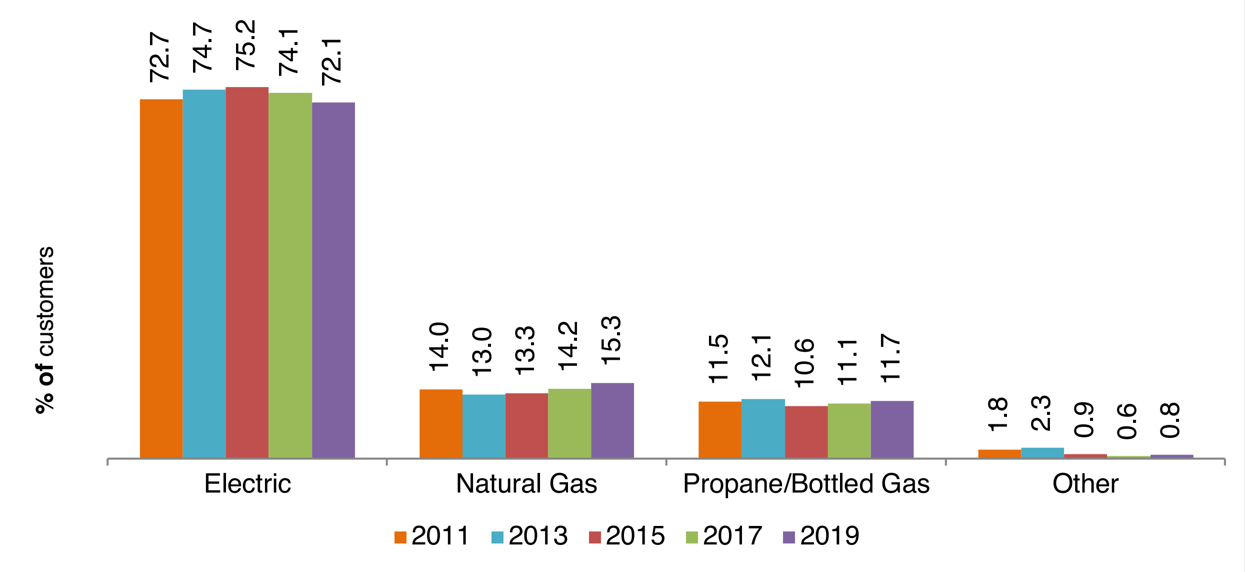
Historical Air Conditioning (Figure 6a)



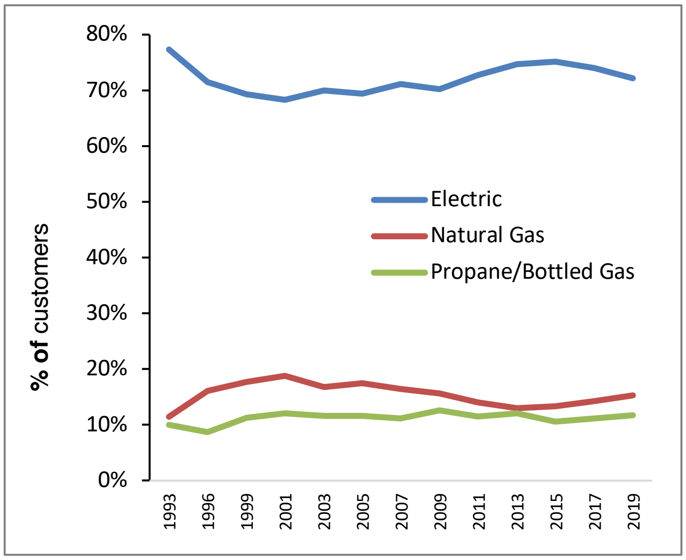

- Overall air conditioning penetration has remained constant for the past several measures (Figure 6a).
- For this survey, saturation levels vary across member systems, ranging from 91% to 98% penetration.
- Heat pumps, including geothermal, are the only equipment type with significant growth, showing a customer preference for more efficient cooling systems (Figure 6).
- This year geothermal and ductless mini-split systems were added, refining the overall results.

# Water Heating

Primary Water Heating Fuel (Figure 7)



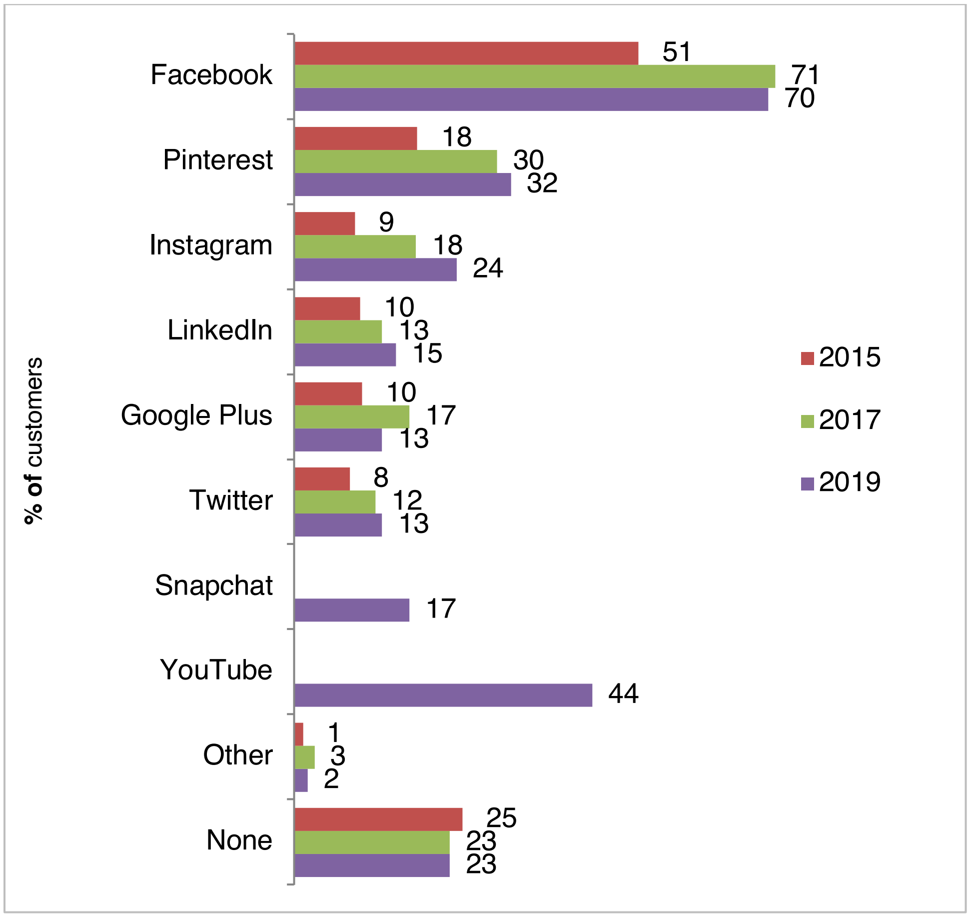

Historical Water Heating (Figure 7a)




- While electric continues to be the dominant fuel for water heating, a slight erosion in share was seen in this survey measure, with corresponding gains realized for both natural gas and propane.
- In addition to the forces driving electric heat share, water heating fuel changes may also be a function of switching to other types of equipment, such as tankless, which captures 3% of units (see Frequencies & Trends Tables FT 14).
- More than 6% of households have more than one water heater (see Frequencies & Trends Table FT 12).

# Social Network Use

Social Networking (Figure 8)




- Social network use seems to have plateaued, with less than one-fourth of those interviewed continuing to choose to use no form of social networking.
- The fastest growing platform is Instagram. Facebook has actually seen a decline in usage.
- YouTube and Snapchat were measured for the first time this year and both have sizable audiences.
- Despite this slowing of growth, the Internet is clearly an appropriate vehicle for communicating with customers, with 87% of those with electronic devices being online at home (see Frequencies & Trends Tables FT 21).

# Energy Management Technology

(Figure 9)

| Technology Used in Household | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|
| **Programmable Thermostat** | 33.0% | 40.6% | 45.8% | 44.3% | 45.8% |
| **Smart Thermostat (web enabled)** | NA | NA | NA | NA | 7.6% |
| **Programmable Thermostat (non-web enabled)** | NA | NA | NA | NA | 38.2% |
| **CFL Bulbs** | 86.0% | 87.1% | 85.9% | 80.1% | 77.9% |
| **LED Bulbs** | NA | NA | 32.3% | 56.0% | 73.0% |
| **Plug-in Electric Car** | NA | NA | 0.2% | 0.2% | 0.5% |
| **Plug-in Hybrid Vehicle** | NA | NA | NA | NA | 0.2% |
| **Full-Electric Vehicle** | NA | NA | NA | NA | 0.3% |

- While programmable thermostats exhibit no real growth, nearly a sixth are now known to be smart thermostats.
- LED usage continues to show strong growth, now noted in nearly three-quarters of homes.
- While plug-in vehicles have low penetration, the rate has more than doubled since the last measure with most customers charging at home at night (see Frequencies & Trends Tables FT 32-33).

(Figure 9a)

| Customer-owned Generation | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|
| **Back-up Generation** | NA | 18.3% | 19.0% | 17.7% | 17.5% |
| **Renewable Resources for Power Generation from Solar and Wind** | NA | NA | 1.6% | 1.4% | 1.6% |

- Back-up generation has realized no real growth, although there has been a growth in whole house stationary units instead of portable ones. A large majority of the equipment consists of gasoline powered units (see Frequencies & Trends Tables FT 28-29).
- A small but stable number of members have some form of renewable power generation in their homes, all of which is basically solar (see Frequencies & Trends Table FT 31).

# Housing Type

(Figure 10)

| Housing Characteristics | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|
| **Single Family Traditional-Built Home** | 80.2% | 79.0% | 80.2% | 79.8% | 80.4% |
| **Apt./Condo/Duplex** | 3.0% | 3.1% | 2.4% | 3.8% | 3.0% |
| **Mobile/ Manufactured Home/Modular** | 16.9% | 17.9% | 17.3% | 16.4% | 16.6% |
| *** Age of home (years)** | 22 | 23 | 23 | 33 | 32 |
| **Size of home (sq. ft.)** | 1,923 | 1,957 | 1,950 | 1,989 | 2,002 |

*Higher age of home categories added in 2017. If using the same coding as 2011, 2013 & 2015, 2017 would be 24 years and 2019 would be 24 years for HEPN comparatively.

- In terms of the housing stock of the system's members, it has remained very stable over the last several survey periods.
- Few changes in the age of home suggests that there is little shift in the housing stock – with new construction at a pace on par with retirements.
- The trend to gradually increasing square footage continues.

# Customer Profile

(Figure 11)

| Demographics | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|
| **Age** [1] | 57 | 58 | 60 | 58 |
| **Occupation** | | | | |
| Professional | 20% | 20% | 21% | 24% |
| White Collar | 11% | 11% | 11% | 13% |
| Blue Collar | 25% | 24% | 22% | 23% |
| Farmer | 3% | 3% | 4% | 3% |
| Unemployed | 1% | 2% | 1% | 2% |
| Retired | 34% | 38% | 40% | 35% |
| Other [2] | 4% | 2% | 1% | <1% |
| **Average Income** [3] | $60,508 | $62,168 | $64,914 | $74,335 |
| **Education** | | | | |
| High School or Less | 35% | 34% | 32% | 24% |
| Some College/Tech School | 25% | 26% | 25% | 27% |
| College Grad/Post-Grad | 40% | 39% | 43% | 48% |

[1] Adjusted age categories implemented in 2019. If using the same coding as 2015 and 2017, 2019 would be 59 comparatively.
[2] Other occupation category includes students, self-employed and other.
[3] Higher income categories added in 2019. If using the same coding as 2013 – 2017, 2019 $72,511 comparatively.

- In this year's measure, a slightly younger, better educated and higher income population is revealed, with fewer retired members and more professional/white collar occupations.
- Average income jumped by nearly 12% when using comparable coding, recording the greatest increase reported in these surveys.

# Frequencies & Trends

The following tables present key survey information. In addition, data from the past five studies are included to highlight trends. When referring to figures reported in past studies, some numbers may appear different due to a prior presentation approach. The numbers have been converted to facilitate direct comparisons to the latest data.

<u>Example</u>

The first table shows that in 2019, 38.7% of customers reported electricity as their primary fuel, while in 2009, 32.3% reported electricity as their primary fuel. If you wanted to use these numbers to estimate a specific number of households, the following equation can be used. In this case, we'll assume the total number of households on the system is 1,165 in 2009 and 1,681 in 2019.

| Frequencies & Trends Example | 2009 | 2019 |
|---|---|---|
| Households on system | 1,165 | 1,681 |
| % Reporting electricity as their primary fuel | x 32.3% | x 38.7% |
| Estimated system households with electricity as primary fuel | 376 | 651 |

# Frequencies and Trends Topics

| FT # | Topic |
|---|---|
| 1 | Primary fuel you currently use to heat your home? |
| 2 | Natural gas currently available in your neighborhood? |
| 3 | Primary method of heating your home? |
| 4 | Electric heating share? |
| 5 | Heat pump auxiliary fuel? |
| 6 | Supplemental heating method in your home? |
| 7 | Type of air conditioning in your home? |
| 8 | Window/wall mounted room air conditioners in home? |
| 9 | Ductless mini-split room unit air conditioners in home? |
| 10 | Water heating fuel types? |
| 11 | Water heating fuel type – Primary? |
| 12 | Number of water heaters? |
| 13 | Water heater sizes? |
| 14 | Water heater size - Primary? |
| 15 | Cooking fuel? |
| 16 | Refrigeration? |
| 17 | Washing/clothes drying? |
| 18 | Ceiling fans? |
| 19 | Computers desktop/laptop? |
| 20 | Primary home phone service? |
| 21 | Electronic devices and Internet access? |
| 22 | Devices used to access home Internet? |
| 23 | Television sets? |
| 24 | Other appliances/devices? |
| 25 | Pool heating fuel? |
| 26 | CFL bulbs used? |
| 27 | LED bulbs used? |
| 28 | Back-up generation fuel? |
| 29 | Back-up generation system? |
| 30 | Size of generator? |
| 31 | Renewable resources for electric generation? |
| 32 | Plug-in electric car? |
| 33 | Home charging times? |
| 34 | Home charger type? |
| 35 | Home type? |
| 36 | Home age? |
| 37 | Home size? |
| 38 | Number living in home? |

**Frequencies and Trends:**

| ***(FT 1) Primary Fuel*** *(Question 2)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Natural Gas | 21.0% | 20.4% | 18.1% | 19.6% | 19.5% | 20.4% |
| Electric | 32.3% | 34.9% | 38.9% | 39.0% | 38.4% | 38.7% |
| Fuel Oil | 4.0% | 3.0% | 2.6% | 2.2% | 2.6% | 1.8% |
| Propane/Bottled Gas | 33.2% | 31.0% | 30.0% | 29.8% | 29.5% | 30.0% |
| Wood | 8.9% | 9.9% | 9.9% | 8.7% | 9.3% | 8.7% |
| Other | 0.6% | 0.8% | 0.5% | 0.6% | 0.7% | 0.5% |

| ***(FT 2) Natural Gas Availability*** *(Question 1)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| | 35.5% | 35.6% | 33.1% | 32.7% | 33.8% | 32.6% |

| ***(FT 3) *Primary Electric*** *(Question 3)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Electric Furnace | 12.5% | 13.8% | 15.2% | 15.8% | 14.0% | 13.5% |
| Electric Wall Unit | 0.4% | 0.6% | 0.5% | 0.6% | 0.5% | 0.4% |
| Electric Base Board | 3.4% | 2.9% | 2.6% | 2.9% | 2.6% | 2.5% |
| Electric Ceiling Cable | 1.3% | 1.0% | 1.4% | 1.2% | 1.3% | 1.0% |
| Heat Pump | 9.6% | 9.6% | 12.8% | 11.9% | 12.4% | 13.4% |
| Geothermal | 3.2% | 4.3% | 4.1% | 4.2% | 5.2% | 5.4% |
| Ductless Mini-Split | NA | NA | NA | NA | NA | 0.2% |
| Electric Thermal Storage | 0.7% | 0.8% | 0.7% | 0.5% | 0.9% | 0.7% |
| Electric Room Heater | 0.8% | 0.7% | 0.8% | 1.2% | 0.9% | 1.0% |

% Based on all study respondents to Q2 less the "Don't Know."

| ***(FT 4) Electric Heating Share*** *(Question 3)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Electric Furnace | 38.8% | 39.6% | 39.1% | 40.5% | 36.5% | 35.6% |
| Electric Baseboard | 10.5% | 8.3% | 6.6% | 7.4% | 6.8% | 6.6% |
| Heat Pump | 29.6% | 29.7% | 33.1% | 30.6% | 32.3% | 35.1% |
| Geothermal | 9.8% | 12.2% | 10.7% | 10.7% | 13.5% | 14.2% |
| *Other Electric | 11.1% | 10.2% | 10.5% | 10.8% | 10.9% | 8.6% |

% Based on all study respondents who have primary electric systems.

*Other Electric may be portable room heaters, ceiling cable, wall units, central ETS, room ETS, multi-room ductless mini-split, single-room ductless mini-split, or other electric heating systems.

| ***(FT 5) Heat Pump Auxiliary Fuel*** *(Question 3g)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Natural Gas | NA | NA | 5.2% | 3.1% | 3.3% | 2.5% |
| Electric | NA | NA | 63.9% | 75.0% | 78.2% | 79.3% |
| Fuel Oil | NA | NA | 1.5% | 0.6% | 0.5% | 0.5% |
| Propane/Bottled Gas | NA | NA | 13.3% | 9.3% | 9.8% | 10.2% |
| Wood | NA | NA | 13.2% | 6.9% | 6.8% | 4.6% |
| Other | NA | NA | 2.9% | 5.0% | 1.4% | 3.0% |

% Based on respondents with a heat pump less "Don't Know."

| ***(FT 6) Supplemental Heating*** *(Questions 5 & 5a)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Central Furnace: Natural Gas | 0.8% | 0.6% | 0.9% | 0.8% | 0.6% | 0.7% |
| Central Furnace: Bottled Gas | 3.1% | 3.3% | 3.9% | 3.0% | 3.5% | 3.2% |
| Central Furnace: Fuel Oil | 0.3% | 0.4% | 0.6% | 0.3% | 0.4% | 0.3% |
| Central Furnace: Electric | 1.4% | 1.8% | 2.5% | 1.7% | 1.9% | 2.2% |
| Central Furnace: Wood | 0.7% | 0.7% | 0.7% | 0.7% | 0.9% | 0.8% |
| Heat Pump | 1.4% | 1.6% | 2.4% | 3.0% | 2.9% | 3.0% |
| Geothermal | 0.1% | 0.6% | 0.2% | 0.3% | 0.4% | 0.3% |
| Ductless Mini-Split | NA | NA | NA | NA | NA | 0.5% |
| Electric Thermal Storage | 0.7% | 0.5% | 0.5% | 0.4% | 0.7% | 0.3% |
| Electric: Wall Unit | 0.8% | 0.8% | 0.5% | 0.8% | 0.9% | 1.0% |
| Electric: Ceiling Cable | 0.3% | 0.3% | 0.3% | 0.5% | 0.5% | 0.3% |
| Electric: Base Board | 2.1% | 2.4% | 2.2% | 2.0% | 2.0% | 1.7% |
| Room Heater: Gas-Oil-Kerosene | 2.9% | 2.8% | 2.7% | 2.1% | 2.3% | 2.3% |
| Room Heater: Electric | 14.9% | 15.1% | 15.1% | 16.5% | 13.9% | 14.3% |
| Free Standing Wood Stove | 7.0% | 7.5% | 6.9% | 7.8% | 6.3% | 6.3% |
| Fireplace: Wood Stove Insert | 4.6% | 4.2% | 5.5% | 5.2% | 5.6% | 5.6% |
| Wood Burning Fireplace | 4.4% | 4.1% | 4.6% | 3.9% | 4.2% | 4.2% |
| Outdoor Wood Burning Furnace | NA | NA | 0.6% | 0.4% | 0.4% | 0.4% |
| Solar Panels | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% |
| Other | 3.1% | 3.3% | 4.2% | 5.0% | 3.3% | 2.8% |

% Based on all study respondents to Q5 less the "Don't Know."

| ***(FT 7) Air Conditioning Systems*** *(Questions 6 – 6c)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| No Air Conditioning | 7.2% | 5.9% | 5.5% | 5.8% | 5.4% | 4.9% |
| Central Air | 68.8% | 70.5% | 69.8% | 68.2% | 68.6% | 69.1% |
| Heat Pump | 11.6% | 13.3% | 14.7% | 15.9% | 15.8% | 12.7% |
| Geothermal | NA | NA | NA | NA | NA | 5.0% |
| Window/Wall Mounted Units-Whole House Cooling | 8.8% | 6.6% | 7.5% | 7.0% | 7.4% | 6.1% |
| Window/Wall Mounted Units-Room Cooling | 6.9% | 7.5% | 7.6% | 7.9% | 9.3% | 8.9% |
| Ductless Mini-Split Units-Whole House Cooling | NA | NA | NA | NA | NA | 0.2% |
| Ductless Mini-Split Units-Room Cooling | NA | NA | NA | NA | NA | 0.5% |

% Based on all study respondents.

| ***(FT 8) # of Window/Wall Mounted Room Units*** *(Questions 6c)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 | 84.8% | 85.8% | 84.9% | 85.6% | 82.5% | 84.4% |
| 1 | 11.4% | 9.9% | 10.5% | 9.9% | 12.3% | 6.8% |
| 2 | 2.3% | 2.8% | 2.8% | 2.8% | 3.3% | 5.4% |
| 3 or more | 1.5% | 1.5% | 1.8% | 1.7% | 2.0% | 3.3% |

% Based on study respondents that have air conditioning.

| ***(FT 9) # of Ductless Mini-Split Room Units (Questions 6b)*** | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 | NA | NA | NA | NA | NA | 99.2% |
| 1 | NA | NA | NA | NA | NA | 0.4% |
| 2 | NA | NA | NA | NA | NA | 0.2% |
| 3 or more | NA | NA | NA | NA | NA | 0.2% |

% Based on study respondents that have air conditioning.

| ***(FT 10) Water Heating Fuels in Household*** *(Question 8)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Electric | NA | NA | 74.7% | 76.0% | 74.6% | 72.6% |
| Natural Gas | NA | NA | 13.0% | 13.5% | 14.3% | 15.4% |
| Propane/Bottled Gas | NA | NA | 12.1% | 10.8% | 11.4% | 11.9% |
| Fuel Oil | NA | NA | 0.1% | 0.1% | 0.0% | 0.1% |
| Wood | NA | NA | 1.3% | 1.0% | 0.8% | 0.3% |
| Other | NA | NA | 0.9% | 0.4% | 0.1% | 0.8% |

*Question structure change in 2013 to allow multiple fuels.

% Based on those households with a water heater.

| ***(FT 11) Water Heating Fuel - Primary*** *(Question 8)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Electric | 70.2% | 72.7% | 74.7% | 75.2% | 74.1% | 72.1% |
| Natural Gas | 15.6% | 14.0% | 13.0% | 13.3% | 14.2% | 15.3% |
| Propane/Bottled Gas | 12.6% | 11.5% | 12.1% | 10.6% | 11.1% | 11.7% |
| Fuel Oil | 0.0% | 0.1% | 0.1% | 0.1% | 0.0% | 0.1% |
| Wood | NA | NA | 1.3% | 0.7% | 0.5% | 0.3% |
| Other | 1.6% | 1.6% | 0.9% | 0.2% | 0.1% | 0.4% |

*Question structure change in 2013 to allow multiple sizes without distinguishing primary. Starting in 2017, distinguish primary. For 2013 only, total may equal more than 100%.

% Based on those households with a water heater.

| ***(FT 12) # of Water Heaters*** *(Question 8x)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 | NA | NA | 0.6% | 0.6% | 0.2% | 1.0% |
| 1 | NA | NA | 93.2% | 93.5% | 93.7% | 92.6% |
| 2 | NA | NA | 5.9% | 5.5% | 5.9% | 5.9% |
| 3 or more | NA | NA | 0.3% | 0.3% | 0.3% | 0.5% |

| ***(FT 13) Water Heater Sizes in Household*** *(Question 8a)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Under 30 gallons | NA | NA | 3.3% | 3.5% | 4.0% | 4.6% |
| 30 but less than 40 gallons | NA | NA | 15.2% | 16.0% | 17.6% | 18.4% |
| 40 but less than 50 gallons | NA | NA | 35.4% | 37.0% | 34.0% | 34.3% |
| 50 but less than 60 gallons | NA | NA | 34.6% | 31.8% | 33.5% | 31.7% |
| 60 but less than 80 gallons | NA | NA | 5.7% | 5.4% | 5.6% | 5.8% |
| 80 or more gallons | NA | NA | 6.2% | 5.7% | 4.9% | 4.4% |
| Tankless | NA | NA | 1.6% | 1.9% | 2.0% | 3.2% |
| Other | NA | NA | 0.4% | 0.5% | 0.1% | 0.2% |

*Question structure change in 2013 to allow multiple sizes.

% Based on those households with a water heater less the “Don’t Know”.

| ***(FT 14) Water Heater Size - Primary*** *(Question 8a)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Under 30 gallons | 4.6% | 3.4% | 3.3% | 3.2% | 3.4% | 3.9% |
| 30 but less than 40 gallons | 19.8% | 18.8% | 15.2% | 15.6% | 17.3% | 17.9% |
| 40 but less than 50 gallons | 35.0% | 36.0% | 35.4% | 36.8% | 33.7% | 33.7% |
| 50 but less than 60 gallons | 28.7% | 29.7% | 34.6% | 31.7% | 33.2% | 31.4% |
| 60 but less than 80 gallons | 5.2% | 5.2% | 5.7% | 5.3% | 5.6% | 5.6% |
| 80 or more gallons | 5.3% | 6.0% | 6.2% | 5.7% | 4.8% | 4.3% |
| Tankless | NA | 1.2% | 1.6% | 1.8% | 1.9% | 3.0% |
| Other | 1.5% | 0.6% | 0.4% | 0.1% | 0.1% | 0.2% |

*Question structure change in 2013 to allow multiple sizes without distinguishing primary. Starting in 2017, distinguish primary. For 2013 only, total may equal more than 100%.

% Based on those households with a water heater.

| ***(FT 15) Cooking Fuel*** *(Question 9)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Electric | 73.3% | 74.7% | 75.1% | 75.7% | 74.3% | 72.7% |
| *Gas | 25.7% | 24.2% | 22.1% | 21.4% | 22.7% | NA |
| Natural Gas | NA | NA | NA | NA | NA | 7.5% |
| LP/Bottled Gas/Propane | NA | NA | NA | NA | NA | 14.2% |
| *Gas and Electricity | NA | NA | 2.3% | 2.3% | 2.4% | NA |
| Natural Gas & Electricity | NA | NA | NA | NA | NA | 1.5% |
| LP/Bottled Gas/Propane & Electricity | NA | NA | NA | NA | NA | 3.7% |
| Wood | NA | NA | 0.1% | 0.1% | 0.1% | 0.0% |
| Other | 0.4% | 0.5% | 0.2% | 0.1% | 0.1% | 0.0% |
| None | 0.6% | 0.5% | 0.2% | 0.4% | 0.4% | 0.3% |
| Microwave | 98.3% | 98.3% | 98.4% | 98.5% | 98.3% | 97.8% |

*Gas includes Natural Gas & Propane/Bottled Gas. Asked gas type beginning in 2019.

| ***(FT 16) Refrigeration*** *(Question 11)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| No Refrigerator | 0.3% | 0.3% | 0.2% | 0.2% | 0.5% | 0.5% |
| 1 Refrigerator | 67.4% | 65.6% | 66.4% | 65.4% | 63.5% | 59.6% |
| 2 Refrigerators | 29.1% | 30.9% | 30.0% | 30.6% | 31.3% | 34.6% |
| 3 or More Refrigerators | 3.2% | 3.2% | 3.4% | 3.9% | 4.7% | 5.2% |
| Standard Freezer | 35.8% | 33.0% | 35.3% | 34.8% | 37.1% | 36.8% |
| Frost Free Freezer | 38.6% | 39.4% | 40.0% | 38.1% | 42.5% | 39.4% |

| ***(FT 17) Washing/Drying*** *(Questions 10 & 11)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Washing Machine | 95.0% | 96.5% | 95.8% | 96.3% | 96.2% | 96.5% |
| Electric Dryer | 86.6% | 89.6% | 89.6% | 90.0% | 90.7% | 90.0% |
| *Gas Dryer | 7.4% | 6.0% | 6.5% | 6.1% | 6.0% | NA |
| Natural Gas Dryer | NA | NA | NA | NA | NA | 3.6% |
| LP/Bottled Gas/Propane Dryer | NA | NA | NA | NA | NA | 2.8% |
| No Dryer | 5.8% | 4.3% | 3.7% | 3.8% | 3.1% | 3.5% |

*Gas includes Natural Gas & Propane/Bottled Gas. Asked gas type beginning in 2019.

| ***(FT 18) Ceiling Fans*** *(Question 11)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 | 14.3% | 13.4% | 12.7% | 12.0% | 12.1% | 11.2% |
| 1 | 19.3% | 18.4% | 18.5% | 18.4% | 17.8% | 15.7% |
| 2 | 18.8% | 17.7% | 17.9% | 18.3% | 17.5% | 17.3% |
| 3 | 15.1% | 16.2% | 15.3% | 17.0% | 15.4% | 15.9% |
| 4 | 14.0% | 14.2% | 14.5% | 15.4% | 15.5% | 16.3% |
| 5 or more | 18.5% | 20.0% | 21.0% | 18.9% | 21.6% | 23.7% |

| ***(FT 19) Computers (desktop / laptop)*** *(Question 11)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 | 32.2% | 27.3% | 27.0% | 27.7% | 28.8% | 20.7% |
| 1 | 48.2% | 48.3% | 43.4% | 41.7% | 46.5% | 40.5% |
| 2 | 13.3% | 15.6% | 19.6% | 20.7% | 16.7% | 24.3% |
| 3 | 3.9% | 5.4% | 6.6% | 6.5% | 5.2% | 9.1% |
| 4 | 1.4% | 2.1% | 2.1% | 2.1% | 1.6% | 3.2% |
| 5 or more | 0.7% | 1.2% | 1.3% | 1.3% | 1.1% | 2.3% |

| ***FT 20) Primary Home Phone Service*** *(Questions 11e & 11f)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Landline | NA | 68.7% | 55.6% | 46.9% | 45.8% | 37.1% |
| Cell Phone | NA | 29.5% | 42.6% | 51.1% | 51.8% | 60.1% |
| Voice Over IP | NA | 1.8% | 1.8% | 2.0% | 2.4% | 2.8% |

| ***(FT 21) Electronic Devices & Internet Access*** *(Questions 11, 11a)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Computer (desktop / laptop) | NA | NA | 73.0% | 72.3% | 71.2% | 79.3% |
| Smart Phone | NA | NA | 47.3% | 61.4% | 69.3% | 81.1% |
| Tablet, iPad, Reader, other Portable Device | NA | NA | 34.4% | 47.5% | 60.0% | 63.2% |
| Have at least one of these devices | NA | NA | 79.4% | 82.0% | 85.8% | 91.3% |
| Do not use Internet at home | NA | NA | 30.2% | 26.8% | 23.6% | 13.3% |

| ***(FT 22) *Devices Used to Access Internet at Home (Question 11a)"*** | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Computer (desktop / laptop) | NA | NA | 93.0% | 88.0% | 70.5% | 69.0% |
| Smart Phone | NA | NA | 72.8% | 71.5% | 65.9% | 67.7% |
| Tablet, iPad, Reader, other Portable Device | NA | NA | 76.2% | 62.5% | 51.6% | 46.7% |
| TV | NA | NA | NA | NA | NA | 27.3% |

*Question change in 2019. 2013-2017 percentages based upon previous question.

| ***(FT 23) Television Sets*** *(Question 11)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 | 2.5% | 3.0% | 2.3% | 2.5% | 3.0% | 2.3% |
| 1 | 21.9% | 23.2% | 21.1% | 21.6% | 20.4% | 20.3% |
| 2 | 32.7% | 31.9% | 32.8% | 32.1% | 33.1% | 31.6% |
| 3 | 22.5% | 23.2% | 23.0% | 23.4% | 22.6% | 23.2% |
| 4 | 13.1% | 11.4% | 13.1% | 12.6% | 12.7% | 13.8% |
| 5 or more | 7.3% | 7.2% | 7.7% | 7.8% | 8.2% | 8.8% |

| ***(FT 24) Other*** *(Questions 7a, 11, 11aa - 11ad)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Water Bed Heater | 4.2% | 3.4% | 2.9% | 2.5% | 2.2% | 1.9% |
| Swimming Pool Pump | NA | NA | NA | 9.3% | 9.8% | 10.2% |
| Swimming Pool Heating System | 0.8% | 1.1% | 1.0% | 0.5% | 0.3% | 0.8% |
| Hot Tub Heating System | 5.2% | 4.6% | 5.1% | 5.0% | 5.7% | 5.8% |
| Dishwasher | 61.6% | 64.5% | 64.6% | 65.2% | 66.6% | 70.6% |
| *Programmable Thermostat | NA | 33.0% | 40.6% | 45.8% | 44.3% | NA |
| Smart Thermostat (web enabled) | NA | NA | NA | NA | NA | 7.6% |
| Programmable Thermostat (non-web enabled) | NA | NA | NA | NA | NA | 38.2% |
| Compact Fluorescent Lighting | NA | 86.0% | 87.1% | 85.9% | 80.1% | 77.9% |
| LED Lighting | NA | NA | NA | 32.3% | 56.0% | 73.0% |
| Gaming Systems | NA | NA | NA | 29.8% | 29.2% | 32.0% |
| Satellite or Cable Boxes | NA | NA | NA | 72.7% | 72.5% | 67.9% |

*Programmable Thermostat includes Smart Thermostat (web enabled) and Programmable Thermostat (non-web enabled.) Asked Programmable Thermostat type beginning in 2019.

| ***(FT 25) Pool Heating Fuel*** *(Question 11ab)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| *Natural Gas | NA | NA | NA | 4.0% | 5.5% | 5.1% |
| *Electric | NA | NA | NA | 5.1% | 3.6% | 8.6% |
| *Propane/Bottled Gas | NA | NA | NA | 3.8% | 6.0% | 5.3% |
| *Solar | NA | NA | NA | 15.3% | 20.1% | 14.5% |
| *Other | NA | NA | NA | 0.9% | 1.2% | 0.1% |
| *Do not heat pool | NA | NA | NA | 71.0% | 63.6% | 66.4% |
| Do not have Swimming Pool with Pump | NA | NA | NA | 90.7% | 90.2% | 89.8% |

*Based on households with a pool with a pump less the “Don’t Know”.

| ***(FT 26) CFL Bulbs*** *(Question 11ac)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 | 21.6% | 14.0% | 12.9% | 14.1% | 19.9% | 22.1% |
| 1 to 5 | 31.8% | 24.7% | 21.0% | 19.9% | 19.9% | 20.9% |
| 6 to 10 | 23.5% | 26.9% | 25.2% | 24.8% | 24.9% | 22.8% |
| 11 to 15 | 11.7% | 14.3% | 16.2% | 16.3% | 12.9% | 12.5% |
| 16 to 20 | 5.6% | 9.9% | 11.6% | 11.5% | 9.2% | 9.3% |
| 21 to 25 | 2.4% | 4.0% | 5.5% | 4.6% | 4.6% | 4.2% |
| 26 to 30 | 1.6% | 3.2% | 3.3% | 4.1% | 3.7% | 3.4% |
| More than 30 | 1.8% | 3.1% | 4.3% | 4.8% | 4.8% | 4.8% |

| ***(FT 27) LED Bulbs*** *(Question 11ad)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 | NA | NA | NA | 67.7% | 44.0% | 27.0% |
| 1 to 5 | NA | NA | NA | 20.4% | 24.9% | 27.6% |
| 6 to 10 | NA | NA | NA | 7.2% | 14.9% | 16.4% |
| 11 to 15 | NA | NA | NA | 2.3% | 5.5% | 7.8% |
| 16 to 20 | NA | NA | NA | 1.1% | 4.5% | 7.3% |
| 21 to 25 | NA | NA | NA | 0.4% | 1.8% | 3.3% |
| 26 to 30 | NA | NA | NA | 0.4% | 1.7% | 3.5% |
| More than 30 | NA | NA | NA | 0.6% | 2.7% | 7.0% |

| ***(FT 28) Back-up Generation Fuel*** *(Questions 11g & 11h)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Back-up electricity generation | NA | NA | 18.3% | 19.0% | 17.7% | 17.5% |
| *Natural Gas | NA | NA | 2.9% | 1.7% | 3.7% | 3.8% |
| *Gasoline | NA | NA | 84.0% | 84.3% | 77.1% | 74.8% |
| *LP/Propane/Bottled Gas | NA | NA | 4.9% | 8.0% | 12.2% | 16.2% |
| *Diesel | NA | NA | 5.8% | 4.7% | 5.7% | 4.1% |
| *Other Fuel | NA | NA | 2.4% | 1.2% | 1.3% | 1.2% |

*% Based on households with a back-up electricity generator.

| ***(FT 29) Back-up Generation Systems*** *(Questions 11gg & 11ggg)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Stationary Whole-house | NA | NA | NA | 8.2% | 11.4% | 14.2% |
| Stationary Partial-house | NA | NA | NA | 4.8% | 4.3% | 4.6% |
| Portable | NA | NA | NA | 87.0% | 84.7% | 81.8% |

% Based on households with a back-up electricity generator.

Q11gg was changed in 2017 to allow multiple responses to back-up electricity generator type.

| ***(FT 30) Size of Generator*** *(Question 11hh)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 0 - 5 KW | NA | NA | NA | 23.6% | 18.9% | 20.8% |
| Greater than 5 KW | NA | NA | NA | 38.3% | 41.2% | 45.8% |
| Don't Know | NA | NA | NA | 38.1% | 39.9% | 33.4% |

% Based on households with a back-up electricity generator.

| ***(FT 31) Renewable Resources for Electric Generation*** *(Question 11i)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Generate Electric through Renewable Resources | NA | NA | NA | 1.6% | 1.4% | 1.6% |
| Solar | NA | NA | NA | 1.5% | 1.4% | 1.5% |
| Wind | NA | NA | NA | 0.4% | 0.1% | 0.1% |

| ***(FT 32) Plug-in Electric Car*** *(Questions 11ii & 11j)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| *Have Plug-in Electric Car | NA | NA | NA | 0.2% | 0.2% | NA |
| Plug-in Hybrid vehicle | NA | NA | NA | NA | NA | 0.2% |
| Full-electric vehicle | NA | NA | NA | NA | NA | 0.3% |
| **Home | NA | NA | NA | 78.1% | 89.6% | 91.3% |
| **Work | NA | NA | NA | 0.0% | 20.9% | 13.0% |
| **Other | NA | NA | NA | 21.9% | 0.0% | 11.3% |

*Have Plug-in Electric Car includes Plug-in Hybrid and Full-electric vehicles. Asked Electric Car type beginning in 2019.

**% Based on households with plug-in electric car.

| ***(FT 33) Home Charging Times (Questions 11jjj)*** | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Weekdays from 7:00 AM to 10:00 AM | NA | NA | NA | NA | NA | 23.6% |
| Weekdays from 10:00 AM to 2:00 PM | NA | NA | NA | NA | NA | 24.6% |
| Weekday evenings from 2:00 PM to 9:00 PM | NA | NA | NA | NA | NA | 44.3% |
| Weekdays overnight from 9:00 PM to 7:00 AM | NA | NA | NA | NA | NA | 70.6% |
| Weekends | NA | NA | NA | NA | NA | 35.3% |

*% Based on households with plug-in electric car.

| ***(FT 34) Home Charger Type (Questions 11jj)*** | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Standard 120-volt charger | NA | NA | NA | NA | NA | 42.1% |
| Fast 240-volt charger | NA | NA | NA | NA | NA | 49.8% |
| Other | NA | NA | NA | NA | NA | 0.0% |
| Don’t know | NA | NA | NA | NA | NA | 8.0% |

*% Based on households with plug-in electric car.

| ***(FT 35) Home Type*** *(Questions 12 & 12a)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Single-Family Traditionally Built Home | 80.6% | 80.2% | 79.0% | 80.2% | 79.8% | 80.4% |
| Two-Family Home (Duplex) | 1.3% | 1.4% | 1.6% | 1.0% | 2.4% | 1.5% |
| Apartment (3+ Families) | 0.9% | 1.4% | 1.2% | 1.2% | 1.0% | 1.2% |
| Condominium | 0.2% | 0.2% | 0.3% | 0.2% | 0.4% | 0.3% |
| Mobile Home | 7.7% | 7.5% | 7.6% | 7.2% | 6.4% | 5.3% |
| *Manufactured Home | 9.2% | 9.4% | 10.3% | 10.1% | 5.0% | 5.9% |
| *Modular Home | NA | NA | NA | NA | 5.1% | 5.4% |

*Manufactured and modular homes broken out separately starting in 2017.

| ***(FT 36) Home Age*** *(Question 13)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 5 Years or Less | 10.1% | 7.8% | 6.3% | 6.0% | 4.9% | 6.1% |
| 6 to 10 Years | 11.9% | 11.4% | 10.7% | 9.0% | 7.2% | 5.3% |
| 11 to 20 Years | 15.8% | 18.9% | 20.7% | 19.1% | 18.5% | 19.6% |
| *21 to 40 Years | 60.8% | 60.4% | 60.3% | 64.1% | 25.9% | 26.9% |
| *Over 40 Years | NA | NA | NA | NA | 40.8% | 39.7% |
| Don't Know/Refused | 1.4% | 1.5% | 2.0% | 1.9% | 2.8% | 2.4% |

*Higher age of home categories added in 2017.

| ***(FT 37) Total Home Living Space*** *(Question 15)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| Under 800 Square Feet | 3.1% | 3.5% | 3.0% | 2.3% | 2.4% | 2.5% |
| 800 to 1500 Square Feet | 24.2% | 24.1% | 23.5% | 23.0% | 22.4% | 22.8% |
| 1500 to 2500 Square Feet | 36.9% | 38.2% | 38.2% | 38.4% | 37.7% | 40.2% |
| Over 2500 Square Feet | 12.3% | 12.6% | 13.4% | 12.4% | 13.4% | 15.1% |
| Over 3500 Square Feet | 4.5% | 5.8% | 6.5% | 5.8% | 7.1% | 7.2% |
| Don't Know/Refused | 18.9% | 15.8% | 15.4% | 18.1% | 16.9% | 12.2% |

| ***(FT 38) Number Living in Home*** *(Question 17)* | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 |
|---|---|---|---|---|---|---|
| 1 | 18.1% | 18.1% | 18.3% | 20.0% | 20.2% | 19.0% |
| 2 | 46.7% | 45.3% | 45.3% | 47.0% | 48.3% | 48.7% |
| 3 | 14.4% | 14.6% | 14.9% | 13.9% | 13.3% | 12.6% |
| 4 | 12.8% | 13.5% | 12.4% | 10.8% | 10.2% | 11.1% |
| 5 | 4.7% | 5.4% | 5.6% | 5.0% | 4.8% | 5.3% |
| 6 or more | 3.3% | 3.1% | 3.6% | 3.3% | 3.2% | 3.3% |

# Cross-Tabulations

The following cross-tabulations allow for the simultaneous exploration of two questions. For example, the first cross-tab provides information on the age of each type of primary heat system. The first table indicates that 246 respondents or 18.4% of primary natural gas heating systems are less than three (3) years old, while 280, or 21.0%, of systems are more than fifteen (15) years old.

The following cross-tabulations are presented in the tables:

| CT # | Topic |
|---|---|
| 1 | Primary heating system type versus age of heating system? |
| 2 | What is the average home size for each primary heating fuel? |
| 3 | Home heating fuel versus water heating fuel? |
| 4 | Primary electric heating systems versus housing type? |
| 5 | Primary electric heating systems versus income category? |
| 6 | Primary water heater size versus water heating fuel? |
| 7 | Primary water heating fuel versus age of water heater? |
| 8 | Primary water heater size versus age of water heater? |
| 9 | Air conditioning type versus age of air conditioner? |
| 10 | Electric generation system versus generation fuel? |
| 11 | Number of refrigerators versus stand-alone freezers? |
| 12 | Computer, smart phone and tablet/iPad/reader in household vs. level of education? |
| 13 | Computer, smart phone and tablet/iPad/reader in household vs. age of respondent? |
| 14 | Size of home vs. age of home? |

## Approximately how old is your primary heating system? (CT 1)

| (Questions 3 & 4) | Age of System | | | | | |
|---|---|---|---|---|---|---|
| Type Heating System | < 3 yrs old | 3-5 yrs old | 6-10 yrs old | 11-15 yrs old | > 15 yrs old | Don't Know |
| Central Furnace using natural gas | 246 | 229 | 271 | 206 | 280 | 107 |
| | 18.4% | 17.1% | 20.2% | 15.4% | 21.0% | 8.0% |
| Central furnace using LP/bottled gas/propane | 360 | 261 | 382 | 243 | 529 | 115 |
| | 19.0% | 13.8% | 20.2% | 12.8% | 28.0% | 6.1% |
| Central furnace using fuel oil | 6 | 9 | 25 | 13 | 50 | 9 |
| | 5.5% | 7.6% | 22.7% | 11.9% | 44.6% | 7.7% |
| Central furnace using electricity | 139 | 138 | 173 | 159 | 207 | 94 |
| | 15.3% | 15.2% | 19.0% | 17.5% | 22.8% | 10.3% |
| Central furnace using wood | 7 | 8 | 12 | 9 | 23 | 4 |
| | 10.4% | 12.2% | 18.6% | 15.1% | 36.8% | 6.8% |
| Air to air heat pump | 258 | 168 | 231 | 117 | 92 | 32 |
| | 28.7% | 18.7% | 25.7% | 13.0% | 10.3% | 3.6% |
| Geothermal heat pump | 69 | 76 | 113 | 49 | 51 | 6 |
| | 19.0% | 20.8% | 31.0% | 13.5% | 14.0% | 1.6% |
| Other Electric | 53 | 44 | 35 | 29 | 227 | 42 |
| | 12.3% | 10.2% | 8.2% | 6.8% | 52.8% | 9.8% |
| Other | 85 | 147 | 168 | 77 | 187 | 42 |
| | 12.1% | 20.8% | 23.8% | 10.9% | 26.5% | 5.9% |

*Percentages may not add to 100% due to rounding. Totals may not add to sample size because of missing data.
*Percentages calculated by row.

## What is the average home size for each primary heating fuel? (CT 2)

| (Questions 2 & 15) | Size of Home |
|---|---|
| Primary Heating Fuel | Average size of home (sq. ft.) |
| Natural Gas | 2,121 |
| Electric | 1,999 |
| Fuel Oil | 1,833 |
| LP/Bottled Gas | 1,940 |
| Wood | 1,969 |
| Other | 2,009 |

## What type of fuel is used to heat water in your home? (CT 3)

| (Questions 2 & 8a) | Water Heating Fuel | | | | | |
|---|---|---|---|---|---|---|
| Primary Heating Fuel | Natural Gas | Electric | Fuel Oil | LP/Bottled Gas | Wood | Other |
| Natural Gas | 901 | 442 | 0 | 3 | 0 | 0 |
| | 67.5% | 33.1% | 0.0% | 0.2% | 0.0% | 0.0% |
| Electric | 87 | 2384 | 1 | 65 | 1 | 36 |
| | 3.4% | 93.8% | 0.1% | 2.5% | 0.0% | 1.4% |
| Fuel Oil | 1 | 116 | 2 | 1 | 0 | 0 |
| | 0.7% | 97.0% | 1.6% | 0.7% | 0.0% | 0.0% |
| LP/Bottled Gas | 9 | 1325 | 2 | 639 | 0 | 11 |
| | 0.5% | 67.5% | 0.1% | 32.6% | 0.0% | 0.5% |
| Wood | 11 | 469 | 1 | 67 | 19 | 4 |
| | 2.0% | 83.3% | 0.2% | 11.8% | 3.5% | 0.7% |
| Other | 1 | 23 | 0 | 6 | 0 | 0 |
| | 3.0% | 77.6% | 0.0% | 19.4% | 0.0% | 0.0% |

*Percentages may add to more than 100% due to multiple water heaters.
*Percentages calculated by row.

## <u>Primary</u> electric heating systems versus housing type? (CT 4)

| (Questions 3, 12 & 12a) | Type of Home | | | | | |
|---|---|---|---|---|---|---|
| Primary Electric Heating System | Single Family Traditionally Built Home | Apartment Condo Duplex | Mobile Home | Manufactured Home | Modular Home | Don't Know |
| Electric Furnace | 456 | 53 | 134 | 130 | 106 | 30 |
| | 50.2% | 5.9% | 14.7% | 14.2% | 11.7% | 3.4% |
| Electric Baseboard | 136 | 6 | 4 | 8 | 5 | 8 |
| | 81.1% | 3.6% | 2.6% | 4.8% | 3.2% | 4.7% |
| Heat Pump | 764 | 7 | 13 | 48 | 52 | 14 |
| | 85.2% | .8% | 1.4% | 5.3% | 5.8% | 1.5% |
| Geothermal | 344 | 2 | 1 | 3 | 8 | 6 |
| | 94.7% | .5% | .2% | .7% | 2.3% | 1.5% |
| Other Electric | 201 | 11 | 22 | 10 | 4 | 15 |
| | 76.6% | 4.1% | 8.2% | 3.8% | 1.7% | 5.6% |

*Percentages may not add to 100% due to rounding.  Totals may not add to sample size because of missing data.
*Percentages calculated by row.

## **Primary** electric heating systems versus income category? (CT 5)

| (Questions 3 & 21) | Household Income | | | | | | |
|---|---|---|---|---|---|---|---|
| Primary Electric Heating System | Less than $30,000 | $30,000 but less than $50,000 | $50,000 but less than $80,000 | $80,000 but less than $100,000 | $100,000 but less than $150,000 | $150,000 but less than $200,000 | $200,000 or more |
| Electric Furnace | 159 | 150 | 176 | 80 | 83 | 21 | 20 |
| | 23.1% | 21.8% | 25.6% | 11.6% | 12.0% | 3.0% | 2.9% |
| Electric Baseboard | 31 | 25 | 33 | 11 | 9 | 2 | 2 |
| | 28.1% | 22.1% | 29.4% | 9.4% | 8.0% | 1.6% | 1.5% |
| Heat Pump | 53 | 126 | 160 | 104 | 123 | 31 | 29 |
| | 8.5% | 20.1% | 25.6% | 16.6% | 19.7% | 4.9% | 4.6% |
| Geothermal | 13 | 27 | 58 | 40 | 66 | 26 | 28 |
| | 5.0% | 10.6% | 22.4% | 15.6% | 25.5% | 10.1% | 10.8% |
| Other Electric | 51 | 40 | 32 | 13 | 14 | 4 | 1 |
| | 33.1% | 25.6% | 20.8% | 8.1% | 9.2% | 2.6% | 0.6% |

*Percentages may not add to 100% due to rounding. Totals may not add to sample size because of missing data.
*Percentages calculated by row.

## **Primary** water heater size versus **primary** water heating fuel? (CT 6)

| (Questions 8a & 8) | Primary Water Heating Fuel | | | | | |
|---|---|---|---|---|---|---|
| Size in gallons | Natural Gas | Electric | Fuel Oil | LP/Bottled Gas | Wood | Other |
| Under 30 gallons | 24 | 157 | 0 | 24 | 0 | 0 |
| | 11.8% | 76.5% | 0.0% | 11.8% | 0.0% | 0.0% |
| 30 but less than 40 | 141 | 675 | 0 | 131 | 1 | 0 |
| | 14.9% | 71.2% | 0.0% | 13.8% | 0.1% | 0.0% |
| 40 but less than 50 | 288 | 1276 | 1 | 215 | 4 | 4 |
| | 16.1% | 71.4% | 0.0% | 12.0% | 0.2% | 0.2% |
| 50 but less than 60 | 211 | 1297 | 1 | 136 | 6 | 8 |
| | 12.7% | 78.2% | 0.1% | 8.2% | 0.4% | 0.5% |
| 60 but less than 80 | 52 | 203 | 0 | 39 | 1 | 5 |
| | 17.3% | 67.8% | 0.0% | 13.0% | 0.3% | 1.7% |
| 80 or more | 34 | 166 | 0 | 26 | 0 | 2 |
| | 15.0% | 72.6% | 0.0% | 11.4% | 0.0% | 0.9% |
| Tankless | 54 | 33 | 0 | 66 | 3 | 2 |
| | 34.4% | 21.0% | 0.0% | 41.5% | 1.8% | 1.3% |
| Other | 1 | 5 | 1 | 0 | 1 | 0 |
| | 12.3% | 63.3% | 11.5% | 0.0% | 12.9% | 0.0% |

*Percentages may not add to 100% due to rounding. Totals may not add to sample size because of missing data.
*Percentages calculated by row.

## Approximately how old is your primary water heater? (CT 7)

| (Questions 8ax & 8b) | Age of System | | | | |
|---|---|---|---|---|---|
| Water Heating Fuel | < 5 yrs old | 6-10 yrs old | 11-15 yrs old | > 15 yrs old | Don't Know |
| Natural gas | 454 | 272 | 123 | 84 | 72 |
| | 45.2% | 27.0% | 12.3% | 8.4% | 7.1% |
| Electric | 1758 | 1396 | 620 | 557 | 398 |
| | 37.2% | 29.5% | 13.1% | 11.8% | 8.4% |
| Fuel Oil | 2 | 1 | 1 | 2 | 1 |
| | 28.3% | 22.0% | 15.0% | 24.8% | 9.9% |
| LP/bottled gas/propane | 305 | 205 | 84 | 115 | 59 |
| | 39.7% | 26.7% | 10.9% | 15.0% | 7.7% |
| Wood | 9 | 5 | 0 | 5 | 0 |
| | 48.3% | 27.4% | 0.0% | 24.3% | 0.0% |
| Other | 12 | 8 | 4 | 1 | 2 |
| | 46.0% | 29.7% | 15.4% | 2.4% | 6.6% |

*Percentages may not add to 100% due to rounding. Totals may not add to sample size because of missing data.
*Percentages calculated by row.

## Size of primary water heater by age of system? (CT 8)

| (Questions 8a & 8b) | Age of System | | | | |
|---|---|---|---|---|---|
| Size of Water Heater | < 5 yrs old | 6-10 yrs old | 11-15 yrs old | > 15 yrs old | Don't Know |
| Under 30 gallons | 61 | 54 | 34 | 37 | 22 |
| | 29.3% | 25.9% | 16.2% | 18.0% | 10.6% |
| 30 but less than 40 | 336 | 303 | 120 | 122 | 67 |
| | 35.4% | 31.9% | 12.7% | 12.9% | 7.1% |
| 40 but less than 50 | 732 | 544 | 228 | 203 | 85 |
| | 40.8% | 30.3% | 12.7% | 11.3% | 4.8% |
| 50 but less than 60 | 731 | 508 | 197 | 162 | 68 |
| | 43.9% | 30.5% | 11.8% | 9.7% | 4.1% |
| 60 but less than 80 | 128 | 86 | 43 | 32 | 11 |
| | 42.7% | 28.7% | 14.2% | 10.8% | 3.6% |
| 80 or more | 85 | 74 | 33 | 31 | 7 |
| | 36.8% | 32.2% | 14.2% | 13.6% | 3.3% |
| Tankless | 111 | 36 | 9 | 4 | 0 |
| | 69.4% | 22.7% | 5.4% | 2.3% | 0.3% |
| Other | 3 | 3 | 0 | 0 | 2 |
| | 39.2% | 40.1% | 0.0% | 0.0% | 20.7% |

*Percentages may not add to 100% due to rounding. Totals may not add to sample size because of missing data.
*Percentages calculated by row.

## Approximately how old is your air conditioner? (CT 9)

| (Questions 6a, 6b & 7) | Age of System | | | | |
|---|---|---|---|---|---|
| A/C System Type | < 5 yrs old | 6-10 yrs old | 11-15 yrs old | > 15 yrs old | Don't Know |
| Central Air Conditioning | 1454 | 1052 | 748 | 1061 | 323 |
| | 31.4% | 22.7% | 16.1% | 22.9% | 7.0% |
| Heat Pump AC | 417 | 220 | 111 | 72 | 33 |
| | 48.9% | 25.8% | 13.0% | 8.5% | 3.9% |
| Geothermal Heat Pump | 129 | 104 | 45 | 50 | 9 |
| | 38.3% | 30.8% | 13.3% | 14.8% | 2.7% |
| Window/Wall AC Room Cooling | 348 | 148 | 29 | 37 | 37 |
| | 58.1% | 24.7% | 4.9% | 6.1% | 6.2% |
| Window/Wall AC Whole House | 231 | 111 | 22 | 20 | 24 |
| | 56.6% | 27.2% | 5.4% | 4.9% | 5.9% |
| Ductless AC Room Cooling | 26 | 7 | 2 | 1 | 0 |
| | 72.7% | 19.2% | 5.5% | 2.6% | 0.0% |
| Ductless AC Whole House | 14 | 2 | 1 | 0 | 0 |
| | 86.2% | 9.7% | 4.0% | 0.0% | 0.0% |

*Percentages may not add to 100% due to rounding.  Totals may not add to sample size because of missing data.
*Percentages calculated by row.

## What fuel is used for your back-up electricity generation? (CT 10)

| (Questions 11qq & 11h) | Back-up electricity generation fuel | | | | |
|---|---|---|---|---|---|
| Type of generation system | Natural Gas | Gasoline | LP/Bottled Gas | Diesel | Other |
| Stationary whole-house | 24 | 6 | 125 | 5 | 1 |
| | 15.0% | 3.7% | 77.7% | 3.2% | 0.4% |
| Stationary partial-house | 13 | 15 | 22 | 0 | 1 |
| | 25.6% | 29.4% | 42.3% | 0.0% | 2.7% |
| Portable Generator | 7 | 826 | 41 | 41 | 12 |
| | 0.7% | 89.2% | 4.4% | 4.4% | 1.3% |

*Percentages may not add to 100% due to rounding.  Totals may not add to sample size because of missing data.
*Percentages calculated by row.

## Number of refrigerators versus stand-alone freezers? (CT 11)

| (Questions 11) | Type of Stand-Alone Freezers | | |
|---|---|---|---|
| Number of Refrigerators | Frost-Free Freezer | Standard Freezer | Any Stand-Alone Freezer |
| None | 7 | 10 | 14 |
| | 18.6% | 26.0% | 38.6% |
| 1 | 1410 | 1352 | 2443 |
| | 35.6% | 34.2% | 61.4% |
| 2 | 1029 | 928 | 1711 |
| | 44.5% | 40.3% | 73.9% |
| 3 or more | 180 | 154 | 274 |
| | 52.1% | 44.2% | 78.9% |

*Percentages based on all respondents with specified number of refrigerators.

## Electronic Device in household by level of education? (CT 12)

| (Questions 11 & 22) | Type of electronic device | | |
|---|---|---|---|
| Education Level | Computer (desktop/laptop) | Tablet, iPad, reader, etc. | Smart Phone |
| High School or less | 909 | 639 | 987 |
| | 58.0% | 40.9% | 63.2% |
| Technical school | 319 | 267 | 336 |
| | 82.1% | 69.0% | 86.4% |
| Some College | 1125 | 876 | 1141 |
| | 81.5% | 63.6% | 82.7% |
| College Graduate | 1823 | 1509 | 1838 |
| | 88.7% | 73.5% | 89.6% |
| Post graduate | 993 | 834 | 978 |
| | 91.5% | 76.9% | 90.2% |

*Percentages based upon respondents who have electronic device noted at each of the education levels.

## Electronic Device in household by age of respondent? (CT 13)

| (Questions 11 & 19) | Type of electronic device | | |
|---|---|---|---|
| Respondent Age | Computer (desktop/laptop) | Tablet, iPad, reader, etc. | Smart Phone |
| 18 to 24 | 49 | 35 | 61 |
| | 78.4% | 56.0% | 98.1% |
| 25 to 34 | 453 | 414 | 524 |
| | 85.1% | 77.7% | 98.4% |
| 35 to 44 | 649 | 617 | 732 |
| | 86.8% | 82.6% | 97.8% |
| 45 to 54 | 915 | 769 | 986 |
| | 86.2% | 72.6% | 92.9% |
| 55 to 64 | 1257 | 978 | 1280 |
| | 84.4% | 65.9% | 86.1% |
| 65 to 74 | 1287 | 962 | 1220 |
| | 81.4% | 60.9% | 77.5% |
| 75 or over | 600 | 375 | 515 |
| | 56.0% | 35.2% | 48.4% |

*Percentages based upon respondents who have electronic device noted at each of the age levels.

## Size of home by age of home? (CT 14)

| (Questions 13 & 15) | Size of Home | | | | |
|---|---|---|---|---|---|
| Age of Home | < than 800 square feet | 800 but less than 1500 square feet | 1500 but less than 2500 square feet | 2500 but less than 3500 square feet | 3500 square feet or more |
| 5 years or less | 20 | 57 | 167 | 87 | 61 |
| | 5.1% | 14.5% | 42.6% | 22.1% | 15.6% |
| 6 to 10 years | 16 | 69 | 126 | 75 | 49 |
| | 4.7% | 20.6% | 37.6% | 22.3% | 14.8% |
| 11 to 20 years | 30 | 251 | 559 | 237 | 134 |
| | 2.5% | 20.7% | 46.2% | 19.6% | 11.0% |
| 20 to 39 years | 28 | 396 | 743 | 304 | 140 |
| | 1.7% | 24.6% | 46.1% | 18.9% | 8.7% |
| 40 or more years | 56 | 681 | 1057 | 304 | 88 |
| | 2.6% | 31.2% | 48.4% | 13.9% | 4.0% |

*Percentages may not add to 100% due to rounding. Totals may not add to sample size because of missing data.
*Percentages calculated by row.

# Methodology

The data obtained from this survey ultimately are used to further develop the existing end-use residential consumer database for each member system and Hoosier Energy. This database was developed through the process of executing surveys on the two- to three-year cycle recommended by the Rural Utilities Service. Currently, this database consists of the 16 sampling years beginning in 1979. Each survey provides a snapshot of the residential consumer's appliance saturation and characteristics at a specific time. In addition, through continuous building and maintenance of a survey database such as the one established, historical appliance and consumer characteristic trends can be examined. Through these historical observations, insight into the development of future appliance and consumer characteristics may be developed, along with processes to better serve and meet the needs of consumers in the distribution system.

While the staffs of Hoosier Energy and member distribution systems assist with and direct these survey efforts, the research itself is conducted by a professional data-gathering firm. Since 1996, Hoosier Energy contracted with the staff at Strategic Marketing & Research Insights, LLC, (SMARInsights) to conduct the survey.

Prior to the 2009 survey, all of the responses were collected through a telephone survey among each member distribution system's residential customers. In 2009, it was recognized that changing technologies and consumer behaviors resulted in an erosion of the representativeness of surveying by telephone only. As a result, in that year a blended survey effort, employing both telephone and Internet data collection, was introduced. Since that time the utilization of online surveys has continued to be expanded to enhance representativeness. This methodology currently accounts for nearly two-thirds of the total.

The blended approach employed this year:

A. *Obtained existing customer populations inclusive of any email addresses available from individual cooperatives.*
B. *Established the number of Internet interviews conducted per cooperative by the following method:*
    a. *Chose the system with the fewest number of emails received in the total populous collection of EUS 2017.*
    b. *Used the "best response rate" from EUS 2017, which was 8.5%.*
    c. *Calculated the appropriate fixed target Internet quota % across all systems for the EUS 2019 project by multiplying the "best response rate" by the email count at the system with the lowest email populous collected in 2017 to yield the number of Internet surveys to be completed, and then dividing by that system's 2017 total survey quota*
    d. *Applied the resultant 64% Internet/ 36% phone spread to be used for each individual member system 2019 EUS sampling.*

*C. Used kWh quartiles to assure representation of the entire sample for each cooperative.*

A complete residential customer file was provided by each member system, including usage data to help test representativeness. These files were matched to Hoosier Energy records developed from the member system's Form 7 report to assess completeness. Any variances were reviewed with individual cooperatives and Hoosier Energy to ensure completeness. (For example, in some cases, cooperatives had removed such things as seasonal customers.) To ensure the representativeness of the sample pull, the files were stratified by kWh usage quartiles for files with emails and those without. In addition, customers who had participated in the most recent survey were removed from the sample, along with board members and customers who requested not to be contacted again.

In total, 7,301 interviews were conducted across the Hoosier Energy Power Network, including 4,634 via the web and the remainder utilizing the traditional phone data-collection approach. The total sample quotas for each of the 18 cooperatives ranged from 365 to 380 completed surveys. These sample sizes were established to allow for a sampling error of plus or minus 5.0% at the individual cooperative level, hence producing an overall sampling error of plus or minus 1.18% at the Hoosier Energy system level. Both sampling error magnitudes are based upon a 95% confidence level. The number of e-mails sent out was based on an anticipated response rate. In some cases, strong member response resulted in email survey responses exceeding the required quota. In order to provide a more robust sampling, all Internet surveys were used by weighting responses to the Internet quota.

The 2019 randomly sampled Residential End-Use Survey was conducted between September 4 and October 31, 2018, through emails sent to customers or by professional interviewers from SSI's call center. The End-use Survey instrument employed for this project is included under the "Questionnaire" Tab of this report.

Upon completion of the data-collection process, the data were cleaned, coded and tabulated for analysis. The resultant survey data were compared to the customer population with respect to kWh usage to assure representativeness. As this is strictly an end-use survey, the results are typically best viewed through the establishment of "frequency-trend" tables, along with "cross-tabulation" tables, although a summary of key findings related to usage and customer profiling is provided. The frequency-trend tables provide a snapshot of saturation or consumer characteristic levels specific to the particular year in review and the historical trending of relevant topics under review. The cross-tabulation tables provide a tool for simultaneous exploration of the potential relationship between two variables for a single survey year.

Results of the 2019 survey, along with the results of prior years, are presented in three sections. The first is a written overview of findings that compares 2019 Hoosier Energy Power Network findings to those of past studies. The "Frequencies and Trends" tab contains frequency-trend tables for HEPN that illustrate current and past year results. "Cross-Tabulations" contains tables for HEPN. Variables displayed in these tables were based upon results of interest in the current and previous surveys.

HOOSIER ENERGY

***Appliance Saturation Study – 2019 Final Questionnaire***

*August 31, 2018*

*Job #: HOOS139*

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**INSTRUMENT'S KEY**

1. All items which are "capitalized" are **NOT TO BE READ.**
2. All items "capitalized", in "**bold**" and in "( )" are survey function instructions related items.
3. All items in "[ ]" are insert items to be read as normal.
4. If the text is not capitalized but "**bold**", item may be read or not based upon the survey function instruction.
5. If the text is ***"RED"***, in "**bold**", in ***"italics"*** and in "***(Note:….)",*** it is a general interpretation note.

=============================================================================

**(ASK FOR MALE/FEMALE HEAD OF HOUSEHOLD)**

Hello, I'm **[**Surveyor's Name**]** representing Strategic Marketing & Research Insights, an independent research company located in Indianapolis, Indiana, and today/tonight we are calling on behalf of [CO-OP NAME]. This survey is for research purposes only and is being conducted to help your electric cooperative better understand the current energy usage of their customers to help meet future energy needs. This survey should only take about 11 - 12 minutes of your time and your feedback is truly appreciated.

**IF ASKED WHO PROVIDED THEIR PHONE NUMBER OR IF THE COOPERATIVE PROVIDED IT, THEN ANSWER:**
[CO-OP NAME] provided the information directly to SMARInsights with an agreement that the information will be held strictly confidentiality and not used or shared by anyone involved in this effort except to perform the survey. This information will in no way be used for direct or telemarketing purposes. May we continue with the survey? **IF NO OR STILL VOICING COMPLAINT**: If you wish we can place this number on our survey "no-call" list.

==============================================================================

S1. Just to confirm, your electricity is provided by [COOP NAME]?

Yes........................................................-1 **(CONTINUE)**
No ........................................................-2 **(THANK AND TERMINATE)**
Don't know ...........................................-3 **(THANK AND TERMINATE)**

1. As you probably know, there are two different types of gas used in homes. Natural gas is transported to homes through pipes in the ground. Propane is delivered in trucks to homes and stored in tanks. Is natural gas currently used in your home or available in your immediate area?

YES.......................................................-1
NO ........................................................-2
DON'T KNOW ....................................-3

2. What is the <u>primary fuel</u> you use to heat the majority of your home?

NATURAL GAS ............................-1 **(IF Q1 = "NO" AND Q2 = 1 (NG) ASK 2a, ELSE SKIP to 3a)0)**
ELECTRICITY ....................................-2 **(SKIP TO 3b)**
FUEL OIL ............................................-3 **(SKIP TO 3d)**
LP/BOTTLED GAS/PROPANE..........-4 **(SKIP TO 3c)**
WOOD.................................................-5 **(SKIP TO 3e)**
OTHER (Specify ______)....................-6 **(SKIP TO 3f)**
DON'T KNOW ....................................-8 **(IF STILL DON'T KNOW - SKIP TO 3f)**

**(IF Q1 = "NO" AND Q2 = 1 (NG) ASK 2a)**

2a. Please help clarify your answer. Natural Gas was just chosen as the <u>primary fuel currently used to heat your home</u>, yet earlier you noted that Natural Gas <u>is not</u> available or used in your home.

Please confirm: Is Natural Gas (gas transported to homes through pipes in the ground) used in your home <u>or</u> available in your immediate area?

YES......................................................-1 **(CONTINUE)**
NO .......................................................-2 **(RE-ASK Q2)**
DON'T KNOW ....................................-3 **(CONTINUE)**

3. What type of system is used as the <u>primary heating system</u> in your home?

<u>3a. Natural Gas</u>
Central furnace using natural gas ........................................-1
Other (Specify)__________ ................................................-19

<u>3b. Electricity</u>
Central furnace using electricity..........................................-4
Central electric thermal storage-(ETS) ................................-25
Heat pump ..........................................................................-6
Geothermal heat pump (pipes run underground).................-7
Multi-room ductless mini-split heat pump ..........................-26
Built in electric ceiling cable...............................................-10
Built in electric baseboard ...................................................-11
Electric thermal storage room heat (ETS) ...........................-8
Single-room ductless mini-split heat pump .........................-27
Built in electric wall units....................................................-9
Electric portable room heaters.............................................-13
Other (Specify)__________ ................................................-19

<u>3c. LP/Bottled Gas/Propane</u>
Central furnace using LP/bottled gas/propane .....................-2
Room heaters burning LP/bottled gas/propane ....................-12
Other (Specify)__________ ................................................-19

<u>3d. Fuel Oil</u>
Central furnace using fuel oil ..............................................-3
Room heaters burning fuel oil .............................................-12
Other (Specify)__________ ................................................-19

<u>3e. Wood</u>
Central furnace using wood.................................................-5
Outdoor wood burning furnace (Outdoor Wood Boiler).......-17
Wood stove .........................................................................-14
Fireplace insert ....................................................................-15
Wood burning fireplace .......................................................-16
Other (Specify)__________ ................................................-19

<u>3f. Other</u>
OTHER (Specify)________ ...............................................-19

**(IF Q3b = 6 or 7, ASK Q3g)**

3g. Heat pump systems include backup heating sometimes referred to as emergency or auxiliary heat. What type of fuel is used for your backup system?

NATURAL GAS ..................................-1
ELECTRICITY ....................................-2
FUEL OIL ...........................................-3
LP/BOTTLED GAS/PROPANE ...........-4
WOOD..................................................-5
OTHER (Specify ______)....................-6
DON'T KNOW ....................................-8

**(IF Q1 = "NO" AND Q3g = 1 (NG) AND Q2a <> 1 OR 3 ASK 3h)**
3h. Please help clarify your answer. Natural Gas was just chosen as the type of fuel used with your backup heating system, yet earlier you noted that Natural Gas is not available or used in your home.

Please confirm: Is Natural Gas (gas transported to homes through pipes in the ground) currently used in your home or available in your immediate area?

YES.......................................................-1 **(CONTINUE)**
NO ........................................................-2 **(RE-ASK Q3g)**
DON'T KNOW ....................................-3 **(CONTINUE)**

4. Approximately how old is your primary heating system or heating equipment?

LESS THAN 3 YEARS OLD ...............-1
3 TO 5 YEARS OLD ............................-2
6 TO 10 YEARS OLD ..........................-3
11 TO 15 YEARS OLD ........................-4
OLDER THAN 15 YEARS..................-5
DON'T KNOW.....................................-6

5. Do you use other types of heat in addition to your primary heating system in your home?

YES……………....1 **(IF "YES"…GO TO Q5a.)**
NO……………..…2 **(IF "NO"… GO TO Q6)**
DON'T KNOW….3 **(IF "DON'T KNOW"… GO TO Q6)**

5a. Which of the following additional types of heating equipment or systems do you have available for use in your home? (**MAKE AVAILABLE ENTIRE LISTING OF POSSIBLE ALTERNATE HEATS, EXCEPT FOR THE ITEM CHOSEN BY THE RESPONDENT OF Q3.)** Select all that apply.

Central furnace using natural gas ........................................... 1/0
Central furnace using LP/bottled gas/propane ........................ 1/0
Central furnace using fuel oil ................................................. 1/0
Central furnace using electricity............................................. 1/0
Central furnace using wood.................................................... 1/0
Outdoor wood burning furnace (Outdoor Wood Boiler) ............ 1/0
Heat pump .............................................................................. 1/0
Geothermal heat pump ........................................................... 1/0
Multi-room ductless mini-split heat pump ............................. 1/0
Central electric thermal storage (ETS) .................................... 1/0
Electric thermal storage room heat (ETS) ............................. 1/0
Single-room ductless mini-split heat pump............................ 1/0
Built-in electric wall unit........................................................ 1/0
Built in ceiling cable................................................................ 1/0
Built in electric baseboard ...................................................... 1/0

Electric portable room heaters (space heaters)........................ 1/0
Room heaters burning gas, fuel oil or kerosene ...................... 1/0
Wood burning fireplace .......................................................... 1/0
Fireplace insert ....................................................................... 1/0
Wood stove .............................................................................. 1/0
Other (Specify)______. .......................................................... 1/0

**(IF Q5a = 7 (Heat Pump) or 8 (Geothermal Heat Pump), ASK Q5ab)**

5ab. Is the heat pump used to heat the same areas of your home as your primary heating system?
YES..................................................................... -1
NO ...................................................................... -2
DON'T KNOW .................................................. -3

**(IF Q1 = "NO" <u>AND</u> Q5a = 1 (NG) <u>AND</u> Q2a <> 1 or 3 <u>AND</u> Q3h <> 1 or 3 ASK 5b)**
5b. Please help clarify your answer. <u>A central furnace using natural gas</u> was just chosen as an additional type of heating equipment or system in your home, yet earlier you noted that natural gas <u>is not</u> available or used in your home.

Please confirm: Is Natural Gas (gas transported to homes through pipes in the ground) currently used in your home <u>or</u> available in your immediate area?
YES..................................................................... -1 **(CONTINUE)**
NO ...................................................................... -2 **(RE-ASK Q5a)**
DON'T KNOW .................................................. -3 **(CONTINUE)**

6. Do you have an air conditioner in your home?
YES..................................................................... -1
NO ...................................................................... -2 **(SKIP TO Q7a)**

6a Is it a...? Select all that apply.
Window or wall mounted air conditioner............ -1
Ductless mini-split air conditioner ...................... -2
Central air conditioner......................................... -3
Heat pump ........................................................... -4
Geothermal heat pump (pipes run underground). -5
OTHER (Specify________).................

**(IF "3","4", OR "5" IS SELECTED, PRESUME WINDOW, WALL MOUNT, OR MINI-SPLIT IS NOT WHOLE HOUSE)**

**(IF Q6a <> "1" OR "2", SKIP TO Q7)**
**(IF Q6a = "1" AND "2", ONLY, ASK 6b)**
**(IF Q6a = "1" ONLY, ASK Q6c)**
**(IF Q6a = "2" ONLY, ASK Q6b)**
**(IF Q6a = "1" AND "3", "4" OR "5", SKIP TO Q6ca)**
**(IF Q6a = "2" AND "3", "4" OR "5", SKIP TO Q6bb)**
**(IF Q6a = "1" AND "2" AND "3","4" OR "5", SKIP TO Q6bb)**

6b. Is your ductless mini-split air conditioner used for…? (Ask if q6a = ductless mini-split & q6a does NOT = Central air, heat pump or geothermal.)
Whole house ..................................................... -1
Room cooling.................................................... -2
Ask bb and bc if ductless mini-split at q6a.

6bb How many ductless mini-split air conditioners are located in bedrooms? _______

6bc. How many ductless mini-split air conditioners are located in other rooms? _____
**(IF Q6a <> "1", SKIP to Q7.)**
**(IF Q6a = "1" AND Q6b = "1", SKIP to Q6ca)**
**(IF Q6a = "1" AND "3","4" OR "5", SKIP to Q6ca)**

6c. Is your window or wall mounted air conditioner used for...?
Whole house .................................................... -1
Room cooling................................................... -2

Ask if ca and cb if wall mounted ac at q6a.
6ca. How many window or wall mounted air conditioner units are located in bedrooms? ________

6cb. How many window or wall mounted air conditioner units are located in other rooms? ______

7. Approximately how old is your air conditioner(s)? If you own more than one of the same type, please select the age of the oldest unit. (PRESENT SYSTEMS CHOSEN IN Q6a)
LESS THAN 5 YEARS OLD .............-1
6 TO 10 YEARS OLD ........................-2
11 TO 15 YEARS OLD ......................-3
OLDER THAN 15 YEARS.................-4
DON'T KNOW...................................-5

7a. What type of thermostat do you have in your home?
Smart thermostat (web-enabled)................................................................1
Programmable thermostat (non-web-enabled) ..........................................2
Basic thermostat that you have to manually adjust the temperature .........3 (SKIP TO Q7C)
Don't know ..................................................................................................4 (SKIP TO Q7C)

7b. How is it programmed? Select all that apply.
By time of day ....................................-1/0
By day of week...................................-1/0
By season of year................................-1/0
Self-programmed (Smart thermostat)..-1/0
Do not use...........................................-1/0

**(IF Q7b = 5 "DO NOT USE," ASK Q7c)**

7c. Do you usually manually adjust your thermostat depending upon the time of day, and/or day of week?
YES......................................................-1
NO ......................................................-2

8x. How many water heaters do you have in your home?
0 ..........................................................-0 **(SKIP TO Q8c)**
1 ..........................................................-1
2 ..........................................................-2
3 ..........................................................-3
4 ..........................................................-4
DON'T KNOW ..................................-5

PROVIDE DROP DOWN MENU FOR NUMBER OF WATER HEATERS, FUEL TYPE, AGE.

| | 8. What type of fuel(s) is used by this water heater in your home? (DROP DOWN MENU) | 8a. What is the size of this water heater in gallons? (DROP DOWN MENU) | 8b. What is the age of this water heater? (DROP DOWN MENU) |
|---|---|---|---|
| Primary Water Heater | | | |
| Water heater 2 | | | |
| Water heater 3 | | | |
| Water heater 4 | | | |

8. What type of fuel(s) is used by this water heater in your home? (DROP DOWN MENU)

NATURAL GAS ................................ -1/0
ELECTRICITY .................................. -1/0
FUEL OIL .......................................... -1/0
LP/BOTTLED GAS/PROPANE......... -1/0
WOOD................................................ -1/0
OTHER (Specify_______)................. -1/0
DON'T KNOW.................................... -1/0

**(IF Q1 = "NO" AND Q8 = 1 (NG) AND Q2a <> 1 or 3 AND Q5b <> 1 or 3 ASK 8aa)**

8aa. Please help clarify your answer. Natural Gas was just chosen as the fuel used to heat water in your home, yet earlier you noted that Natural Gas is not available or used in your home.

Please confirm: Is Natural Gas (gas transported to homes through pipes in the ground) currently used in your home or available in your immediate area?

YES........................................................-1 **(CONTINUE)**
NO .........................................................-2 **(RE-ASK Q8)**
DON'T KNOW .....................................-3 **(CONTINUE)**

**(IF Q8 = MULTIPLE FUELS ASK Q8ax)**

8a. What is the size of this water heater in gallons? (DROP DOWN MENU)

Under 30 gallons..............................1/0
30 but less than 40 ...........................1/0
40 but less than 50 ...........................1/0
50 but less than 60 ...........................1/0
60 but less than 80 ...........................1/0
80 or more .....................................1/0
Tankless ..........................................1/0
An on-demand system that heats cold water instantaneously to a preset temperature only as needed
OTHER (Specify______)................1/0
DON'T KNOW ...............................1/0
*An on-demand system that heats cold water instantaneously to a preset temperature only as needed

**(IF 8a = 7 (Tankless) ASK Q8ab, ELSE SKIP TO Q8b)**

8ab. Is your tankless water heater a Point of Use System which is dedicated to heating water for just one fixture such as a sink, shower, or dishwasher, or is it a Whole House System that provides hot water to multiple fixtures? Select all that apply.

Point of use System ..........................1/0
Whole House System .......................1/0
DON'T KNOW ...............................1/0

8b. **Approximately how old is your primary water heater?** (DROP DOWN MENU)

LESS THAN 5 YEARS OLD ..........-1
6 TO 10 YEARS OLD .....................-2
11 TO 15 YEARS OLD ...................-3
OLDER THAN 15 YEARS.............-4
DON'T KNOW................................-5

**((If Q8 = ONLY 2 or Q8ax = 2) and Q8b = 1 or 2 ASK Q8bb) and (Q8axx <> 7 tankless)**
**(If (Q3 = 7) or (Q5A = 8) Present option "3" (Geothermal desuperheater option))**

8bb. Is your primary water heater a…?

Standard water heater ......................................... -1
Heat pump water heater...................................... -2
Geothermal desuperheater option........................ -3
Other (Specify)___________________________-4
DON'T KNOW................................................... -5

8c. Is your household's water supplied by a...?

Well/Cistern.....................................-1
A water utility company ...................-2
or Both .............................................-3

The next several questions concern the appliances which are currently used in your home.

9. What type of fuel do you use in your home for your range/cook top/oven?

NATURAL GAS ...................................................................... -1
NATURAL GAS & ELECTRICITY ...................................................... -2
ELECTRICITY ....................................................................... -3
LP/BOTTLED GAS/PROPANE........................................................ -4
LP/BOTTLED GAS/PROPANE & ELECTRICITY ............................. -5
WOOD.................................................................................. -6
OTHER (Specify)................................................................... -7
NO RANGE/COOK TOP/OVEN .......................................................... -8

**(IF Q1 = "NO" AND Q9 = 1 (NG) AND Q2a <> 1 or 3 AND Q5b <> 1 or 3 AND Q8aa <> 1 or 3 ASK 9a)**

9a. Please help clarify your answer. Natural Gas was just chosen as the type of range/cook top/oven used in your home, yet earlier you noted that Natural Gas is not available or used in your home.

Please confirm: Is Natural Gas (gas transported to homes through pipes in the ground) currently used in your home or available in your immediate area?

YES..................................................-1 **(CONTINUE)**
NO ...................................................-2 **(RE-ASK Q9)**
DON'T KNOW ...............................-3 **(CONTINUE)**

10. What type of clothes dryer do you use in your home?

NATURAL GAS .............................-1
ELECTRICITY ...............................-2
LP/BOTTLED GAS/PROPANE......-3
OTHER (Specify________)............-4
NO DRYER.....................................-5

**(IF Q1 = "NO" AND Q10 = 1 (NG) AND Q2a <> 1 or 3 AND Q5b <> 1 or 3 AND Q8aa <> 1 or 3 AND Q9a <> 1 or 3 ASK 10a)**

10a. Please help clarify your answer. Natural Gas was just chosen as the type of clothes dryer used in your home, yet earlier you noted that Natural Gas is not available or used in your home.

Please confirm: Is Natural Gas (gas transported to homes through pipes in the ground) currently used in your home or available in your immediate area?

YES........................................................-1 **(CONTINUE)**
NO ........................................................-2 **(RE-ASK Q10)**
DON'T KNOW ....................................-3 **(CONTINUE)**

11. Please indicate how many of each of the following appliances or devices are used in your home. Please choose one answer for each appliance or device.

| | 0 | 1 | 2 | 3 | 4 | 5 | 7 |
|---|---|---|---|---|---|---|---|
| Ceiling fans | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Microwave ovens | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Refrigerators | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Frost-free stand-alone freezers | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Standard stand-alone freezers | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Flat panel televisions (wall mountable) | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Other televisions | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Smart phones (cell phones providing Internet access) | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Computers (desktop, laptop) | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Tablets, iPads, readers or other portable electronic devices | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Electric waterbed heaters | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Electric hot tub heating systems | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Clothes washers | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Dishwashers | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Gaming systems connected to a TV (Xbox, Nintendo, Sony, etc.) | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |
| Satellite or cable boxes connected to a TV | 0 | 1 | 2 | 3 | 4 | 5 or more | DK |

11aa. Do you have a swimming pool with a pump at your home?

YES........................................................-1
NO ........................................................-2
DON'T KNOW ....................................-3

**(IF Q11aa = 1, ASK Q11ab.)**

11ab. How do you heat your pool?

Natural gas.............................................-1
Electricity ..............................................-2
LP/bottled gas/propane..........................-3
Solar.......................................................-4
Other (specify ______)..........................-5
Don't heat pool......................................-6
DON'T KNOW ....................................-7

**(IF Q1 = "NO" AND Q11ab = 1 (NG) AND Q2a <> 1 or 3 AND Q5b <> 1 or 3 AND Q8aa <> 1 or 3 AND Q9a <> 1 or 3 AND Q10a <> 1 or 3 ASK 11abb)**

11abb. Please help clarify your answer. Natural Gas was just chosen as the type of fuel used to heat your swimming pool, yet earlier you noted that Natural Gas is not available or used in your home.

Please confirm: Is Natural Gas (gas transported to homes through pipes in the ground) currently used in your home or available in your immediate area?

YES........................................................-1 **(CONTINUE)**
NO ........................................................-2 **(RE-ASK Q11ab)**
DON'T KNOW ....................................-3 **(CONTINUE)**

There are different types of energy-efficient, longer-lasting light bulbs on the market. These are Compact Fluorescent Lights (CFL) and LED Lights. CFL bulbs use a tube that is curved or folded to fit into the space of a traditional incandescent bulb. LED bulbs generally have multiple small lamps or chips that produce light. Approximately how many CFL and LED light bulbs do you currently use in your home?

11ac. CFL #__________
DON'T KNOW ☐

11ad. LED #__________
DON'T KNOW ☐

**CFL (SHOW IMAGE ON INTERNET SURVEY)**

**LED (SHOW IMAGES ON INTERNET SURVEY)**

11a. Which devices do adults in your household use to access the Internet while at home? Select all that apply.

Computers (desktop, laptop) _____
Tablet like an iPad, Kindle or Nook _____
Smart phone _____
TV _____
Other (Specify_______________) _____
DO NOT USE THE INTERNET AT HOME ☐

11b. Which of the following social networks do the adults in the household currently use? Select all that apply.

Facebook............................................................-1/0
Pinterest ............................................................-1/0
Instagram ..........................................................-1/0
LinkedIn.............................................................-1/0
Google Plus........................................................-1/0
Twitter ...............................................................-1/0
Snapchat.............................................................-1/0
YouTube ............................................................-1/0
Other (Specify____________) ...........................-1/0
None .................................................................-1/0

11e. Which of the following phone services do you use in your home? Select all that apply.

- Land line (traditional service through phone lines coming into home)....................-1/0
- Cell phone (mobile phone service that can also be used away from home).............-1/0
- Voice over IP (phone service through your Internet connection) ............................-1/0

**(IF Q11e = MULTIPLES, ASK Q11f)**

11f. Which would you consider to be your primary home phone service? **(LIST ONLY THOSE CHOSEN IN Q11e.)**

- Land line (traditional service through phone lines coming into home)....................-1
- Cell phone (mobile phone service that can also be used away from home).............-2
- Voice over IP (phone service through your Internet connection) ............................-3

11g. Does your home have a backup electricity generator?

- YES........................................................-1
- NO .........................................................-2
- DON'T KNOW .....................................-3

**(IF Q11G = YES, ASK Q11gg & Q11h & Q11hh)**

11gg. Is it a…? Select all that apply.

- Stationary generator...............................-1
- Portable generator..................................-2
- DON'T KNOW .....................................-3

**(IF 11gg = 1 ASK 11ggg)**

11ggg. Is the Stationary generator a…?

- Whole-house generator..........................-1
- Partial-house generator..........................-2

11h. What fuel is used for your primary backup electricity generator?

- NATURAL GAS ..................................-1
- GASOLINE ...........................................-2
- LP/BOTTLED GAS/PROPANE...........-3
- DIESEL .................................................-4
- OTHER (Specify ______).....................-5
- DON'T KNOW .....................................-6

**(IF Q1 = "NO" AND Q11h = 1 (NG) AND Q2a <> 1 or 3 AND Q5b <> 1 or 3 AND Q8aa <> 1 or 3 AND Q9a <> 1 or 3 AND Q10a <> 1 or 3 AND Q11ab <> 1 or 3 ASK 11ha)**

11ha. Please help clarify your answer. Natural Gas was just chosen as the type of fuel used for your backup electricity generator, yet earlier you noted that Natural Gas is not available or used in your home.

Please confirm: Is Natural Gas (gas transported to homes through pipes in the ground) currently used in your home or available in your immediate area?

- YES........................................................-1 **(CONTINUE)**
- NO .........................................................-2 **(RE-ASK Q11h)**
- DON'T KNOW .....................................-3 **(CONTINUE)**

11hh. What is the total size of your primary generator?

- 0 – 5 KW ...............................................-1
- Greater than 5 KW.................................-2
- DON'T KNOW .....................................-3

11i. Do you have any of the following renewable resources for electric power generation installed and in use at your home? Select all that apply.

SOLAR ..................................................-1/0
WIND ....................................................-1/0
OTHER (Specify_____) ........................-1/0
NO ........................................................-1/0

11ii. Do you own a plug-in electric car?

Yes, a plug-in hybrid vehicle.................-1
Yes, a full-electric vehicle .....................-2
No .........................................................-3
DON'T KNOW .....................................-4

**(IF Q11ii = 1 or 2, ASK Q11j)**

**11j.** Where do you charge your electric car? Select all that apply.

HOME ...................................................-1/0
WORK...................................................-1/0
OTHER (Specify_____) ........................-1/0

**(IF Q11j = HOME, ASK Q11jj & Q11jjj)**

Q11jj. What type of home charger do you primarily use?

Standard 120-volt charger .....................1
Fast 240-volt charger.............................2
Other (Specify _____) ...........................3
Don't know.............................................4

Q11jjj. What time periods do you commonly charge your vehicle at home? Select all that apply.

Weekdays from 7:00 AM to 10:00 AM ................ -1/0
Weekdays from 10:00 AM to 2:00 PM ................. -1/0
Weekday evenings from 2:00 PM to 9:00 PM ...... -1/0
Weekdays overnight from 9:00 PM to 7:00 AM... -1/0
Weekends ............................................................. -1/0

**(IF Q11jjj = MORE THAN ONE ANSWER, SHOW PERIODS SELECTED BELOW)**

Q11jjjj. Which time period do you most commonly charge your vehicle at home? .

Weekdays from 7:00 AM to 10:00 AM ................ 1
Weekdays from 10:00 AM to 2:00 PM ................. 2
Weekday evenings from 2:00 PM to 9:00PM ....... 3
Weekdays overnight from 9:00 PM to 7:00 AM... 4
Weekends ............................................................. 5

The next few questions concern your home and are for classification purposes only.

12. Which of the following best describes your home?

***(Note: Assumes duplex, apartments & condominiums are all "traditional structure")***

Single family residence ............................-1 **(IF THIS… GO TO Q12a)**
Two-family residence (duplex) ................-2 **(IF THIS… GO TO Q12b)**
Apartment (3+ families) ...........................-3 **(IF THIS… GO TO Q15)**
Condominium...........................................-4 **(IF THIS… GO TO Q12b)**
DON'T KNOW ....................................... -5 **(IF THIS… GO TO Q13)**

12a. Would you consider the construction of your home to be …?

Traditionally constructed ........................-1 **(IF THIS… GO TO Q12b)**
Modular ...................................................-5 **(IF THIS… GO TO Q12b)**
Manufactured...........................................-6 **(IF THIS… GO TO Q12ab)**
Mobile Home...........................................-3 **(IF THIS… GO TO Q12ab)**
DON'T KNOW .....................................-4 **(IF THIS… GO TO Q13)**

12ab. Is your home…?

Single-wide............................... 1
Double-wide ............................. 2
Other (Specify______) ............. 3
DON'T KNOW ......................... 4

**(If 12a = 3 skip to Q13)**

12b. Is your home built above a…? Select all that apply.

Basement or cellar where you can stand upright
1/0
Crawlspace where you cannot stand upright, but can be used to access plumbing and electrical wiring
1/0
Slab of concrete with no space below your home.
1/0
NOT SURE
1/0

13. What is the approximate age of your home?

5 years or less ..................................................... -1
6 to 10 years........................................................ -2
11 to 20 years...................................................... -3
20 to 39 years...................................................... -4
40 or more years ................................................. -5
DON'T KNOW .................................................. -6

14. Do you own or rent your home?

OWN................................................................... -1
RENT.................................................................. -2

15. What is your best estimate of the total living space in your home?

Less than 800 square feet ................................... -1
800 but less than 1500 square feet...................... -2
1500 but less than 2500 square feet.................... -3
2500 but less than 3500 square feet ................... -4
3500 square feet or more .................................... -5
DON'T KNOW................................................... -6

17. Including yourself, how many people are currently living in your household who are…?
**(ALLOW TO SKIP)**

Under age 18 ____________
Age 18 or older ___________

18. How many adults currently living in your home are employed outside the household? **(ALLOW TO SKIP. LIMIT RESPONSES TO Q17 NUMBER OF ADULTS IN HOUSEHOLD.)**

ONE ..................................................................... -1
TWO ..................................................................... -2
THREE ................................................................ -3
FOUR .................................................................. -4
FIVE .................................................................... -5
SIX OR MORE..................................................... -6
ZERO.................................................................. -8

19. Which of the following best describes your age? **(ALLOW TO SKIP)**

18 to 24 ................................................................ -1
25 to 34 ................................................................ -2
35 to 44 ................................................................ -3
45 to 49 ................................................................ -4
50 to 54 ................................................................ -5
55 to 64 ................................................................ -6
65 to 74 ............................................................... -7
75 or over............................................................. -8

20. What is the occupation of the primary wage earner in your household? **(ALLOW TO SKIP)**

PROFESSIONAL ................................................ -1
WHITE COLLAR ............................................... -2
BLUE COLLAR.................................................. -3
FARMER............................................................. -4
STUDENT ........................................................... -5
UNEMPLOYED.................................................. -6
RETIRED ........................................................... -7

**Occupation Definitions used** in placement of the individual into the occupation categories of "professional", "white collar" or "blue collar":

"**Professional**" – Those with specialized advanced degrees or training such as: medical professionals, engineers, lawyers, computer programmers, social workers, therapists and teachers.

"**White Collar**" – Office workers such as: accountants, administrative assistants/secretaries, clerks, salespeople, computer operators, legislators, and data entry personnel.

"**Blue Collar**" -- Those who use their physical skill such as: construction workers, food service workers, garbage collectors, health service aides, installers and repairers, machine operators and assemblers, protective servants (police/firefighters), and hairdressers.

21. For the next question, I want to remind you that you have the option to refuse. However, I do want to point out that the following question is for classification purposes only, used to group your responses with others we have interviewed.

Which of the following categories best represents your total annual household or combined income before taxes?

Under $30,000 ........................... -1
$30,000 but less than $50,000 ............................. -2
$50,000 but less than $80,000 ............................. -3
$80,000 but less than $100,000 ........................... -4
$100,000 but less than $150,000 ......................... -5
$150,000 but less than $200,000 ......................... -6
$200,000 or more................................................ -7
Do not wish to answer ........................................ -8

22. Of the people living in your home, what is the highest level of education that has been completed by anyone? **(ALLOW TO SKIP)**

High school or less ............................................ -1
Technical school................................................. -2
Some college ...................................................... -3
College graduate................................................. -4
Post graduate ...................................................... -5

**<u>THANK RESPONDENT</u>**

Final Screen - Cooperative Web Address

# PRS Regions

| REGION 1 |
|---|
| Daviess-Martin County REMC |
| Utilities District of Western Indiana REMC |
| Wayne-White Counties Electric Cooperative |
| WIN Energy REMC |

| REGION 2 |
|---|
| Dubois REC, Inc. |
| Orange County REMC |
| Southern Indiana Power |

| REGION 3 |
|---|
| Bartholomew County REMC |
| Decatur County REMC |
| Johnson County REMC |
| South Central Indiana REMC |

| REGION 4 |
|---|
| Henry County REMC |
| RushShelby Energy |
| Whitewater Valley REMC |

| REGION 5 |
|---|
| Clark County REMC |
| Harrison REMC |
| Jackson County REMC |
| Southeastern Indiana REMC |

# APPENDIX B
# Forecast Manager Weather Scenario Development

## Data Tables: Peak Weather

FM is configured to maintain weather used to forecast cooperative peaks in Data Tables. These weather data consist of four scenarios: normal (base case), severe, mild, and extreme. Each weather scenario is stored in a separate data table.

The data are organized using subfolders in the **/PeakWeather** folder. Each subfolder includes the three-character identifier (e.g., BAR_PeakWthr). Within the subfolder, FM stores three tables, one for each scenario. Below is an example of the folder and table structure for one cooperative, BAR.

/PeakWeather
    /BAR_PeakWeather
        BAR_PeakWthr_Normal
        BAR_PeakWthr_Severe
        BAR_PeakWthr_Mild
        BAR_PeakWthr_Extreme

Each table (e.g., XXX_PeakWthr_Normal, XXX_PeakWthr_Severe, XXX_PeakWthr_Mild, and XXX_PeakWthr_Extreme) contains three variables. These variables are defined below.

- **AvgTemp**. This variable is the daily average temperature on the day of the monthly peak.
- **AvgTempLag1**. This variable is the daily average temperature on the day prior to the monthly peak
- **AvgTempLag2**. This variable is the daily average temperature two days before the monthly peak.

These variables are forecast weather values for each scenario. The values for normal, severe, and mild scenarios are externally developed based historical average of peak producing temperatures from 2007 through 2019. The values for the extreme scenario are externally developed based on the third most extreme temperatures in January and July form 1990 through 2019.

**<u>Import Format</u>**. Updated peak weather scenario data are imported into FM from the **Input_PeakWeatherScenarios.xlsx** file. The file contains one tab for each cooperative. The tab's file format consists of Table, Year, and Month index columns which specify the cooperative scenario and monthly peak temperature values. After the index columns, the table contains the three variables identified above. This format requires that the Table index be grouped and the Year and Month index to increase sequentially. Input data must be in the FM defined units. The import file only needs data for 2020. MetrixND will extend the 2020 data to all future forecast periods.

| | Table | Year | Month | AvgTemp | AvgTempLag1 | AvgTempLag2 |
|---|---|---|---|---|---|---|
| 8 | BAR_PeakWthr_Normal | 2020 | 7 | 78.54 | 76.75 | 75.55 |
| 9 | BAR_PeakWthr_Normal | 2020 | 8 | 78.83 | 77.00 | 74.23 |
| 10 | BAR_PeakWthr_Normal | 2020 | 9 | 76.62 | 74.36 | 73.12 |
| 11 | BAR_PeakWthr_Normal | 2020 | 10 | 42.23 | 45.05 | 45.61 |
| 12 | BAR_PeakWthr_Normal | 2020 | 11 | 30.34 | 37.00 | 42.45 |
| 13 | BAR_PeakWthr_Normal | 2020 | 12 | 23.70 | 28.82 | 28.97 |
| 14 | BAR_PeakWthr_Severe | 2020 | 1 | (2.52) | 16.03 | 27.70 |
| 15 | BAR_PeakWthr_Severe | 2020 | 2 | 15.28 | 22.47 | 28.85 |
| 16 | BAR_PeakWthr_Severe | 2020 | 3 | 26.21 | 29.99 | 33.91 |
| 17 | BAR_PeakWthr_Severe | 2020 | 4 | 38.42 | 48.22 | 53.60 |
| 18 | BAR_PeakWthr_Severe | 2020 | 5 | 73.87 | 71.73 | 71.35 |
| 19 | BAR_PeakWthr_Severe | 2020 | 6 | 77.64 | 74.68 | 73.67 |
| 20 | BAR_PeakWthr_Severe | 2020 | 7 | 84.37 | 83.54 | 81.65 |
| 21 | BAR_PeakWthr_Severe | 2020 | 8 | 78.83 | 77.00 | 74.23 |
| 22 | BAR_PeakWthr_Severe | 2020 | 9 | 76.62 | 74.36 | 73.12 |
| 23 | BAR_PeakWthr_Severe | 2020 | 10 | 42.23 | 45.05 | 45.61 |
| 24 | BAR_PeakWthr_Severe | 2020 | 11 | 30.34 | 37.00 | 42.45 |
| 25 | BAR_PeakWthr_Severe | 2020 | 12 | 23.70 | 28.82 | 28.97 |
| 26 | BAR_PeakWthr_Mild | 2020 | 1 | 29.95 | 33.16 | 33.16 |
| 27 | BAR_PeakWthr_Mild | 2020 | 2 | 29.95 | 33.16 | 33.16 |
| 28 | BAR_PeakWthr_Mild | 2020 | 3 | 26.21 | 29.99 | 33.91 |
| 29 | BAR_PeakWthr_Mild | 2020 | 4 | 38.42 | 48.22 | 53.60 |

**Import Command and Process**. Importing new peak weather scenario data may be performed using FM's standard import capabilities or the saved tasks. FM includes saved tasks that import each cooperative's peak weather scenarios from a predefined location. For instance, the "**Import PeakWeather – BAR**" command will import the data from the **Input_PeakWeatherScenarios.xlsx** file, **BAR** tab located in the **ImportData** folder.

FM includes a batch task that will import all cooperative peak weather scenario data (i.e., all 18 cooperatives). The batch task will consecutively run each cooperative's peak weather scenario import task.

## Transformation Tables: Weather Daily

The Weather Daily Transformation Tables convert the division daily average temperatures from the **Weather** Data Table into cooperative daily average temperatures, heating degree days (HDD), and cooling degree days (CDD). One table is used for each cooperative as well as for the system total. The following transformation tables are used to calculate the daily weather.

- System_DailyWthr
- BAR_DailyWthr
- CLA_DailyWthr
- DAV_DailyWthr
- DEC_DailyWthr
- DUB_DailyWthr
- HAR_DailyWthr
- HEN_DailyWthr

- JAC_DailyWthr
- JOH_DailyWthr
- ORA_DailyWthr
- RSE_DailyWthr
- SCI_DailyWthr
- SOE_DailyWthr
- SOU_DailyWthr
- UDW_DailyWthr
- WIE_DailyWthr
- WWC_DailyWthr
- WWV_DailyWthr

Each daily weather transform table contains the same set of daily weather variables. With the exception of the **AvgTemp** variable, all other variables (i.e., heating and cooling degree days) utilize the same set of formulas. The **AvgTemp** variable changes for each cooperative based on the different division weather weighting scheme used for the cooperative. The table below shows the variables for each weather station using BAR as the formula example.

| Variable | Description | Formula |
|---|---|---|
| AvgTemp | Average Temperature | (1/3) * Weather.IN5 + (1/3) * Weather.IN8 + (1/3) * Weather.IN9 |
| HDD30 | HDD Base 30 | HDD(BAR_DailyWthr.AvgDB,30) |
| HDD35 | HDD base 35 | HDD(BAR_DailyWthr.AvgDB,35) |
| HDD40 | HDD base 40 | HDD(BAR_DailyWthr.AvgDB,40) |
| HDD45 | HDD base 45 | HDD(BAR_DailyWthr.AvgDB,45) |
| HDD50 | HDD base 50 | HDD(BAR_DailyWthr.AvgDB,50) |
| HDD55 | HDD base 55 | HDD(BAR_DailyWthr.AvgDB,55) |
| HDD60 | HDD base 60 | HDD(BAR_DailyWthr.AvgDB,60) |
| HDD65 | HDD base 65 | HDD(BAR_DailyWthr.AvgDB,65) |
| CDD55 | CDD base 55 | CDD(BAR_DailyWthr.AvgDB,55) |
| CDD60 | CDD base 60 | CDD(BAR_DailyWthr.AvgDB,60) |
| CDD65 | CDD base 65 | CDD(BAR_DailyWthr.AvgDB,65) |
| CDD70 | CDD base 70 | CDD(BAR_DailyWthr.AvgDB,70) |
| CDD75 | CDD base 75 | CDD(BAR_DailyWthr.AvgDB,75) |
| CDD80 | CDD base 80 | CDD(BAR_DailyWthr.AvgDB,80) |

## Transformation Tables: Weather Monthly

The Weather Monthly Transformation Tables convert the daily average temperatures from the **DailyWthr** Transform Tables into monthly HDDs and CDDs. The monthly values are calculated by averaging the daily average temperatures or summing the daily HDD and CDD values. One table is used for each cooperative as well as for the system total. The following transformation tables are used to calculate the monthly weather.

- System_MonthlyWthr
- BAR_MonthlyWthr
- CLA_MonthlyWthr
- DAV_MonthlyWthr

- DEC_MonthlyWthr
- DUB_MonthlyWthr
- HAR_MonthlyWthr
- HEN_MonthlyWthr
- JAC_MonthlyWthr
- JOH_MonthlyWthr
- ORA_MonthlyWthr
- RSE_MonthlyWthr
- SCI_MonthlyWthr
- SOE_MonthlyWthr
- SOU_MonthlyWthr
- UDW_MonthlyWthr
- WIE_MonthlyWthr
- WWC_MonthlyWthr
- WWV_MonthlyWthr

Each monthly weather transform table contains the same set of monthly weather variables. The table below shows the variables for each weather station using BAR as the formula example,

| Variable | Description | Formula |
|---|---|---|
| AvgTemp | Average Temperature | MonthlyAvg(BAR_DailyWthr.AvgDB) |
| HDD30 | HDD Base 30 | MonthlySum(BAR_DailyWthr.HDD30) |
| HDD35 | HDD base 35 | MonthlySum(BAR_DailyWthr.HDD35) |
| HDD40 | HDD base 40 | MonthlySum(BAR_DailyWthr.HDD40) |
| HDD45 | HDD base 45 | MonthlySum(BAR_DailyWthr.HDD45) |
| HDD50 | HDD base 50 | MonthlySum(BAR_DailyWthr.HDD50) |
| HDD55 | HDD base 55 | MonthlySum(BAR_DailyWthr.HDD55) |
| HDD60 | HDD base 60 | MonthlySum(BAR_DailyWthr.HDD60) |
| HDD65 | HDD base 65 | MonthlySum(BAR_DailyWthr.HDD65) |
| CDD55 | CDD base 55 | MonthlySum(BAR_DailyWthr.CDD55) |
| CDD60 | CDD base 60 | MonthlySum(BAR_DailyWthr.CDD60) |
| CDD65 | CDD base 65 | MonthlySum(BAR_DailyWthr.CDD65) |
| CDD70 | CDD base 70 | MonthlySum(BAR_DailyWthr.CDD70) |
| CDD75 | CDD base 75 | MonthlySum(BAR_DailyWthr.CDD75) |
| CDD80 | CDD base 80 | MonthlySum(BAR_DailyWthr.CDD80) |

## Transformation Tables: Weather Normal

The Weather Normal Transformation Tables calculate two types of normal weather. First, the **Normal_DailyWthr** table calculates daily normal average temperatures using a rank and average method. Second, the **XXX_NMonthlyWthr** tables calculates the monthly normal weather from **MonthlyWthr** Transform.

### Normal Daily Weather

The **Normal_DailyWthr** table calculates daily average normal temperatures for each cooperative using a rank and average method. This process involves multiple steps as listed below.

**Step 1. Rank and Average.** Calculate daily rank and average values for the division weather.

**Step 2. Map Rank and Average.** Map the division Rank and Average result to the future calendar based on the **Weather_DailyRankOrder** Data Table mapping.

**Step 3. Cooperative Daily Normal.** Calculate the cooperative normal daily average temperatures by weighting the division Map Rank and Average values for each cooperative.

Variables included in the **Normal_DailyWthr** table perform these steps. The following table summarizes the variables.

<table>
<tr><th>Step</th><th>Variable</th><th>Description</th><th>Formula</th></tr>
<tr><td>1</td><td>RankAvg_IN4</td><td>Rank and Average method for division IN4 weather. Average is calculated from 1990 to 2019.</td><td>RankAvgByMonth (Weather.IN4,Weather.IN4, #1/1/1990#, #12/31/2019# )</td></tr>
<tr><td colspan="4">Similar variables are created for divisions IN4, IN5, IN6, IN7, IN8, IN9, IL7, IL9, KY1, KY2, KY3, OH4, and OH8.</td></tr>
<tr><td>2</td><td>IN4</td><td>Map the RankAvg_IN4 result to the order in the Weather_DailyRankOrder table.</td><td>RotateByDate (Normal_DailyWthr.RankAvg_IN4, Weather_DailyRankOrder.RankDT)</td></tr>
<tr><td colspan="4">Similar variables are created for divisions IN4, IN5, IN6, IN7, IN8, IN9, IL7, IL9, KY1, KY2, KY3, OH4, and OH8. All divisions use the same rank order map.</td></tr>
<tr><td>3</td><td>BAR</td><td>Weighted average of the Rank and Averaged weather division for the BAR cooperative</td><td>(1/3) * Normal_DailyWthr.IN5 +<br>(1/3) * Normal_DailyWthr.IN8 +<br>(1/3) * Normal_DailyWthr.IN9</td></tr>
<tr><td colspan="4">Similar variables are created for all cooperatives and the system: System, BAR, CLA, DAV, DEC, DUB, HAR, HEN, JAC, JOH, ORA, RSE, SCI, SOE, SOU, UDW, WIE, WWC and WWV. Each cooperative uses different weights.</td></tr>
</table>

Future changes to the daily normal temperatures may be made by updating the historical data range used in calculating the average in Step 1. The current transformations utilize data from 1990 through 2019. To update the normal data period range, edit the dates and recalculate the table.

## XXX_NMonthlyWthr

The **XXX_NMonthlyWthr** tables calculate the monthly normal heating and cooling degrees for each cooperative. Monthly normal weather is calculated as a straight average over a historical period. The period is currently set from 1990 through 2019. The following transformation tables are used to calculate the monthly weather.

- System_NMonthlyWthr
- BAR_NMonthlyWthr
- CLA_NMonthlyWthr
- DAV_NMonthlyWthr
- DEC_NMonthlyWthr
- DUB_NMonthlyWthr
- HAR_NMonthlyWthr
- HEN_NMonthlyWthr
- JAC_NMonthlyWthr
- JOH_NMonthlyWthr
- ORA_NMonthlyWthr
- RSE_NMonthlyWthr
- SCI_NMonthlyWthr
- SOE_NMonthlyWthr
- SOU_NMonthlyWthr
- UDW_NMonthlyWthr
- WIE_NMonthlyWthr
- WWC_NMonthlyWthr
- WWV_NMonthlyWthr

Each normal monthly weather transform table contains the same set of weather variables. The table below shows the variables for each weather station using BAR as the formula example,

| Variable | Description | Formula |
|---|---|---|
| HDD30 | HDD Base 30 | Normal(BAR_MonthlyWthr.HDD30,1990,2019) |
| HDD35 | HDD base 35 | Normal(BAR_MonthlyWthr.HDD35,1990,2019) |
| HDD40 | HDD base 40 | Normal(BAR_MonthlyWthr.HDD40,1990,2019) |
| HDD45 | HDD base 45 | Normal(BAR_MonthlyWthr.HDD45,1990,2019) |
| HDD50 | HDD base 50 | Normal(BAR_MonthlyWthr.HDD50,1990,2019) |
| HDD55 | HDD base 55 | Normal(BAR_MonthlyWthr.HDD55,1990,2019) |
| HDD60 | HDD base 60 | Normal(BAR_MonthlyWthr.HDD60,1990,2019) |
| HDD65 | HDD base 65 | Normal(BAR_MonthlyWthr.HDD65,1990,2019) |
| CDD55 | CDD base 55 | Normal(BAR_MonthlyWthr.CDD55,1990,2019) |
| CDD60 | CDD base 60 | Normal(BAR_MonthlyWthr.CDD60,1990,2019) |
| CDD65 | CDD base 65 | Normal(BAR_MonthlyWthr.CDD65,1990,2019) |
| CDD70 | CDD base 70 | Normal(BAR_MonthlyWthr.CDD70,1990,2019) |
| CDD75 | CDD base 75 | Normal(BAR_MonthlyWthr.CDD75,1990,2019) |
| CDD80 | CDD base 80 | Normal(BAR_MonthlyWthr.CDD80,1990,2019) |

Future changes to the monthly normal temperatures may be made by updating the historical data range used in calculating the average. The current transformations utilize data from 1990 through 2019. To update the normal data period range, edit the dates and recalculate the table.

## Transformation Tables:  Weather Severe

The Weather Severe Transformation Tables convert the monthly normal weather to the severe weather scenario.  The severe weather is calculated by multiply the monthly normal heating and cooling degree days by a scale factor. The scale factors are externally developed and input into FM as constants in these tables.

The following transformation tables are used to calculate the severe weather scenarios.

- BAR_SevereMonthlyWthr
- CLA_SevereMonthlyWthr
- DAV_SevereMonthlyWthr
- DEC_SevereMonthlyWthr
- DUB_SevereMonthlyWthr
- HAR_SevereMonthlyWthr
- HEN_SevereMonthlyWthr
- JAC_SevereMonthlyWthr
- JOH_SevereMonthlyWthr
- ORA_SevereMonthlyWthr
- RSE_SevereMonthlyWthr
- SCI_SevereMonthlyWthr
- SOE_SevereMonthlyWthr
- SOU_SevereMonthlyWthr
- UDW_SevereMonthlyWthr
- WIE_SevereMonthlyWthr
- WWC_SevereMonthlyWthr
- WWV_SevereMonthlyWthr
- System_SevereMonthlyWthr

Each monthly severe weather transform table contains the same set of monthly weather variables.  These variables use the same formulas but reference different scale factors and normal monthly weather.  The table below shows the variables for each weather station using BAR as the formula example.

| Variable | Description | Formula |
|---|---|---|
| HDDMult | Heating Degree Day scale factor | 1.111 |
| CDDMult | Cooling Degree Day scale factor | 1.260 |
| HDD30 | HDD Base 30 | BAR_NMonthlyWthr.HDD30 * BAR_SevereMonthlyWthr.HDDMult |
| HDD35 | HDD base 35 | BAR_NMonthlyWthr.HDD35 * BAR_SevereMonthlyWthr.HDDMult |
| HDD40 | HDD base 40 | BAR_NMonthlyWthr.HDD40 * BAR_SevereMonthlyWthr.HDDMult |
| HDD45 | HDD base 45 | BAR_NMonthlyWthr.HDD45 * BAR_SevereMonthlyWthr.HDDMult |
| HDD50 | HDD base 50 | BAR_NMonthlyWthr.HDD50 * BAR_SevereMonthlyWthr.HDDMult |
| HDD55 | HDD base 55 | BAR_NMonthlyWthr.HDD55 * BAR_SevereMonthlyWthr.HDDMult |
| HDD60 | HDD base 60 | BAR_NMonthlyWthr.HDD60 * BAR_SevereMonthlyWthr.HDDMult |
| HDD65 | HDD base 65 | BAR_NMonthlyWthr.HDD65 * |

| | | |
|---|---|---|
| | | BAR_SevereMonthlyWthr.HDDMult |
| CDD55 | CDD base 55 | BAR_NMonthlyWthr.CDD55 * BAR_SevereMonthlyWthr.CDDMult |
| CDD60 | CDD base 60 | BAR_NMonthlyWthr.CDD60 * BAR_SevereMonthlyWthr.CDDMult |
| CDD65 | CDD base 65 | BAR_NMonthlyWthr.CDD65 * BAR_SevereMonthlyWthr.CDDMult |
| CDD70 | CDD base 70 | BAR_NMonthlyWthr.CDD70 * BAR_SevereMonthlyWthr.CDDMult |
| CDD75 | CDD base 75 | BAR_NMonthlyWthr.CDD75 * BAR_SevereMonthlyWthr.CDDMult |
| CDD80 | CDD base 80 | BAR_NMonthlyWthr.CDD80 * BAR_SevereMonthlyWthr.CDDMult |

Future changes to the monthly Severe temperatures may be made by updating the scale factors. To update the scale factors, edit the values and recalculate the table.

## Transformation Tables: Weather Mild

The Weather Mild Transformation Tables convert the monthly normal weather to the mild weather scenario. The mild weather is calculated by multiply the monthly normal heating and cooling degree days by a scale factor. The scale factors are externally developed and input into FM as constants in these tables.

The following transformation tables are used to calculate the mild weather scenarios.

- BAR_MildMonthlyWthr
- CLA_MildMonthlyWthr
- DAV_MildMonthlyWthr
- DEC_MildMonthlyWthr
- DUB_MildMonthlyWthr
- HAR_MildMonthlyWthr
- HEN_MildMonthlyWthr
- JAC_MildMonthlyWthr
- JOH_MildMonthlyWthr
- ORA_MildMonthlyWthr
- RSE_MildMonthlyWthr
- SCI_MildMonthlyWthr
- SOE_MildMonthlyWthr
- SOU_MildMonthlyWthr
- UDW_MildMonthlyWthr
- WIE_MildMonthlyWthr
- WWC_MildMonthlyWthr
- WWV_MildMonthlyWthr
- System_MildMonthlyWthr

Each monthly mild weather transform table contains the same set of monthly weather variables. These variables use the same formulas but reference different scale factors and normal monthly weather. The table below shows the variables for each weather station using BAR as the formula example.

| Variable | Description | Formula |
|---|---|---|

| | | |
|---|---|---|
| HDDMult | Heating Degree Day scale factor | 0.879 |
| CDDMult | Cooling Degree Day scale factor | 0.784 |
| HDD30 | HDD Base 30 | BAR_NMonthlyWthr.HDD30 * BAR_MildMonthlyWthr.HDDMult |
| HDD35 | HDD base 35 | BAR_NMonthlyWthr.HDD35 * BAR_MildMonthlyWthr.HDDMult |
| HDD40 | HDD base 40 | BAR_NMonthlyWthr.HDD40 * BAR_MildMonthlyWthr.HDDMult |
| HDD45 | HDD base 45 | BAR_NMonthlyWthr.HDD45 * BAR_MildMonthlyWthr.HDDMult |
| HDD50 | HDD base 50 | BAR_NMonthlyWthr.HDD50 * BAR_MildMonthlyWthr.HDDMult |
| HDD55 | HDD base 55 | BAR_NMonthlyWthr.HDD55 * BAR_MildMonthlyWthr.HDDMult |
| HDD60 | HDD base 60 | BAR_NMonthlyWthr.HDD60 * BAR_MildMonthlyWthr.HDDMult |
| HDD65 | HDD base 65 | BAR_NMonthlyWthr.HDD65 * BAR_MildMonthlyWthr.HDDMult |
| CDD55 | CDD base 55 | BAR_NMonthlyWthr.CDD55 * BAR_MildMonthlyWthr.CDDMult |
| CDD60 | CDD base 60 | BAR_NMonthlyWthr.CDD60 * BAR_MildMonthlyWthr.CDDMult |
| CDD65 | CDD base 65 | BAR_NMonthlyWthr.CDD65 * BAR_MildMonthlyWthr.CDDMult |
| CDD70 | CDD base 70 | BAR_NMonthlyWthr.CDD70 * BAR_MildMonthlyWthr.CDDMult |
| CDD75 | CDD base 75 | BAR_NMonthlyWthr.CDD75 * BAR_MildMonthlyWthr.CDDMult |
| CDD80 | CDD base 80 | BAR_NMonthlyWthr.CDD80 * BAR_MildMonthlyWthr.CDDMult |

Future changes to the monthly mild temperatures may be made by updating the scale factors. To update the scale factors, edit the values and recalculate the table.

## Transformation Tables: Weather Extreme

The Weather Extreme Transformation Tables convert the monthly normal weather to the extreme weather scenario. The extreme weather is calculated by multiply the monthly normal heating and cooling degree days by a scale factor. For the initial configuration, the extreme scale factors are the same as the severe scale factors.

The following transformation tables are used to calculate the severe weather scenarios.

- BAR_ExtremeMonthlyWthr
- CLA_ExtremeMonthlyWthr
- DAV_ExtremeMonthlyWthr
- DEC_ExtremeMonthlyWthr
- DUB_ExtremeMonthlyWthr
- HAR_ExtremeMonthlyWthr
- HEN_ExtremeMonthlyWthr
- JAC_ExtremeMonthlyWthr
- JOH_ExtremeMonthlyWthr
- ORA_ExtremeMonthlyWthr
- RSE_ExtremeMonthlyWthr
- SCI_ExtremeMonthlyWthr
- SOE_ExtremeMonthlyWthr
- SOU_ExtremeMonthlyWthr
- UDW_ExtremeMonthlyWthr
- WIE_ExtremeMonthlyWthr
- WWC_ExtremeMonthlyWthr
- WWV_ExtremeMonthlyWthr
- System_ExtremeMonthlyWthr

Each monthly extreme weather transform table contains the same set of monthly weather variables. These variables use the same formulas but reference different scale factors and normal monthly weather. The table below shows the variables for each weather station using BAR as the formula example.

| Variable | Description | Formula |
|---|---|---|
| HDDMult | Heating Degree Day scale factor | 1.111 |
| CDDMult | Cooling Degree Day scale factor | 1.260 |
| HDD30 | HDD Base 30 | BAR_NMonthlyWthr.HDD30 * BAR_ExtremeMonthlyWthr.HDDMult |
| HDD35 | HDD base 35 | BAR_NMonthlyWthr.HDD35 * BAR_ExtremeMonthlyWthr.HDDMult |
| HDD40 | HDD base 40 | BAR_NMonthlyWthr.HDD40 * BAR_ExtremeMonthlyWthr.HDDMult |
| HDD45 | HDD base 45 | BAR_NMonthlyWthr.HDD45 * BAR_ExtremeMonthlyWthr.HDDMult |
| HDD50 | HDD base 50 | BAR_NMonthlyWthr.HDD50 * BAR_ExtremeMonthlyWthr.HDDMult |
| HDD55 | HDD base 55 | BAR_NMonthlyWthr.HDD55 * BAR_ExtremeMonthlyWthr.HDDMult |
| HDD60 | HDD base 60 | BAR_NMonthlyWthr.HDD60 * BAR_ExtremeMonthlyWthr.HDDMult |
| HDD65 | HDD base 65 | BAR_NMonthlyWthr.HDD65 * BAR_ExtremeMonthlyWthr.HDDMult |
| CDD55 | CDD base 55 | BAR_NMonthlyWthr.CDD55 * BAR_ExtremeMonthlyWthr.CDDMult |
| CDD60 | CDD base 60 | BAR_NMonthlyWthr.CDD60 * BAR_ExtremeMonthlyWthr.CDDMult |
| CDD65 | CDD base 65 | BAR_NMonthlyWthr.CDD65 * |

| | | |
|---|---|---|
| | | BAR_ExtremeMonthlyWthr.CDDMult |
| CDD70 | CDD base 70 | BAR_NMonthlyWthr.CDD70 * BAR_ExtremeMonthlyWthr.CDDMult |
| CDD75 | CDD base 75 | BAR_NMonthlyWthr.CDD75 * BAR_ExtremeMonthlyWthr.CDDMult |
| CDD80 | CDD base 80 | BAR_NMonthlyWthr.CDD80 * BAR_ExtremeMonthlyWthr.CDDMult |

Future changes to the monthly Extreme temperatures may be made by updating the scale factors. To update the scale factors, edit the values and recalculate the table.

# Section 3: Resource Assessment

Section 3 of this IRP describes Hoosier Energy's existing resources, including generation, transmission, rate design and demand-side management. Future Resource Assessments are presented in Section 4 of this IRP.

The 2023 Hoosier Energy Integrated Resource Plan was developed to enable Hoosier Energy to seek the lowest power supply cost possible for member distribution systems for a targeted level of low market and business risk, while maintaining a high degree of generation and transmission reliability. Through this IRP, Hoosier Energy has attempted to include all economic and reliable resources, both traditional supply-side resources and demand-side resources, to meet future electric service requirements.

## 3.1 Existing Resource Assessment

Hoosier Energy's portfolio has seen significant changes over the past decade. Over the past 10 years, Hoosier Energy has made a number of changes to its resource portfolio demonstrating a commitment to an "all of the above" power supply strategy. Hoosier Energy has added resources fueled by natural gas, landfill gas, wind, solar, hydro as well as continued energy efficiency and demand response efforts.

- Implementation and update of new wholesale tariff options to support demand response efforts.
- Multiple updates of an extensive analysis of member consumer energy usage to develop and implement appropriate energy efficiency and demand-side management programs.
- Development of a 10 MW regional solar program throughout southern Indiana.
- Purchase of 75 MW of wind generation from the Meadow Lake Wind Farm in White County, Indiana through a PPA.
- Purchase of 200 MW of solar generation from the Riverstart Solar Park in Randolph County, Indiana through a PPA.
- Sale of the Merom facility to Hallador Energy and subsequent agreement to purchase 300 MW of capacity and up to 1,600 GWh of annual energy.
- Purchase of 250 MW of capacity and energy under a slice of system agreement with Duke Energy Indiana.
- Purchase of 120 MW of capacity from the Gibson City, Illinois CT and 220 MW of capacity from the Shelby County, Illinois CT through a PPA.
- A three-year agreement for 50 MW of capacity from the Clinton nuclear facility in central Illinois.
- A ten-year agreement that provides Hoosier Energy with 100 MW of capacity in the Summer and Fall seasons and 50 MW of capacity in the Winter and Spring seasons.
- A ten-year agreement that provides Hoosier Energy with 157 MW of capacity in all seasons.

- Purchase of 400 MW of capacity and energy from the Palisades nuclear plant in South Haven, Michigan through a long-term PPA.

The above resource changes have continued the diversification of Hoosier Energy's resource mix with the primary goal of maintaining reliable and affordable energy for consumers.

### *3.1.1 2020 and 2022 All-Source Request for Proposals*

In March 2020, Hoosier Energy issued an all-source Request for Proposal (RFP) seeking up to 1,000 MW of capacity and energy resources to fill the need created by the prospective Merom retirement. This RFP received a broad range of responses from both a resource type and geographic perspective.

Capacity (MW) by Project Type and State

| State | Storage | Other | Solar | Solar + Storage | Gas or Coal* | Wind | Total |
|---|---|---|---|---|---|---|---|
| IN | 200 | 3,766 | 8,780 | 554 | 3,633 | 0 | 16,932 |
| IL | 0 | 3 | 1,134 | 274 | 1,144 | 302 | 2,858 |
| KY | 0 | 0 | 925 | 0 | 0 | 0 | 925 |
| AR | 0 | 0 | 135 | 0 | 680* | 0 | 815 |
| WI | 0 | 0 | 0 | 0 | 503 | 0 | 503 |
| MI | 0 | 0 | 50 | 0 | 450 | 0 | 500 |
| Other | 0 | 0 | 0 | 100 | 0 | 0 | 100 |
| **Total** | **200** | **3,769** | **11,024** | **928** | **6,410** | **302** | **22,633** |
| MISO Credit | 200 | 300 | 5,512 | 928 | 5,769 | 45 | 12,754 |

Following a lengthy period of analysis and negotiations, Hoosier Energy acquired 250 MW of capacity and energy resources and 490 MW of capacity-only resources through bilateral agreements. These PPAs have terms ranging from three to ten years, which provide flexibility and allows Hoosier Energy to stagger the additions of future replacement resources. It should be noted that only 300 MW of potential Wind resource proposals were received in the RFP, which was far below the anticipated response. Consequently, Hoosier Energy was unable to procure the 800 MW of Wind resources that were expected to be online by 2023 as discussed in its 2020 IRP Preferred Plan.

Hoosier Energy issued a follow-up all-source RFP in July 2022 to procure an unspecified amount of capacity and energy resources to meet its future requirements and inform supply-side resource assumptions in this IRP. Again, this RFP response received a broad range of resource types and locations.

| State | Solar | Solar + Storage | Standalone Storage | Wind | Gas | Hydrogen | Financial Power | Capacity | Capacity Location |
|---|---|---|---|---|---|---|---|---|---|
| IL | 844 | - | 850 | 200 | 314 | | | 1,150 | MISO Zone 4 |
| IN | 2,082 | 600 | 751 | 200 | 720 | 244 | 450 | 143 | MISO Zone 6 |
| MI | - | - | 250 | - | | | | 125 | MISO Zone 7 |
| MO | 214 | - | - | - | | | | | |
| KY | 270 | 270 | 200 | - | 100 | | | | |
| WI | 200 | - | - | - | | | | | |
| PJM (OH) | - | | | | 200 | | | | PJM ERZ |
| Total | 3,610 | 870 | 2,051 | 400 | 1,334 | 244 | 450 | 1,418 | |

As a result of this RFP, Hoosier Energy entered into a 10-year agreement to procure capacity-only resources. Other responses remain in the negotiation phase and have been used to inform the assumptions of the resource modeling in this IRP.

### *3.1.2 Generation Facilities – Owned Resources*

Hoosier Energy owns and operates generating stations with a total Summer net demonstrated production capacity of approximately 660 MW. This capacity consists of 640 MW of natural gas-fired capacity and 20 MW of renewable resource capacity.

The Worthington facility consists of four General Electric LM6000s with a net summer demonstrated capacity of 170 MW. The LM6000 combustion turbines are more efficient than “frame-type” combustion turbines with a heat rate of approximately 10,000 Btu per kWh. LM6000s also have quick start capability and their relatively small individual size allows significant scheduling and ramping flexibility.

The Lawrence generation facility became operational in 2005. Lawrence consists of six General Electric LM6000s combustion turbines with a net summer capacity rating of 258 MW. Hoosier Energy owns two-thirds of the facility and the output while Wabash Valley Power Association owns one-third. The CTs have a heat rate of approximately 10,000 Btu per kWh and have quick start capability.

Hoosier Energy owns 50% of the Holland generation facility. Holland is a gas-fired, combined cycle facility located in Effingham County, Illinois. Holland is a 2x1 CC with two GE 7FA combustion turbine generators and a single Toshiba steam turbine generator. The facility is also equipped with two Nooter/Eriksen Heat Recovery Steam Generators with $NO_x$ selective catalytic reduction (SCR) and 75 MW duct burners for each HRSG. Total plant heat rate is approximately 7,500 Btu per kWh.

The 15 MW Livingston Renewable Energy Plant, located near Pontiac, Illinois, is a baseload, landfill methane-gas facility. This facility was acquired by Hoosier Energy in November 2011 and has been refurbished and began operations in October 2013. The plant consists of three turbine engines fueled by landfill methane gas, which is sourced from the 460-acre Livingston Landfill. Energy from the Livingston plant is delivered to the grid through an interconnection with ComEd.

Beginning in 2015, Hoosier Energy commenced a 10 MW regional solar program. The program consists of construction and operation of ten different 1 megawatt solar arrays located along highly visible roadways across southern Indiana. Each array provides benefits for both the nearby local cooperatives as well as all 18 member systems. The cost for generating solar power through a utility-scale program is significantly less per kilowatt hour when compared with individual, smaller scale systems. Collectively, the ten solar sites provide approximately 18,000 MWh of energy annually. Sites are located in New Castle, Scotland, Lanesville, Ellettsville, New Haven, Henryville, Trafalgar, Center, Ogilville and Spring Mill.

Table 3 summarizes Hoosier Energy's owned generation facilities.

| Resource | Type | Net Demonstrated Capacity (MW) | ISO/RTO Unforced Summer Capacity (MW) | ISO/RTO Unforced Winter Capacity (MW) |
|---|---|---|---|---|
| Holland | Gas | 295 | 292 | 355 |
| Worthington | Gas | 165 | 159 | 211 |
| Lawrence | Gas | 176 | 174 | 217 |
| Livingston | Landfill Gas | 13 | 13 | 13 |
| Solar Units | Solar | 10 | 8 | 0 |

**Table 3: Hoosier Energy's Owned Generation**

### *3.1.3 Power Purchases*

In addition to owned generation resources, Hoosier Energy uses a mix of long-term and short-term power purchases to provide reliable and least-cost service to member systems.

Hoosier Energy purchases 300 MW from Duke Energy Indiana under two separate, cost-based, long-term purchase agreements. The first agreement is for 50 MW and runs through 2025, while the second agreement is for 250 MW and runs through MISO Planning Year 2027-28. The 250 MW agreement was a result of Hoosier Energy's 2020 RFP. These slice-of-system purchases provide better diversity and less operating risk than an owned resource.

Hoosier Energy also purchases capacity, energy and renewable energy credits from resources through a number of purchased power agreements.

A 20-year purchased power agreement for electricity produced by the Dayton Hydro facility, which runs through November 2031. This project is a 3.6 MW hydroelectric facility near Dayton, IL. The plant produces about 18,000 megawatt-hours annually.

The Rail Splitter facility is a 100 MW facility located near Lincoln, Illinois. Hoosier Energy entered into a 15-year agreement with EDP Renewables to purchase 25 MW from the facility. Energy purchases under the PPA began in December 2014 and continue through the end of 2029. In addition to capacity and renewable energy credits, Hoosier Energy receives approximately 70,000 MWh of energy annually from the facility.

Hoosier Energy entered into a PPA with developer EDP Renewables on a wind project in White County in northwest Indiana. The PPA includes the purchase of 75 MW from the Meadow Lake V project. The Meadow Lake V project represents an expansion of the existing 500 MW wind farm that has been in service for a number of years. Hoosier Energy purchased 75 MW beginning in January 2020 for a 20-year term. Hoosier Energy receives approximately 235,000 MWh of energy annually from the facility.

Hoosier Energy entered into a long-term agreement with EDP Renewables for energy and capacity from the Riverstart Solar Park in Modoc, IN. This facility was built in Hoosier Energy's service territory and interconnected to the PJM regional transmission organization. The PPA calls for 200 MW of installed capacity, and an expected 340,000 MWh of energy, annually beginning July 1, 2022, and extending through December 31, 2039. The energy price is fixed throughout the term. In addition, Hoosier Energy will receive Renewable Energy Credits (RECs) as part of this transaction.

In 2022, Hoosier Energy reached agreement to sell the Merom plant to Hallador Energy Company rather than retire the facility. As part of the agreement, Hoosier Energy entered into a PPA with Hallador to purchase the full plant share of capacity and energy for MISO Planning Year 2022-23 and then 300 MW through calendar year 2025. In 2023, the parties amended the agreement to extend the term through MISO Planning Year 2027-28. Hoosier Energy receives approximately 1,400 GWh of energy annually from the facility.

In September 2023, Hoosier Energy entered an agreement with Holtec, Inc. and Wolverine Power Cooperative (Wolverine) to restart the 800 MW Palisades nuclear plant near South Haven, MI. The facility would become the first decommissioned nuclear plant to be restarted in the entire United States. Under the agreement, Wolverine would purchase up to two-thirds of the power generated by the plant, while Hoosier Energy would purchase the remaining share. Hoosier Energy anticipates that the facility will return to service in 2026 and that it will provide 400 MW of capacity and 3,300 GWh of annual energy.

As referenced in Section 3.11, Hoosier Energy entered into a number of agreements as a result of its 2020 and 2022 all-sources RFPs.

- A five-year agreement with Duke Energy Indiana for 250 MW of capacity and energy in all seasons.
- Two contracts with Earthrise Energy, a three-year contract for 120 MW of capacity from its Gibson City, Illinois CT and a ten-year agreement for 220 MW of capacity from its Shelby County, Illinois CT.
- A three-year agreement with Exelon for 50 MW of capacity from its Clinton nuclear facility in central Illinois.
- A ten-year agreement with NextEra Energy that provides Hoosier Energy with 100 MW of capacity in the Summer and Fall seasons and 50 MW of capacity in the Winter and Spring seasons.
- A ten-year agreement with Invenergy that provides Hoosier Energy with 157 MW of capacity in all seasons.

Table 4 summarizes Hoosier Energy's existing contracted power purchases.

| Resource | Type | Expires | Contracted Capacity (MW) | ISO/RTO Summer Unforced Capacity (MW) | ISO/RTO Winter Unforced Capacity (MW) |
|---|---|---|---|---|---|
| Duke Indiana | Slice of System | 2025 | 50 | 50 | 50 |
| Exelon - Clinton | Nuclear | 2026 | 50 | 50 | 50 |
| Earthrise - Shelby Co | Gas | 2026 | 120 | 120 | 120 |
| Duke Indiana | Slice of System | 2028 | 250 | 250 | 250 |
| Hallador - Merom | Coal | 2028 | 300 | 300 | 300 |
| Rail Splitter | Wind | 2029 | 25 | 2 | 3 |
| Dayton Hydro | Hydro | 2031 | 4 | 3 | 2 |
| Invenergy - Nelson | Gas | 2033 | 157 | 157 | 157 |
| NextEra | Hydro | 2033 | 100 Su,F/50 W,Sp | 100 | 50 |
| Earthrise - Gibson Cit | Gas | 2033 | 220 | 220 | 220 |
| Meadow Lake | Wind | 2037 | 25 | 4 | 4 |
| Meadow Lake | Wind | 2039 | 50 | 8 | 8 |
| Riverstart | Solar | 2039 | 200 | 76 | 76 |
| Palisades[1] | Nuclear | 2053 | 400 | 400 | 400 |

1 - Contract begins in 2026

**Table 4: Hoosier Energy's Power Purchases**

## 3.2 Demand-Side Resource Assessment

DSM is generally defined as utility action or policy that reduces energy consumption or curtails end-use equipment or processes. DSM includes programs that are focused and immediate such as the brief curtailment of energy-intensive processes (demand response). In addition, DSM includes programs that are broad and less immediate such as the promotion of energy-efficient lighting, equipment and devices.

### *3.2.1 DSM Programs*

Hoosier Energy and its member distribution cooperatives have developed a number of demand response and energy efficiency programs. Appendix D is the 2022 Demand Side Management Annual Report, which provides detail on the impact by member system. The Annual Report also provides demand and energy savings and economic benefit projections by program.

Hoosier Energy has developed a website to provide member consumers with online access to information on each of the available DSM programs, including how to sign up for each program. A link to Hoosier Energy's DSM website is below.

Source: http://whyelectrify.com

#### *3.2.1.2 Residential HVAC Rebates*

The residential heating, ventilation and air conditioning (HVAC) program provides incentives to homeowners to upgrade to more efficient systems. More than 1,470 HVAC, attic insulation and duct sealing rebates were paid in 2022 to consumers who installed qualifying equipment. Since 2009, the Residential HVAC program has resulted in energy savings of 58,500 MWh and a 15.34 MW reduction in Summer peak demand. Program results are projected to reduce lifetime energy costs for participating businesses by almost $40 million.

#### *3.2.1.3* Commercial and Industrial Programs

Commercial and Industrial (C&I) program incentives are designed to assist businesses in reducing electric demand in their facilities by purchasing and installing energy-efficient equipment, including lighting, HVAC systems, motors and compressed air systems. Through the C&I program, Hoosier Energy assisted member systems in providing incentives for 25 projects in 2022. Since 2009, the C&I program has resulted in energy savings of 150,000 MWh and a 25.31 MW reduction in Summer peak demand. Program results are projected to reduce lifetime energy costs for participating businesses by more than $110 million.

#### *3.2.1.4* Energy Management Savings Switch Program

In conjunction with Member Systems, an energy management switch program is offered. This load control or demand response program is designed to alleviate demand increases by briefly cycling the retail customer's air conditioners, water heaters, pool pumps and irrigation systems. Activation of switches during peak demand periods by Hoosier Energy helps reduce the need for more expensive generation or purchased power. Member System participation is encouraged through price signals from the Standard Wholesale Tariff and Member Systems may also provide incentives to retail customers through bill credits or rebates. All Member Systems have installed advanced metering infrastructure or AMI and some use this to technology to implement this program.

#### *3.2.1.5* Smart Thermostat Program

This program, open to all member cooperatives, installs Wi-Fi enabled thermostats in participating member-consumer homes. The program focuses on identifying differing value propositions in the MISO energy, transmission and capacity markets. The Smart Thermostat Program had 299 participants in 2022 resulting in annual energy savings of 5.7 MWh and a 1.7 MW reduction in Summer peak demand.

#### *3.2.1.6* Pilot Programs

Hoosier Energy designs innovative beneficial electrification pilot projects to explore emerging technologies, support member needs and assess applicability for expansion across service territories. Hoosier Energy is conducting two pilot DSM programs, an Electric Outdoor Equipment program and a HVAC Tune-up program. The Electric Outdoor Equipment program provides incentives to member cooperatives for participants to purchase electric outdoor equipment such as lawn mowers, leaf blowers, string trimmers and chainsaws. The Electric Outdoor Equipment program had 486 Total Measures Purchased in 2022.

The HVAC Tune-up program provides incentives for participants to have HVAC equipment serviced including Air Conditoners, Geothermal Heat Pumps, Multi-Source Heat Pumps and Air-Source Heat Pumps. In 2022, the HVAC Tune-up program had 321 Total Measures Installed.

### *3.2.2 Wholesale Tariffs*

Hoosier Energy wholesale tariffs are designed to encourage demand response participation by the member systems and to introduce time-of-use energy pricing. The tariffs were reviewed and rates updated by Hoosier Energy in 2021 for implementation in April 2023. Below is a description of the Standard Wholesale Tariff:

> Production Demand Charge - The Standard Wholesale Tariff aligns the G&T tariff and system capacity costs through higher seasonal demand charges that more accurately reflect the greater cost of capacity in summer and winter peak months. Production Demand charges are billed on the MISO coincident peak in the summer months of June, July and August and the winter months of December, January and February. The off-peak months of September – November are billed on the average coincident peak for the three previous summer months. Similarly, the off-peak months of March – May are billed on the average coincident peak for the three previous winter months.

Transmission Demand Charge – The charges are based upon MISO coincident demand (CP) for the months of December – February and June – August. All other months the Transmission Demand Charge is billed at the time of the Hoosier Energy system peak. The transmission charge recovers costs associated with system-wide transmission facilities and MISO costs.

Substation/Radial Line Demand Charge – Billed on the non-coincident peak (NCP) for a 30-minute clock interval, this charge recovers the substation and local line costs for each meter point.

Member Service Charge – Billed on the non-coincident peak NCP for a 30-minute clock interval, this charge recovers a variety of member specific costs.

Energy Charge - The Standard Wholesale Tariff includes both on-peak and off-peak energy charges, with the on-peak charges set higher than the off-peak energy charges. On-peak periods for energy charges are narrowly defined as including six hours per day on summer weekdays and two, three-hour periods on winter weekdays. All weekend days and all days in "valley" months of March through May and September through November are defined as off-peak for energy charges. The differentiation between on and off-peak energy charges is intended to recover energy costs in a manner more consistent with the market price signals. In addition, this differentiation provides an incentive to members and end consumers to shift load to off-peak periods.

*Optional Wholesale Tariffs*

Hoosier Energy offers wholesale tariffs that are intended to provide consumers with options to manage energy costs. The tariffs are also designed to provide the G&T with tools to better manage costs during periods of high demand and market prices and to promote consumer-owned distributed generation, including the purchase of consumer power by Hoosier Energy. While not required by the Energy Policy Act of 2005, the provisions of these tariffs are consistent with key principles of that legislation. The tariffs reflect the G&T's continuing effort to develop efficiency and demand response/demand-side management (DSM) options for consumers. Tariff provisions are summarized below.

Schedule CPP – Avoided Rates for Qualifying Facilities and Distributed Generation Resources

- Customer-owned power production resources between 50 kW and 20,000 kW
- Purchases from Qualifying Facilities paid in accordance with formulae are found at 170 IAC 4-4.1-8 and 4-4.1-9.
- Purchases from Distributed Generation resources shall be negotiated on a case-by-case basis but shall not exceed the rates for purchases of energy and capacity from Qualifying Facilities.

## 3.3 Significant Issues Affecting Resources

### *3.3.1 Environmental Factors*

Environmental Rules and Regulations

In recent years, the U.S. Environmental Protection Agency (EPA) has issued numerous regulations intended to reduce harmful air emissions and wastewater contaminants. Due to challenges from past and current Administrations, the potential impact and timing of these regulations to Hoosier Energy remains unclear in some instances. The sale of the Merom facility to Hallador Energy provides a major change in the focus of the environmental rules pertaining to Hoosier Energy's generation.

NOX Emission Reduction Requirements under CSAPR and Good Neighbor Plan

Hoosier Energy is required to comply with the Cross-State Air Pollution Rule (CSAPR) ozone season program. This program addresses the summertime (May – September) transport of ozone pollution in the eastern United States that crosses state lines. This rule adopts federal implementation plans (FIPs) for all twenty-two states, updating the existing CSAPR NOx ozone season emission budgets for each state's power generating units. States are allowed to replace the FIPs by submitting state plans that adopt the CSAPR update trading program budgets. Hoosier Energy must maintain the Water Injection systems for NOx reduction in order to comply. On August 4, 2023, the Good Neighbor Plan went into effect and is administered under EPA's CSAPR Program. The plan requires twenty-two states to further reduce ozone season NOx emissions during ozone season (May – September). Currently, the plan is being implemented in ten states: Illinois, Indiana, Maryland, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia, and Wisconsin. Hoosier Energy must maintain the Water Injection systems for NOx reduction in order to comply.

Clean Air Act 111 (b) and (d) Existing Plant Rulemaking

On May 23, 2023, the EPA published proposed Clean Air Act emission limitations for Carbon Dioxide (CO2) for new and existing fossil fuel-fired power plants using the best system of emission reduction (BSER) technology. The proposed standards are based on technologies such as carbon capture and sequestration/storage (CCS), low-GHG hydrogen co-firing, and natural gas co-firing. Existing coal-fired generating units that will not retire before 2040 would be required to achieve a degree of emission limitation equivalent to CCS with 90% capture of CO2 by January 1, 2030. Existing units that will retire between 2032 and 2039 would be required to achieve a degree of emission limitation equivalent to 40% natural gas co-firing by January 1, 2030. Under current operating conditions there would be minimal to no impact to Hoosier Energy's electric generating units, but if operational requirements or market pressures increased, there could be potential implications. Existing units that will co-fire low-GHG hydrogen must achieve a degree of emission limitation equivalent to co-firing 30% by volume low-GHG hydrogen by January 1, 2032 and 96% by January 1, 2038. By January 1, 2035, Existing units that will install CCS must achieve a degree of emission limitation equivalent to CCS with 90% capture of CO2 or impose a 50% capacity factor. IDEM is required to develop a state plan to establish emission guidelines.

In August 2018, the EPA proposed the Affordable Clean Energy (ACE) rule, which repeals and replaces the CPP. The final rule was issued by the EPA in June 2019. The ACE rule establishes emission guidelines for states to use when developing plans to limit carbon dioxide (CO2) at their coal-fired electric generating units and empowers states to develop their own plans to reduce Green House Gas. The ACE rule directs States to establish performance standards for power plants based solely on heat rate improvements and includes a list of "candidate technologies" for improving heat-rate efficiency that states can use to establish standards of performance for individual power plants. IDEM is currently developing the state plan. The ACE rule and repeal of the CPP has been challenged by more than two dozen states and numerous interest groups.

In July 2023, the EPA announced proposed rules aimed at reducing carbon dioxide emissions from coal- and gas-fired power plants by requiring them to use carbon capture and sequestration and co-firing of hydrogen. This proposal was issued under Section 111 of the Clean Air Act for both new and existing plants and would repeal the ACE rule. The new rule would set nationwide standards on plants based on whether they are new or existing, their fuel type, frequency of usage, capacity and how long they plan to operate. The EPA proposed two pathways for baseload units: using Carbon Capture and Sequestration to capture 90% of GHG emissions by 2035 and the co-firing of 30% (by volume) low-GHG hydrogen by 2032, increasing to 96% by 2038. While this proposal has already been challenged and the ultimate outcome is uncertain, Hoosier Energy has included these standards in its IRP modeling. When implemented, the changes above with the Clean Air Act will replace ACE.

*Illinois Climate and Equitable Jobs Act*
Hoosier Energy owns and contracts with electrical generating resources in Illinois that are subject to state jurisdictional environmental regulations. In September 2021, Governor J.B. Pritzker signed the Climate and Equitable Jobs Act (CEJA) into law. This law is a set of policies designed to move Illinois close to a carbon-free future power sector by 2045 and 100 percent clean energy by 2050. Among the CEJA requirements is that all natural gas power plants be retired or switch to green hydrogen fuel by 2045. As such, Hoosier Energy assumes that for purposes of this IRP, all of its Illinois resources will either meet the CEJA standards or retire by 2045.

*Potential Future Environmental Regulations*
In addition to current environmental regulations addressed above, Hoosier Energy also considered the impact of potential future environmental regulations on its portfolio. The impact of Clean Air Act 111(b) on new fossil generation was modeled in the following scenarios:

- Base + 111(b)
- Carbon Tax + EPA
- Aggressive Environmental
- High Price Environment

The impact of a potential Carbon Tax was modeled in the following scenarios:

- Carbon Tax
- Carbon Tax + EPA
- Aggressive Environmental

The modeling of these scenarios is discussed in Section 4 of this IRP.

### *3.3.2 Economic Factors*

*Fuel Prices and Fuel Practices*

With the sale of the Merom facility, Hoosier Energy's fuel and commodity procurement activities have dramatically changed since the 2020 IRP. The fuel procurement is now essentially made up of the following material acquisitions:

- Natural gas
- Ammonia
- Sulfuric Acid
- Sodium Hypochlorite

*Natural Gas and Transportation*

Hoosier Energy and Wabash Valley Power are joint owners of the Holland facility and are responsible for procuring natural gas and gas transportation. Currently, the parties have a contract with Tenaska Marketing Ventures to supply natural gas and transportation to Holland via the NGPL pipeline. Tenaska is a reliable and appropriate service provider.

Transportation of supply to Worthington Generation is provided through agreements with Texas Gas Transmission. Hoosier administers an Hourly Overrun Transportation (HOT) and Park & Loan (PAL) Service Agreements with Texas Gas to satisfy the supply needs of all four units.

Hoosier Energy also has a supply agreement with Citizens Energy Group to connect the Worthington generating facility to their supply system. This has provided both reliability and fuel diversity by establishing access to multiple major interstate pipelines as well as Citizens' natural gas storage field.

Transportation of supply to Lawrence County is provided through a marketing agreement with Sequent Energy, Hoosier Energy, and ANR Pipelines. This agreement provides Lawrence County with greater flexibility in transportation and more competitive pricing, thereby creating increased efficiencies and reduced cost to satisfy the supply needs of all six units.

*Avoided Cost Calculation*

As defined in 170 IAC 4-7-1 (b), "avoided cost" means the incremental or marginal cost to a utility of energy or capacity, or both, not incurred by a utility if an alternative supply-side resource or demand-side resource is included in the utility's IRP. Table 5 presents Hoosier Energy's calculation of the avoided Demand and Energy costs for the years 2024 through 2043 in nominal dollars per kW-month and dollars per MWh. These rates are based upon the cost of a generic Combustion Turbine and have been developed consistent with the IURC's QF calculation. The annual costs have been escalated by a percentage rate consistent with the annual increase in the Consumer Price Index as forecasted by EIA in its 2023 Annual Energy Outlook.

| | Avoided Fixed Cost ($/kW-mo) | Avoided On-Peak Energy Cost ($/MWh) | Avoided Off-Peak Energy Cost ($/MWh) |
|---|---|---|---|
| 2024 | $ 4.16 | $ 46.42 | $ 36.01 |
| 2025 | $ 4.25 | $ 52.57 | $ 40.34 |
| 2026 | $ 4.34 | $ 57.54 | $ 44.50 |
| 2027 | $ 4.43 | $ 59.00 | $ 45.97 |
| 2028 | $ 4.53 | $ 60.18 | $ 46.68 |
| 2029 | $ 4.63 | $ 60.30 | $ 47.03 |
| 2030 | $ 4.73 | $ 61.34 | $ 47.40 |
| 2031 | $ 4.84 | $ 57.59 | $ 41.47 |
| 2032 | $ 4.95 | $ 57.19 | $ 39.88 |
| 2033 | $ 5.07 | $ 56.75 | $ 40.38 |
| 2034 | $ 5.19 | $ 57.31 | $ 40.56 |
| 2035 | $ 5.31 | $ 59.32 | $ 41.91 |
| 2036 | $ 5.44 | $ 60.54 | $ 43.17 |
| 2037 | $ 5.56 | $ 61.07 | $ 44.62 |
| 2038 | $ 5.68 | $ 61.54 | $ 46.17 |
| 2039 | $ 5.80 | $ 61.70 | $ 47.74 |
| 2040 | $ 5.93 | $ 61.77 | $ 49.39 |
| 2041 | $ 6.07 | $ 61.29 | $ 51.01 |
| 2042 | $ 6.20 | $ 60.50 | $ 53.25 |
| 2043 | $ 6.35 | $ 59.78 | $ 55.26 |

**Table 5: Summary of Avoided Costs**

### *3.3.3 Transmission Resources*

*Analysis of Existing Utility Transmission System*

Hoosier Energy cooperates with all utilities within the Midcontinent ISO as well as our regional reliability council, ReliabilityFirst Corporation (RFC), to ensure that system changes are compatible with an orderly, economic and reliable development of the entire grid.

Hoosier Energy currently has physical interconnections with the following utilities:

- Big Rivers Electric Corp. (Big Rivers)
- Duke Energy Indiana
- CenterPoint

- AES Indiana (AES)
- Ameren
- Indiana & Michigan Power (I&M)
- Louisville Gas & Electric (LGE)

Hoosier Energy's transmission system consists of more than 1,700 miles of transmission line at 34.5 kilovolts (kV), 69 kV, 138 kV, 161 kV, and 345 kV. Approximately 59 percent of the member systems' power requirements are delivered to Hoosier Energy substations and delivery points using the transmission facilities of Duke Energy Indiana, CenterPoint, AES, LGE, I&M and Ameren. The remainder is delivered through Hoosier Energy's transmission facilities.

Hoosier Energy's system presently includes twenty-eight primary substations and approximately 295 distribution substations/delivery points. The distribution substations that serve the member systems are owned in part by Hoosier Energy and the member system. Hoosier Energy owns all the high voltage equipment, transformers, regulators, metering, the low voltage bus disconnect, all associated structures, the property and all in-ground fixtures (foundations, grounding, fencing, etc.). The member systems own the low voltage equipment and structures used for the service to the distribution circuits. Hoosier Energy performs the required maintenance on the entire substation and is responsible for upgrading of the transformer, etc., to meet increased requirements.

Hoosier Energy must coordinate any maintenance outages, expansions or upgrades on its bulk transmission system with the MISO and report these improvements to Reliability First (RF). Hoosier Energy personnel and contractors actively participate in various MISO and RF committees and work groups. Hoosier Energy complies with NERC standards that are enforceable under FERC Order 693 (reliability) and FERC Order 706 (cyber). RF is one of eight regions that enforce NERC reliability standards. Significant man-hours, documentation procedures and maintenance tracking software has been added in an effort to adequately comply with such reliability standards under Hoosier Energy's Internal Compliance Program, Administrative Bulletin 28 and Board Policy 3-7.

*Transmission Access*

Member system loads and power purchases from outside Hoosier Energy have costs associated with them for transmission access, either through agreement with the specific utility involved, or the MISO. The MISO transmission expansion cost allocation methodology requires Hoosier Energy to bear some cost of regional transmission projects. MISO continues efforts to reduce congestion throughout the footprint and recently begun an analysis that could lead to significant expansion of the bulk transmission system.

*Capital Asset Management*

Capital asset management is focused on ensuring that required maintenance is performed and necessary investments are made to economically maintain the long-term safety, security, adequacy, and reliability of these power delivery assets. A critical element of asset health that must be considered in the long-term planning process is the aging infrastructure of Hoosier Energy's transmission system; the majority of which was built more than 50 years ago. The current rate of asset replacement will eventually become insufficient to maintain reliability as those assets exceed the end of their serviceable lives. Hoosier Energy performs comprehensive asset inspections to determine which assets require replacement before substantial degradation or failure affects reliability. Ongoing comprehensive inspections, which began in 2015, will continue to guide sustainable asset replacement strategies.

In addition to replacing aging infrastructure, Hoosier Energy's expected future transmission investment depends, in part, on the development of the Preferred Plan. Table 6 displays Hoosier Energy's expected future transmission capital investment through 2028.

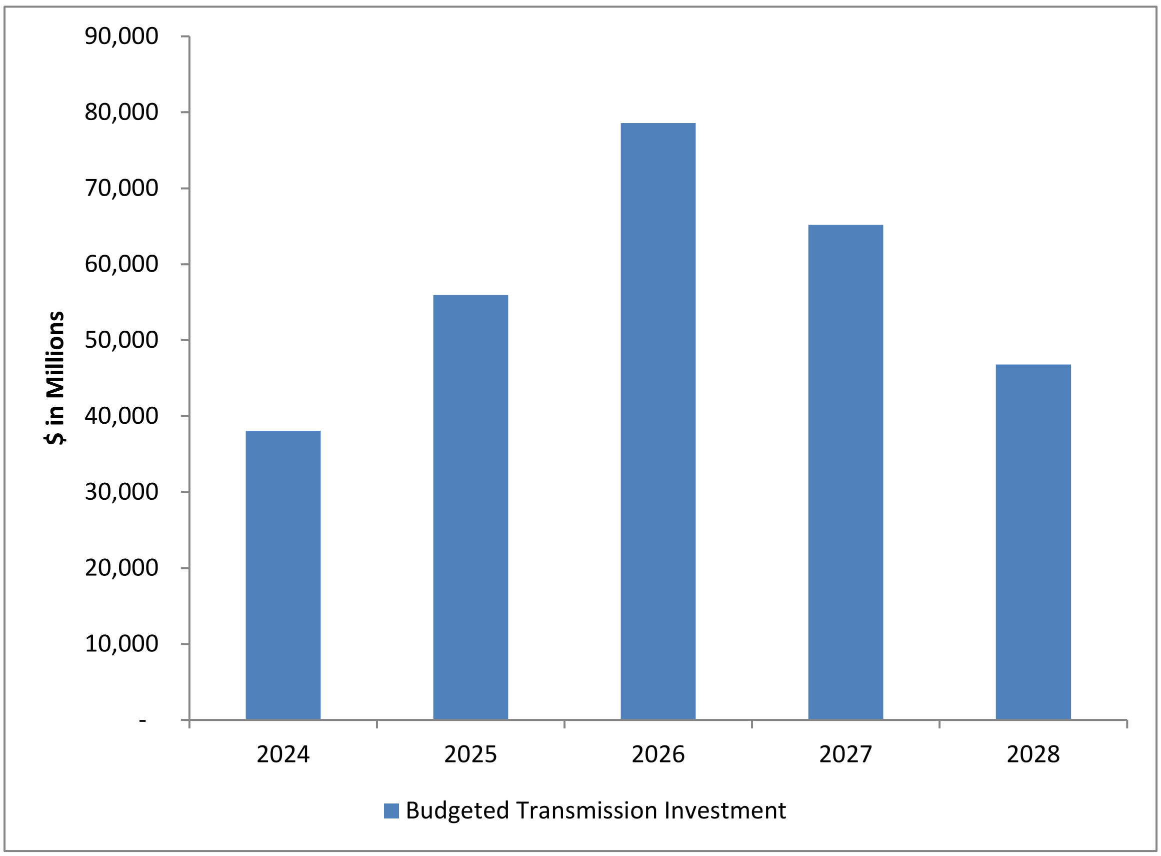



**Table 6: Budgeted Transmission Investment**

*Operations & Maintenance*

The operations and maintenance (O&M) function drives the development and execution of maintenance planning practices. These practices are designed to identify equipment maintenance tasks based on the health of equipment assets. Equipment asset health is determined through periodic inspections, monitoring, calibration, evaluation, testing, and repair. The purpose of the maintenance program is to ensure equipment asset health is sustained to ensure the highest level of reliability in a cost effective manner that protects and prolongs asset life.

As described in Section 1.1.2, Hoosier Energy has transmission crews stationed in Spencer, Seymour, Rushville, Worthington, Petersburg, Poseyville, Napoleon, and English The operations and maintenance functions serve to collect and report data points for maintenance planning as well as to construct, repair and replace equipment assets. Equipment assets include substations, transmission lines, communications equipment, and all equipment related to these major assets. In addition to equipment assets, property assets such as rights-of-way (easements) and real property are maintained under a vegetation management program. This program is generally governed by a Transmission Vegetation Management Program (TVMP) which develops the guidelines used to effectively manage vegetation on Hoosier Energy's property assets and undergoes continual improvement as methodologies and equipment evolve and within the scope of current and evolving NERC/RF requirements. The operations and maintenance functions serve as the executing entity for all transmission system maintenance plans, TVMP, and capital improvement projects including oversight of select contractors.

*FERC Form 715*

Historically, Hoosier Energy has performed an annual analysis of its transmission network to determine whether the system can reliably support the loads and resources placed upon the network. Beginning with the 2014 filing, this analysis, FERC Form 715 Annual Transmission Planning and Evaluation Report (FERC Form 715), has been filed by the Midcontinent ISO as part of the Regional FERC Form 715 filing made on behalf of the Transmission Owning members of MISO. All power flow studies and dynamic simulations incorporated into the FERC Form 715 filing were performed by MISO as part of its MISO Transmission Planning Process (MTEP) and are not specific to Hoosier Energy. MISO's annual MTEP plan assesses transmission requirements and proposes projects to maintain a reliable electric grid and deliver the lowest-cost energy to customers in the MISO region. FERC Form 715 is considered to be Critical Energy Infrastructure Information (CEII).

Hoosier Energy periodically prepares a long-range plan (Plan) as a guide for developing the system to meet present and future needs of its consumers. The purpose of the Plan is to study the current system, including asset health projections, identify system shortfalls and develop system mitigation measures that will provide the most practical and economical means of serving future loads.

The Plan was developed to examine the ability of the Hoosier Energy system to serve the projected load levels for the near term (year 0 to year 5) and longer term (year 10) planning horizons. This Plan included additional study models to align with NERC TPL001-4 Standards. Hoosier Energy is a winter peaking system, therefore, the summer peak, light load and winter peak loading conditions were evaluated. In addition to the ability to serve projected load, the health of existing assets is considered in the Plan.

Seven (7) cases were analyzed in the steady state analysis: 2022 summer, 2026 summer, 2026 spring light load, 2031 summer, and sensitivity cases for 2022 summer, 2026 summer, and 2026

spring light load. The sensitivity cases assumed generation is not available at the Merom generating station across the all the study years.
The base cases and contingency combinations described in the NERC Reliability Standard TPL-001-4 were evaluated to determine if any Hoosier Energy BES facility ratings were exceeded. For any potential criteria violations identified, system adjustments were used to mitigate the criteria violations if such adjustments were executable within the duration applicable to the facility ratings. If system adjustments were unable to resolve the violations, a system upgrade or other solution was identified.

Results of the steady state analysis show that the Hoosier Energy BES will operate reliably over a broad spectrum of system conditions and following the planning contingency events as defined by the NERC Reliability Standard TPL-001-4. All potential thermal and voltage violations were able to be mitigated through means allowed in the NERC Reliability Standard TPL-001-4.

Results of the short circuit analysis show that no Hoosier Energy BES circuit breaker interrupting capabilities were exceeded.

The results of the transient stability analysis results show all faults tested result in a stable system response except for a fault followed by a stuck breaker at the Lawrence County substation. It was determined that reducing the backup clearing time on the Lawrence County generator breakers by four (4) cycles resolves the criteria violations identified.

# Section 4: Selection of Future Resources and Resource Integration

This section presents the process that Hoosier Energy uses to select future resources. Through lengthy discussion, ACES and the Hoosier Energy portfolio team collaborated on the potential resource options to be evaluated. For the resource screening, the capacity alternatives were evaluated based on cost, reliability, availability and the maturity of technology.

## 4.1 Demand-Side Resources

In 2009, Hoosier Energy completed an extensive analysis of energy efficiency and demand-side management programs. This work has been performed by GDS Associates and Summit Blue Consulting and has been updated several times, most recently in 2023. The individual measures recommended by the analysis, and approved through a collaboration with Hoosier Energy's Member Systems, are then offered to customers through the DSM program. An effort is made to offer a menu of programs to ensure all customers the opportunity to participate. The demand and energy savings and economic benefits of each measure are included in Hoosier Energy's 2022 Demand Side Management Annual Report, which is provided as Appendix D. The DSM Report provides a description and estimated performance through 2022 and also describes changes for the future.

It is anticipated that Hoosier Energy's future Demand Response/DSM programs will be based heavily on the introduction of a new/revised wholesale rate structure, which was implemented in 2023, as well as a push for load growth within its beneficial electrification initiatives with emerging technologies. Hoosier Energy registered approximately 30 MW of Demand Response resources with MISO for each season of Planning Year 2023-24. That number will increase by more than 50% for Planning Year 2024-25.

## 4.2 Supply-Side Resources

### *4.2.1 Market Power Purchases*

The wholesale power market has developed standard products that are commonly traded in increments of 50 MW for specific hours of the day or week, such as on-peak hours (5x16), around-the-clock hours (7x24), and wrap hours (weekend 2x16 + off peak 7x8). The two most common products are forwards and options. Forward contracts are take-or-pay and, over the period of one month or more, amount to a capacity factor of approximately 45%. Option contracts are generally day-ahead whereas the buyer provides day-ahead notice to take energy. With the MISO LMP market, the industry has transitioned to financial products as primary risk management tools.

Hoosier Energy actively participates in the wholesale market to serve member load and maximize the value of resources. Hoosier Energy is a member of ACES, which acts as Hoosier Energy's agent for wholesale transactions. ACES is owned by and is the market broker for 21 cooperative members and has a working knowledge of the power market. ACES uses this market knowledge to develop proprietary market pricing information. Hoosier Energy uses information from ACES and other sources to make resource decisions.

### *4.2.2 Long-Term Power Purchases*

Long-Term power purchases are generally at least one year in length and up to 20-30 years. Long-Term purchases may allow for a more diverse portfolio of generation assets, can reduce operating risk, unit contingent risk, and diversify fuel and power supplies. Long-Term Purchases also provide the opportunity to add a resource without taking on construction and operating risk.

Hoosier Energy recognizes the value of purchases as part of a diverse portfolio of generation resources. Hoosier Energy will continue to seek power purchases as not simply an alternative but also as a complimentary component to owned generation assets.

#### *4.2.3 Natural Gas Peaking - Combustion Turbines*

Combustion turbines (CT) are generally used for peaking needs and to satisfy capacity requirements. The primary fuel for CT is natural gas with some potential for diesel as a back-up fuel. The key characteristics of CTs include low capital costs, quick start capability, short construction time and somewhat high variable cost. A shorter decision-making lead-time of for procurement, licensing and construction make CTs an attractive option from a flexibility standpoint. Hoosier Energy monitors the capacity and variable costs of the CT resources based upon quotes from vendors and consultants, as well as industry publications.

#### *4.2.4 Natural Gas Combined Cycle Generation*

Natural Gas Combined Cycle (NGCC) capacity is preferred for providing intermediate to baseload energy needs. While variable operating costs are generally lower than CTs due to greater efficiency, capital costs are higher. NGCCs require a larger footprint and usually greater amounts of water for cooling. Due to efficiency degradation if cycled, in order to recoup higher fixed costs, NGCCs are likely to be economical with annual capacity factors above 25-30%.

New NGCCs have traditionally been at a disadvantage in the Midcontinent region versus existing coal-fired, baseload resources. The incremental cost of the older coal facilities tended to drive the forward market and supply the region's baseload and intermediate energy needs. However, due to environmental regulations and natural gas price decreases due to improvements in extraction technology, NGCCs are increasingly on the margin in the spot and forward markets of the Midcontinent region. Future environmental regulations are likely to improve the economics of natural gas-fired combined-cycle facilities due to the CO2 emission advantage versus coal generation.

#### *4.2.5 Nuclear*

Nuclear capacity is used for long-term baseload generation as their operations, maintenance, and fuel costs are relatively inexpensive when compared to other generating resource types. However, their capital costs are higher as a result of their long construction times, which increase financing costs significantly when compared to other generation. These resources have a carbon footprint comparable to that of renewable energy such as solar and wind, and much lower than fossil fuels such as natural gas and coal. This aspect of nuclear generation is becoming more important as countries move away from traditional fossil resources and toward carbon-free generation.

#### *4.2.6 Wind Generation*

Energy from wind resources has become a prominent component of most resource plans as cost reductions due to technology improvements allow wind to be more competitive. The problem with wind generation remains the intermittent nature of the resource, which means the value is significantly lower due to the intermittent and unpredictable nature. Another hurdle for wind resources is the availability and expense of sufficient transmission infrastructure to move the wind energy from producing regions to load centers.

The installed cost of wind ranges from $1,350 - $1,600 per kW ($2023), depending upon the size of the installation.[6] For purposes of the IRP, Hoosier Energy modeled assumed wind PPAs in 50 MW blocks, with a maximum of 500 MW available in any particular year.

### *4.2.7 Solar Generation*

Due to decreasing costs of photovoltaic panels, solar energy generation is becoming more economically competitive relative to other supply-side resources. The intermittent nature of solar generation tends to limit its value unless paired with energy storage. The cost for generating solar power through a utility-scale program is significantly less per kilowatt hour when compared with individual, smaller scale systems.

The installed cost of Solar PV ranges from $1,500 - $2,300 per kW ($2023) for a utility-scale PV installation[1]. For purposes of the IRP, a 50 MW Solar PPA was used as a proxy to model solar generation, up to a maximum of 500 MW allowable in any year.

### *4.2.8 Battery Storage*

Battery storage falls in the broad category of energy storage and is now in the deployment phase of the technology continuum for electrical generation. Frequency regulation and grid support are primary drivers of commercial deployments for battery storage however, as battery costs continue to decrease, a shift towards multiple services such as capacity, ramping support and ancillary services is expected. Planned and currently operational U.S. utility-scale battery capacity totaled around 16 GW at the end of 2023. Developers plan to add another 15 GW in 2024 and around 9 GW in 2025[7].

There is a variety of battery technologies available including metal air, flow, sodium chemistries, lead acid and lithium ion. While lead acid is the most mature, lithium ion is the most widely selected technology by utilities, and in fact is the only battery technology that has advanced from grid support to the bulk-energy management level. Sodium sulfur batteries offer high density and efficiency, and are used for grid support but have experienced some safety concerns throughout the industry. Hoosier Energy is considering applications within its power network for battery storage, and closely following technology advancements, as well as costs. Installed costs for lithium ion technologies, range from $1,350/kW to $2,000/kW depending on duty (frequency regulation, grid support, bulk storage) and scales. Potential applications include co-location of a battery storage facility with a consumer solar PV array, or storage located at an existing base load plant to offset auxiliary power during on peak hours.

### *4.2.9 Other Renewable Resources*

Other resources considered renewable are technologies fueled by landfill gas, coalbed methane and biomass. These technologies can be promising as continued technological advances increase efficiencies and experience reduces the development and operating risk. However, in order to be cost effective versus other resources, these technologies generally require a specific need, such as a requirement to find an alternate method to dispose of waste. In addition, in order to be cost competitive these technologies generally require a sufficient, reliable and economically advantageous fuel source.

Other alternative energy projects, such as cogeneration and coal waste technologies, may or may not qualify as renewable energy but could prove economic and provide supply-side diversification. Hoosier Energy

[6] U.S. Energy Information Administration; Capital Cost and Performance Characteristics for Utility Scale Electric Power Generating Technologies; January 2024

[7] U.S. Battery Storage Capacity Expected to Nearly Double in 2024, U.S. Energy Information Administration, January 9, 2024

has analyzed a number of these proposals and has demonstrated a commitment to considering all economically viable renewable energy resources.

### *4.2.10 Distributed Generation*

Options for distributed generation include both fossil and renewable sources. On the fossil side, the cost of distributed generating capacity for diesel or gas turbines is estimated to be greater than $1,000 per kW. The actual cost is highly dependent upon a number of factors, including the type of engine (diesel reciprocating engine or gas turbine), size, manufacturer, emission level, efficiency, etc. Given the higher capital cost, the economics of distributed generation does not compare favorably to central station power without a customer specific need for increased reliability and/or an economically advantageous fuel source.

Reciprocating internal combustion engine (RICE) is a mature technology that has grown in popularity for use in the electric power generation sector. Historically, RICE was not considered for power generation due to economies of scale; however, utilities have increased interest in RICE because of flexibility, completive life cycle costs and operating characteristics including:

- Flexibility – fast start and fast ramping
- Modularity – increments of 1 to 20 MW
- Fuel Diversity – biogas, hydrogen, natural gas, landfill gas and diesel
- Low Emissions – clean burning requiring minimal water usage
- Low capital cost – comparable to NGCCs from $900 to $1500 per unit

An internal Hoosier Energy team continues to analyze and valuate RICE system configurations and technology applications for potential projects. The group monitors new installed project costs, unit performance updates, and technology applications. Hoosier Energy also participates with the Electric Power Research Institute (EPRI) RICE interest group to monitor and understand the evolving market for these quick-start resources.

### *4.2.11 Non-Utility Generation*

Commercial and industrial (C&I) consumers served by Hoosier Energy members have expressed growing interest in developing renewable energy resources adjacent to their facilities. Hoosier Energy has experienced a 400% increase in interconnect requests for projects ranging from a few hundred kW up to 10 megawatts of nameplate capacity with most projects averaging 500KW. Interest is motivated by multiple factors including corporate sustainability policies and goals, support for marketing programs based on green attributes, pressure from customers who encourage or offer incentives to suppliers to use renewable energy..

C&I interest in carbon free energy continues to increase. Hoosier Energy has revamped our Interconnect Process, Renewable Energy Credit (REC) Program and implemented a Member Flexibility Policy to continue to insure we have the programs and processes in place to support the evolving interests of our C&I customers and Members. Hoosier Energy's Interconnect Process continues to process and complete requests within 90 days. Hoosier Energy's REC Program results in an additional 45,000MWh of carbon free energy entering our service territory annually in addition to the carbon free energy that is already part of Hoosier Energy's Resource Portfolio. Hoosier Energy's REC Program has also received new inquires which could potentially double the size of the program within the next year. C&I Customers participating in or inquiring about Hoosier Energy's REC program are typically attempting to meet internal goals established ranging from 25%-100% carbon free energy delivered. Hoosier Energy's Member Flexibility Policy designed a mechanism for Member-Owners and Member-Consumers or Developers to partner on alternative energy supply projects to meet the differing needs or goals of Members at a local level as well.

Hoosier Energy's Member systems have 1,359 solar and 14 wind distributed generation residential customers. These customers installations have a nameplate capacity of 13.25 MW of solar and 0.1 MW of wind. Battery storage is paired with many of the residential systems as well: 310 of these residential customers have battery storage paired with their systems for total capacity of 1.96 MW. Commercial customers have 21 solar systems, one wind system and one gasification system installed with a total capacity of 0.9 MW, 0.015 MW, and 1 MW respectively. Hoosier Energy and the majority of its Members have adopted a consistent compensation mechanism applicable to all installations of less than 50kW. The rate is based upon Hoosier Energy's projected variable production cost from the G&T's Budget and provided to the members in October for the upcoming budget year.

For customer-owned generation qualifying facilities greater than 50kW (and less than 20MW), Hoosier Energy and its Member Cooperatives have adopted a policy that requires excess energy to be purchased by Hoosier Energy under Schedule CPP. Schedule CPP is consistent with the IURC's QF rules and includes the following compensation amounts:

If the qualifying facility meets the requirements of Schedule CPP, Hoosier Energy will purchase energy at the following rates:

| | |
|---|---|
| For all on-peak energy supplied | $0.03705 per kWh |
| For all off-peak energy supplied | $0.03705 per kWh. |

Hoosier Energy may also purchase capacity supplied from the QF in accordance with the conditions and limitations of the contract at the following minimum rate:

| | |
|---|---|
| Unadjusted rate for Capacity | $4.51 per kW-month. |

### *4.2.12 Emerging Technologies*

Hoosier Energy monitors mature and emergent generation technologies as potential options to provide low cost, reliable generation and to ensure grid and business process resilience in supporting emerging technologies and their potential impacts. Hoosier Energy pursues Emerging Technology through grants and pilot processes for real world experience before large scale implementation. Below are a few examples of Emerging Technologies that have demonstrated the ability and potential affordability to futher our mission of together with our member systems, being an efficient and adaptive organization that provides reliable and economically priced energy and member-driven services.

- Electric Vehicles – Hoosier Energy and Member Systems studied the impact and penetration rates of Electric Vehicles entering their service territory. Granular results and data allowed for individual Member Systems to modify programs and process to ensure readiness for a potential influx of electric vehicles into the service territory. Data and experience from the overall study were provided as part of a tailored collaboration and whitepaper in an effort to share our data and experience nationally.

- Distributed Energy Storage – Through a grant process, Hoosier Energy, Pacific Northwest Laboratories, and Delorean Power partnered to develop a model sponsored by the Department of Energy to determine the optimal locations to install smaller, distributed energy storage systems that would benefit all consumers. While this model studied Hoosier Energy's System and results were specific to Hoosier Energy, the model was designed to be replicable and available for G&Ts nationally. Hoosier Energy is pursuing execution of the model results.

- Grid Resilience and Portfolio Transformation – Hoosier Energy is pursuing over $1 Billion in grant applications from the Inflation Reduction Act (IRA) to reduce cost, increase hardness, and bring community benefits from this program into our service territory. These funds would make relatively novel, high cost, emerging technologies such as: long duration storage, microgrids, new generation resources viable and impact our service territory directly. Beyond traditional impacts to our grid resilience and portfolio, these programs are also designed to benefit the individual communities and consumers through workforce development, educational partnerships and programs which could create alternate revenue streams for member-consumers who install flexible resources.

- Virtual Power Plants (DERMS) – Hoosier Energy is investing in technologies which can utilize the flexibility of Member Consumers to respond to the constantly changing demands of the MISO Grid. Organization and utilization of these resources potentially offset the need for large investments or procurement of energy or capacity. The benefits of these offsets would be experienced by all Members whereas participating Members would receive an additional incentive for their participation.

#### *4.2.13 Transmission Facilities*

Hoosier Energy prepares a Long-Range Transmission Plan to serve as a guide for developing its system to meet present and future needs of its consumers. This Plan is updated on a 5-year cycle or as the result of a significant change to the transmission system, whichever is sooner. As described in Section 3.3.3, the purpose of the Plan is to study the current system, including asset health projections, identify system shortfalls and develop system mitigation measures that will provide the most practical and economical means of serving future loads.

Additionally, as a member of MISO, Hoosier Energy participates in the MISO Transmission Expansion Plan (MTEP) process, which is an annual assessment of the regional transmission system reliability. This process identifies long-term regional transmission requirements and develops a portfolio of projects designed to maintain grid reliability and address congestion issues.

### 4.3 Wholesale Rate Design

The current tariffs, as described in Section 3.2.2, were reviewed with the member systems through the Members' Managers Association and rates updated by Hoosier Energy in 2021. The structure of the wholesale tariffs were confirmed, and rates updated, for implementation in April 2023. The wholesale tariffs are designed to encourage demand response participation by the member systems and to introduce time-of-use energy pricing. Hoosier Energy periodically reviews and updates its rate design for reasonableness and applicability to current market conditions. In addition, Hoosier Energy is currently assessing the reasonableness of its wholesale rate structure.

## 4.4 Future Resource Planning Criteria

### *4.4.1 Reserve Margin*

Reserve margin is likely the most common reliability measure. Reserves are a necessary addition to the resource requirement plan and are used to offset the effects of contingencies that arise either because of generation unavailability or changes in load (e.g. weather effects, customer mix and usage). Reserve margin is defined as follows:

$$\text{Reserve Margin} = \frac{(\text{Total Resources} - \text{Total Load})}{\text{Total Load}}$$

As a member of ReliabilityFirst (RFC), Hoosier Energy is required to adhere to specific standards regarding resource adequacy. Specifically, RFC requires the calculation of a planning reserve margin that will result in the sum of the probabilities for loss of load for the integrated peak hour for all days of each planning year being equal to 0.1. This is commonly referred to as a Loss of Load Expectation (LOLE) analysis based upon a one day in 10 years criterion.[8] MISO serves as the Planning Coordinator for RFC and is responsible for annually calculating the appropriate planning reserve margin.

Historically, MISO has required its Load Serving Entities (LSE) to maintain a reserve margin to meet its Summer peak load. This reserve margin was calculated on an annual basis and the required Planning Reserve Margin covered the entire MISO Planning Year. In recent years, MISO has faced declining reserves as a result of resource retirements, causing increasing frequency of Emergency Events and a migration of these events into non-Summer seasons where they have not traditionally occurred.

As a result, MISO has implemented a Seasonal Resource Adequacy construct, in which Planning Reserve Margins are set for Summer, Fall, Winter and Spring seasons of each Planning Year. The Summer season is defined as June – August, Fall is defined as September - November, Winter is defined as December – February and Spring is defined as March – May.

The Planning Reserve percentages found in Table 7 reflect values for Planning Years 2023 – 24 and 2024 – 25.

| Planning Year | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| 2023 – 24 | 7.4% | 14.9% | 25.5% | 24.5% |
| 2024 - 25 | 9.0% | 14.2% | 27.4% | 26.7% |

**Table 7: MISO Planning Reserve Margins**

In addition, resources are accredited seasonally based primarily upon their contribution to the tightest 65 hours of each season, with 80% of accreditation based upon performance during the tightest hours beginning in Planning Year 2025-26. Discussions are ongoing at MISO to change the resource accreditation methodology to a Direct Loss of Load (D-LOL) method in which resource classes are accredited according to their performance during Loss of Load hours. MISO intends to file this proposal at FERC in the first quarter of 2024, with full implementation for Planning Year 2028-29.

[8] ReliabilityFirst standard BAL-502-RF-03

### *4.4.2 Environmental Analysis*

A key component of any future comprehensive national energy policy will likely be the establishment of a long-term strategy for addressing climate change with particular focus on electric power generation. In the face of a challenging operating environment, including uncertain energy demand, competition from alternative energy sources and aging power infrastructure, electric utilities need a clear understanding of future emission reduction obligations in order to make the right investment decisions. This includes further reductions of air emissions as well as future regulatory restrictions on carbon, particulate and other pollutants. If a new generation facility is selected through the integrated resource planning process and then proposed, Hoosier Energy will comply with all then-current state and federal environmental regulations.

### *4.4.3 Risk*

The ultimate test for the preferred plan is its impact on the principal risks faced by Hoosier Energy in its current operating environment. Hoosier Energy has identified these risks as MISO Transitions, Market Volatility and Price, Environmental Rules and Regulations, Transmission Price Constraints and Counterparties and Resource Costs.

MISO Transitions: Hoosier Energy's service territory is part of the broader Midcontinent Independent System Operator (MISO) footprint. At peak times, Hoosier Energy's current forecast projects a capacity deficit in Zone 6 that is offset by capacity excess in other zones. One of the goals of MISO's efforts to build additional transmission is to increase transfer capability between zones. Therefore, the price differential between the zones is expected to remain manageable. However, these projections may change especially if load growth is different than expected and/or due to unanticipated resource retirements.

Market Volatility and Price: The resource planning process includes market price forecasts for power, natural gas, capacity and other commodities. These forecasts will change over time. Dramatic changes, such as price spikes from severe weather or an economic recession, will have material impact on expected outcomes. While several market price scenarios are incorporated into the portfolio modeling to attempt to recognize a variety of market futures, it is impossible to capture all variability. Therefore, the Integrated Resource Plan should be viewed as a snapshot in time based upon current market forecasts and economic assumptions. The resources selected as part of the IRP process are highly dependent upon market price and will change over time, requiring additional hedging strategies such as managing market position and exposure, fixed-price energy contracts, a balance of owned assets, and a proactive formal hedging program.

Environmental Rules and Regulations: The EPA 111(b) and 111(d) rules pose significant challenges to a reliability portfolio. This ruling would require additional energy-producing resources in order to fill the gap from reduced natural gas generation. Other federal regulations such as a carbon tax could put additional cost pressure on a future resource strategy that does not add additional renewables and battery storage. This ruling also includes technology that needs additional time for development and infrastructure whose pricing is difficult to incorporate into modeling scenarios. Hoosier works with regulatory counsel and consultants within the cooperative network to navigate an accelerated regulatory environment with very few paths to success.

Transmission Price Constraints: Congestion is a significant cost risk. Congestion results from the locational marginal pricing (LMP) market methodology, which reflects the value of energy at specified locations throughout the electrical footprint. If the same priced electricity can reach all locations throughout the grid, then LMPs are the same. Transmission congestion, which can be caused by changes in consumer load requirements, generation outages, stress on the transmission system, etc., results when energy cannot flow either from or to other locations. This requires more expensive and/or more advantageously located electricity to flow in order to meet the demand. As a result, the LMP is higher in the constrained locations.

Hoosier Energy works with both ACES and outside consultants to analyze congestion between generation resources and load. This forward-looking analysis includes MISO-approved transmission expansion generation resource additions and retirements. In general, the analysis projects improved congestion impacts even though construction of new lines may impact dispatchability of existing generating units. Therefore, long-term congestion impacts appear to be a low risk at this time.

Counterparties and Resource Costs: Hoosier Energy members are well served by maintaining a mix of owned and purchased resources. Hoosier uses PPAs to acquire a mix of generation types including gas, nuclear, wind, solar and hydro. Future and current resource options include additional partnerships with existing or new counterparties to meet capacity and energy requirements. In addition to traditional PPAs, options may include shared ownership or Hoosier Energy taking a partial interest in generation resources owned by other companies. The increase and diversification of counterparties has opportunity but also includes risk with counterparty credit, reduction of negotiation position during times of scarcity or high pricing, and execution risk in an environment where new generation is increasingly more difficult to build.

It has also been extremely difficult to bring new generation online due to supply chain obstructions, construction costs, significant ISO interconnection delays, and inflationary interest rates. These setbacks exist whether contracting or self-building and drive the cost of the resource (and therefore it's capacity and energy) higher, impacting overall power supply costs .Some of these costs can be avoided by contracting with existing resources, pursuing federal funding for resource development assistance, extending existing agreements, and participating more actively in the market. However, the risks of those efforts have to be measured and compared in order to make prudent resource decisions in an uncertain and volatile environment.

### *4.4.4 Transmission Analysis*

From a reliability perspective, Hoosier Energy's preference is to interconnect any new supply-side resource to the Hoosier Energy transmission system. Hoosier would be required to follow Midcontinent ISO rules for generation interconnections. The Midcontinent ISO tariff includes rules for both large and small generation interconnection projects.

From a market perspective, Hoosier Energy's preference is to interconnect any new supply-side resource to the Hoosier Energy transmission system to lessen LMP risk (i.e, resources located near load generally reduces LMP risk). Membership in the Midcontinent ISO allows consideration of supply-side options that are within the Midcontinent ISO footprint, with emphasis on options that are both economical and correlated with the locational marginal prices of Hoosier Energy's loads.

Hoosier Energy continues to expand the bulk transmission network to meet local and regional system needs as well as changing RFC criteria. Any bulk expansion plans require review and approval of the Midcontinent ISO through its MTEP process.

Hoosier Energy continuously monitors the need for additional transmission facilities. At the time the need for additional facilities is identified, the timing, type and approximate costs of additional facilities will be developed.

### *4.4.5 Reliability Analysis*

It is clear that resources have varying impacts on system reliability. Generation resources may be used for voltage control and reactive support, spinning reserves, and quick and/or black-start capabilities. In addition, properly sited and operated generation resources are more capable of enhancing or increasing available transfer capability (ATC) or total transfer capability (TTC) than purchased power. Ultimately, the responsibility for system reliability belongs to MISO as planning coordinator. As a MISO market participant, Hoosier Energy works with MISO to ensure that system reliability is maintained.

As MISO transitions toward a resource portfolio that includes more intermittent and non-dispatchable resources, system reliability and resiliency have become more important resource planning concerns. Hoosier Energy contracted with Quanta Technology (Quanta) for the review and development of Metrics, Scoring Methodology, Reliability Analysis, and Rankings to assess Reliability and Energy Adequacy of its IRP portfolios. Quanta consulted with Hoosier Energy's IRP team to compile and assess the key reliability metrics and potential mitigation measures that are unique to Hoosier Energy's system and IRP. Quanta assessed and quantified these metrics on each IRP candidate portfolio. These reliability metrics and mitigation measures included:

- Power ramping
- Frequency response (inertial, primary)
- Frequency regulation
- Dispatchability and output predictability
- Short circuit strength
- Blackstart
- Deliverability of dynamic VARs to load centers
- Geographic location and evacuation of power

Quanta's analysis is attached to this IRP as Appendix B.

### *4.4.6 Market Analysis*

The ability to access the Midcontinent ISO market as a resource for potential capacity and energy purchases or sales allows Hoosier Energy to balance its needs in the short-to-intermediate term. This mitigates the impacts of market price and load volatility. In this IRP, Hoosier Energy has included market exposure tolerance levels of 20 percent above and below member load in its analyses. Hoosier Energy is also an active participant in many of the Midcontinent ISO committees and working groups. Hoosier Energy will continue to monitor the LMP market and its potential impact on resource planning.

## 4.5 Results of Initial Screening Analysis

Based upon an initial screening analysis, the list of potential resource options were reduced to those resources that demonstrated economic viability, operational reliability and were flexible enough to meet expected, and potentially more stringent, environmental standards. These resources were then included in the portfolio modeling scenarios developed by ACES. In addition to the above supply-side resources, some member systems have expressed an interest in pursuing distributed energy resources with retail customers. These resources may be different than Hoosier Energy's current DSM offerings. Hoosier Energy has committed to assist and support members in these efforts and will incorporate those resources into the G&T's portfolio. A summary of the screening analysis results is provided below in Table 8.

| Resource/Strategy | Net Nominal Operating Capacity (MW) | Fuel Type | Accepted or Rejected as Resource Alternative? | Reason why Resource was Accepted or Rejected |
|---|---|---|---|---|
| New-build Nuclear | – | Nuclear | Rejected | Not cost effective |
| Biomass/Landfill Gas | – | Biomass | Rejected | Limited opportunities to develop programs |
| Solar Thermal | – | Solar | Rejected | Not cost effective |
| Hydro | – | Hydro | Rejected | Resource not available |
| Geothermal | – | Geothermal | Rejected | Resource not available |
| **Combined Cycle (2 x 1 H Frame)** | **233** | **Natural Gas** | **Accepted** | **Cost effectiveness and Reliability** |
| **New CT (F Frame)** | **233** | **Natural Gas** | **Accepted** | **Cost effectiveness and Reliability** |
| **Reciprocating Internal Combustion Engine** | **216** | **Natural Gas** | **Accepted** | **Cost effectiveness and Reliability** |
| **Onshore Wind** | **50 MW block; 300 MW max per year** | **Wind** | **Accepted** | **Cost effectiveness and Reliability** |
| **Solar Photovoltaic** | **25 MW block; 500 MW max per year** | **Solar** | **Accepted** | **Cost effectiveness and Reliability** |
| **Battery Storage** | **20 MW block; 400 MW max per year** | **Storage** | **Accepted** | **Cost effectiveness and Reliability** |

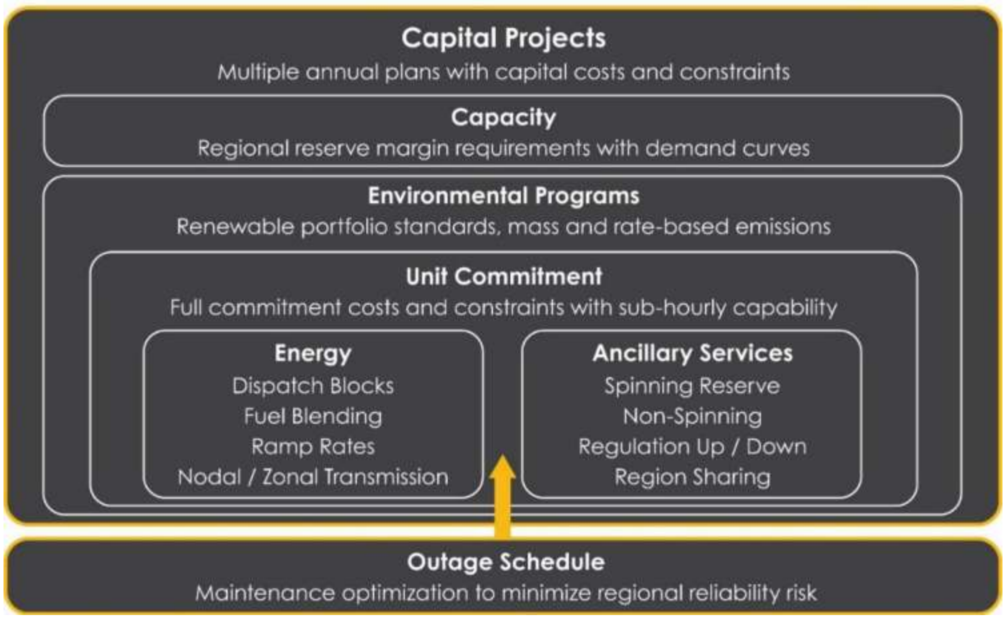
**Table 8: Summary of Resources Included in Portfolio Modeling**

### 4.6 Modeling Methodology

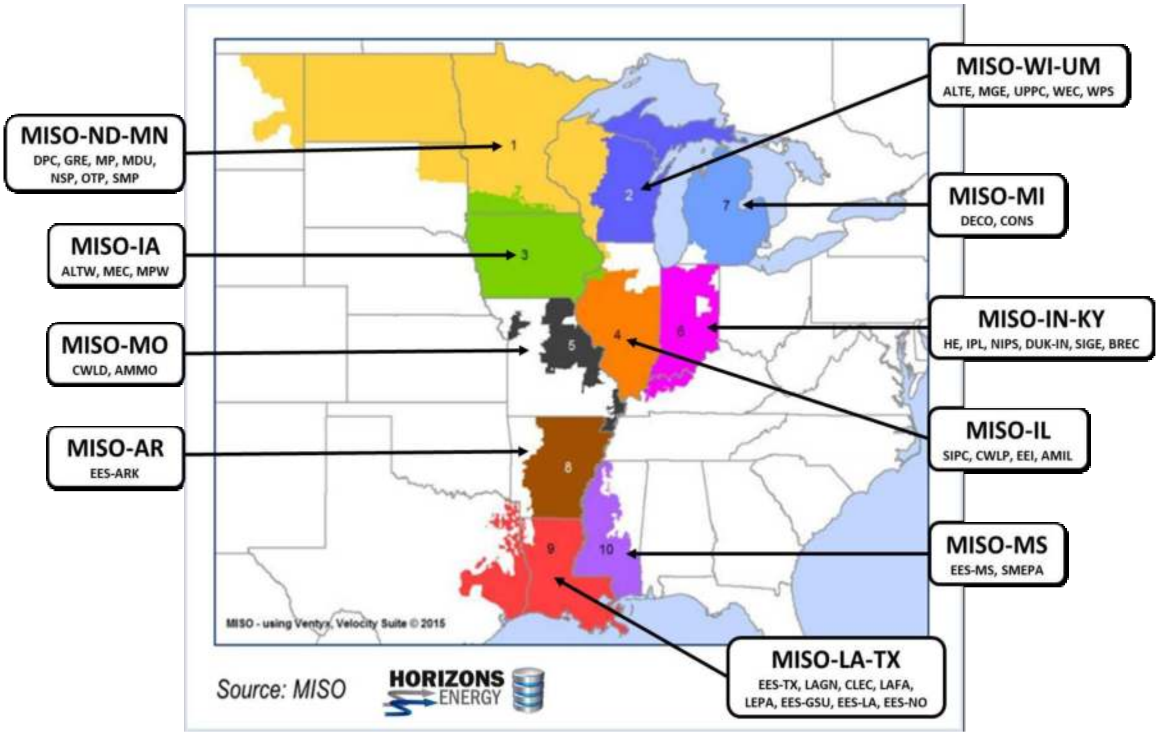
The Hoosier IRP utilized EnCompass, a long-term capacity expansion and production cost modeling tool. EnCompass provides best-in-class modeling technology and allows for simultaneous optimization of multiple criteria as part of a complex portfolio evaluation. Capacity expansion runs optimize long-term resource additions and retirements for the lowest cost portfolios subject to reserve margin targets, energy market limits, and other constraints.

Hourly production cost runs were also conducted for each portfolio and scenario. Production cost runs provide a more granular, detailed look at every hour, utilizing hourly price shapes, renewable energy shapes, and market connections in a full 8,760-hour model run.

The high-level architecture of the EnCompass modeling platform is depicted below.




Forward curves for coal, power, natural gas, and capacity were constructed using a combination of market forward curves and long-term fundamental forecasts from Horizons Energy. Horizons Energy also utilizes EnCompass, modeling MISO and the entire country in a zonal modeling framework. Long-term views on environmental regulation, cost projections for new resource technologies, and all regional reserve planning targets are included in the modeling. Horizons also provides a set of scenarios that incorporate changes to load, natural gas, and carbon assumptions. Hoosier utilized a subset of these scenarios to fit the intended goal of the scenarios described in Figure 1 and Table 9 show the MISO Zones included in the Horizons Energy topology and model results.




## 4.7 Scenario Development

Scenarios represent a combination of variable adjustments to capture a possible future market, regulatory, and/or technology cost outcomes. Scenario analysis allowed Hoosier to evaluate different resource combinations, all varied across all scenarios to create a range of costs with changing market conditions. Figure 1 contains a high-level summary of each scenario, and Table 9 contains the specific assumptions that are changed in each scenario.

| Status Quo | EPA Rule | Carbon Tax | EPA Rule + Carbon Tax | Aggressive Environmental | High Price Environment | Low Price Environment |
|---|---|---|---|---|---|---|
| • Tax credits per the IRA<br>• No carbon legislation<br>• Technology costs benchmarked to market<br>• Base power and gas prices | • Capacity factor limits for new and existing resources per EPA 111(b) and 111(d) | • Federal Carbon Tax Starting in 2028 | • Capacity factor limits for new and existing resources per EPA 111(b) and 111(d)<br>• Federal Carbon Tax Starting in 2028 | • Low Renewable & Storage Costs to reflect IRA extension, additional incentives<br>• High natural gas prices with upstream regulations<br>• EPA Rule<br>• Carbon Tax starting in 2028 | • High cost of replacement resources offset IRA benefits<br>• High natural gas prices<br>• EPA Rule<br>• No Carbon Tax | • Supply chain, inflationary pressure subside by 2025<br>• Low natural gas prices<br>• Tax Credits extended per IRA |

**Figure 1: Annual Energy Load Forecast (GWh)**

| | Natural Gas Prices | Renewable & Storage Cost | Carbon Tax | EPA |
|---|---|---|---|---|
| Status Quo | Base | Base | - | No |
| Base + EPA 111(b) | Base | Base | - | 2030 |
| Carbon Tax | Base | Base | 2028 | No |
| Carbon Tax + EPA | Base | Base | 2028 | 2030 |
| Aggressive Environmental | High | Low | 2028 | 2030 |
| High Price Environment | High | High | - | 2030 |
| Low Price Environment | Low | Low | - | - |

**Table 9: Scenario Assumptions**

**Load Forecast Scenarios**

Additional scenarios were conducted to evaluate the impact of varying load forecasts on the capacity expansion portfolios using the Status Quo assumptions. Separating the load forecast from the scenario matrix allows portfolios to be compared on a more consistent basis from a reserve margin and capacity standpoint. Load forecast scenarios capture uncertainty related to load growth, which could include factors such as climate change, new large industrial customers, changing customer load behavior, electrification of home heating, electric vehicles, and other factors.

High and low load forecasts were created by analyzing historical volatility of Hoosier load data, accounting for variability due to economic conditions, weather, and seasonal variability inherent in the observed load patterns. The load scenarios can help answer questions on new build patterns impacted by load:

1. If load is higher than expected, what additional resources would need to be pursued to meet capacity and energy requirements?
2. What technology options are the "marginal" or next best resource that the model selects?
3. If projected load projections are overestimated and load is lower than expected, what resource additions could be delayed or removed?

**Figure** 2 and Figure 3 depict the load forecast scenarios for both energy and peak, respectively.

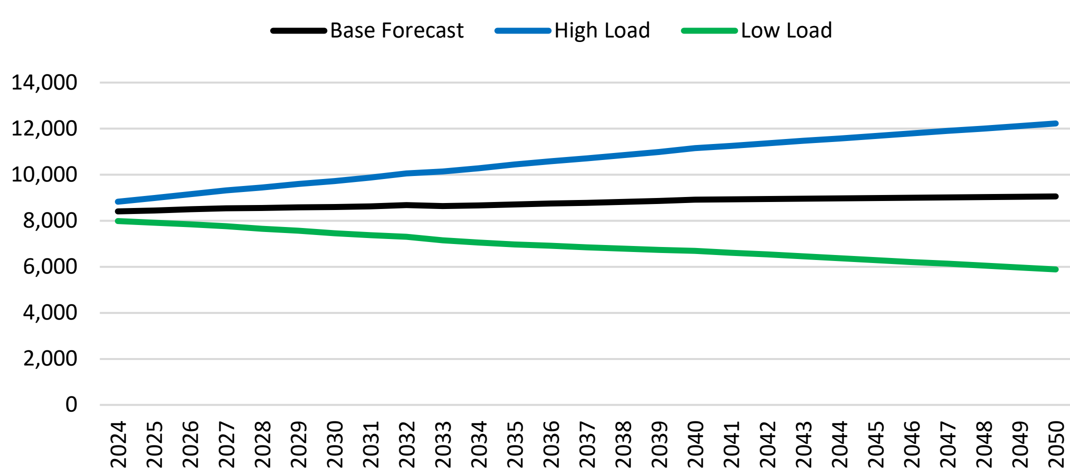



**Figure 2: Annual Energy Load Forecast (GWh)**

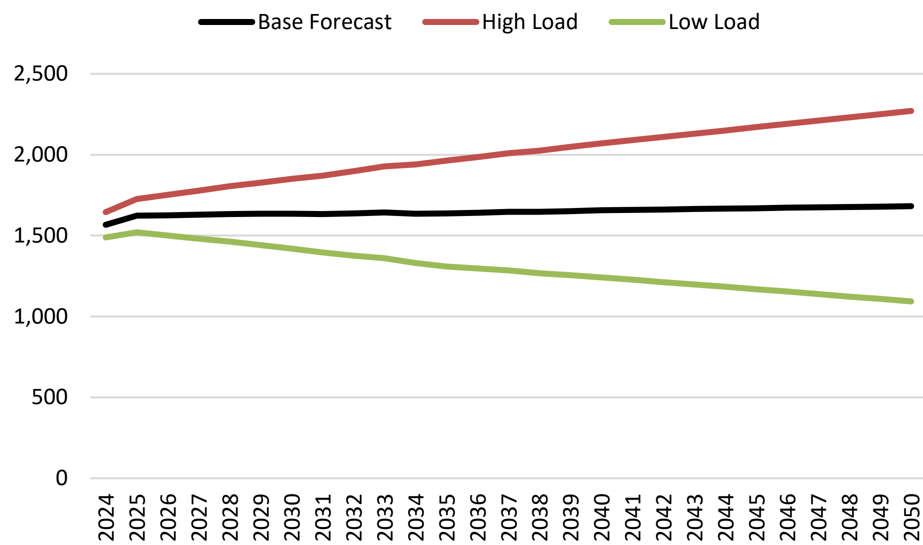



**Figure 3: Annual Peak Load Forecast (MW)**

**Figure 30** contains the cumulative installed capacity volumes for each load scenario. **Figure 31** shows the difference in installed capacity from the Status Quo portfolio for the High and Low load scenarios.

***High Load Forecast***

In the high load forecast scenario, an additional 200-300 MW of installed capacity is needed ahead of 2030, with about two-thirds of the incremental capacity coming from battery storage and the rest from a natural gas combustion turbine. The 325 MW combined cycle that is added in the Status Quo to replace expiring contracted energy and capacity is advanced five years to 2031 in the high load forecast. Additional capacity and energy needs are met by additional battery storage, wind, and solar in the 2030s through the end of the study period. An additional need of 280 MW of storage, 850 MW of solar, and 150 MW of wind are needed relative to the Status Quo capacity expansion portfolio.

***Low Load Forecast***

The Low Load Forecast scenario results in a reduced and delayed need for capacity, with no new capacity added until 2033. Battery storage is the only resource added until 2038 and 2039, when incremental natural gas capacity is added with the retirement of existing owned natural gas resources. The 325 MW combined cycle is delayed four years in this scenario, added to replace Holland in 2040. No wind and solar resources are added through the study period due to the lower capacity and energy needs.

***Conclusions and Observations***

The load forecast scenarios show the challenge and importance of constantly evaluating load projections in the face of uncertainty. Committing years advance to high capital cost, long-lived assets is inherently risky if load needs end up coming in lower than expected. On the other hand, acquiring, building, or contracting for, and/or advancing power plants is risky in the world of high interest rates, log-jammed interconnection queues, and supply chain inflation, so waiting too long to make asset decisions could expose Hoosier to risk if load is higher than expected. Hoosier will continue to build on the existing cross-functional load forecasting efforts, engaging Member cooperatives, identifying new large load opportunities, and building on already robust energy efficiency and demand response programs.

## 4.8 Modeling Assumptions

### *4.8.1 Risks Inherent in the Modeling Process*

Risks are addressed through the varying assumptions associated with scenarios and sensitivity cases in the modeling process. The incorporation of different resource alternatives, market conditions, load growth and future environmental regulations into the modeling process provides a range of scenarios and outcomes. However, it is not possible to predict and capture all risks and the models are simply another tool for management to employ to make resource decisions. Hoosier Energy reviews its assumption selection process during each IRP to improve its modeling inputs and to confirm that the assumptions used in the IRP are consistent with those costs available in actual practice.

### *4.8.2 Supply-Side Resource Options*

Supply-side resource cost and operating parameters were sourced from the NREL 2023 Annual Technology Baseline, and cost adjustments were applied in the near-term to bring levelized costs in line with the overall market.

Table 10 contains annual build limits used to reflect the real-life limitations of transmission, construction, procurement, physical constraints, and market availability.

| Technology Type | Capacity per Resource Block (MW) | First Year Available | Max Additions Per Year (MW) | Cumulative Max Additions (MW) |
|---|---|---|---|---|
| Wind | 50 | 2030 | 300 | 300 |
| Solar | 25 | 2026 | 500 | 1,000 |
| Battery Storage | 20 | 2026 | 400 | 800 |
| Combustion Turbine | 100 | 2028 | 400 | 600 |
| Combined Cycle | 300 | 2030 | 325 | 650 |

**Table 10: New Resources Additions**

***Renewables and Storage***

Generic new battery storage was modeled as a 20 MW/80 MWh, 4-hour standalone battery storage project. While the cost of battery storage has decreased significantly over the past decade, recent supply chain issues, interconnection costs, and other factors have been reflected in higher PPA and construction costs for standalone battery storage. New standalone battery storage is assumed to be limited to 365 cycles per year (equivalent to annual 16.67% capacity factor limit in model) with a round-trip efficiency of 88%. Figure 4 contains the levelized cost of capacity for battery storage in the IRP. The levelized cost of capacity includes the capital cost and fixed O&M for the storage.

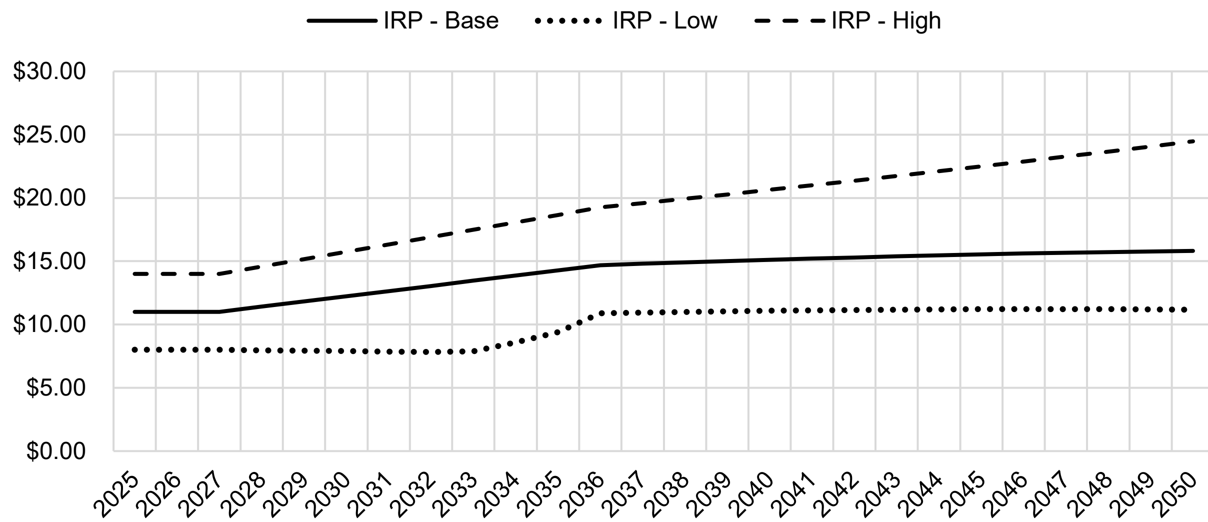



**Figure 4: 4-Hour Battery Storage: Levelized Cost of Capacity (Nominal $/kW-mo)**

***Wind***

Generic new wind resources in the IRP were modeled as Indiana wind in the Northwestern part of the state. Production profiles were sourced from NREL and Horizons energy, and near-term costs were established using a blend of market indications and NREL cost projections. Figure 5 contains levelized cost projects in the IRP for wind.

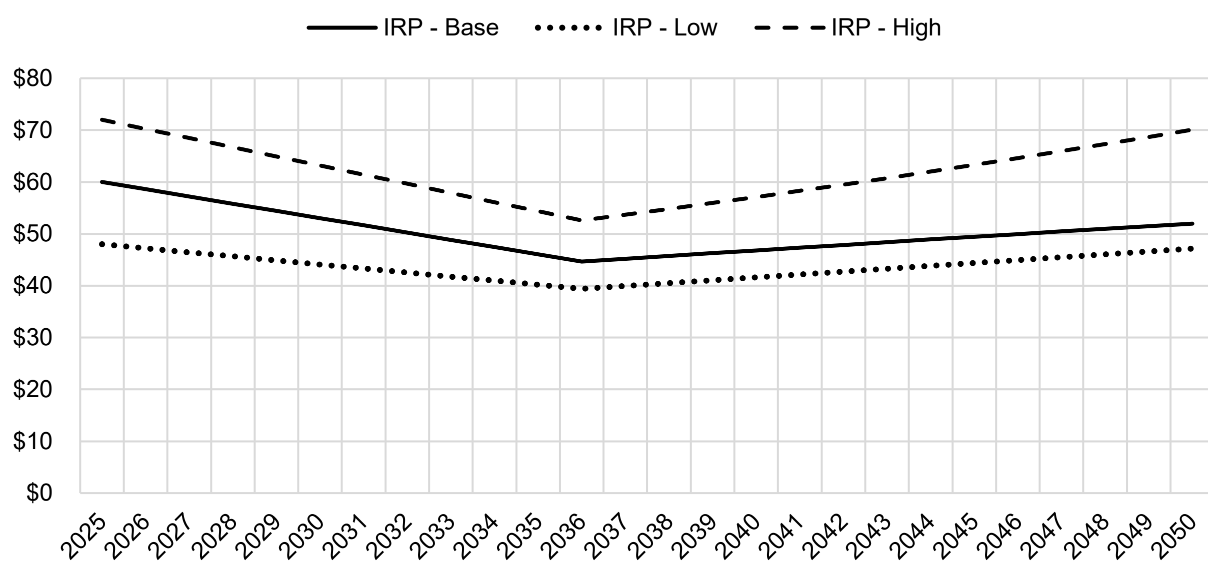



**Figure 5: Wind Levelized Cost of Energy (Nominal $/MWh)**

### *Solar*

Utility-scale solar in the IRP is assumed to be southern Indiana, single-axis tracking solar. Hoosier is active in the market through formal RFPs and informal price discovery in the market. There is significant variability in solar project pricing, as factors such as interconnection costs, the in-service date of the project, and the size of the project can influence the final contract price. The IRP includes base, high, and low estimates based on the current market, eventually blending into the NREL ATB costs for long-term projections. **Figure 6** contains the levelized cost of utility-scale solar used in the IRP.

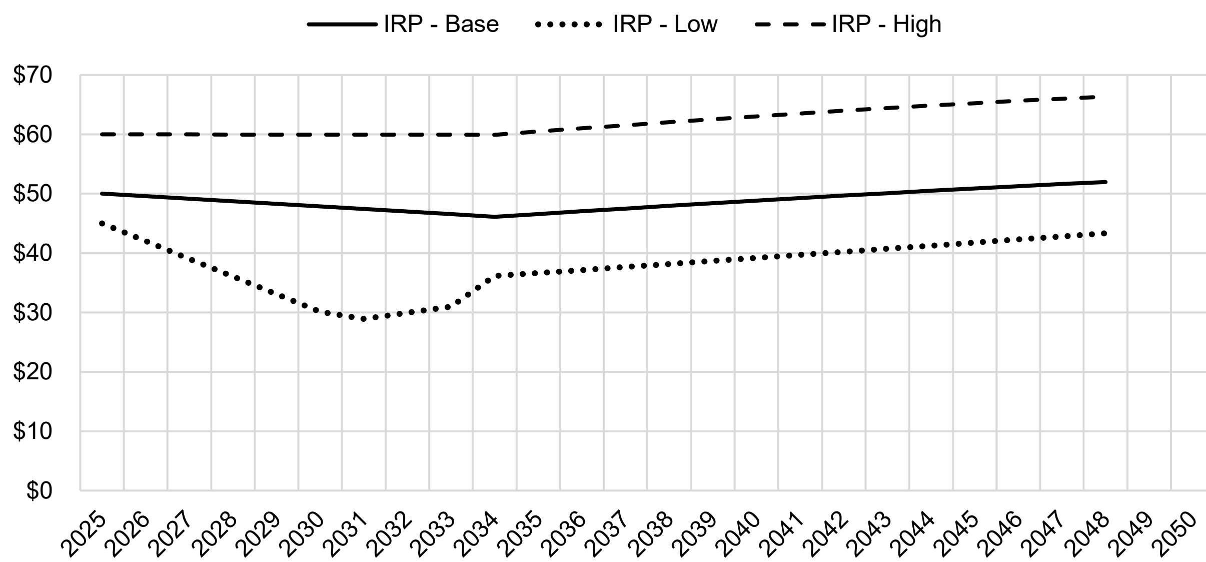



**Figure 6: Utility-Scale Solar: Levelized Cost of Energy (Nominal $/MWh)**

### *Renewables and Storage Firm Capacity Accreditation*

**Figure 7** contains the annual capacity accreditation for solar, wind, and 4-hour storage. Rules for capacity credit in MISO are constantly evolving and are expected to change over time as MISO adjusts to the changing dynamics of the future resource mix. The capacity values used in this IRP rely on a combination of current MISO rules along with estimated future changes in the MISO resource mix.

| | Solar | | | Wind | | | 4-Hour Storage | |
|---|---|---|---|---|---|---|---|---|
| | Summer | Fall/Spring | Winter | Summer | Fall/Spring | Winter | Summer/Fall/Spring | Winter |
| 2025 | 44% | 22% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2026 | 38% | 19% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2027 | 34% | 17% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2028 | 30% | 15% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2029 | 27% | 14% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2030 | 24% | 12% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2031 | 22% | 11% | 0% | 8% | 12% | 16% | 95% | 80% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2032 | 21% | 10% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2033 | 19% | 10% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2034 | 18% | 9% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2035 | 17% | 9% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2036 | 16% | 8% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2037 | 15% | 8% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2038 | 15% | 7% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2039 | 14% | 7% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2040 | 14% | 7% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2041 | 13% | 7% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2042 | 13% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2043 | 12% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2044 | 12% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2045 | 12% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2046 | 12% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2047 | 12% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2048 | 12% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2049 | 12% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |
| 2050 | 12% | 6% | 0% | 8% | 12% | 16% | 95% | 80% |

**Figure 7: Annual ELCC for Solar, Wind, and 4-Hour Battery Storage**

### *4.8.3 Inflation Reduction Act in Supply-Side Modeling*[9]

The Inflation Reduction Act (IRA), signed into law by President Biden in August 2022, provides a number of incentives for renewable/carbon neutral energy development. Among these are extension of the Investment Tax Credit (ITC) of 30% and Production Tax Credit (PTC) of $0.0275/kWh (2023 value), as long as projects meet prevailing wage & apprenticeship requirements for projects over 1 MW AC.

Through at least 2025, the Inflation Reduction Act extends the Investment Tax Credit (ITC) of 30% and Production Tax Credit (PTC) of $0.0275/kWh (2023 value), as long as projects meet prevailing wage & apprenticeship requirements for projects over 1 MW AC.

For systems placed in service on or after January 1, 2025, the Clean Electricity Production Tax Credit and the Clean Electricity Investment Tax Credit will replace the traditional PTC / ITC.

Hoosier Energy has made the following ITC/PTC assumptions in its IRP modeling:

- Wind:
    - PTC Safe Harbor
        - 100% through 2033

[9] https://www.epa.gov/green-power-markets/summary-inflation-reduction-act-provisions-related-renewable-energy

        - 75% - 2034
        - 50% - 2035
        - 0% thereafter
- Solar:
    - ITC
        - 30% through 2033
        - 23% - 2034
        - 15% - 2035
        - 0% thereafter
- Battery Storage:
    - ITC
        - 30% through 2033
        - 23% - 2034
        - 15% - 2035
        - 0% thereafter

### *4.8.4 Modeling Energy Efficiency and Demand Response*

The GDS Market Potential Study identified energy efficiency and demand response options for residential and non-residential customer categories in Table 6 of the Study, which is included as Appendix C. These blocks were hard coded into the model and assumed to be pursued by Hoosier Energy and its Members. Future IRPs could expand the Market Potential Study to include more bundles or decrements of energy efficiency. Hoosier Energy will continue to engage with its Members to ensure that robust demand-saving resources are part of the overall portfolio.

## 4.9 Capacity Expansion Portfolios

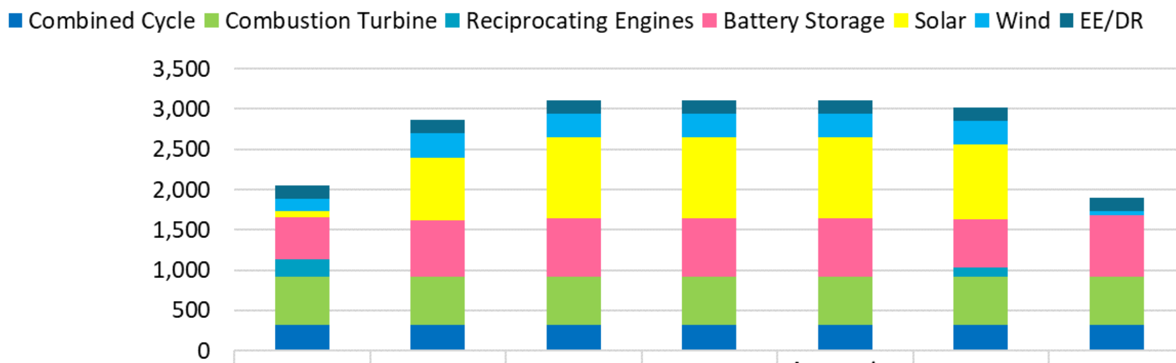
The modeling framework produced seven (7) unique portfolios, all optimized to the specific scenario assumptions and constraints. In this IRP, Hoosier Energy was not facing decisions around any retirements of existing or contracted resources. Therefore, the capacity expansion was focused on filling capacity shortfalls in the future and a separate retirement analysis was not completed.

For all portfolios, certain resource decisions are included by default, which includes but is not limited to:

- <u>Palisades Nuclear</u>: the 400 MW Palisades Nuclear contract is in all portfolios and assumed to be online in 2026.
- <u>Existing Natural Gas Resources</u>: The Holland, Lawrence and Worthington facilities are all expected to reach the end of their age-based life at the end of 2039.
- <u>Lincoln Land Combined Cycle:</u> The Lincoln Land Energy Center is a 1,040 MW Combined Cycle facility currently under development in Sangamon County, Illinois. A 200 MW capacity-only PPA with a 20-year term is assumed in each portfolio. The PPA is expected to begin in 2027.
- <u>Invenergy Nelson PPA:</u> A capacity-only PPA off of Invenergy's Nelson Energy Center in Rock Falls, Illinois is assumed in each portfolio. The PPA is anticipated to begin in 2026, with a capacity value of 157 MW and a ten-year term.

While these resources are modeled based upon best-case assumptions, the Palisades and Lincoln Land resource decisions remain tentative and there remains a possibility that one or both could be replaced in the portfolio by other resources if they prove uneconomic or fail to become operational.

Figure 8 contains cumulative resource additions through 2043 for each scenario and portfolio in the IRP.




| | Status Quo | EPA Rule | Carbon Tax | EPA Rule + Carbon Tax | Aggressive Environmental | High Price Scenario | Low Price Scenario |
|---|---|---|---|---|---|---|---|
| EE/DR | 163 | 163 | 163 | 163 | 163 | 163 | 163 |
| Wind | 150 | 300 | 300 | 300 | 300 | 300 | 50 |
| Solar | 75 | 775 | 1,000 | 1,000 | 1,000 | 925 | |
| Battery Storage | 520 | 700 | 720 | 720 | 720 | 600 | 760 |
| Reciprocating Engines | 216 | | | | | 108 | |
| Combustion Turbine | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| Combined Cycle | 325 | 325 | 325 | 325 | 325 | 325 | 325 |

**Figure 8: Cumulative Generic Resource Additions through 2043 by Scenario (ICAP MW)**

## 4.10. Candidate Portfolios

### *4.10.1. Status Quo Portfolio*

The Status Quo Portfolio includes the following scenario assumptions:

- Base natural gas and power prices
- No federal price on carbon
- No EPA 111(d) or 111(b) carbon rules impacting new or existing natural gas
- Base technology cost estimates for all new resources

Table 11 contains cumulative installed capacity volumes for the Status Quo portfolio from 2028 through 2043. When contracted resources end in 2028 and 2029, 200 MW of natural gas peaking combustion turbines are added along with 80 MW of 4-hour battery storage. Another 300 MW of battery storage is added 2033 and 2034 with the expiration of other firm bilateral capacity contracts. A 325 MW combined cycle is added along with increment solar and storage in the mid- to late-2030s to fill additional capacity needs.

| | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EE/DR | 81 | 86 | 92 | 97 | 103 | 109 | 114 | 120 | 126 | 131 | 136 | 142 | 147 | 152 | 158 | 163 |
| New Gas CT:1 | 0 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 600 | 600 | 600 | 600 |
| New Gas Combined Cycle:CC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas RICE:IC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 216 | 216 | 216 | 216 |
| New Battery Storage:BAT1 | 0 | 80 | 100 | 100 | 100 | 200 | 440 | 440 | 440 | 440 | 440 | 440 | 520 | 520 | 520 | 520 |
| New Wind:WT1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 150 | 150 | 150 |
| New Solar:PV1 | 0 | 0 | 0 | 0 | 0 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |

**Table 11: Status Quo: Cumulative Installed Generic New Capacity (Installed MW)**

Figure 9 contains the annual Summer season firm capacity position for the Status Quo portfolio. With the addition of Palisades in 2026, Hoosier Energy is in a net long capacity position for Summer, and additional resources are needed beginning in 2029. The addition of Battery Storage supplements the resource portfolio in the 2030s.

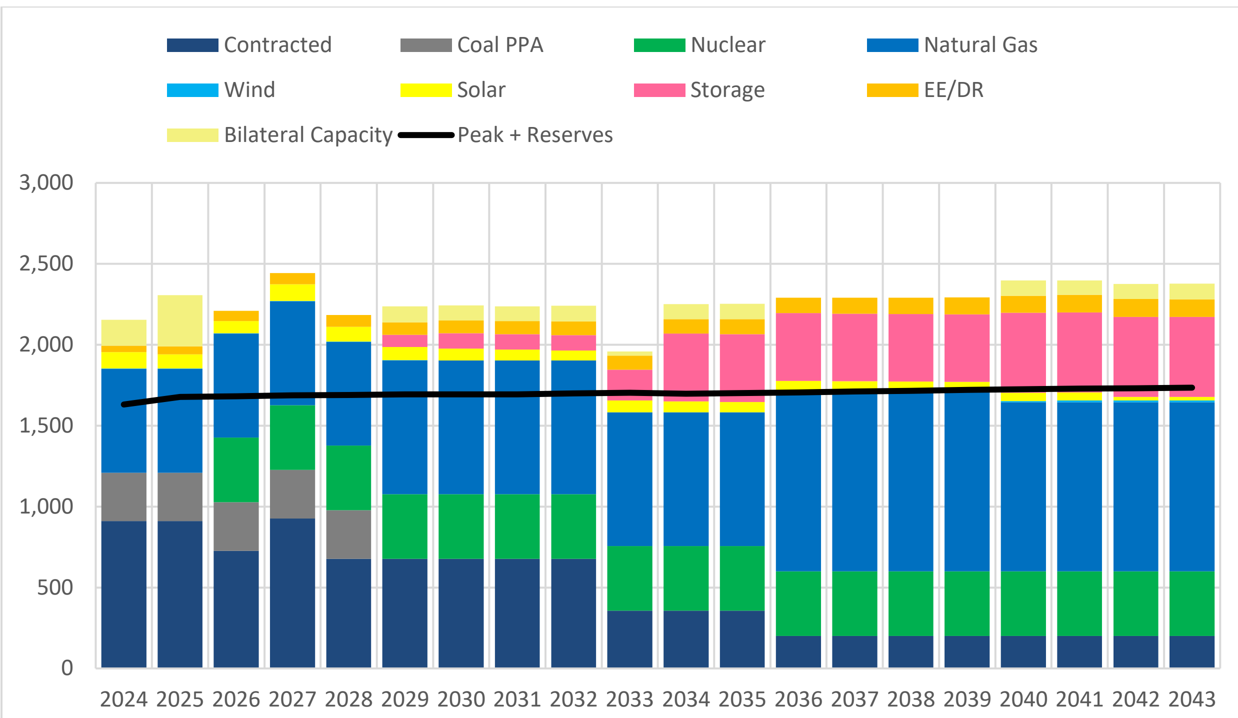



**Figure 9: Status Quo Portfolio: Summer Firm Capacity Position (Firm MW)**

Figure 10 contains the annual Winter season firm capacity position for the Status Quo portfolio. With the addition of Palisades in 2026, Hoosier Energy is in a net long capacity position for Winter, and additional resources are needed beginning in 2029. Solar does not contribute to Winter capacity, so it is not shown in the firm capacity chart.

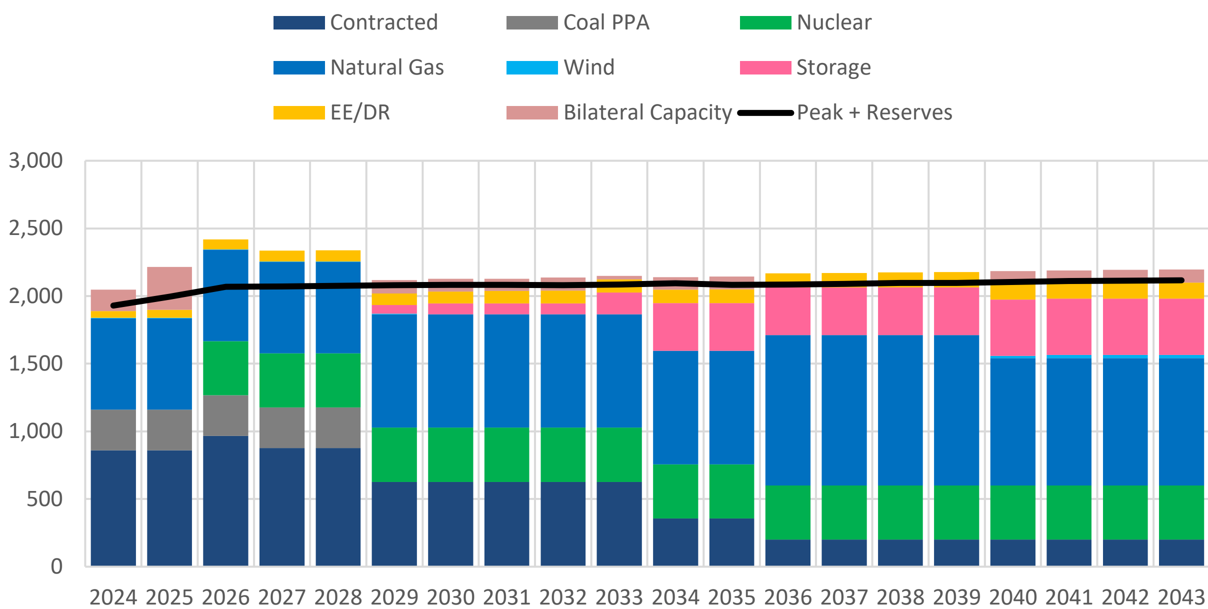



**Figure 10: Status Quo Portfolio: Winter Firm Capacity Position (Firm MW)**

\Figure 11contains the annual energy position for Hoosier Energy for this portfolio. Nuclear consistently makes up 30-40% of annual generation for Hoosier Energy through the study, and incremental solar and wind additions later in the study increase the amount of zero-carbon generation. Natural gas generation varies year to year based on the amount of installed capacity and the power and natural gas fluctuations in the forward curve. Under this scenario, Hoosier Energy finds itself relying on a significant amount of market energy purchases beginning in 2029.

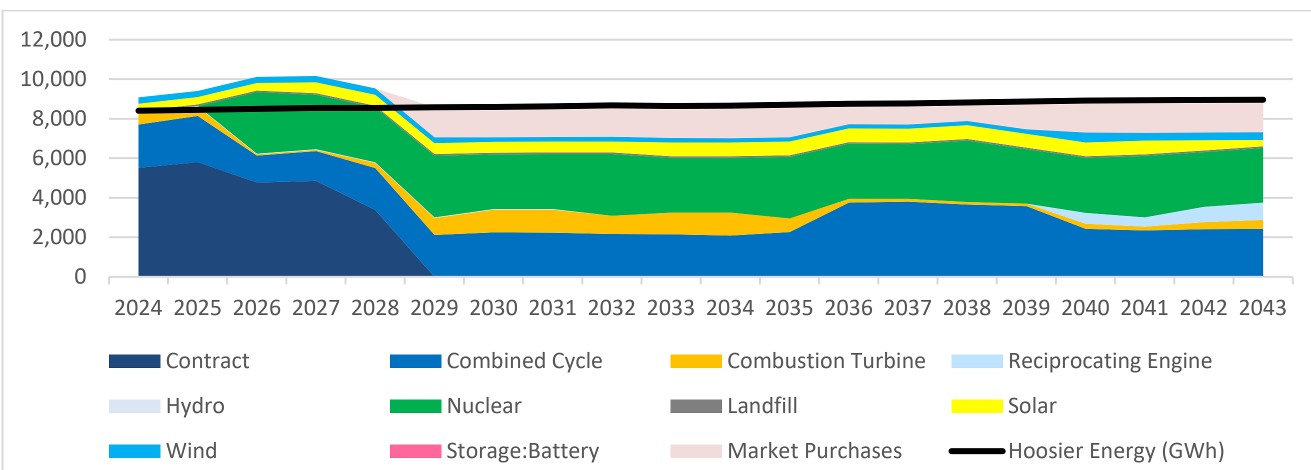



**Figure 11: Status Quo Portfolio: Annual Energy Position (GWh)**

### *4.10.2. EPA Rule Portfolio*

The EPA Rule Portfolio includes the following scenario assumptions:

- Base natural gas and power prices
- No federal price on carbon
- 50% net capacity limit on new and existing natural gas resources
- Base technology cost estimates for all new resources

Table 12 contains cumulative installed capacity volumes for the EPA Rule portfolio from 2028 through 2043. The addition of a capacity factor limit on combined cycle generation reduces the ability of the portfolio lean on that resource type for generation, and wind and solar is added to provide replacement generation. 350 MW of solar capacity is added as soon as 2028, and wind is added to the portfolio in 2030. A 325 MW combined cycle is still added to the portfolio in 2036, but the utilization of the resource is significantly lower than the status quo.

| | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EE/DR | 81 | 86 | 92 | 97 | 103 | 109 | 114 | 120 | 126 | 131 | 136 | 142 | 147 | 152 | 158 | 163 |
| New Gas CT:1 | 0 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 600 | 600 | 600 | 600 |
| New Gas Combined Cycle:CC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas RICE:IC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Battery Storage:BAT1 | 0 | 0 | 0 | 0 | 0 | 100 | 300 | 300 | 300 | 300 | 300 | 300 | 700 | 700 | 700 | 700 |
| New Wind:WT1 | 0 | 0 | 100 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 250 | 300 | 300 | 300 |
| New Solar:PV1 | 0 | 350 | 350 | 350 | 350 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 550 | 550 | 775 | 775 |

**Table 12: EPA Rule: Cumulative Installed Generic New Capacity (Installed MW)**

Figure 12 shows the annual Summer seasonal firm capacity position for the EPA Rule portfolio. Gas generation is supplemented with new Solar and Wind resources beginning in 2029 and new Battery Storage beginning in 2033.

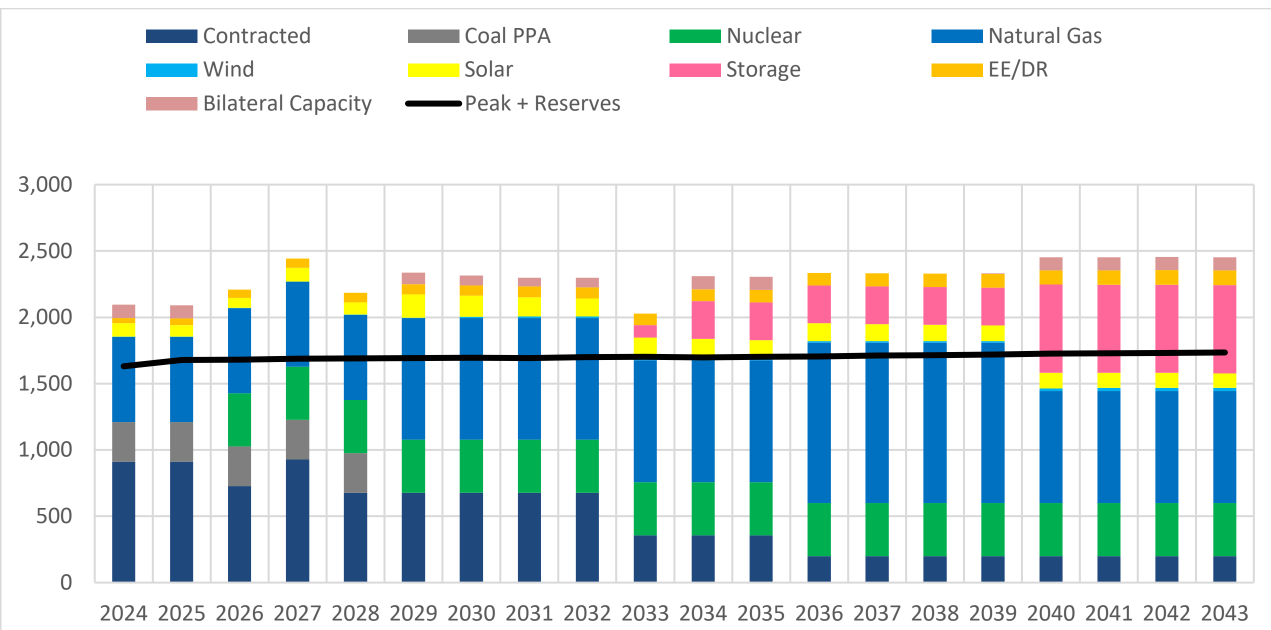



**Figure 12: EPA Rule Portfolio: Summer Firm Capacity Position (Firm MW)**

Figure 13 shows the annual Winter seasonal firm capacity position for the EPA Rule portfolio. Despite a more aggressive renewable buildout compared to the Status Quo portfolio, the limited firm capacity contribution of wind and solar means that this portfolio still receives most of the new firm capacity from natural gas and battery storage.

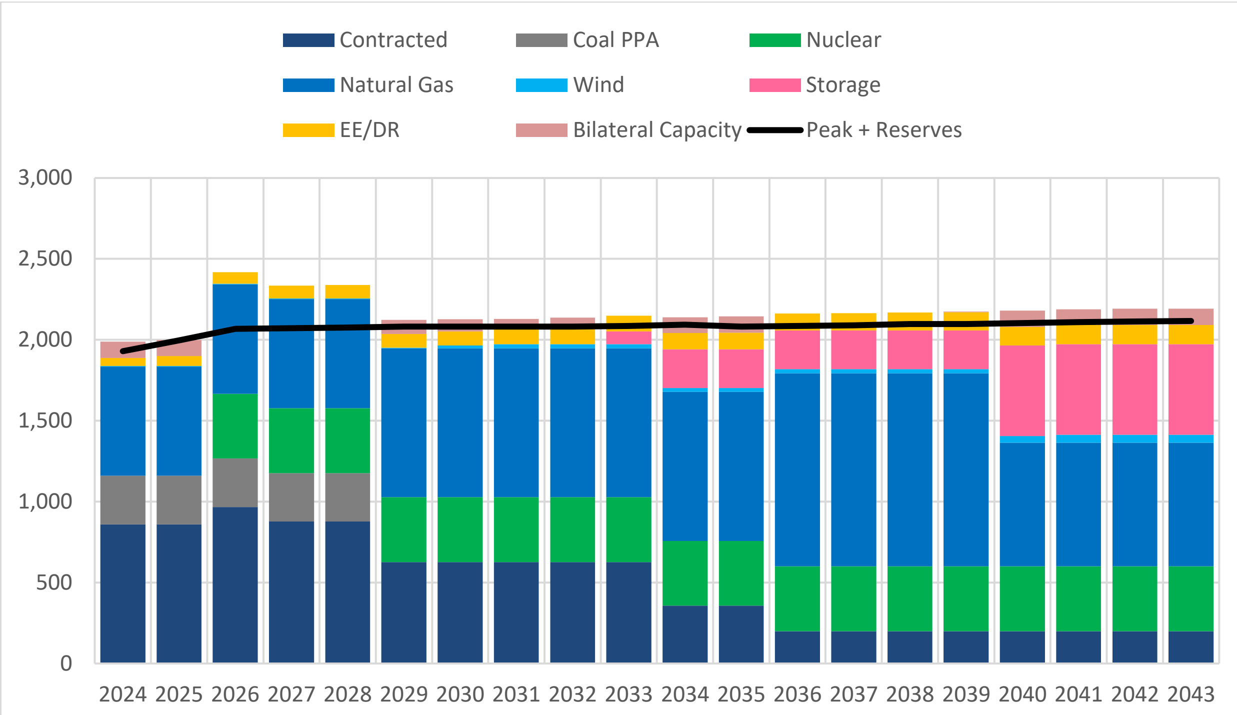



**Figure 13: EPA Rule Portfolio: Winter Firm Capacity Position (Firm MW)**

Figure 14 contains the annual energy position for Hoosier Energy for this portfolio. Nuclear consistently makes up 30-40% of annual generation for Hoosier Energy through the study, and incremental solar and wind additions later in the study increase the amount of zero-carbon generation. Natural gas generation increases in 2036 with the addition of the new Combined-Cycle facility, but Hoosier Energy will rely on market purchases for over 10% of its annual energy requirements in most years after 2028.

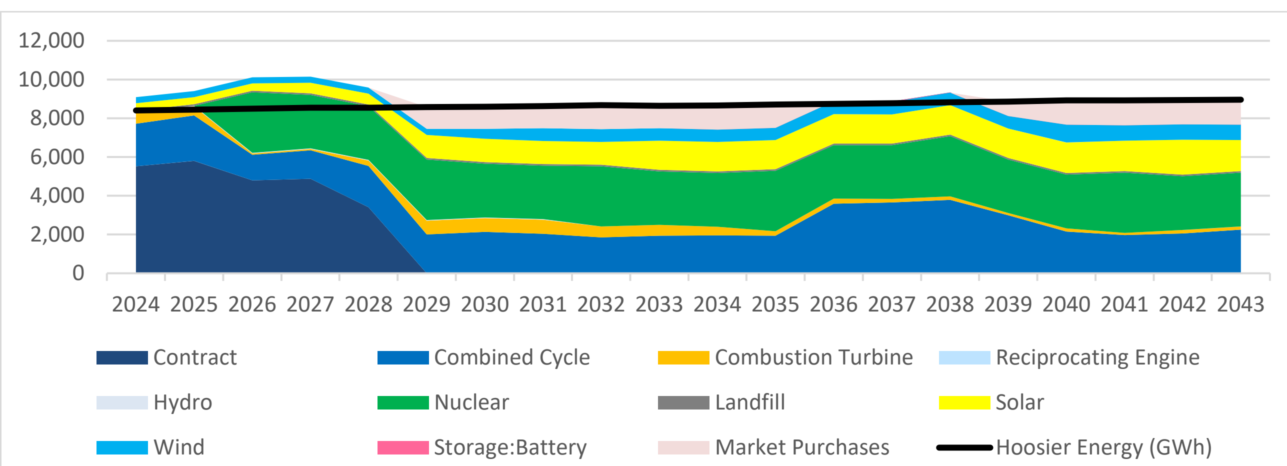



**Figure 14: EPA Rule: Hoosier Annual Energy Position (GWh)**

### *4.10.3. Carbon Tax Portfolio*

The Carbon Tax Portfolio includes the following scenario assumptions:

- Base natural gas
- Power prices higher to include the impact of the carbon tax
- $21/ton carbon tax starting in 2028. Carbon tax increases to $62/ton by 2050.
- No EPA 111(d) or 111(b) carbon rules impacting new or existing natural gas
- Base technology cost estimates for all new resources

With the addition of a carbon tax starting in 2028, higher power prices incentivize additional renewable buildout, with solar coming online slowly in 2029-2032 but ramping up significantly into the mid-2030s. Wind and battery storage are also added, along with a firm capacity addition of a combined cycle in 2026. Less combustion turbine capacity is added in this portfolio with additional capacity coming from battery storage.

| | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EE/DR | 81 | 86 | 92 | 97 | 103 | 109 | 114 | 120 | 126 | 131 | 136 | 142 | 147 | 152 | 158 | 163 |
| New Gas CT:1 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 600 | 600 | 600 | 600 |
| New Gas Combined Cycle:CC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas RICE:IC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Battery Storage:BAT1 | 0 | 180 | 180 | 180 | 180 | 300 | 520 | 520 | 520 | 520 | 520 | 520 | 700 | 700 | 700 | 720 |
| New Wind:WT1 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 200 | 300 | 300 | 300 | 300 |
| New Solar:PV1 | 0 | 25 | 25 | 50 | 100 | 600 | 875 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |

**Table 13: Carbon Tax Portfolio: Cumulative Installed Capacity (MW)**

**Figure 15** shows the annual Summer seasonal firm capacity position for the Carbon Tax portfolio. New firm capacity additions are primarily coming from new battery storage and natural gas. Wind and Solar provide some incremental firm capacity.

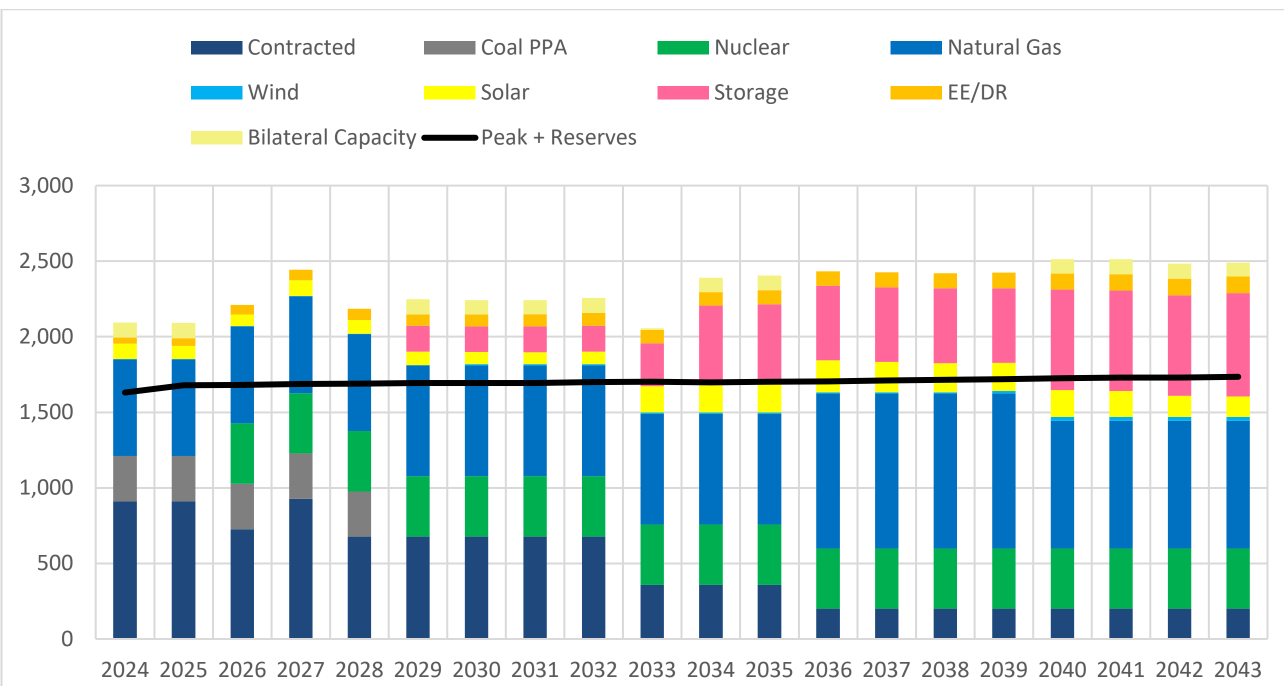



**Figure 15: Carbon Tax Portfolio: Summer Firm Capacity Position (Firm MW)**

**Figure** 16 shows the annual Winter seasonal firm capacity position for the Carbon Tax portfolio. New firm capacity additions are primarily coming from new battery storage and natural gas. Wind provides some incremental firm capacity, and solar is not shown as this for Winter firm capacity.

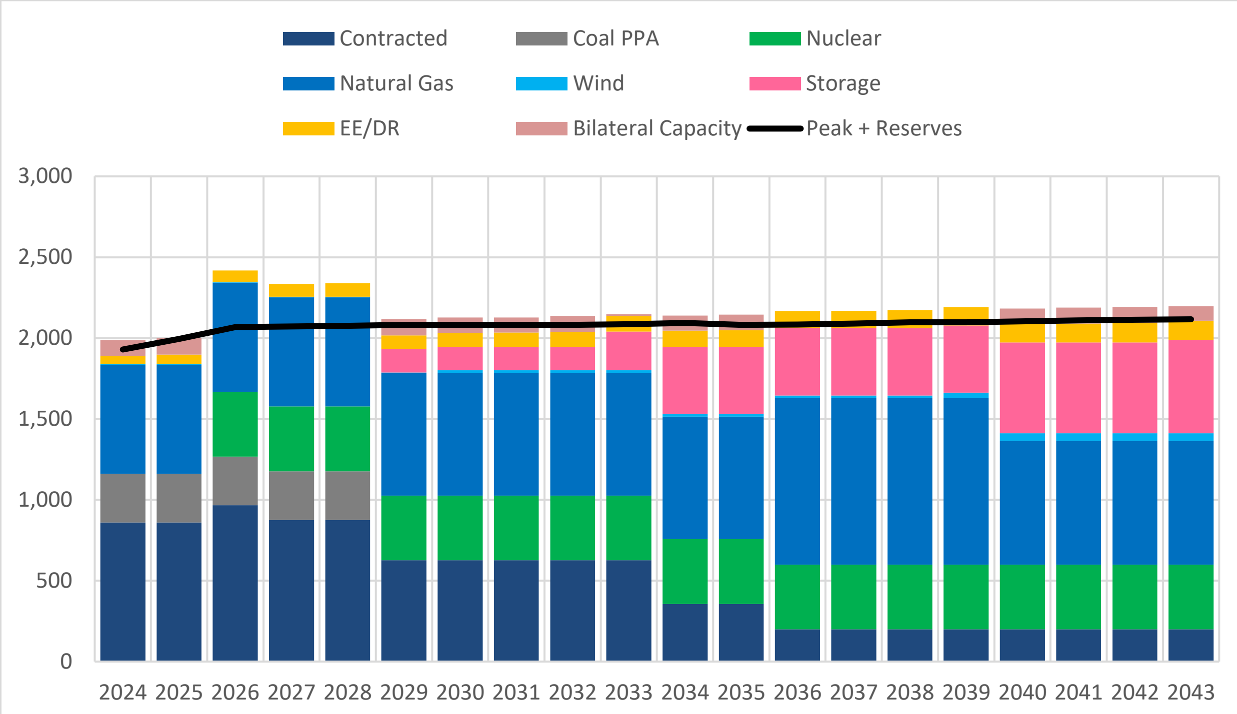



**Figure 16: Carbon Tax Portfolio: Winter Firm Capacity Position (Firm MW)**

Figure 17 shows the significant solar additions in the 2030s, as solar generation makes up close to 25% of the portfolio by 2039. Combined cycle generation is significantly less with each MWh assessed with a carbon tax. Hoosier Energy will rely on market purchases for 10% - 20% of its annual energy requirements in most years after 2028.

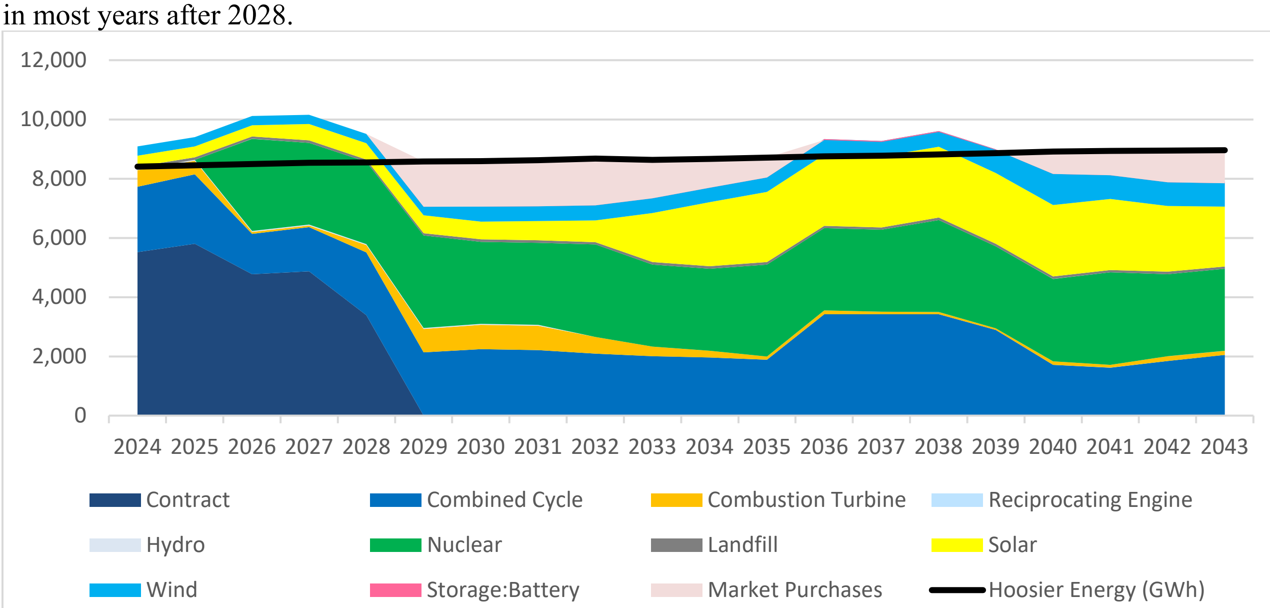



**Figure 17: Carbon Tax: Annual Energy Position (GWh)**

### *4.10.4. EPA Rule + Carbon Tax Portfolio*

The EPA Rule plus Carbon Tax Portfolio includes the following scenario assumptions:

- Base natural gas
- Power prices higher to include the impact of the carbon tax
- $21/ton carbon tax starting in 2028. Carbon tax increases to $62/ton by 2050.
- 50% net capacity limit on new and existing natural gas resources
- Base technology cost estimates for all new resources

The combination of the EPA rule limiting carbon emissions for natural gas combined cycle and a carbon tax starting in 2028 increases and accelerates the amount of wind, solar, and storage added in the portfolio compared to the portfolios with the standalone rules. 500 MW of solar is added in 2028 and combined with 80 MW of storage and 100 MW of wind in 2030. Additional natural gas generation is added later in the decade.

| | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EE/DR | 81 | 86 | 92 | 97 | 103 | 109 | 114 | 120 | 126 | 131 | 136 | 142 | 147 | 152 | 158 | 163 |
| New Gas CT:1 | 0 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 600 | 600 | 600 | 600 |
| New Gas Combined Cycle:CC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas RICE:IC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Battery Storage:BAT1 | 0 | 80 | 80 | 80 | 80 | 220 | 420 | 420 | 420 | 420 | 420 | 420 | 700 | 700 | 700 | 720 |
| New Wind:WT1 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 200 | 300 | 300 | 300 | 300 |
| New Solar:PV1 | 0 | 500 | 575 | 575 | 575 | 950 | 950 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |

**Table 14: EPA Rule + Carbon Tax: Cumulative Installed Capacity Additions (MW)**

Figure 18 shows the annual firm Summer seasonal capacity position for the EPA Rule plus Carbon Tax portfolio. Capacity additions come from a combination of Solar, Wind and Battery Storage. New Natural Gas-fired resources add to the portfolio base beginning in 2029, and again in 2036.

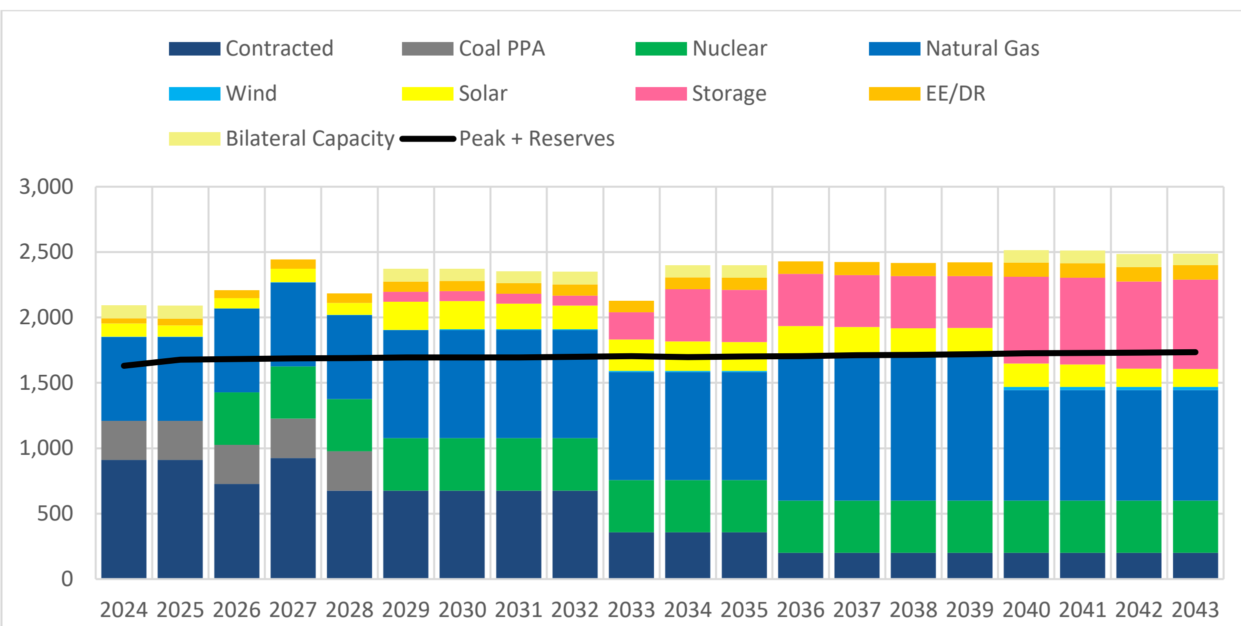



**Figure 18: EPA Rule + Carbon Tax Portfolio: Summer Firm Capacity Position (Firm MW)**

**Figure 19** shows the annual firm Winter seasonal capacity position for the EPA Rule plus Carbon Tax portfolio. This continues to tell a similar story – new Winter firm capacity resources are a combination of natural gas and storage. Solar provides non-winter firm capacity, and the wind does contribute to both winter and summer firm capacity totals.

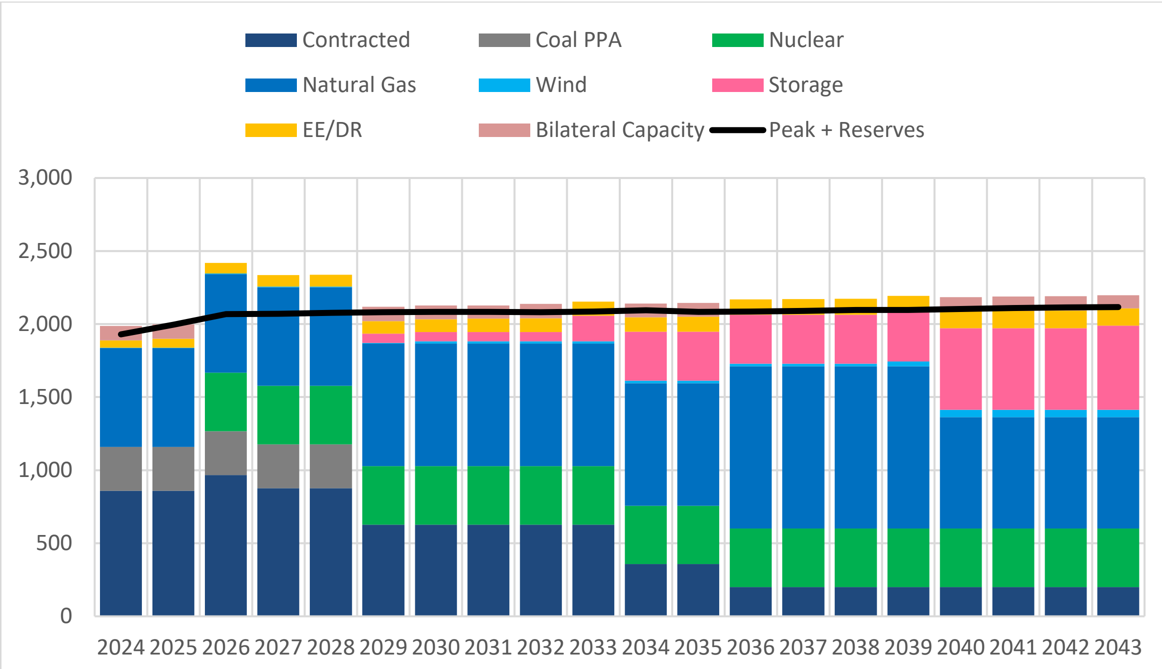



**Figure 19: EPA Rule + Carbon Tax Portfolio: Winter Firm Capacity Position (Firm MW)**

Figure 20 shows the significant solar additions in the 2030s, as solar generation makes up 20% to 25% of the portfolio beginning in 2029. Combined cycle generation is significantly less with each MWh assessed with a carbon tax. Hoosier Energy will rely on market purchases for 10% of its annual energy requirements in most years after 2028.

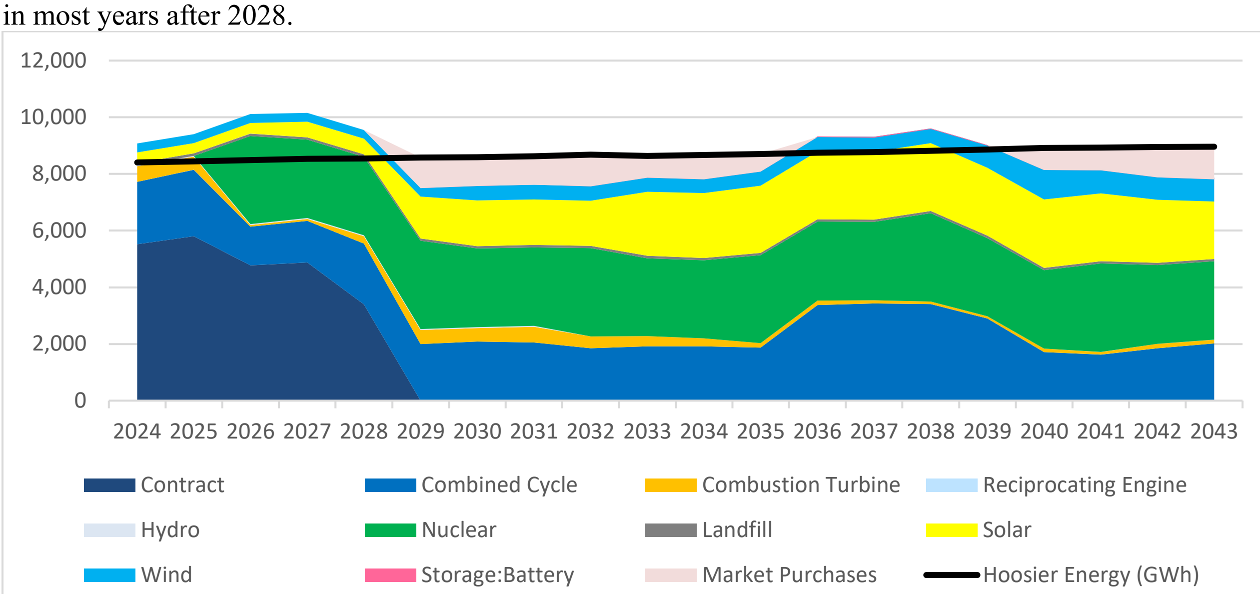



**Figure 20: EPA Rule + Carbon Tax Portfolio: Annual Energy Position (GWh)**

### *4.10.5. Aggressive Environmental*

The Aggressive Environmental Portfolio includes the following scenario assumptions:

- High natural gas prices
- Power prices higher to include the impact (a) higher natural gas prices and (b) the impact of the carbon tax
- $21/ton carbon tax starting in 2028. Carbon tax increases to $62/ton by 2050.
- 50% net capacity limit on new and existing natural gas resources
- Low technology cost estimates for all new resources

The Aggressive Environmental scenario and resulting portfolio includes the most aggressive buildout of wind, solar, and storage. New combustion turbine buildout is removed in favor of wind and battery storage for winter capacity. Similar to all other portfolios, a 325 MW combined cycle is added in the mid-2030s, even with a lower utilization factor on the plant due to a capacity factor limit and a carbon tax.

| | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EE/DR | 81 | 86 | 92 | 97 | 103 | 109 | 114 | 120 | 126 | 131 | 136 | 142 | 147 | 152 | 158 | 163 |
| New Gas CT:1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 600 | 600 | 600 | 600 |
| New Gas Combined Cycle:CC1 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas RICE:IC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Battery Storage:BAT1 | 0 | 280 | 280 | 280 | 280 | 360 | 440 | 460 | 460 | 460 | 460 | 460 | 720 | 720 | 720 | 720 |
| New Wind:WT1 | 0 | 0 | 100 | 200 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| New Solar:PV1 | 125 | 500 | 500 | 500 | 500 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |

**Table 15: Aggressive Environmental Portfolio: Cumulative Installed Capacity Additions (MW)**

Figure 21 and Figure 22 tell a similar story as the EPA Rule and Carbon Tax scenarios – despite a significantly more aggressive buildout of renewables and storage, the firm capacity position for the Aggressive Environmental portfolio is not that different from the Status Quo portfolio. Natural gas and battery storage provide the bulk of new capacity additions, with contracted resources and Palisades Nuclear rounding out the rest of the additions.

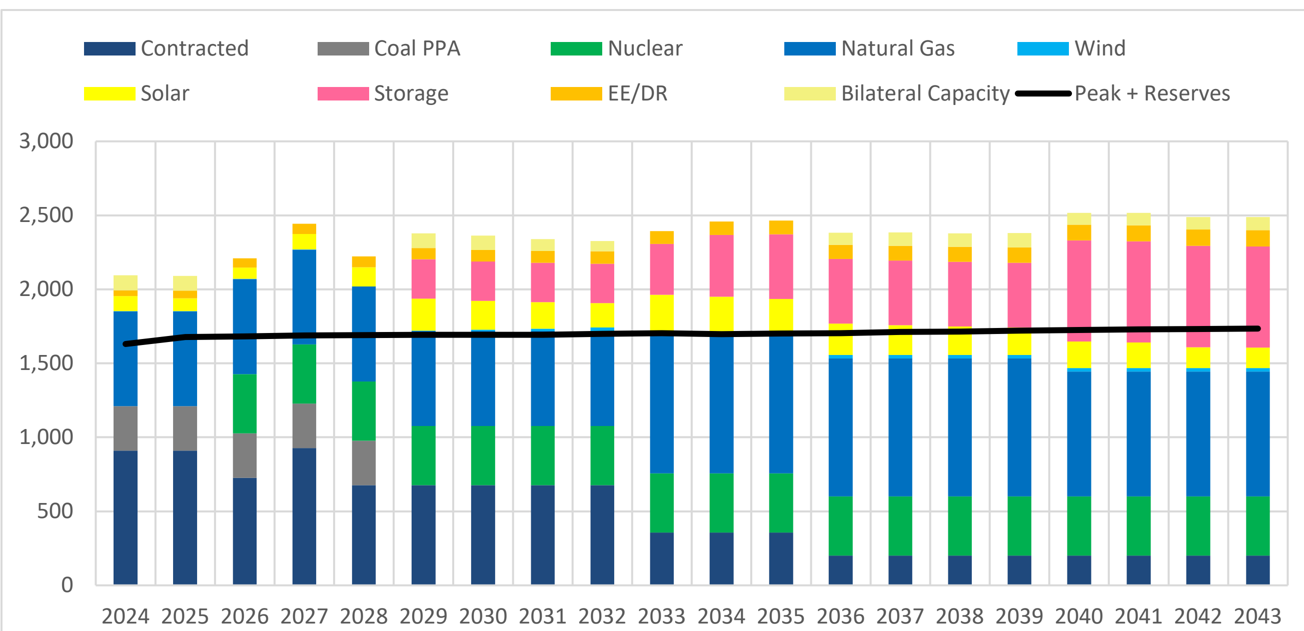



**Figure 21: Aggressive Environmental: Summer Firm Capacity Position (Firm MW)**

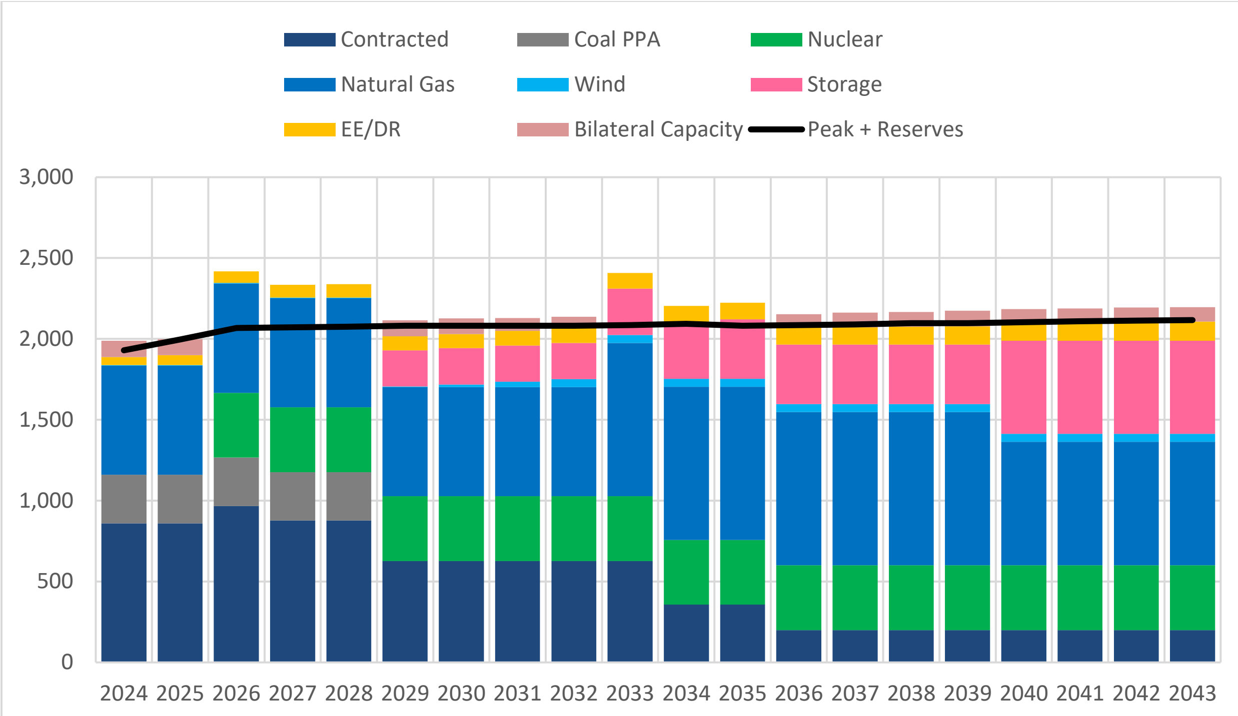



**Figure 22: Aggressive Environmental: Winter Firm Capacity Position (Firm MW)**

Figure 23 shows the annual energy position for this portfolio. The aggressive buildout of renewables results in a portfolio that is 70% zero carbon (nuclear, wind, and solar) by 2040.

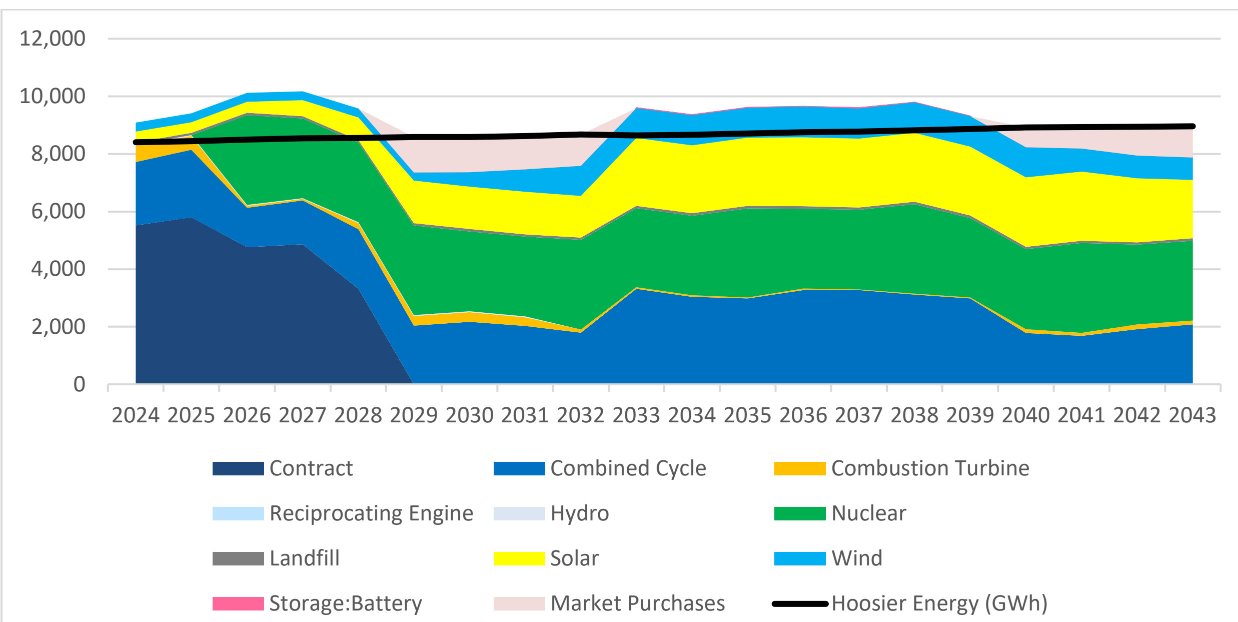



**Figure 23: Aggressive Environmental: Annual Energy Position (GWh)**

### *4.10.6. High Price Environment Portfolio*

The High Price Environment Portfolio includes the following scenario assumptions:

- High natural gas prices
- Power prices higher due to high natural gas prices
- No federal price on carbon
- 50% net capacity limit on new and existing natural gas resources
- High technology cost estimates for all new resources

Despite higher cost of new technologies, the price environment with high gas and power prices drives new investment in solar and wind in starting in 2029 and 2030, respectively. Peaking capacity from combustion turbines is added in 2029 along with 80 MW of battery storage.

| | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EE/DR | 81 | 86 | 92 | 97 | 103 | 109 | 114 | 120 | 126 | 131 | 136 | 142 | 147 | 152 | 158 | 163 |
| New Gas CT:1 | 0 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 600 | 600 | 600 | 600 |
| New Gas Combined Cycle:CC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas RICE:IC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 | 108 | 108 | 108 |
| New Battery Storage:BAT1 | 0 | 80 | 80 | 80 | 80 | 220 | 420 | 420 | 420 | 420 | 420 | 420 | 600 | 600 | 600 | 600 |
| New Wind:WT1 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 200 | 250 | 300 | 300 |
| New Solar:PV1 | 0 | 500 | 550 | 550 | 550 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 850 | 925 |

**Table 16: High Price Portfolio: Cumulative Installed Capacity Additions (MW)**

Figure 24 shows the annual firm Summer seasonal capacity position, with new firm capacity mainly coming from natural gas in the 2020s. Post 2030, new capacity requirements are filled primarily through wind, solar and battery storage.

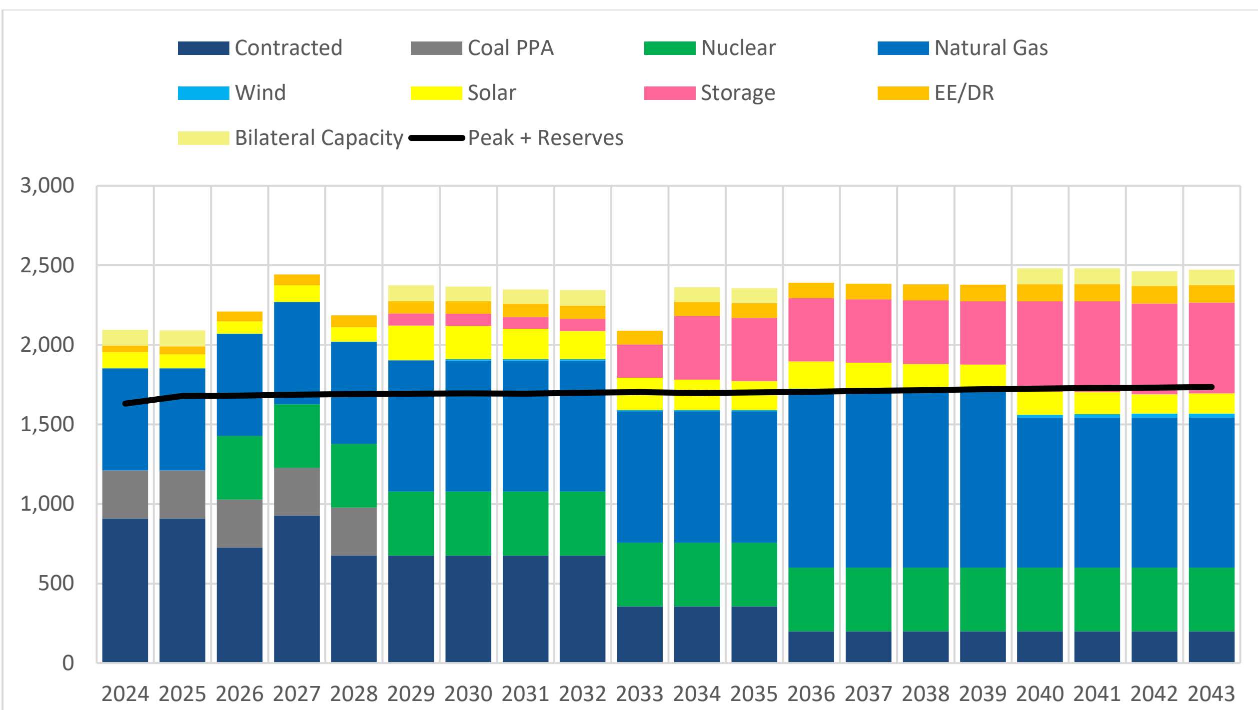



**Figure 24: High Price Environment: Summer Firm Capacity Position (Firm MW)**

Figure 25 shows the annual firm Winter seasonal capacity position, with new firm capacity mainly coming from natural gas and battery storage. The aggressive buildout of renewables increases the share of zero-carbon generation in the portfolio compared to the Status Quo Portfolio, as shown in Figure 25.

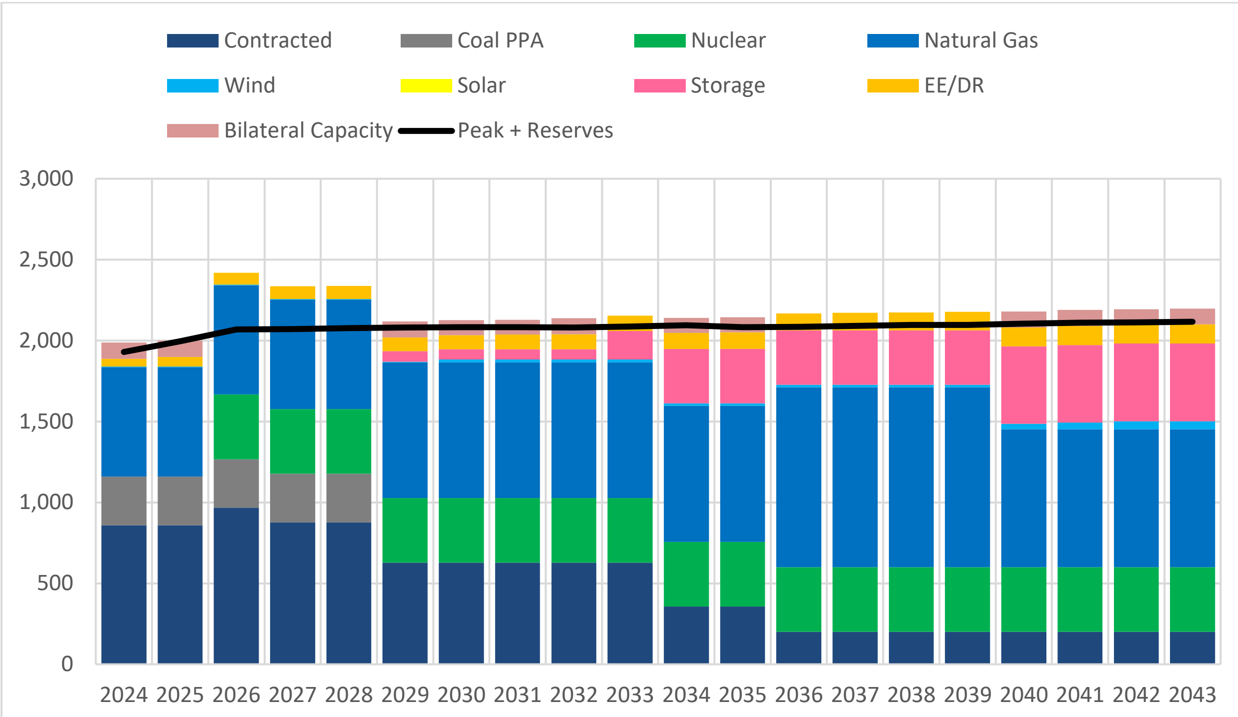



**Figure 25: High Price Environment: Winter Firm Capacity Position (Firm MW)**

Figure 26 shows the annual energy position for the High Price Environment portfolio, and reflect significant gas, nuclear and solar generation. Hoosier Energy will rely on market purchases for 10% of its annual energy requirements in most years after 2028.

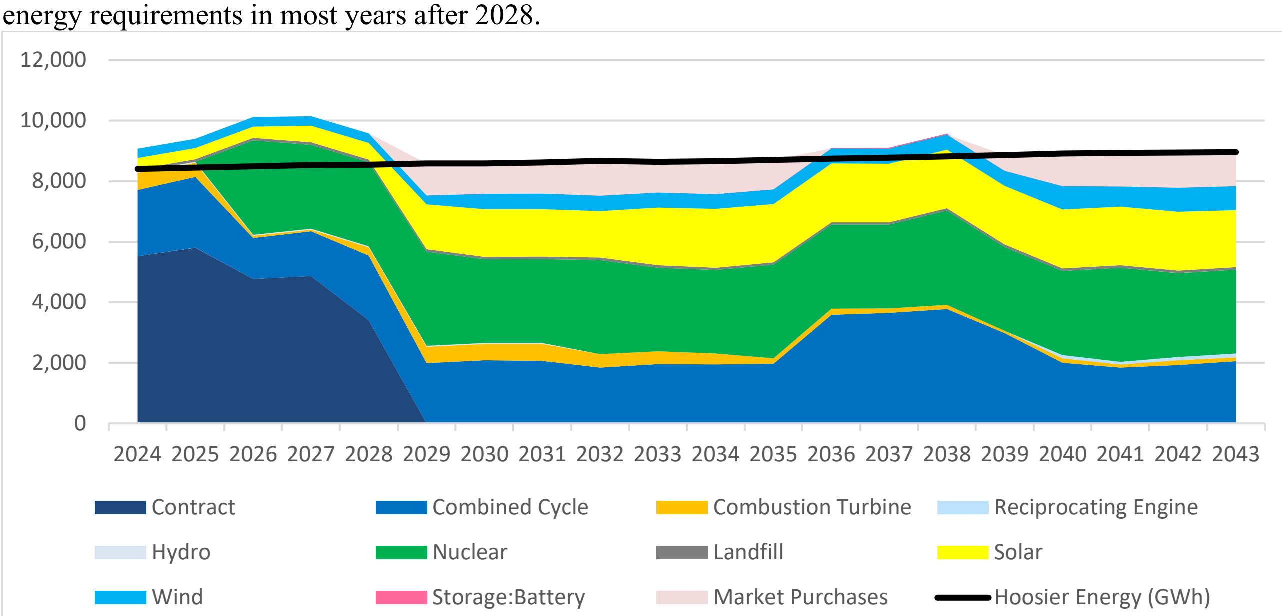



**Figure 26: High Price Environment: Annual Energy Position (GWh)**

### *4.10.7. Low Price Environment Portfolio*

The Low Environment Portfolio includes the following scenario assumptions:

- Low natural gas prices
- Power prices lower due to low natural gas prices
- No federal price on carbon
- No EPA 111(d) or 111(b) carbon rules impacting new or existing natural gas
- Low technology cost estimates for all new resources

Table 17 shows the impact of low gas and power prices along with removal of any carbon regulations in this portfolio. Despite the cost of renewables and storage being lower in this scenario, wind and solar are not added until late in the study. The model is instead selecting low-utilization capacity resources such as natural gas peakers and battery storage to fill capacity needs.

| | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EE/DR | 81 | 86 | 92 | 97 | 103 | 109 | 114 | 120 | 126 | 131 | 136 | 142 | 147 | 152 | 158 | 163 |
| New Gas CT:1 | 0 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 600 | 600 | 600 | 600 |
| New Gas Combined Cycle:CC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas RICE:IC1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Battery Storage:BAT1 | 0 | 80 | 100 | 100 | 100 | 120 | 440 | 440 | 440 | 440 | 440 | 440 | 760 | 760 | 760 | 760 |
| New Wind:WT1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| New Solar:PV1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 17: Low Price Environment: Cumulative Installed Capacity Additions (MW)**

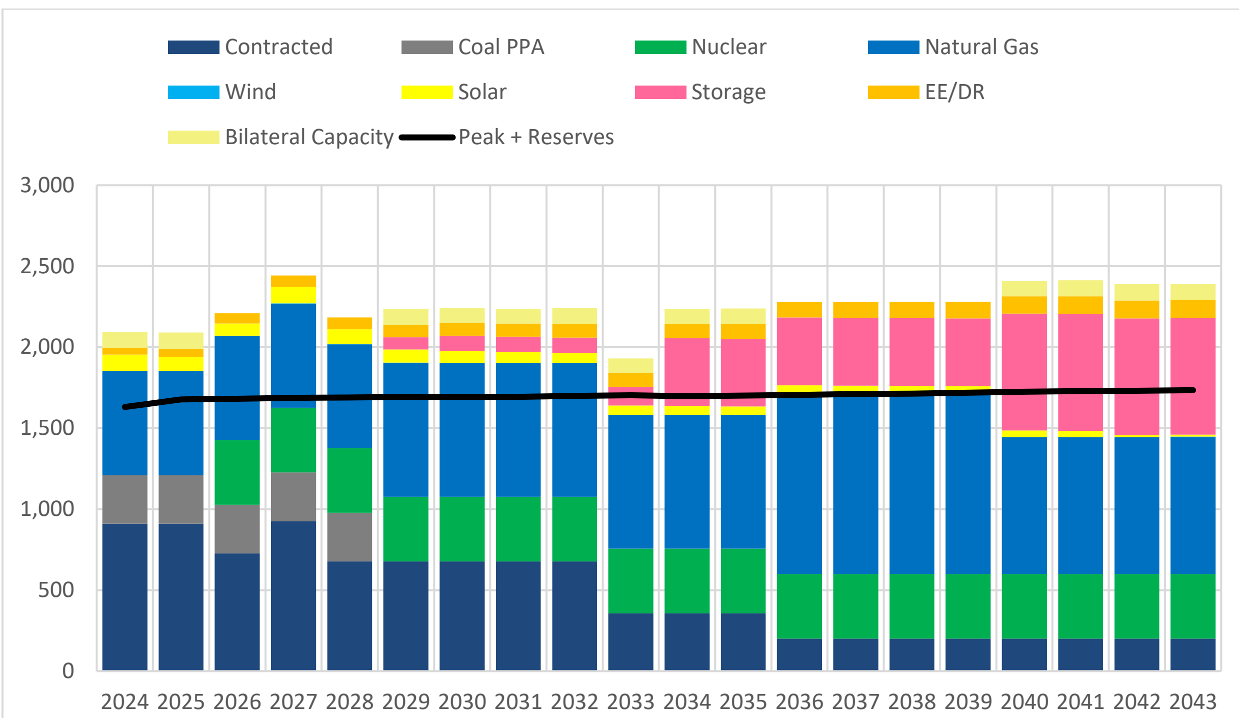



**Figure 27: Low Price Environment: Summer Firm Capacity Position (Firm MW)**

The Winter seasonal firm capacity position for this portfolio is shown in Figure 28, and the annual energy position is shown in **Figure 29**. The 20% annual limit on market purchases constraints all portfolios, but the limit is binding earlier in this scenario compared to all other scenarios as the model builds fewer energy producing resources and wants to lean on low-priced spot market power more.

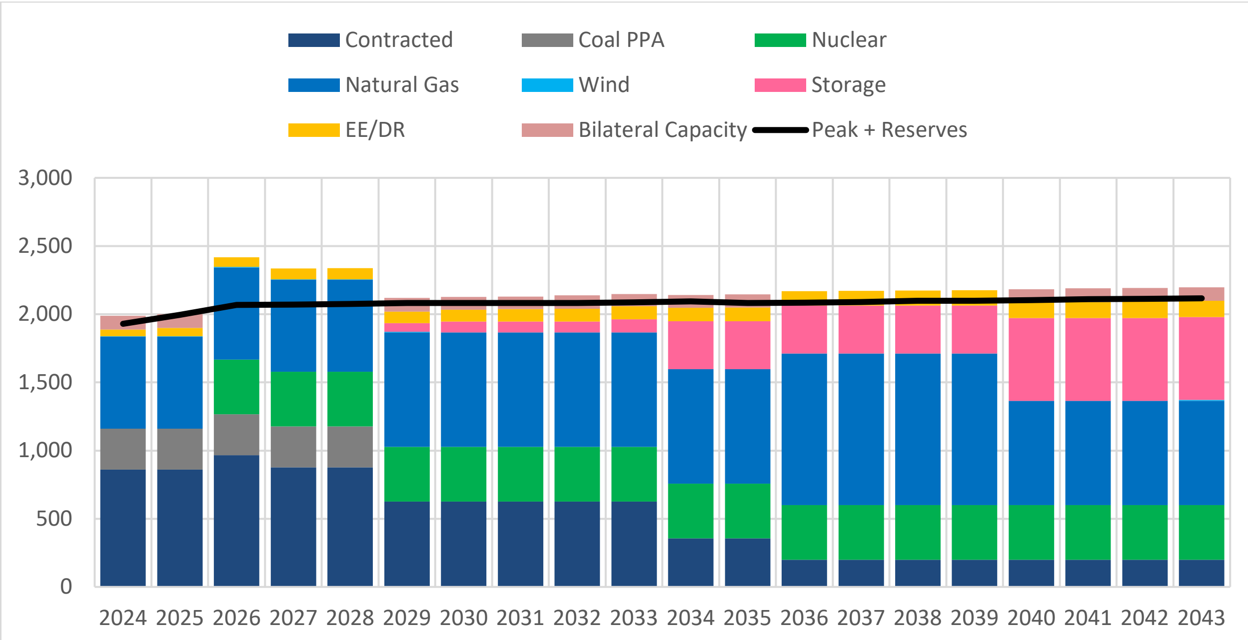



**Figure 28: Low Price Environment: Winter Firm Capacity Position (Firm MW)**

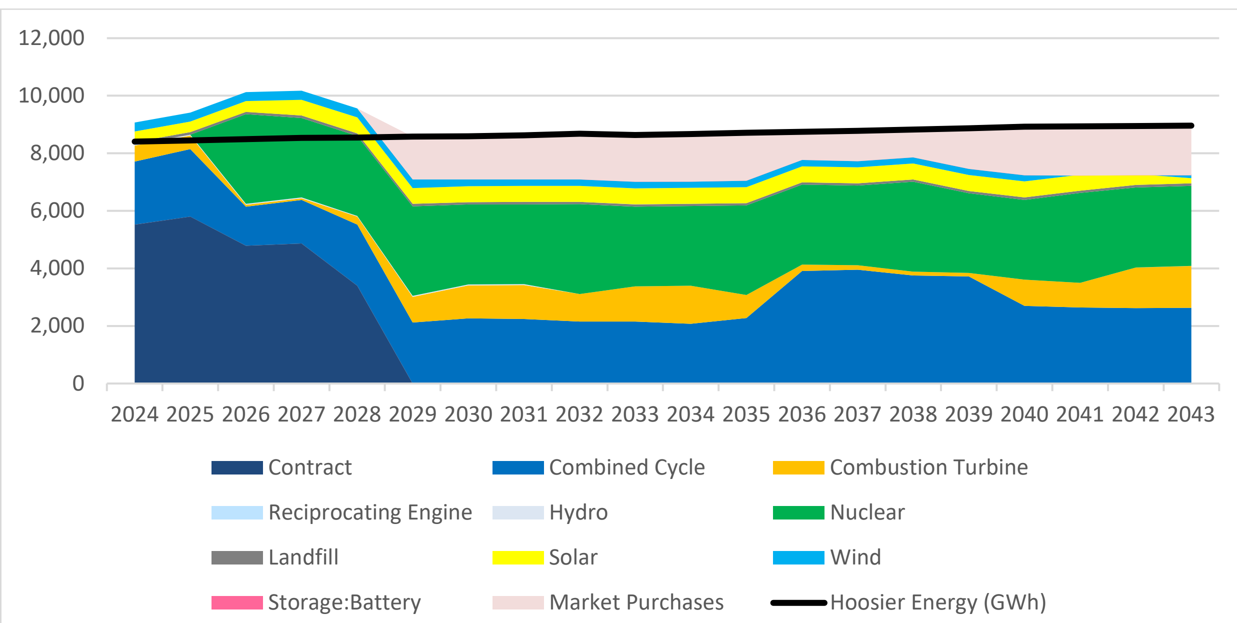



**Figure 29: Low Price Environment: Annual Energy Position (GWh)**

# Section 5: Production Cost Modeling and Scorecard

## 5.1 Scenario Matrix

The portfolios optimized for each set of scenario assumptions were locked and cross-run through each scenario, resulting in a 7x7 scenario matrix. This matrix helps illustrate how portfolios would perform if the future is different than the conditions for which that portfolio was optimized. The results of the scenario analysis can help Hoosier understand risk and opportunities, as well as understand how future potential market or regulatory changes could cause Hoosier to want to adapt the portfolio as resource decisions are being made.

Table 18 contains 20-year PVRR ($MM) for each portfolio and scenario combination. While theoretically the portfolio optimized for the specific scenario assumptions should perform the best in that scenario, certain factors could cause this to not be the case. First, capacity expansion is run in a "typical week" manner, which means that the full 8760 hourly load, price, and renewable profiles are condensed into a single week per month of the year. Running that optimized portfolio through a full hourly production cost run can result in some changes as the modeling is moved from typical week to hourly. Additionally, some other model settings such as how violations of unserved energy and capacity can influence model results.

Table 18 shows several key takeaways. The Status Quo portfolio, which has low to moderate additions of wind and solar and relies more heavily on natural gas generation for energy production, has risk when exposed to environmental regulations such as the EPA 111(b) and 111(d) rules and a federal price on carbon. For example, the Status Quo portfolio introduces approximately $300M of additional cost over the study period compared to the Aggressive Environmental Portfolio.

| *Portfolios ↓* / *Scenarios →* | Status Quo | EPA Rule | CO2 Tax | EPA + CO2 Tax | Aggressive Environmental | High Price | Low Price |
|---|---|---|---|---|---|---|---|
| **Status Quo** | $7,792 | $8,835 | $8,343 | $9,340 | $10,205 | $8,684 | $6,896 |
| **EPA Rule** | $7,970 | $7,994 | $8,400 | $8,400 | $9,042 | $8,817 | $7,150 |
| **CO2 Tax** | $7,925 | $8,626 | $8,330 | $8,626 | $9,218 | $8,743 | $7,102 |
| **EPA + CO2 Tax** | $8,038 | $8,419 | $8,409 | $8,414 | $8,941 | $8,847 | $7,241 |
| **Aggressive Environmental** | $8,082 | $8,107 | $8,435 | $8,445 | $8,888 | $8,897 | $7,300 |
| **High Price** | $8,122 | $8,148 | $8,528 | $8,534 | $9,255 | $8,816 | $7,320 |
| **Low Price** | $7,759 | $10,092 | $8,330 | $10,598 | $11,397 | $8,675 | $6,838 |

**Table 18: IRP Scenario Matrix (20-Year PVRR, $MM)**

| | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Reference Case/Status Quo*** | | | | | | | | | | | | | | | |
| New Solar | 0 | 0 | 0 | 0 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| New Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 150 | 150 | 150 |
| New Battery Storage | 80 | 100 | 100 | 100 | 200 | 440 | 440 | 440 | 440 | 440 | 440 | 520 | 520 | 520 | 520 |
| New Combined Cycle | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas Peaking | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 816 | 816 | 816 | 816 |
| ***High Load*** | | | | | | | | | | | | | | | |
| New Solar | 0 | 0 | 0 | 0 | 0 | 75 | 275 | 275 | 275 | 275 | 450 | 550 | 550 | 750 | 925 |
| New Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 100 | 100 | 200 | 300 | 300 | 300 | 300 |
| New Battery Storage | 260 | 260 | 260 | 260 | 360 | 720 | 720 | 720 | 760 | 780 | 780 | 800 | 800 | 800 | 800 |
| New Combined Cycle | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| New Gas Peaking | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 816 | 816 | 816 | 816 |
| ***Low Load*** | | | | | | | | | | | | | | | |
| New Solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Battery Storage | 0 | 0 | 0 | 0 | 40 | 260 | 280 | 280 | 280 | 280 | 280 | 280 | 280 | 280 | 280 |
| New Combined Cycle | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 325 | 325 | 325 | 325 |
| New Gas Peaking | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 400 | 400 | 400 | 400 |

**Figure 30: Cumulative Installed Capacity Additions by Scenario (MW)**

| | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***High Load*** | | | | | | | | | | | | | | | |
| New Solar | 0 | 0 | 0 | 0 | (75) | 0 | 200 | 200 | 200 | 200 | 375 | 475 | 475 | 675 | 850 |
| New Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 100 | 100 | 200 | 200 | 150 | 150 | 150 |
| New Battery Storage | 180 | 160 | 160 | 160 | 160 | 280 | 280 | 280 | 320 | 340 | 340 | 280 | 280 | 280 | 280 |
| New Combined Cycle | 0 | 0 | 325 | 325 | 325 | 325 | 325 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| New Gas Peaking | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 | 0 | 0 | 0 |
| ***Low Load*** | | | | | | | | | | | | | | | |
| New Solar | 0 | 0 | 0 | 0 | (75) | (75) | (75) | (75) | (75) | (75) | (75) | (75) | (75) | (75) | (75) |
| New Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (100) | (150) | (150) | (150) |
| New Battery Storage | (80) | (100) | (100) | (100) | (160) | (180) | (160) | (160) | (160) | (160) | (160) | (240) | (240) | (240) | (240) |
| New Combined Cycle | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (325) | (325) | (325) | (325) | 0 | 0 | 0 | 0 |
| New Gas Peaking | (200) | (200) | (200) | (200) | (200) | (200) | (200) | (200) | (200) | (200) | (100) | (416) | (416) | (416) | (416) |

**Figure 31: Cumulative Installed Capacity - Difference from Status Quo Portfolio (MW)**

## 5.2 Scorecard Development

Portfolios were scored using three primary categories of measurement:

1. Affordability & Stability
    - Reference Case 20-Year PVRR ($MM)
    - 10-Year Avg. Supply Cost ($/MWh)
    - 20-Year Avg. Supply Cost ($/MWh)

2. Environmental Sustainability
    - Reference Case Cumulative Carbon Emissions
    - Avg. Carbon Emissions Across Scenarios
    - % Zero-Carbon Generation

3. Risk & Opportunity
    - Lowest PVRR Across Scenarios
    - Highest PVRR Across Scenarios
    - Avg. Market Interaction
    - Max % Generation From Single Resource Type

### *5.2.1 Affordability & Stability*

The Scorecard Analysis revealed that, outside of an extremely low-price environment, the Reference Case provides the most affordable strategy for Hoosier Energy Members. This is illustrated by the metric of 20-Year Present Value of Revenue Requirements (PVRR) which represents the total expected future revenue requirements, or revenue collections to cover costs, associated with a particular resource portfolio. Additional Affordability metrics include a 10-year and 20-year average of supply costs. These amounts are not finite or guaranteed, simply representations of the potential cost implications of future decision making.

### *5.2.2 Environmental Sustainability*

Although the Scorecard Analysis did not demonstrate that the Reference Case results in the largest reduction of Cumulative Carbon Emissions, a balance must be struck in order to provide affordability and reliability to our members. Regulatory risk, which may eventually translate as cost risk, can be mitigated by investing in high-efficiency gas as an intermediate load resource replacement for coal, contracting for capacity-only products to create flexibility in order to diversify energy from non-carbon intensive generation, and beginning to layer in wind, solar and battery storage in the late 20’s/early 30’s.

### *5.2.3 Risk & Opportunity*

The Scorecard Analysis also evaluated the portfolios for the risk and opportunity associated with cost exposure ranges in shifting environments, market interaction & exposure, and generation diversity. While the Reference Case had the lowest PVRR across all scenarios, it also had the widest range of costs if conditions significantly change from the ‘most likely’ conditions that were assumed for that capacity expansion. The Reference Case also had the largest concentration of a single resource type by 2030 but it evens out significantly in the next decade.

### *5.2.4 Reliability*

Although reliability is not included on the Scorecard, it was important to understand the portfolios' potential impacts on operational reliability. While reliability and resource adequacy are not holistically the same, there is a significant impact between available and reliable generation and the ability to add stability to the grid. Hoosier consulted with Quanta Technology to perform a reliability analysis of the hypothetical portfolios. Quanta evaluated nine different reliability categories in order to assess the ability to balance energy (ramping, dispatchability, flexibility), the ability to control frequency (inertial response, primary response), the ability to provide adequate short circuit strength to integrate inverterbased resources and mitigate their flicker-induced concerns, and the ability to supply the dynamic reactive power required by loads to avoid motor stalling and ensure rapid transient voltage recovery. Their analysis demonstrated that all scenarios scored relatively similar with a demonstrated need of geographic proximity of generation to load.

| | AFFORDABILITY | | | ENVIRONMENTAL | | | | RISK & OPPORTUNITY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Reference Case 20-Year PVRR ($MM) | 10-Year Avg. Supply Cost ($/MWh) | 20-Year Avg. Supply Cost ($/MWh) | Reference Case Cumulative Carbon Emissions | Avg. Carbon Emissions Across Scenarios | % Zero-Carbon Generation | | Lowest PVRR Across Scenarios | Highest PVRR Across Scenarios | Avg. Market Interaction | | Max % Generation From Single Resource Type | |
| | $MM | $/MWh | $/MWh | Tons | Tons | 2030 | 2040 | $MM | $MM | %, Purchases | %, Sales | 2030 | 2040 |
| **Reference Case** | $7,792 | $64.29 | $72.08 | 56,516,882 | 54,379,730 | 42% | 45% | $6,896 | $10,205 | 17% | 5% | 48% | 37% |
| **EPA Rule** | $7,970 | $65.94 | $73.72 | 48,531,016 | 47,350,905 | 53% | 59% | $7,150 | $9,042 | 16% | 9% | 38% | 35% |
| **CO2 Tax** | $7,925 | $64.59 | $73.29 | 46,729,713 | 44,838,013 | 46% | 70% | $7,102 | $9,218 | 16% | 10% | 43% | 33% |
| **EPA + CO2 Tax** | $8,038 | $66.25 | $74.35 | 45,926,685 | 44,456,416 | 57% | 70% | $7,241 | $8,941 | 16% | 11% | 36% | 33% |
| **Aggressive Environmental** | $8,082 | $66.61 | $74.76 | 46,218,628 | 44, 617,299 | 56% | 70% | $7,300 | $8,897 | 15% | 12% | 37% | 33% |
| **High Price** | $8,122 | $66.37 | $75.11 | 47,305,607 | 46,708,489 | 57% | 62% | $7,320 | $9,255 | 16% | 10% | 36% | 34% |
| **Low Price** | $7,759 | $64.18 | $71.77 | 60,897,317 | 56,939,664 | 42% | 40% | $6,838 | $11,397 | 17% | 5% | 48% | 48% |

**Table 19: IRP Scorecard**

### *5.2.5 Key Takeaways*

- **<u>Winter Firm Capacity</u>**: Hoosier is a winter peaking utility, with a peak coincidence factor of almost 99% with the MISO system. As a result, Hoosier's winter firm capacity need is a significant factor for future resource decisions. Existing firm resources from contracts, natural gas, wind, demand response, and the newly signed 400 MW share of the Palisades nuclear plant provide a diverse mix of known and signed resources for Hoosier's portfolio. However, capacity additions in the 2029-2035 time frame will be critical for Hosier to meet MISO capacity obligations and ensure member load is met through the winter. As the IRP was developed, natural gas resources and battery storage are the two best technologies for meeting winter firm capacity needs. However, additional technology, such as long-duration storage, could emerge as a replacement for the combined cycle addition in the mid-2030s in every scenario.

- **<u>Impacts of Future Environmental Regulation</u>**: The EPA 111(b) and 111(d) rules pose significant challenges to the Status Quo portfolio, as additional energy-producing resources will be needed to fill the gap from reduced natural gas generation. Other federal regulations such as a carbon tax could put additional cost pressure on a future resource strategy that does not add additional renewables and battery storage. Hoosier will closely monitor ongoing EPA proceedings and all state and federal legislation to see if renewable acquisitions (PPA or ownership) needs to be accelerated to meet future laws and supply member demand over time.

- **<u>Diversification</u>**: The addition of a balanced portfolio of utility owned generation (baseload, peaking and intermediate), power purchases and sales, renewables, market contracts, and demand-side resources diversifies risk in the event load or market conditions change. Table 21 provides a comparison of Hoosier Energy's resource diversity in years 2000, 2023 and 2043, as provided by the Preferred Plan. While evident that Hoosier Energy has made significant progress in diversifying its resources, and its reliance on coal-fired generation, from 2000 to 2023, the addition of nuclear, battery storage, solar, wind and natural gas-fired generation in the 2023 – 2043 timeframe further reduces Hoosier Energy's reliance on a single generating source or type. Hoosier Energy also adds to its portfolio of demand-side resources, which also benefits diversity.

## 5.3 Discussion of Preferred Plan

Hoosier Energy's 2023 Integrated Resource Plan was created in an environment of uncertainty, volatility and unprecedented market and industry changes that create continuous challenges for long-range planning. Through changes in EPA regulations, MISO's resource adequacy approach, volatility in commodity prices, and inflated costs for replacement resources, the process of long-range planning has shifted from a long-distance view to a recurring, constant analysis as the industry continues to transition. All of these elements have influenced, and will continue to influence, Hoosier Energy's strategy and process for this IRP.

Hoosier Energy has selected the Reference Case, using the Status Quo portfolio as its Preferred Resource Plan in this IRP.

1. The Plan is one of the least cost Portfolios across all Scenarios.

2. The Plan limits Average Market Interaction to 17% for Purchases and 5% for Sales.
3. The Plan enhances Hoosier Energy's diversity by adding wind, solar, battery storage and gas generation in addition to the resources already in Hoosier Energy's portfolio, as discussed in Sections 3.1.2 and 3.1.3. The maximum generation from a single resource type will be reduced from 48% in 2030 to 37% in 2040.
4. The Plan demonstrates environmental sustainability in that 42% of 2030 generation will be sourced from Zero Carbon sources, with the percentage increasing to 45% in 2040.

The Preferred Plan includes the retirement of 870 MW of current PPAs, including 770 MW that are primarily sourced from coal-fired generation. These PPAs are anticipated to be replaced with a mix of nuclear, wind, solar, battery storage and natural-gas fired resources. A summary of Hoosier Energy's preferred resource plan is provided in the following table. Although not shown in this table, Hoosier Energy, in conjunction with the Member Systems, will continue to provide cost effective demand response and energy efficiency programs.

| Year | Resource Subtractions | Resource Additions |
|---|---|---|
| 2024 | Duke 2 PPA (100 MW) | |
| 2025 | | |
| 2026 | Duke 3 PPA (50 MW); Exelon PPA (50 MW); Earthwise Shelby County PPA (120 MW) | Palisades Nuclear (400 MW); Clenera Rustic Hills Solar PPA (100 MW); Invenergy Nelson PPA (157 MW) |
| 2027 | | EmberClear LincolnLand PPA (200 MW) |
| 2028 | Duke 250 PPA (250 MW); Hallador Merom PPA (300 MW) | |
| 2029 | | New Gas CT (200 MW); Battery Storage (80 MW) |
| 2030 | Rail Splitter Wind PPA (25 MW) | Battery Storage (20 MW) |
| 2031 | | |
| 2032 | Dayton Hydro PPA (4 MW) | |
| 2033 | NextEra PPA (100 MW); Earthwise Gibson City PPA (220 MW) | Battery Storage (100 MW); New Solar (75 MW) |
| 2034 | | Battery Storage (240 MW) |
| 2035 | | |
| 2036 | Invenergy Nelson PPA (157 MW) | New Gas Combined Cycle (325 MW) |
| 2037 | | |
| 2038 | | |
| 2039 | | |
| 2040 | Holland Combined Cycle (316 MW) | New Gas CT (400 MW); New RICE Gas (216 MW); New Wind (100 MW); Battery Storage (80 MW) |
| 2041 | Meadow Lake Wind PPA (75 MW) | New Wind (50 MW) |
| 2042 | | |
| 2043 | Riverstart Solar (200 MW) | |
| Total MW | **1,967 MW** | **2,743 MW** |

**Table 20: Hoosier Energy Preferred Integrated Resource Plan**

Table 21 shows a comparison of Hoosier Energy's portfolio composition over time from 2020 to 2043. During this period, coal generation will decline from 100% of the portfolio in 2000 to 3.5% of the portfolio in 2043. The combination of solar, wind and battery storage is expected to comprise 75% of the portfolio in 2043.

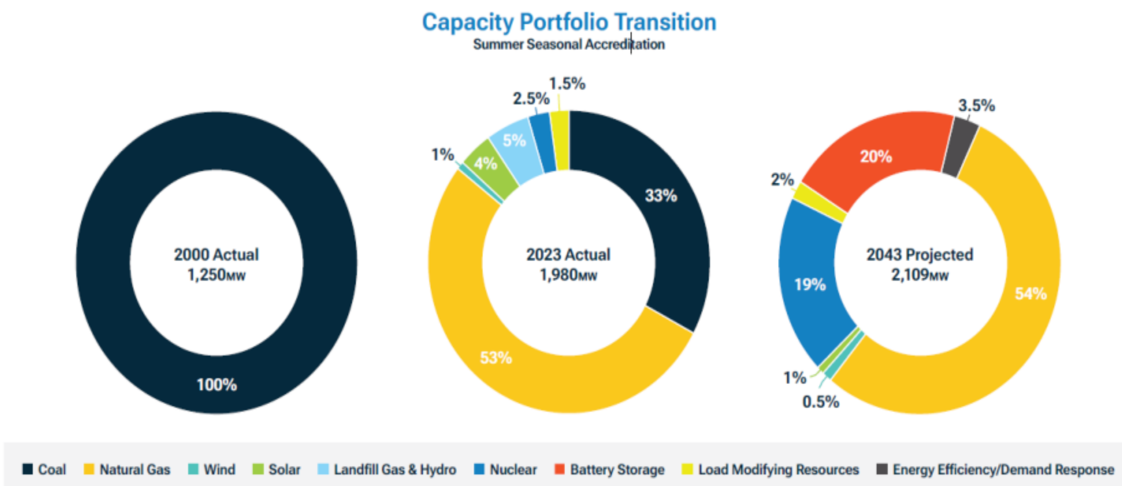



**Table 21: Resource Portfolio Comparison**

### *5.3.1 Cost*

Table 20 represents one of the lowest cost resource plans that were considered in Hoosier Energy's analysis. That said, depending upon conditions, Hoosier Energy may elect to pursue other cost effective and/or advantageous resources. This could include market products, joint development of supply-side resources, power purchase agreements, renewables, and/or additional demand-side management.

### *5.3.2 Reliability*

This IRP addresses reliability in three ways. As a load-serving entity, Hoosier Energy has an obligation to serve member cooperatives. A diverse portfolio of resources assures Hoosier Energy can reliably and economically provide wholesale power to member-owned cooperatives. The IRP also accounts for planning reserves as established by RFC and the MISO and forced outage rates based upon the actual operating history of Hoosier Energy's generation resources. Reserves are a necessary addition to the resource requirement plan and are used to offset the effects of contingencies that arise either because of generation unavailability or changes in load (e.g. weather effects, customer mix and usage). Additionally, Hoosier Energy continues to invest in the transmission system to accommodate growth and ensure reliable service. Membership in the regional transmission organizations (MISO and PJM) allows reliance upon the RTOs' reliability tools, such as the state estimator, real-time contingency analysis and regional outage coordination. In addition, membership in the RTOs allows management of generation facilities that are connected to other RTO utilities but still benefit Hoosier Energy.

### *5.3.3 Market*

The Preferred Plan displayed a low variance across the scenarios, which indicates that the portfolio provides stability against changing economic conditions. Hoosier Energy has identified its primary risks as MISO Transitions, Market Volatility and Price, Environmental Rules and Regulations, Transmission Price Constraints and Counterparties and Resource Costs. The Plan, which includes more nuclear, battery storage, wind, solar and potential gas-fired generation, in combination with Hoosier Energy's current resource portfolio – a broad mix of owned resources, long-term purchases, renewables, demand-side management and short-term power market purchases and sales – mitigates against these risks through development of a diverse resource portfolio which is limited against relying too heavily upon a single resource or resource type.

Hoosier Energy may substitute short-term market purchases for resource acquisition when economic opportunities arise. While the current wholesale market provides short-term economic opportunities, these tend to be transitory in nature and may not be the case for the long-term. The risk mitigation technique of joint ventures for owned resources, which allow for the sharing of risks and reduce overall costs, may be an important component of future resource strategyThe Preferred Plan displayed a low variance across the scenarios, which indicates that the portfolio provides stability against changing economic conditions.

### *5.3.4 Flexibility*

The goal of Hoosier Energy's IRP is to develop a Plan that is low risk, reliable and cost effective. A secondary goal is a Plan that is flexible to enable cost effective responsiveness to changing business circumstances. The preferred plan will enable Hoosier Energy to react to and adapt to load forecast changes, legislative and regulatory mandates, and the potential development or advancement of new technologies.

Environmental legislation and regulations are a significant driver in the development of the IRP. These regulations affect cost assumption tradeoffs between the type, quality and availability of fuel burned and the allowable emissions levels of existing and future generating resources. Therefore, the IRP must not only comply with existing regulations but also allow Hoosier Energy to be flexible enough to adapt to further emission restrictions.

The ability to pursue alternative strategies depending upon regulatory and market environments is an important component of the preferred plan. The Plan use of owned resources and long and short-term purchases and sales not only reduces risk, but also provides the flexibility necessary to respond to changing market conditions.

### *5.3.5 Greatest Influences on the Preferred Resource Plan*

A resource plan is inherently uncertain and major cost categories require risk management. The following is a list of these major categories:

- MISO Transitions

    - Risk: MISO continues to adjust their Resource Adequacy approach amid a territory-wide generation mix transition.
    - Mitigation: Maintain coordination and partnerships with industry experts, maintain and enhance direct MISO relationships, and create sensitivities within modeling analyses to understand potential impacts of future changes.

- Market Volatility
    - Risk: Additional elements impacting market volatility (asset age/retirements, extreme weather events, international conflicts, etc.) are increasing uncertainty for potential rate impacts.
    - Mitigation: Multi-dimensional hedging program, additional risk analysis for short- and medium-term resource selection.

- Environmental Rules & Regulations
    - Risk: EPA rules pose challenges to an affordable and reliable portfolio. Strict environmental regulation would require additional energy-producing resources that would add cost pressures and uncertainty to future rate stability.
    - Mitigation: Work closely with regulatory counsel and interest groups to monitor ongoing state and federal legislation, and continue to model risk scenarios.

- Counterparties & Resource Cost
    - Risk: While enhancing diversification, increasing counterparties also carries a risk of credit security, reduction of negotiation power during scarcity of high pricing, and execution/development risk.
    - Mitigation: Contract extensions, federal funding and peer partnerships for self-development, participate more actively in the market.

- Reliability Impact
    - Risk: While reliability and resource adequacy are not the same, there is a significant impact between available and reliable generation and the ability to maintain stability in the grid – particularly during extreme weather events, regulatory pressure or lack of proven/affordable technologies.
    - Mitigation: While all scenarios demonstrated resilience through volatility threats, intermittent resources as primary generation replacements will compromise reliability. Hoosier can only play a small part in this solution, but the resources planned for our membership are robust.

### *5.3.6 Consideration of Non-Traditional Supply*

With respect to energy efficiency and demand response, Hoosier Energy continues to collaborate with Member Systems to provide a variety of DSM programs to their retail members. These efforts lower demand and energy consumption and reduce retail member electricity costs through these programs wherever economically feasible.

## 5.4 Development of the Preferred Plan

The goals of this IRP are to achieve low power supply cost for member systems while maintaining a low market and business risk profile and ensuring a high degree of reliability. This IRP considered a variety of generation options (supply-side) and consumer usage modification (demand-side) alternatives to develop an appropriate blend of resources to minimize overall system cost.

An assessment of Hoosier Energy's current generation capacity and purchased power agreements is found in Section 3.1. This section also provides additional detail on environmental, transmission and commodity forecasts. Sections 3.2 Demand-side Resource Assessment, 4.1 Future Demand-Side Resource Assessment and 4.2 Future Supply-Side Resource Assessment outline the demand and supply-side options that are available to Hoosier Energy to meet future demand. Section 4 includes the resource screening analysis for demand and supply-side options. Based on this analysis, the most economical resources were considered in the Hoosier Energy plan.

### *5.4.1 Effects of the Preferred Plan on Revenue Requirements*

For a cooperative, the impact on revenue requirements is one of the primary considerations when determining the proper mix of resources. Hoosier Energy's Preferred Plan projects revenue requirement NPV to be $7,792 million for the 20-year time horizon. The 10-year average supply cost is $64.29/MWh, while the 20-year average supply cost is $72.08/MWh, or 12.1% higher, due to increased capital investments during the period from 2034 - 2043. Hoosier Energy will continue to strive to find additional cost and operational efficiencies to minimize the impact of increasing revenue requirements. The NPV was calculated using a discount rate of 5%.

### *5.4.2 Hoosier Energy's Ability to Finance New Resources*

Hoosier Energy is rated A+ by Standard & Poor's and A2 by Moody's as of January 2023. Both ratings are investment grade and allow for ready access to public and private capital at market-based rates. Hoosier Energy anticipates maintaining this credit quality in the future. Therefore, adequate capital resources are available to finance the construction or acquisition of new resources recommended by this Plan.

## 5.5 Five Pillars

The Indiana Utility Regulatory Commission's General Administrative Order 2023-04 requires that electric utilities consider, evaluate and comment on the "Five Pillars" defined in Indiana Code 8-1-2-0.6 when preparing an IRP. These are:

1. Reliability, including:
    a. the adequacy of electric utility service, including the ability of the electric system to supply the aggregate electrical demand and energy requirements of end use customers at all times, taking into account:
        i. scheduled; and
        ii. reasonably expected unscheduled;

        outages of system elements; and

    b. the operating reliability of the electric system, including the ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system components.
2. Affordability, including ratemaking constructs that result in retail electric utility service that is affordable and competitive across residential, commercial, and industrial customer classes.
3. Resiliency, including the ability of the electric system or its components to:
    a. adapt to changing conditions; and
    b. withstand and rapidly recover from disruptions or off-nominal events.
4. Stability, including the ability of the electric system to:
    a. maintain a state of equilibrium during:
        i. normal and abnormal conditions; or
        ii. disturbances; and
    b. deliver a stable source of electricity, in which frequency and voltage are maintained within defined parameters, consistent with industry standards.
5. Environmental Sustainability, including:
    a. the impact of environmental regulations on the cost of providing electric utility service; and
    b. demand from consumers for environmentally sustainable sources of electric generation.

Affordability and Environmental Sustainability are addressed in Hoosier Energy's Scorecard. Affordability was quantified through a calculation of the 20-Year PVRR for each scenario, which is a calculation of all portfolio generation-related costs over the IRP time-horizon, adjusted by a 5% discount rate. Total System costs for 10-Year and 20-Year periods were divided by expected load to calculate Portfolio Average Supply costs for each period. These results provide an estimate of affordability over time for each portfolio.

The Environmental Sustainability pillar was addressed through a comparison of Reference Case Carbon Emissions to Average Carbon Emissions across all scenarios. Hoosier Energy also compared Zero Carbon generation percentages in 2030 and 2040 for each scenario.
Reliability and Stability were addressed in the Quanta study for each of Hoosier Energy's proposed portfolios. The results provided a percentage sore for each portfolio and also provided reliability mitigations for each portfolio to improve reliability and stability.

Hoosier Energy's preferred portfolio will provide resiliency through the addition of dispatchable resources such as the Palisades nuclear PPA, new natural gas-fired generation and the addition of Battery Storage on the system. These resources ensure reliability during periods of high demand and times when wind and solar resources are unable to respond to load requirements. Additionally, resources such as CTs, Battery Storage and RICE engines will provide responsive quick start capability to allow for system balancing when required.

### 5.6 Conclusion

Hoosier Energy has selected the Reference Case, using the Status Quo portfolio as its Preferred Resource Plan in this IRP. Hoosier Energy has a need for additional capacity in the mid-2020s as current PPAs expire. This need is expected to be filled with a diverse portfolio of nuclear and natural gas-fired generating resources and battery storage, along with capacity and market purchases. Solar and wind resources are also expected to be added to the portfolio in future years. Assuming forecasted load growth, the optimal online date for new capacity, as well as the most economic type of resource, depends upon the assumptions in the various scenarios, such as member load growth, environmental regulations and market conditions.

Hoosier Energy will pursue a plan based upon the following strategies:

1. Hoosier Energy will limit Wholesale rates and provide a level of rate certainty over the 20-year time horizon by through a diverse portfolio of resources, along with capacity and market purchases.
2. Enhance resource diversity through the addition of new nuclear, solar and natural gas-fired resources to meet capacity and energy requirements.
3. Provide stability and predictability in portfolio costs through the acquisition of a diverse portfolio of resources through fixed-price PPAs of varying lengths.
4. The addition of nuclear, solar, wind and natural gas-fired resources, along with battery storage, will allow Hoosier Energy to limit its environmental risk.

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