



Northern Indiana Public Service Company LLC

2018
Integrated Resource Plan

October 31, 2018

**YOUR
ENERGY
YOUR FUTURE**

IRP

2018 Integrated Resource Plan Executive Summary

At NIPSCO, we're proud that our work provides the energy that northern Indiana families and businesses rely on to power their daily lives. We work each day with the goal of growing alongside our communities and responding to our customers' needs.

As our customers' needs have changed, so has the energy market. Now we stand at the crossroads of the future, with the opportunity to invest in balanced energy options and make energy more affordable and cleaner.

With an eye toward the future, we've been performing a comprehensive analysis of our future energy mix and meeting with our customers, our employees and local community leaders over the past year. The result of this process is an Integrated Resource Plan (IRP).

The plan—which presents over \$4 billion in long-term cost savings—is a balanced, gradual transition that will strengthen our region now and put us on a path to a more cost-effective, cleaner and more sustainable future.

It's "Your Energy" and it's "Your Future."

NIPSCO
A NiSource Company

About NIPSCO

More than 460,000 northern Indiana homes and businesses depend on NIPSCO each day for safe, reliable and affordable energy. Northern Indiana is fortunate to be home to some of the top production facilities in the United States. This has a unique impact on NIPSCO's energy demand profile. Five of our largest industrial customers, primarily in steel and oil refining, account for about 40 percent of NIPSCO's energy demand.

As a member of the regional transmission organization Midcontinent Independent System Operator (MISO), NIPSCO is able to supplement its own energy resources through other participating utilities in MISO's footprint. This relationship helps ensure reliability and cost-effective operations.

About the 2018 Integrated Resource Plan

To help ensure that we continue to meet the needs of our customers, we must have a road map to prepare for future energy needs. Our 2018 IRP charts a path for how best to meet those needs over the next 20 years. NIPSCO presents this plan to the Indiana Utility Regulatory Commission (IURC).

The electric industry, customer needs, expectations and the way energy is consumed continue to evolve. Technologies are rapidly changing and expanding. The electric generation landscape is shifting dramatically, not just for NIPSCO but for the country as a whole.

NIPSCO's 2018 Integrated Resource Plan

Resource planning is a complex undertaking, one that requires addressing the inherent uncertainties and risks that exist in the electric industry. Key factors referred to in the IRP include market conditions, fuel prices, environmental regulations, economic conditions and technology advancements.

Using in-depth data, modeling and risk-based analysis provided by internal and external subject matter experts, we project future energy needs and evaluate available options to meet those needs.

New to NIPSCO's IRP, we issued a formal Request for Proposals (RFP) solicitation to uncover the breadth of actionable projects that were available to NIPSCO within the marketplace across all technology types. The RFP also served to collapse uncertainty about the costs of various technologies, particularly renewables.

The projections included in our plan are based on the best available information at this point in time. Changes that affect our plan may arise, which is why it's important for us to remain flexible and continually evaluate current market conditions, the evolution of technology—particularly renewables—and demand side resources, as well as laws and environmental regulations.

Engaging Customer and Public Stakeholders

Resource planning requires the consideration of diverse points of view, which is one of the reasons that external stakeholder involvement is a critical component throughout the development of the IRP.

We engaged stakeholder groups and individuals in a variety of ways throughout the entirety of the planning process.

Portfolio

Affordable
Reliable
Compliant
Diverse
Flexible

NIPSCO initiated stakeholder advisory efforts for its 2018 IRP in March, hosting a public meeting and launching a web page for interested stakeholders to follow the progress. Four additional public meetings followed in May, July, September and October. NIPSCO also hosted public forums to discuss specific topics arising from the IRP.

In addition to posting public invitations on our IRP web page, we sent an invitation to past IRP stakeholder participants. Members of our executive leadership team and several of our subject matter experts attended each meeting to hear feedback and answer questions.

Throughout the IRP process, stakeholders were also invited to meet with us on a one-on-one basis to discuss key concerns and perspectives. Each interaction provided a forum for discussion and feedback related to the many components of the IRP.

Valuable discussions arose in several key areas, including environmental regulations, fuel costs, load forecasting calculations, energy efficiency program analysis and renewable energy development.

The feedback gathered during the stakeholder process raised valuable questions, helped us better evaluate our options and improved the final plan. A summary of the meeting materials, including presentations and stakeholder questions, is available at NIPSCO.com/IRP.

Forecasting Future Customer Demand

Projecting customers' energy needs is another key component of the IRP process. Looking 20 years into the future does not come without challenges, so we rely on data-driven models to help develop our best estimates. Specific models are developed for residential users, commercial users and industrial users, as well as for all other types of customers, including street lighting, public authorities, railroads and company use.

Data sources used in creating the forecast include energy, customer and price data, economic drivers, weather data and appliance saturation. Given the unique makeup of NIPSCO's customer base, industrial operations are another significant variable. In order to best model their load requirements, we rely on discussions with our 20 largest industrial customers.

With this data, we developed multiple scenario forecasts to capture the range of uncertainty for both energy requirements and peak demand.

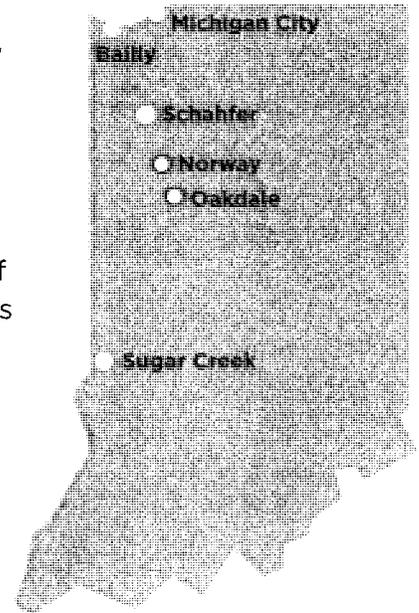
Current Supply

NIPSCO's current resource portfolio is composed of hydroelectric, wind, demand-side resources and natural gas-fired sources in addition to the company's coal-fired plants.

Coal remains the largest part of NIPSCO's fleet, accounting for more than half of total capacity, followed by natural gas-fired electric generation.

NIPSCO also offers a Net Metering Program and a Feed-in Tariff Program (FIT), which allows commercial and residential customers to generate their own power from renewable resources such as wind, solar, hydro and biomass.

To further support renewable energy development, we give customers the power to choose green energy not only through the Net Metering and FIT Programs, but also through the Green Power Program, in which we buy renewable energy credits on customers' behalf.



- Natural Gas
- Hydro
- Coal

NIPSCO Generating Resources

Resource	Unit	Fuel	Capacity NDC (MW)	Year in Service
Michigan City	12	Coal	469	1974
Schahfer	14	Coal	431	1976
	15	Coal	472	1979
	16A	NG	78	1979
	16B	NG	77	1979
	17	Coal	361	1983
	18	Coal	361	1986
Subtotal			1,780	
Sugar Creek		NG	535	2002
Baily	10	NG	31	1968
Hydro	Norway	Water	4	1923
	Oakdale	Water	6	1925
Subtotal			10	
Wind		Wind	100	2009
NIPSCO			2,925	

Analyzing Future Supply Options— Request for Proposals

New to the process in the 2018 IRP, NIPSCO issued a formal Request for Proposals (RFP) to help inform the planning process, and to gain better information on available, real projects at real costs from within the marketplace.

All energy technologies were eligible to participate, and NIPSCO received 90 proposals—the sum of which represented over three times NIPSCO’s current generating capacity.

Evaluating each source of electric generation for its total cost, environmental benefits, reliability, impact on the electric system and risks is an important step in the IRP.

Results from the RFP provided better information that could be incorporated into the analysis and decision-making process.

Specific screening criteria include energy source availability, technical feasibility, commercial availability, economic attractiveness and environmental compatibility.

2018 Proposals Submitted to NIPSCO

Technology	CCGT*	CT*	Coal	Wind	Wind + Solar + Storage	Solar	Solar + Storage	Storage	Demand Resp.	Total Bids
# of Bids	15	1	3	14	1	35	11	9	1	90
Locations	IN, IL	IN	IN, KY	IA, IN, IL, MN	IN	IL, IN, IA	IN	IN	IN	

*CCGT—Combined Cycle Gas Turbine

*CT—Combustion Turbine

Energy Efficiency

Promoting energy efficiency not only is good for customers, it can play an important role in helping ensure that we can meet future energy needs. NIPSCO offers a variety of programs to help residential and business customers save energy. The programs are tailored to customers and designed to help ensure energy savings.

Since 2010, NIPSCO customers have saved more than 1 million megawatt hours of electricity by participating in the range of energy efficiency programs offered by NIPSCO.

Technologies continue to change, and it's important that we constantly evaluate our offerings. We regularly track and report on program performance, which helps to inform and improve future program filings and customer offerings.

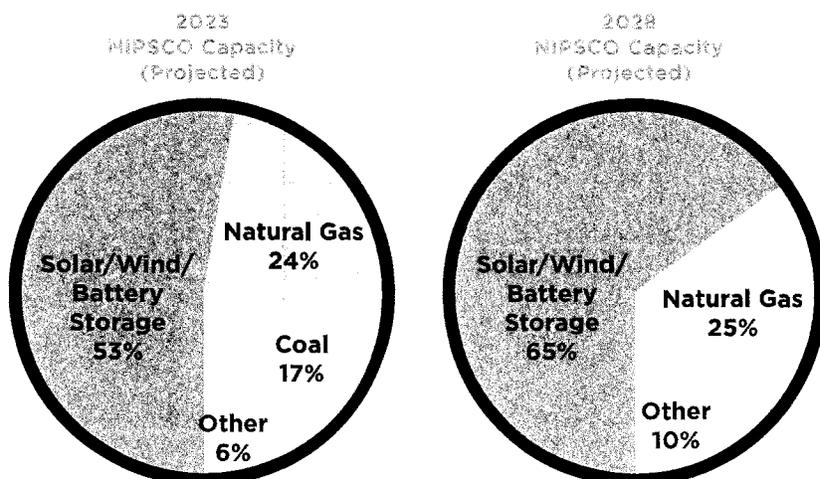
Findings and Next Steps

Throughout the IRP analysis, we are striving to balance the needs of our customers, employees and other community stakeholder interests.

Our goal as we look forward is to transition to the best-cost, cleanest electric supply mix available while keeping options open for the future as technologies and markets change.

Analysis shows that the most viable path for customers involves accelerating the retirement of a majority of NIPSCO's remaining coal-fired generation in the next five years and all coal within the next 10 years. Replacement options point toward lower-cost renewable energy resources such as wind, solar and battery storage technology.

As we gradually transition to creating a more diversified energy mix that will be more cost effective and better serve customers in the future, we are committed to ensuring that this plan limits the impact on local employees and our economy as a result of the remaining coal retirements.



Short-Term Action Plans (2019–Through 2021)

The objective of the plan is to ensure that NIPSCO can confidently transition to the least-cost, cleanest supply portfolio available while maintaining reliability, diversity and flexibility for technology and market changes during this period.

- ✦ Initiate retirement of R.M. Schahfer Coal-Fired Units 14, 15, 17, and 18 by 2023
- ✦ Identify and implement required reliability and transmission upgrades resulting from retirement of the units
- ✦ Select replacement projects identified from the 2018 RFP evaluation process, prioritizing resources that have expiring federal tax incentives to achieve lowest customer cost
- ✦ File for Certificate(s) of Public Convenience and Necessity and other necessary approvals for selected replacement projects
- ✦ Procure short-term capacity as needed from the MISO market or through short-term PPA(s)
- ✦ Continue to actively monitor technology and MISO market trends, while staying engaged with project developers and asset owners to understand landscape
- ✦ Conduct a subsequent All-Source RFP to identify preferred resources to fill remainder of 2023 capacity need (likely renewables and storage)
- ✦ Continue implementation of filed Energy Efficiency Programs Plan for 2019 to 2021
- ✦ Comply with North American Electric Reliability Corporation, U.S. Environmental Protection Agency and other regulations
- ✦ Continue planned investments in infrastructure modernization to maintain the safe and reliable delivery of energy services

Long-Term Action Plans (2023–Beyond)

- ✦ Fully retire the R.M. Schahfer Coal-Fired Units 14, 15, 17, and 18 by the end of 2023 and the Michigan City Coal-Fired Unit 12 by the end of 2028
- ✦ Monitor market and industry evolution and refine future IRP plans

While NIPSCO will continue to update its long-term plan within the next IRP, we believe that these actions coming out of the 2018 IRP will place NIPSCO on a course to continue providing reliable power while enabling lower costs and providing significant environmental benefits.

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Section 1. Integrated Resource Plan

1.1 Short Term Action Plan

Northern Indiana Public Service Company (“NIPSCO” or “Company”) developed a short term action plan consisting of the actions NIPSCO will take for the period 2019 through 2021. The objective of the plan is to ensure that NIPSCO can confidently transition to the least cost, cleanest supply portfolio available while maintaining reliability, diversity and flexibility for technology and market changes during this three year period.

NIPSCO’s short term action plan will focus on initiating the retirement process for all of the coal units at R. M. Schahfer Generating Station (“Schahfer”) and selecting/acquiring replacement projects to fill the capacity gap as a result of the retirements in 2023. The retirements of the Units at Schahfer will likely require upgrades to NIPSCO’s transmission system to maintain system reliability, and NIPSCO will identify and begin implementing the necessary upgrades during this period.

The robust response to the all-source request for proposal (“All-Source RFP”) (discussed in more detail in Section 4) solicitation indicates that there are more than enough diverse resources and projects to meet NIPSCO supply needs in 2023. NIPSCO will adopt a phased-in approach to selecting and acquiring replacement resources, initially prioritizing replacement resources with expiring tax credits in order to maximize the benefits to customers. NIPSCO intends to make the necessary regulatory filings with the Indiana Utility Regulatory Commission (“IURC” or “Commission”) in 2019. During the short-term action plan period, NIPSCO will rely on the Midcontinent Independent System Operator, Inc. (“MISO”) market, short term purchase power agreements (“PPAs”), or other bilateral agreements for short term capacity and energy as needed. NIPSCO will continue to monitor technology and MISO market trends while staying actively engaged with project developers and asset owners to maintain flexibility and optionality. NIPSCO expects to conduct another All-Source RFP to acquire resources to fill the remainder of the 2023 supply that was not met in the 2019-2021 time frame.

NIPSCO will continue the implementation of its current Demand Side Management (“DSM”) plan through 2021.¹ NIPSCO will also continue to comply with existing environmental regulations and all North American Electric Reliability Corporation (“NERC”) compliance standards and requirements. Lastly NIPSCO will continue to invest and modernize its electric infrastructure to maintain the safe and reliable delivery of electricity to its customers

As described in greater detail in Section 9.4 the action items included in NIPSCO’s short term action plan include those listed in Table 1-1:

¹ On September 12, 2018, the IURC issued an Order in Cause No. 45011 approving NIPSCO’s proposed Electric DSM Program for the period of 2019-2021.

Table 1-1: 2018 IRP Short-Term Action Plan

Initiate retirement of Schahfer units 14,15,17,18 by making required notifications to MISO, NERC and other organizations.
Identify and implement required reliability and transmission upgrades resulting from retirement of the units.
Select replacement projects identified from the 2018 All-Source RFP evaluation process, prioritizing resources that have expiring federal tax incentives to achieve lowest customer cost.
File for certificate(s) of public convenience and necessity (“CPCN(s)”) for selected replacement projects.
Procure short-term capacity as needed from the MISO market or through short-term PPA(s).
Continue to actively monitor technology and MISO market trends, while staying engaged with project developers and asset owners to understand landscape.
Conduct a subsequent All-Source RFP in to identify preferred resources to fill remainder of 2023 capacity need (likely renewables and storage).
Continue implementation of approved DSM plan for 2019 to 2021.
Comply with NERC, United States Environmental Protection Agency (“EPA”) and other regulations.
Continue planned investments in infrastructure modernization to maintain the safe and reliable delivery of energy services.

1.2 Plan Summary

NIPSCO’s preferred portfolio plan was developed to ensure that a reliable, compliant, flexible, diverse and affordable supply was available to meet future customer needs. NIPSCO carefully planned and considered the impacts to its employees, the environment and the local economy (property tax, supplier spend, employee base) as the plans were developed.

This plan was developed through substantial quantitative and qualitative analysis. NIPSCO completed a thoughtful analysis to evaluate NIPSCO’s generation units relative to viable alternatives. (See Section 9.) NIPSCO utilized the All-Source RFP process to identify the best combination of supply- and demand-side resources, including those obtained through the market, to meet its capacity needs.

The All-Source RFP provided NIPSCO insight into the most relevant prices and types of resources available to meet customer needs. (See Section 4.9.) NIPSCO performed both the retirement and replacement analysis using robust scenario and risk-based (stochastic) analyses for

different economic, environmental, cost, risk and regulatory uncertainty to inform the optimal plan. NIPSCO also evaluated the impact each of the retirement and replacement alternatives would have on reliability, the local communities and the Company's dedicated employees.

It is important to note that the IRP is a snapshot in time, and while it establishes a direction for NIPSCO, it is subject to change as the operating environment changes. NIPSCO will continue to engage its stakeholders and be transparent in its decisions following submission of this 2018 IRP.

NIPSCO's supply strategy for the next 20 years is expected to:

- Lead to a lower cost, cleaner, diverse and flexible portfolio by accelerating the retirement of 85% of NIPSCO's coal capacity by the end of 2023 and 100% by the end of 2028.
- Continue the Company's commitment to energy efficiency and demand response by executing DSM plans.
- Replace retired coal generation resources with lower cost renewables including wind, solar and battery storage.
- Identify and implement required reliability and transmission upgrades resulting from retirement of the units.
- Reduce customer and Company exposure to customer load, market and technology risks by intentionally allocating a portion of the portfolio to shorter duration supply.
- Continue to actively monitor technology and MISO market trends, while staying engaged with project developers and asset owners to understand landscape.
- Continue to invest in infrastructure modernization to maintain safe and reliable delivery of energy services.
- Continue to comply with NERC and EPA standards and regulations.

1.3 Rationale for NIPSCO 2018 IRP Update Filing

The 2016 IRP action plan was focused on the accelerated retirement of approximately 50% of NIPSCO coal fired generation. Specifically, it called for the retirement of Bailly Generating Station ("Bailly") Units 7 and 8 in 2018 and Schahfer units 17 and 18 in 2023. It projected that the 2023 retirements would create a capacity need of about 600 megawatts ("MW") that NIPSCO would have to address. An IRP in 2018 was necessary to preserve NIPSCO's ability to consider all resource options to meet the capacity need in 2023. Furthermore in light of expected future capital expenditures to comply with the Effluent Limitation Guidelines ("ELG") rules, the 2018 IRP was an opportunity to reexamine the long term viability of the Schahfer and Michigan City Generating Station ("Michigan City") coal units.

1.4 Emerging Issues

NIPSCO's preferred plan follows a diverse and flexible supply strategy, with a mix of market purchases and different low variable cost generation resources, to provide the best balanced mitigation against customer, technology and market risks.

1.4.1 Customer Risk

NIPSCO's five largest industrial customers (ArcelorMittal, US Steel, NLMK, BP and Praxair) account for approximately 40% of NIPSCO's energy demand and approximately 1,200 MW of peak load plus reserves when viewed on a non-coincident, individual customer basis. Most of these customers are closely tied to global steel industry cycles. This concentration of customers tied to a single industry poses significant customer risk. Loss of one or more of these customers, for whatever reason, would result in a significant decline in billing revenues.

Residential, commercial, and smaller industrial customers comprise most of the remaining demand. While this load is diversified and not likely to change significantly, those sectors would likely see impacts from a loss of load from any of the large industrial customers who are major employers in NIPSCO's service territory.

1.4.2 Technology Risk

Technology risk can be thought of as two separate risks from the perspective of a regulated utility. Technology risks play a role in inducing market volatility, and it also has the potential to erode the value of existing assets. Technology changes drive a portion (but by no means all) of the volatility in market prices, both for capacity and energy. To the extent that a utility or its customers are exposed to market risk in general, they are exposed to this aspect of technology risk. Separately, technological and regulatory changes can render specific generation technologies obsolete and can force their premature retirement, which is currently happening to coal generation.

It is difficult to avoid exposure to one or the other type of technology risk when supplying demand using a traditional regulated utility approach. Fully avoiding technological obsolescence risk requires avoiding investing in generation, which exposes the utility and its customers to market risk. Investing in generation mitigates or eliminates market risk but exposes the utility and its customers to some amount of technological obsolescence risk.

Balancing these two risks in light of the technology choices available is key to mitigating overall supply portfolio risk. Currently available new build generation technologies, such as a combined cycle gas turbine ("CCGT") and renewable technologies, have very low fixed operating costs, so the likelihood of forced shutdown in the foreseeable future is likely lower than it has been for coal and nuclear which have very high fixed costs.

1.4.3 Market Risk

Historically, the MISO North region, of which Indiana is a part, has had excess capacity above and beyond the regional reliability requirement. This oversupply in the MISO Planning Resource Auction ("PRA"), has resulted in historically low capacity prices over the last few

planning years. In the 2016/2017 planning year capacity prices rose to \$72 per megawatt-day (“MWD”) as reserve margins declined; however, in the 2017/2018 planning year prices fell to \$1.50MW/MWD, driven by increases in renewable technologies and behind the meter supply resources and the relaxing of import constraints between MISO North and South. In the recent 2018/2019 planning year the capacity prices were \$10/MWD and the expectation is for prices to remain relatively low for the foreseeable future under the current market design.

NIPSCO also participates in the energy market in MISO, since all resources are dispatched according to MISO market signals, as opposed to NIPSCO’s load. The market is currently undergoing change as coal capacity retires and the generation mix shifts towards renewables and natural gas. In recent years, low natural gas prices have resulted in efficient natural gas plants displacing coal-fired generation in the dispatch stack. This dynamic has altered energy prices and has negatively impacted the economics of coal plants. Wind generation has also increased significantly in parts of MISO, and declining technology costs and federal tax credits are likely to result in increased penetration of solar and wind resources. This additional growth of intermittent resources has the potential to shift system peaks, impact capacity credit calculations, and alter the ancillary services markets.

NIPSCO recognizes that system planning with renewable resources is more complex than with dispatchable resources and that assumptions for capacity credit and resource value streams based on today’s market constructs may ultimately change based on future MISO evaluation of Effective Load Carrying Capability and ancillary services market needs in a high renewable environment. NIPSCO also recognizes that congestion and nodal price risk is an important factor for renewable resources and that energy deliverability is critical to realize benefits from renewables. Given these major uncertainties and developments in the market, NIPSCO is committed to tracking market evolutions regarding ancillary services, renewable resource availability, and capacity credit calculations. The preferred plan intentionally leaves room to evaluate market and technology changes on a dynamic basis in order to be flexible and responsive to change.

Section 2. Planning for the Future

2.1 IRP Public Advisory Process

NIPSCO's 2018 IRP stakeholder process focused on continuing to increase transparency around its planning process and enhance public involvement through extensive stakeholder interactions. At each stakeholder meeting, NIPSCO provided information on the processes and assumptions involved in the development of the IRP and solicited relevant input for consideration. Furthermore, to facilitate stakeholder outreach and ongoing communications, NIPSCO maintained a web page on its website with current information about the IRP. NIPSCO posted all meeting agendas, presentations, meeting notes and other relevant documents to the web page.

As part of the IRP process NIPSCO conducted an All-Source RFP solicitation to identify the most viable capacity resources currently available in the market place to best meet customer needs. NIPSCO sought input from stakeholders regarding the approach and design of the All-Source RFP to ensure a robust and transparent process that yield the desired results.

Stakeholders were invited to meet with NIPSCO throughout the IRP process to discuss key issues, concerns and perspectives. NIPSCO extended an invitation to participate in the stakeholder process to the Commissioners and Commission staff, the Indiana Office of Utility Consumer Counselor ("OUCC") and stakeholders that participated in previous IRP public advisory processes. NIPSCO's executive leadership and its subject matter experts attended each public advisory meeting. In the section that follows, NIPSCO provides an overview of its stakeholder process. A more comprehensive accounting of stakeholder meetings, presentations and meeting notes is included in Appendix A.

As part of the 2018 IRP process, NIPSCO hosted four in-person public advisory meetings and one webinar. As a follow up to the public advisory webinar, NIPSCO conducted an additional technical webinar to focus specifically on a single topic - the integration of the All-Source RFP results into the IRP analysis. For all meetings, NIPSCO posted an open invitation on its website for any party wishing to register.

In addition to the public advisory meetings, NIPSCO participated in a number of one-on-one meetings with individual stakeholders to address specific concerns and issues that were raised as a result of information presented and discussed at the public advisory meetings.

2.1.1 Stakeholder Meeting 1

NIPSCO's first stakeholder meeting was held in Merrillville, Indiana on March 23, 2018. For those unable to join in person, a conference call was also made available. In this first meeting, NIPSCO explained the rationale for undertaking an update to its IRP and discussed the process improvements from the 2016 IRP being incorporated in the 2018 update. Furthermore, NIPSCO provided an overview of the resource planning approach, the key drivers of risk and uncertainty and the underlying data. NIPSCO also provided information regarding the All-Source RFP for new capacity, and discussed the public advisory process. Stakeholders requested clarification regarding (1) data points used in the IRP (e.g., percentage of renewables, technologies utilized, emissions, etc.), (2) assumptions regarding carbon pricing, (3) selection of supply-side and demand-side

resources, and (4) how solar was included in the modeling. The meeting presentation (including the agenda), notes (including questions / responses), and registered participants for Meeting 1 are included in Appendix A, Exhibit 1.

2.1.2 Stakeholder Meeting 2

NIPSCO's second stakeholder meeting was held in Merrillville, Indiana on May 11, 2018. For those unable to join in person, a webinar format was also made available. In this second meeting, NIPSCO described the process for modeling risk and uncertainty, and the methodology for modeling DSM in the IRP. Furthermore, the meeting provided an overview of NIPSCO's existing generation resources including the operating costs and key environmental considerations. Lastly, the meeting described the proposed scorecard that would be used to inform the preferred plan, the framework for the retirement and replacement analysis and provided preliminary results from the analysis. Stakeholders requested clarification regarding (1) the construction of scenario themes and the use of stochastics, (2) environmental compliance, (3) scorecard metrics; and (4) All-Source RFP design. Three stakeholders, Dany Brooks; David Chiesa of S&C Electric Company; and a group comprised of Scott Houldieson (United Auto Workers), Barry Halgrimson, and Sam Henderson (Hoosier Environmental Council) provided stakeholder presentations. The meeting presentation (including the agenda), stakeholder presentations, terminology sheet, notes (including questions / responses), and registered participants for Meeting 2 are included in Appendix A, Exhibit 2.

2.1.3 Stakeholder Meeting 3

NIPSCO hosted its third stakeholder meeting as an on-line webinar on July 24, 2018, with the public also invited to attend at NiSource's South Lake or Indianapolis offices. The webinar focused on sharing the preliminary results from the All-Source RFP solicitation. NIPSCO and the All-Source RFP manager Charles River Associates ("CRA") provided an overview of the proposals received and a summary of the pricing. NIPSCO also explained how the All-Source RFP results would be integrated into the IRP analysis and important next steps for both the IRP and All-Source RFP process. Key issues for stakeholders included clarification relating to (1) number of bids vs projects, and (2) integrating the All-Source RFP results into the IRP. The presentation (including the agenda), notes (including questions / responses), and registered participants for Meeting 3 are included in Appendix A, Exhibit 3.

2.1.4 Technical Webinar

NIPSCO hosted a technical webinar on August 28, 2018. The webinar focused on addressing follow ups from the July 24, 2018 meeting. Key issues for stakeholders included clarification relating to (1) how the All-Source RFP results will be incorporated into the IRP; (2) tranche development and assessment; (3) portfolio creation; and (4) how unforced capacity ("UCAP") was determined from the bid data. The meeting presentation (including the agenda) and registered participants for the Technical Webinar is included in Appendix A, Exhibit 4.

2.1.5 Stakeholder Meeting 4

NIPSCO's fourth stakeholder meeting was held in Fair Oaks, Indiana on September 19, 2018. For those unable to join in person, a webinar format was also made available. In this fourth meeting, NIPSCO explained the preliminary findings from the modeling. Key issues for stakeholders included (1) an explanation of how NIPSCO plans for the future; (2) an update the energy and demand forecasts; (3) a discussion of how NIPSCO models uncertainties; (4) an overview of NIPSCO's preliminary retirement and replacement analyses; and (5) an update on stakeholder requested scenarios. In addition, the Sierra Club provided a stakeholder presentation. The meeting presentation (including the agenda), notes (including questions / responses), and registered participants for Meeting 4 are included in Appendix A, Exhibit 5. Please note, the Sierra Club did not provide an electronic version of its presentation to be included with the materials. If provided, the presentation will be available at nipsco.com/irp. The terminology sheet provided as the first meeting was also provided for the fourth meeting, but is not duplicated in Exhibit 5.

2.1.6 Stakeholder Meeting 5

NIPSCO's fifth stakeholder meeting was held in Fair Oaks, Indiana on October 18, 2018. For those unable to join in person, a webinar format was also made available. In this fifth meeting, NIPSCO provided its preferred plan and preliminary action plan. Key issues for stakeholders included (1) a recap of how NIPSCO plans for the future; (2) an update to the stakeholder requested analyses; (3) an update on the retirement and replacement analyses; and (4) NIPSCO's preferred resource plan. In addition, the Indiana State Conference of the NAACP and Indiana DG provided stakeholder presentations. The meeting presentation (including the agenda), stakeholder presentations, notes (including questions / responses), and registered participants for Meeting 5 are included in Appendix A, Exhibit 6.

2.1.7 One-on-one Stakeholder Meetings

NIPSCO held a number of one-on-one meetings with its stakeholders throughout the public advisory process. Generally, the meetings related to either (1) clarifications, (2) additional information regarding the All-Source RFP, or (3) running requested scenarios. Information relating to the results of the requested scenarios can be found in the presentation included in Appendix A, Exhibit 5 (Slides 48 through 52) and Appendix A, Exhibit 6 (Slides 11 through 23).

NIPSCO's 2018 IRP is the result of analysis performed by NIPSCO that includes consideration of stakeholder input. NIPSCO has made a good-faith effort to be open and transparent regarding input assumptions and modeling results. NIPSCO appreciates the participation of its stakeholders, including the Commission staff, the OUCC, NIPSCO's largest industrial customers and community action groups, all of which participated extensively throughout the IRP development process. NIPSCO's stakeholders and Commission staff provided valuable feedback throughout the process, which has been considered and incorporated as applicable. Despite best efforts to address and resolve all input from stakeholders, there were instances wherein NIPSCO still incorporated, for example, methodologies that were not supported by all stakeholders.

2.2 IRP Planning Process

NIPSCO's 2018 IRP is in compliance with the Commission's Proposed Rule to modify 170 IAC 4-7 Guidelines for Electric Utility Integrated Resource Plans ("Proposed Rule"). A matrix showing NIPSCO's compliance with each section of the Proposed Rule (providing a reference to the appropriate Section(s) of the IRP) is included in Section 10: Compliance with Proposed Rule.

Long term resource planning requires addressing risks and uncertainties and for NIPSCO, the first step in this process is to identify objectives and metrics. Next NIPSCO develops market perspectives for key variables such as customer demand, commodity prices and technology costs. An aspect of the developing market perspectives involves the creation of distinct thematic "states-of-the-world" that represent potential future operating environments for NIPSCO. Lastly NIPSCO constructs integrated resource portfolio strategies and performs detailed modeling and analysis to evaluate the performance of various resource portfolios across range of potential futures. NIPSCO's goal is to develop a resource plan that is reliable, compliant with all regulations, diverse, flexible and affordable for customers with careful consideration of all stakeholder viewpoints.

The long-term strategic plan identifies expected energy and demand needs over a 20-year horizon and recommends a potential resource portfolio to meet those needs. The short-term strategic plan identifies the steps NIPSCO will take over the next three years to implement the long-term strategic plan.

NIPSCO recognizes future economic and environmental changes are difficult to accurately predict. The 2018 IRP addresses the most likely contingencies based on uncertainty analyses. New information in NIPSCO's planning process is analyzed and incorporated as it becomes available.

NIPSCO's IRP team included experts from key areas of NIPSCO and its affiliate NiSource Corporate Services Company. The following energy and engineering consultants also provided input:

GDS Associates, Inc. ("GDS") 1850 Parkway Place, Suite800 Marietta, Georgia 30067	Developed DSM measures inputs for a long-term DSM forecast
Itron, Inc. 2111 North Molter Road Liberty Lake, Washington 99019	Provided historical and forecasted end use data
Charles River Associates 200 Clarendon Street Boston, Massachusetts 02116	Provided fundamental long term commodity price forecasts, portfolio modeling and analysis. A separate division of CRA provided assistance in administering the All-Source RFP and evaluating the responses.
Telvent DTN, Inc. 9110 West Dodge Road Omaha, Nebraska 68114	Provided hourly weather data for three Indiana weather stations

2.2.1 Contemporary Issues

NIPSCO also participated in the Commission’s IRP Contemporary Issues Technical Conference held April 24, 2018. The meeting focused on using IRPs to develop avoided costs for energy efficiency, the planning models used by MISO, distribution system planning, load growth trends, using smart meter data, distributed energy resources and the potential for peak demand reduction. To the extent the information applicable and appropriate, NIPSCO included the items discussed during the technical conference in its analysis.

2.2.2 2016 IRP Feedback and 2018 Process Improvement Efforts

NIPSCO strives to continuously improve all aspects of its resource planning process and, for the 2018 IRP, NIPSCO reviewed the feedback from the 2016 IRP and implemented key improvements to its process. The process improvements in the 2018 IRP are primarily designed to incorporate advanced risk modeling techniques, as well as to continue to enhance the transparency and credibility of NIPSCO’s long-term plans by using assumptions based on fundamentals driven analysis and market based data.

Table 2-1 shows feedback received on NIPSCO’s 2016 IRP and the improvements that were included in its 2018 IRP process.

Table 2-1: Process Improvement

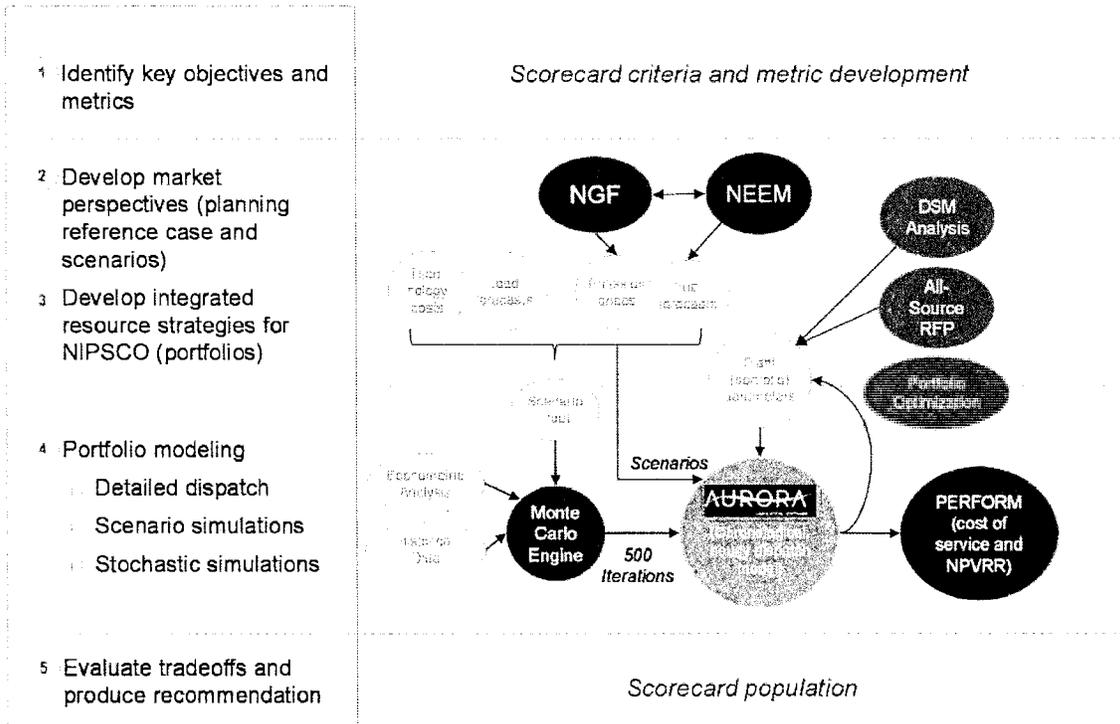
Subject	2016 IRP Feedback	2018 Improvement Plan
Commodity Price Forecasts	<ul style="list-style-type: none"> Fuel price projections do not capture the nuanced and dynamic relationships between oil and natural gas, or whether the historic market correlations are evolving No transparency and availability of underlying assumptions for fuel forecasts 	<ul style="list-style-type: none"> Utilized independently generated commodity price forecasts using an integrated market model Provided transparent assumptions related to key inputs and outputs Benchmarked against publicly available forecasts
Risk Modeling	<ul style="list-style-type: none"> NIPSCO IRP planning model was limited to scenarios and sensitivities 	<ul style="list-style-type: none"> Implemented efficient risk informed (stochastics) analysis with the ability to flex key variables
Scenarios and Sensitivities	<ul style="list-style-type: none"> NIPSCO’s construction of scenarios and sensitivities in the 2016-2017 IRP is a significant advancement over the 2014 IRP. The clarity of the narratives was commendable and transparency was exceptional 	<ul style="list-style-type: none"> Built upon the progress made in the 2016 IRP with thematic and modeling informed selections for detailed cost analysis
Capital Cost Assumptions	<ul style="list-style-type: none"> Capital cost estimates for new capacity resources were based on proprietary consultant information No scenario or sensitivity covered uncertainties of resource technology cost 	<ul style="list-style-type: none"> Leveraged 3rd party and publicly available datasets to develop a range of current and future capital cost estimates for new capacity resources Conducted an ‘all-source’ Request for Proposal solicitation for replacement capacity resources
Preferred Plan and Scorecard	<ul style="list-style-type: none"> Provide additional details around selection of the Preferred Plan and the analysis used to develop Provide a detailed narrative for those metrics that can be quantified as well as those that do not lead to quantification 	<ul style="list-style-type: none"> Provided detailed analysis on selection of the Preferred Plan Developed enhanced scorecard methodology to include more quantifiable metrics that better evaluate tradeoffs
DSM Modeling	<ul style="list-style-type: none"> DSM groupings are not getting quite the same treatment as the supply side resources 	<ul style="list-style-type: none"> Utilized new modeling capabilities to enable DSM to be treated equally with other supply side resources

2.3 Resource Planning Approach

Consistent with the principles set out in Section 1.1, the 2018 IRP identifies changes and additions needed over a 20 year planning horizon for NIPSCO to deliver reliable, compliant, flexible, diverse and affordable electric service to its customers. NIPSCO’s 2018 IRP was performed according to the detailed planning approach process that is outlined in Figure 2-1 and

described in more detail below. While structurally similar to the 2016 IRP process, the 2018 approach has incorporated new software, models and several process enhancements in order to respond to feedback that was received.

Figure 2-1: Overall Integrated Resource Planning Approach



Step 1: Identify key objectives and metrics

The first step in NIPSCO’s planning approach was to identify key planning objectives and develop specific metrics against which to evaluate future portfolios. As in the 2016 IRP, this involved the development of multiple scorecard criteria prior to the commencement of any analysis. This ensures that the objectives and metrics are established without any bias that may come from the production of IRP model runs and analysis. The planning criteria used in the 2018 IRP includes cost to customer, cost risk, fuel security, environmental stewardship, and impact to employees and the local economy. Section 9 of this report describes the scorecard objectives and metrics in more detail.

Step 2: Develop market perspectives

Prior to performing any portfolio-specific analysis, NIPSCO developed perspectives on key market drivers and other major planning assumptions. This involved the use of several market models and forecasting approaches in order to arrive at a Base Case set of inputs and a set of scenarios against which to evaluate resource options. This step involved the following major tasks:

- Commodity price forecasting for fuel, emission, and power prices: NIPSCO commissioned CRA to develop forecasts for natural gas prices, coal prices,

emission allowance prices, and power prices (energy and capacity) for the Base Case and three integrated market scenarios. The details of all Base Case and scenario forecasts are provided in Section 8. CRA relied on the following models to perform this work:

- CRA’s Natural Gas Fundamentals (“NGF”) model, which provides a bottom-up forecast of North American gas production and prices with a focus on shale gas supply and other unconventional resources. Key NGF outputs include a long-term price forecast for domestic natural gas, as well as breakeven costs and production data for major gas basins across the United States. NGF is a national model, useful for macroeconomic scenarios. CRA also licenses the Gas Pipeline Competition Model (GPCM) for regional basis analysis.
 - CRA’s North American Electricity and Environment Model (“NEEM”), which provides an assessment of emission allowance prices, coal consumption and coal pricing, generator retrofit decisions, and capacity expansion and retirements. The NEEM model estimates market prices and unit dispatch using a simplified transmission representation and a select number of representative demand points to produce a fundamentals-based outlook of key macroeconomic outputs for the electricity sector.
 - The Aurora model, which CRA licenses, and which provides hourly MISO market prices at a zonal level based on a fundamental dispatch of the market. Market inputs for the Aurora model include fuel prices, emission prices, and capacity expansion and retirement, which are developed through CRA’s other models. CRA also deploys a capacity market model, which produces an internally consistent capacity price outlook based on MISO market rules.
- Load forecasting, performed by NIPSCO’s internal load forecasting team, and described in more detail in Section 3.
 - Development of technology cost estimates for supply side resource options, which were initially produced on a planning-level basis through market research conducted by NIPSCO and CRA. NIPSCO and CRA’s Auction and Competitive Bidding Practice then conducted an All-Source RFP, which provided real market data on the resource types available and their associated costs and operational parameters. Section 4 describes this process in more detail.

Step 3: Develop integrated resource strategies or portfolios

The third major step in the 2018 IRP process was to develop resource strategies or portfolios for further evaluation. The portfolio development process relied on multiple inputs and approaches. It was conducted first for a retirement analysis and then for a full replacement analysis, with key elements summarized as follows:

- The definition of retirement portfolio options was influenced by environmental policy considerations (as discussed in Section 7) and management input on feasible retirement paths.
- An update to NIPSCO's 2016 DSM Market Potential Study was conducted by GDS in order to provide a set of plausible DSM program bundles and associated costs for evaluation. The details of this study are provided in Section 5.
- Portfolio optimization analysis was conducted with the Aurora model's portfolio optimization tool to develop least-cost portfolio concepts under a variety of constraints. Both supply side and demand side resources were evaluated in the portfolio optimization framework. The details of the process and a summary of the integrated portfolios that were evaluated are provided in Section 8.

Step 4: Portfolio Modeling

After detailed portfolios were constructed, each of them was evaluated in CRA's suite of resource planning tools, namely Aurora and a utility financial model known as PERFORM. The Aurora model performs an hourly, chronological dispatch of NIPSCO's portfolio within the MISO power market, accounting for all variable costs of operation, all contracts or PPAs, and all economic purchases and sales with the surrounding market. Aurora produces projections of asset-level dispatch and the total variable costs associated with serving load. It also produces estimates for other key metrics, such as carbon dioxide ("CO₂") emissions over time and capacity and generation by fuel type. The Aurora output is then used by CRA's PERFORM model to build a full annual revenue requirement, inclusive of capital investments, fixed operating and maintenance costs, and financial accounting of depreciation, taxes, and utility return on investment. The PERFORM model produces annual and net present value estimates of revenue requirements.

The full set of portfolio modeling is undertaken for all portfolio options for the Base Case, each individual integrated market scenario, and a full stochastic distribution of potential outcomes associated with select commodity prices. The stochastic analysis relies on CRA's Monte Carlo engine, which simulates future price outcomes based on historical data analysis and specification of key statistical parameters. The details of the stochastic development process and the outputs of all portfolio modeling are discussed in more detail in Section 9.

Step 5: Evaluate tradeoffs and produce recommendations

The final step in NIPSCO's IRP process is to evaluate the various portfolios with an integrated scorecard and produce recommendations for a preferred plan. As discussed in Step 1, NIPSCO identified several planning objectives for its scorecard. In this step, metrics were recorded against all key planning criteria, and tradeoffs were evaluated. Ultimately, NIPSCO management is responsible for selecting the preferred portfolio based on the scoring of all options. This process and the preferred portfolio selection is described in Section 9.

2.3.1 Key Planning Assumptions

While many of the assumptions details are described further in subsequent sections of this report, the following information provides an introductory overview of several major planning inputs that drive the 2018 IRP.

Market Forecast Inputs

Market and commodity price forecasts are important drivers for NIPSCO’s IRP, since they influence the variable costs of operation for many resources, the dispatch of certain power plants, and NIPSCO’s interaction with the MISO market. As discussed above, CRA produced commodity price forecasts for major inputs, relying on support from NIPSCO’s subject matter experts for certain details or assumptions that are specific to NIPSCO’s current operating fleet. For example, for coal pricing, delivered coal contract details and expected coal transportation rates were provided by NIPSCO’s fuel supply group in order to conform to near-term price expectations for the existing fleet of plants. Long-term fundamental forecasts were blended in over time. Figure 2-2 presents a summary of the source and reference information for each of the major market inputs.

Figure 2-2: Major Market Input Sources

Major Input	Source	Section Reference for More Detail
Natural Gas Prices	CRA forecasts and NIPSCO operations team	8 (fundamental forecasts, including scenarios and stochastics) 4 (current gas procurement strategies)
Coal Prices	CRA forecasts and NIPSCO fuel supply group	8 (fundamental forecasts, including scenarios and stochastics) 4 (coal procurement and current contracts/ transportation arrangements)
Emission Prices	CRA forecasts and NIPSCO environmental group	8
MISO Power Prices	CRA forecasts	8
MISO Capacity Prices	CRA forecasts	8

Environmental Planning Inputs

As noted above, emissions price assumptions were provided by CRA, with review provided by NIPSCO’s environmental group. Estimates were developed by NIPSCO’s Major Projects group for projects required to comply with current and future anticipated regulations pertaining to solid waste management, the Clean Water Act (“CWA”), and the Clean Air Act (“CAA”). A comprehensive review of key environmental planning drivers is provided in Section 7.

Energy and Demand Forecast

NIPSCO's internal load forecasting group produced load forecasts, including high and low cases, which were used in the IRP analysis. For the 2018 IRP modeling NIPSCO utilized the MISO Coincident peak demand forecast. All methods, assumptions and detailed forecast results are provided in Section 3.

Existing NIPSCO Portfolio Parameters

NIPSCO's IRP models incorporate all elements of the existing portfolio. NIPSCO's generation operations and planning groups provided the following characteristics for the existing set of resources: capacity, heat rates, emission rates, other operational characteristics of fossil-fired resources, variable operations and maintenance ("O&M") costs, fixed O&M costs, forced outage rates, maintenance schedules, must run schedules for coal units, energy and capacity contracts, feed-in-tariff contracts, existing DSM data, and renewable shapes. Certain details regarding the existing fleet are provided in Section 4.

New Resource Parameters

NIPSCO relied on multiple sources for major input assumptions associated with new resource options. DSM resource options and costs were developed by GDS, as described in Section 5. Supply-side resource options were developed according to the All-Source RFP conducted in 2018. The All-Source RFP provided cost information and resource operational characteristics, including capacities, heat rates, and expected capacity factors for renewable resources. This is described in further detail in Section 4.

Planning Reserve Margin Target

NIPSCO operates in the MISO market and must demonstrate a sufficient planning reserve margin to ensure reliability and resource adequacy. The MISO UCAP planning protocol was used to determine the planning reserve margin target to use in the 2018 IRP update, and NIPSCO set its target to 8.4%, as per current MISO standards. This target is based on NIPSCO's coincident peak in MISO. When performing portfolio optimization analysis, NIPSCO set a maximum reserve margin of 20% and a maximum level of off-system energy sales of 5%. This was done to avoid developing portfolios where NIPSCO would be relying on a significant level of excess energy and capacity sales to offset resource costs.

Financial Assumptions

Several financial assumptions are relevant to projecting annual revenue requirements, such as the expected return on equity and debt, tax rates, and the discount rate used when calculating the net present value ("NPV"). A summary of the major financial assumptions used in the 2018 IRP is provided in Figure 2-3.

Figure 2-3: Major Financial Assumptions

Financial Assumption	Value
Cost of Equity	9.98%
Cost of Debt	5.71%
Equity %	58.44%
Debt %	41.56%
After-Tax Weighted Average Cost of Capital	7.61%
Federal Income Tax Rate	21.00%
State Income Tax Rate	4.90%
Blended Income Tax Rate	24.87%
Property Tax Rate	2.16%
Discount Rate	7.61%
Allowance for Funds Used During Construction%	7.44%
Blended Depreciation Rate for Existing Assets	4.60%

Section 3. Energy and Demand Forecast

3.1 Major Highlights / High Level Summary / Discussion of Load

Some of the major highlights include:

- NIPSCO's jurisdictional energy sales are projected to remain flat on average over the next 20 years.
- The Residential and Commercial compound annual growth rates are projected to be 0.8% and 0.7%, respectively, during the period 2018-2039. The Industrial class is projected to decrease at a rate of 0.7% during this same period.
- NIPSCO's internal Peak demand is expected to grow from 3,051MW in 2018 to 3,169 MW by 2039 representing an annual growth rate of 0.2% during the period 2018-2039.
- NIPSCO MISO coincident peak demand is expected to grow from 2907MW in 2018 to 2970 MW in 2039 representing an annual growth rate of 0.1% during the period 2018 to 2039

NIPSCO's long term forecast incorporates historical customer usage and its relationship to economic, demographic, end use and weather data. The load forecast reflects historical impacts of past conservation and DSM programs. Regional saturation and efficiency trends are provided by Itron, Inc., a national utility consulting firm. Economic and demographic data utilized in the forecast is from IHS Global Insight.

3.2 Development of the Forecast – Method and Data Sources

NIPSCO's energy and peak forecast process reflects a system of dynamic models that are continually evaluated, updated and selected based on their ability to provide accurate projections of future energy needs of customers. Current modeling trends, statistical properties, data utilized in the forecast process and current peer utility approaches to forecasting are all considered during the forecast development. NIPSCO utilizes individual forecast models for Residential, Commercial, Industrial, Street Lighting, Public Authority, Railroad and Company use. The forecast also relies upon a 60-minute electric peak demand model. Each of the individual forecast models utilizes methods that account for the unique characteristics of each class. The Residential, Commercial, and Street Lighting energy and total peak demand forecast models use an econometric approach to forecast long-term electric energy sales and peak hour demands.

The Industrial Energy Forecast Model is developed in two parts. The first part uses a grassroots approach by developing forecasts for the largest individual industrial customers. The second part of the Industrial outlook represents all other customers included in the Industrial class. To generate the total industrial class forecast, the individual customer forecasts are combined with the portion of the forecast representing the balance of the Industrial class load. The Public Authority and Railroad class models rely on current usage levels and recent patterns. Projections for Company use and losses also rely on recent usage trends and levels. Historical DSM impacts

and trends are reflected in the Residential and Commercial forecast. The Residential and Commercial outlook incorporate existing or past NIPSCO DSM programs by utilizing historical data in the modeling process. Past DSM impacts and trends are captured through the model structure and used in the calculation of the forecast. After the completion of the forecast process, NIPSCO completes regular internal forecast performance assessments for the Residential, Commercial and Industrial models to ensure the accuracy and reasonableness of the projections.

NIPSCO evaluates the forecast process on an ongoing basis looking to incorporate improvements that result in a more robust process. Currently, some of the improvements under consideration include incorporating electric vehicle impacts, the data frequency used in the forecast modeling, and testing alternative efficiency variables and estimation techniques to capture changing usage trends.

3.2.1 Data Sources - Internal

Class energy sales, number of customers by class, internal peak demand, historical interruptions and electric prices are all collected internally by NIPSCO. This information is used to develop the long term sales and demand forecast. NIPSCO uses North American Industrial Classification System (NAICS) coding for its non-residential customers.

3.2.2 Data Sources - External

Schneider Electric

NIPSCO uses two weather measures in the forecast, specifically cooling degree days (“CDD”) and heating degree days (“HDD”) as defined by the National Oceanic and Atmospheric Administration (“NOAA”). The Company purchases weather data for three NOAA stations: Valparaiso, South Bend and Fort Wayne. For modeling purposes, the weather from these three stations is represented as a weighted average with the weights based on the number of residential customers assigned to each station. For the forecast period, the Company assumes the weather data to be equal to the 1976-2010 average for both CDD and HDD. The weighted weather concepts for the peak hour model are cooling degree hours, heating degree hours and relative humidity.

IHS Global Insight

NIPSCO purchases national, state and county economic and demographic data from IHS Global Insight. Economic data used in the production of the forecast represents the most current information from the vendor at the time the forecast is developed.

Itron, Inc.

Historical and forecasted saturation and efficiency data are obtained from Itron, Inc., a national utility consulting firm. Itron, Inc. produces an annual statistically-adjusted end use model by census region reflecting historical and future saturation and efficiency trends. Itron, Inc. works closely with the United States Energy Information Agency (“EIA”) to embed EIA’s latest equipment saturation and efficiency trend forecasts into its annual models. NIPSCO utilizes this

information reflecting the East North Central census region in the long-term Residential forecast model.

3.3 Residential

The Residential Energy Forecast Model is calculated in conjunction with NIPSCO's New Business team, using a residential customer model and an average residential use per customer model. Average residential use per customer projections are multiplied by the total residential customer count forecast to generate the total Residential energy forecast. The residential use per customer model is a function of the residential price of electricity, appliance saturations, and efficiencies as defined in an end use variable supplied by Itron, Inc. and real per capita income. Other forecast considerations integrated into the Residential forecast model include residential customer counts, CDDs and HDDs.

The residential customer count is a function of a five-year outlook for new construction provided by NIPSCO's New Business team and is developed using a grassroots approach. This approach includes conducting interviews with real estate developers and builders; thus, assuring that short-term housing market intelligence and recent trends are included in the forecast. The longer term customer outlook is modeled as a function of housing starts. Both short- and long-term forecasts are adjusted for customer attrition applied at an average historic rate. Total residential customers are calculated by incorporating the new customer outlook, existing customers and the historic attrition rate.

Econometric models are utilized to estimate the residential new customer and usage per customer models. Seventeen years of data was employed in the residential new customer model. The model produces an R-Square of 0.9687 in addition to strong T-Stats for each variable and directionally confirms the relationships expected between the independent and dependent variables. Sixteen years of historical data is used in the development of the residential use per customer long-term outlook. The model yielded an R-Square of 0.9333 and confirms statistically strong relationships between the independent and dependent variables.

- Residential New Customer Equation

$$\text{New Residential Customers} = f(\text{Local Housing Starts})$$

- Residential Usage Per Customer Equation

$$\text{Residential kWh per Customer} = f(\text{Residential Electric Price, Itron Index, Real Per Capita Income, HDD, and CDD})$$

Table 3-1: NIPSCO Residential Customers

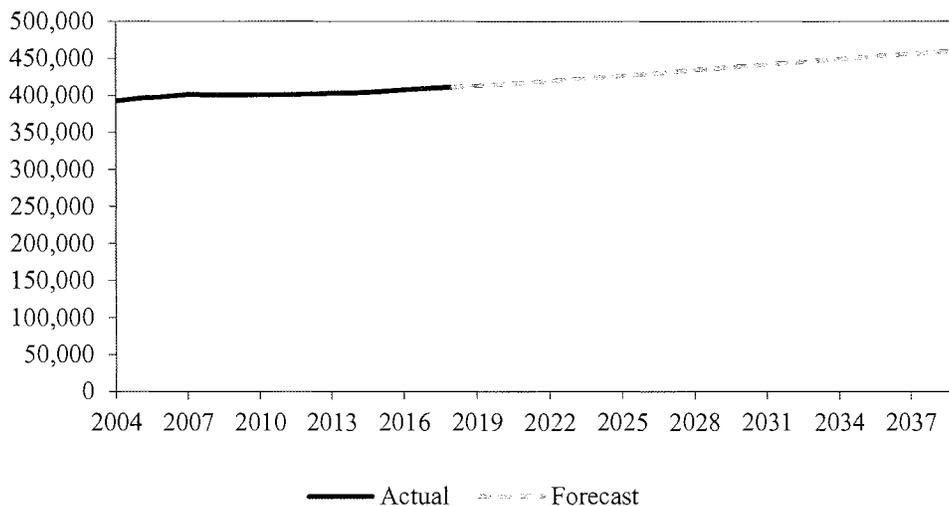
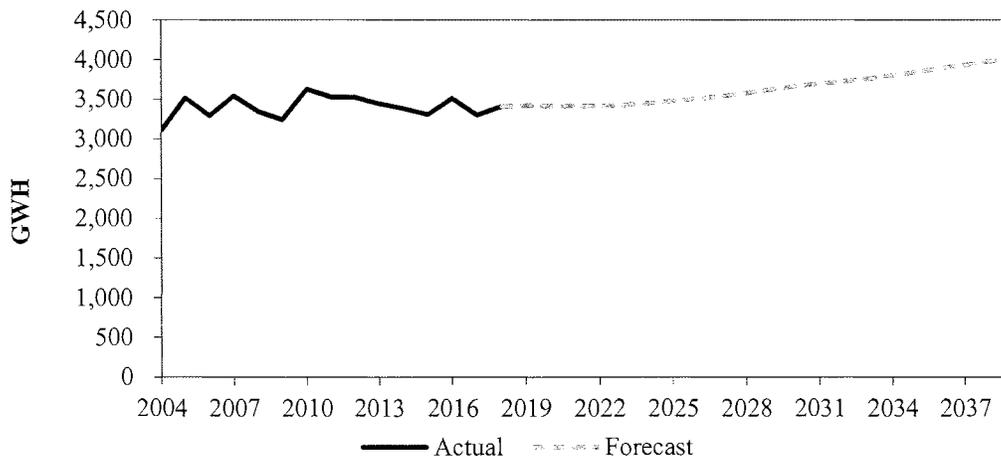


Table 3-2: NIPSCO Residential Energy Sales



3.4 Commercial

The Commercial Energy Forecast Model has been estimated using a total Commercial energy consumption model. Commercial energy consumption is a function of the commercial customer count, employment, commercial electric price, CDD, and HDD. As with Residential, the initial five-year outlook for Commercial customers is provided by NIPSCO’s New Business

team. The longer term view is modeled as a function of local population and real gross county product. The commercial customer count forecast also reflects a historical attrition rate.

Econometric models are utilized to estimate the commercial customer and total usage models. Twenty one years of historical data was employed in the commercial customer model. The model produces an R-Square of 0.9950 in addition to strong T-Stats for each variable and directionally confirms the relationships expected between the independent and dependent variables. Fifteen years of data was used in the development of the commercial energy long-term outlook. The model yielded an R-Square of 0.9833 and confirms statistically strong relationships between the independent and dependent variables.

- Commercial Customer Equation

$$\text{Commercial Customers} = f(\text{Population, Real Gross County Product})$$

- Commercial Usage Equation

$$\text{Commercial Total Use} = f(\text{Commercial Customers, employment, Commercial Electric Price, CDD, HDD})$$

Table 3-3: NIPSCO Commercial Customers

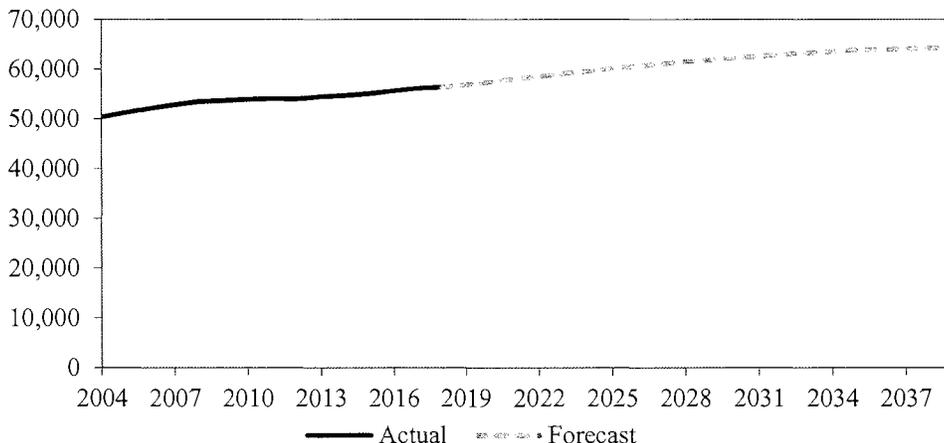
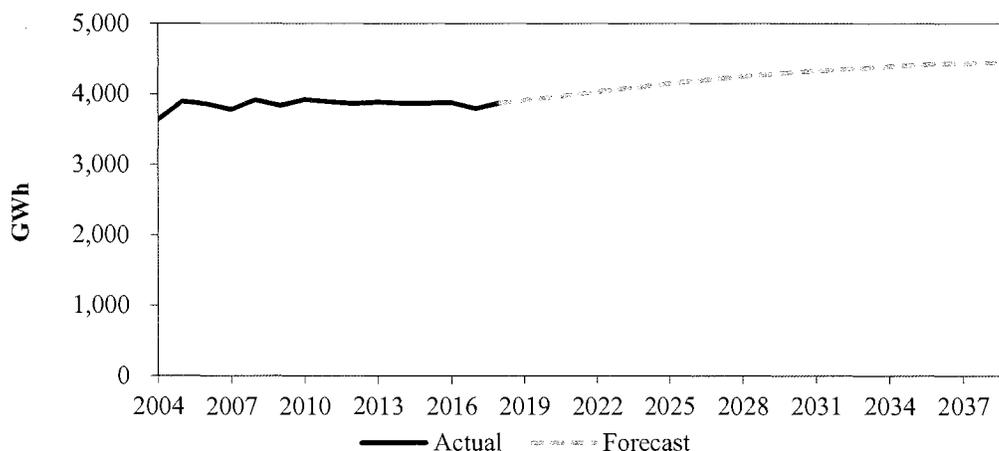


Table 3-4: NIPSCO Commercial Energy Sales



3.5 Industrial

The Industrial Energy Forecast Model projects the expected level of industrial energy sales in NIPSCO's service territory based on individual discussions with its largest industrial customers, recent historical industrial sales trends, and regional and global trends for specific industries. Accordingly, the Industrial Energy Forecast Model contains individual forecasts for the major industrial account customers. This year, the loss of energy demand from a major industrial account customer caused NIPSCO's industrial energy sales forecast to trend downwards compared to previous years' forecasts.

Information specific to the creation of the Industrial sales forecast is obtained through outreach by the NIPSCO Major Accounts Department to each of its 25 individually-forecasted industrial customer accounts. NIPSCO discusses individual business, economic and strategic objectives with each of its individually forecasted industrial accounts. As a part of these discussions, the projected effect of the customer's energy efficiency programs are already taken into account with the forecast provided to NIPSCO. The goals, plans, and concerns outlined in these one-on-one discussions form the basis of a recommendation for each customer's forecast. Other items considered in the development of the forecast include historical consumption, industry trade publications, global market news, business outlook conferences, and routine customer interaction. The resulting forecast incorporates the outlook for steel producers, refiners, industrial gases and a variety of other industrial manufacturing companies in NIPSCO's service territory. Notably, for the development of NIPSCO's industrial energy forecast for the 2018 IRP, this forecast integrates the economic and business projections of these customers and their consumption related to each of their major industrial production sites in NIPSCO's service territory.

The industrial sales forecast model also integrates a sales forecast for the remaining industrial accounts (identified as Other Industrial). This portion of the NIPSCO electric forecast

is based primarily on historical data (billed volume) from the past six years with greater consideration given to use for the most recent year. Annual and monthly volumes were analyzed - min, max, and averages were calculated. Historical trends, if any, were identified and are reflected in the forecast.

Table 3-5: Industrial Energy Sales

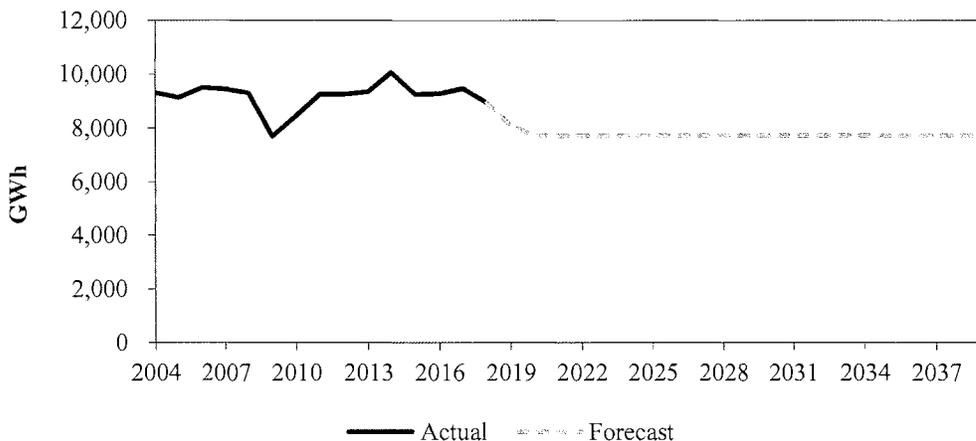


Table 3-6: Total Customers

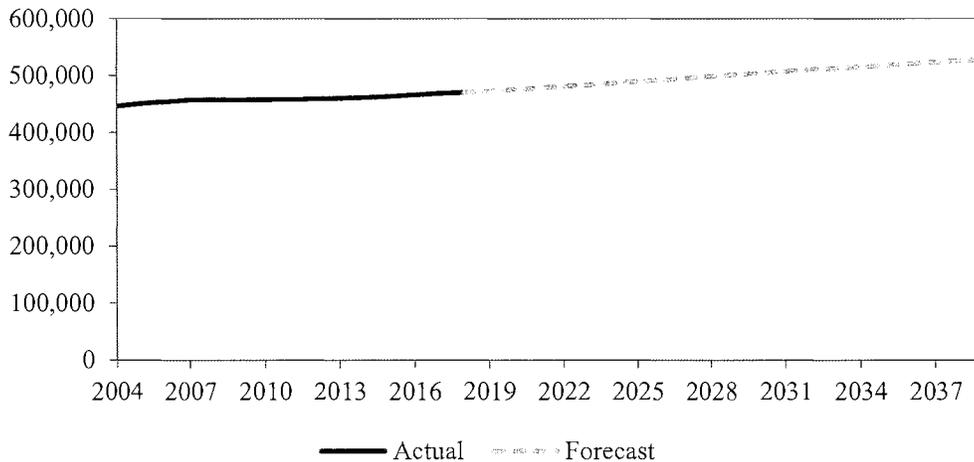
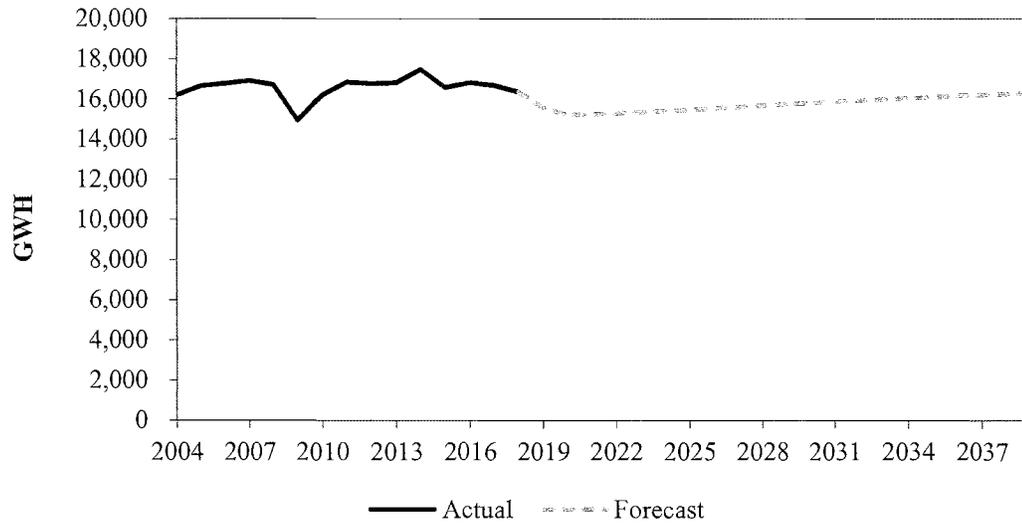


Table 3-7: Total Energy Sales



3.6 Street Lighting, Public Authority, Railroads, Company Use, Losses

The Public Authority, Railroads, Company use and losses forecasts are based on both current usage levels and anticipated future trends. The street lighting model utilizes an econometric model that accounts for the number of hours of dark and anticipated future trends. Nine years of historical data were used in the development of the street lighting long-term outlook. The model yielded an R-Square of 0.9154 and confirms statistically strong relationships between the independent and dependent variables.

$$\text{Street Lighting Energy Use} = f(\text{Number of hours of dark})$$

3.7 Peak

NIPSCO uses an econometric model to project future peak demand on its system. The model incorporates Residential, Commercial, and Industrial energy levels, cooling degrees (summer) and heating degrees (winter) at peak hour, and the level of relative humidity at peak hour. The model also accounts for recent historical load factor levels and patterns associated with NIPSCO’s large industrial customers. Using 32 years of data, the peak forecast is derived with a two-step approach accounting for the large influence of the Industrial class and the contribution of smaller customers.

The first step of the peak model accounts for the impact of Residential, Commercial, and Small Industrial energy levels and patterns. The model also takes into account the influence of weather at the time of the peak. Utilizing 32 years of historical data, the model yielded an R-

Square of 0.9428 and confirms a statistically strong relationships between the independent and dependent variables

The second step of the peak model accounts for the contribution of NIPSCO’s large industrial customers to the NIPSCO peak. The model estimates the load factor associated with large customers and utilizes this to project peak. The load factor is estimated using a polynomial model that employs recent monthly load factory data to identify a monthly pattern. Once the load factor is estimated, it is combined with the large customer energy forecast to calculate this portion of the peak forecast. The large customer peak is then added to the initial peak generated from the first step to yield the total company peak outlook.

Peak Model

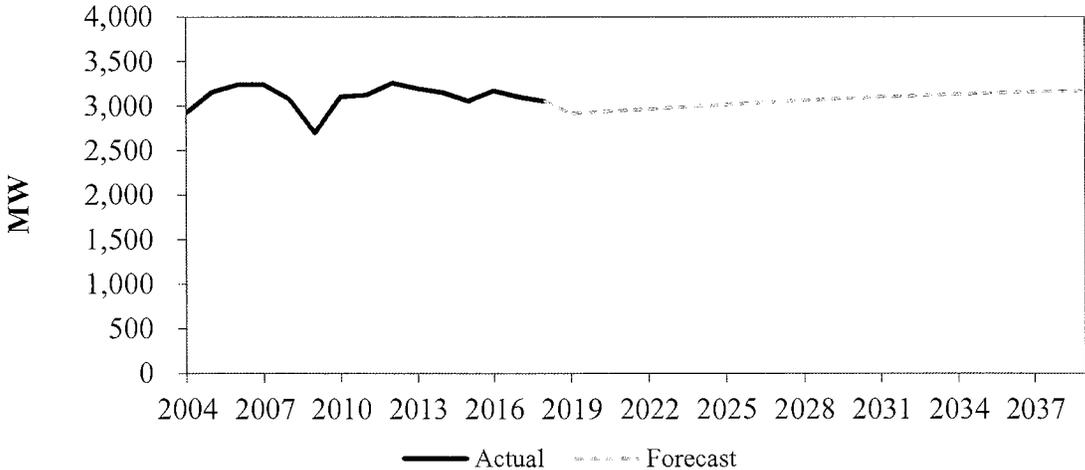
$$Peak_Step1 = f(Residential\ Energy, Commercial\ Energy, Small\ Industrial\ Energy, Cooling\ Degree\ Hours(Summer), Heating\ Degree\ Hours(Winter), Summer\ Humidity,)$$

$$Large\ Company\ Load\ Factor = f(Time, Time^2)$$

$$Peak_Step2 = f(Large\ Company\ Load\ Factor, Large\ Company\ Energy, Monthly\ Hours)$$

$$NIPSCO\ Peak = Peak_Step1 + Peak_Step2$$

Table 3-8: Peak Hour



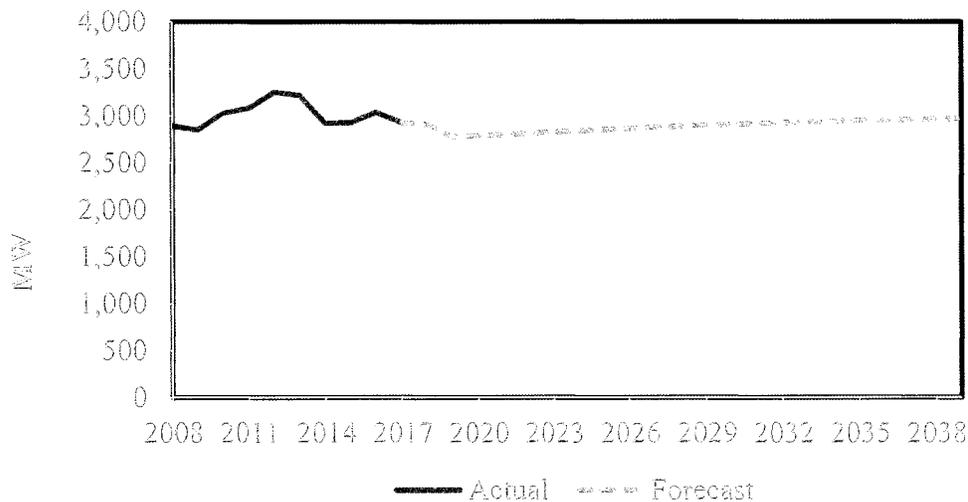
3.8 MISO Coincident Peak

MISO Coincident Peak is NIPSCO’s monthly system peak at the time of MISO’s system peak. NIPSCO uses an econometric model to project future demand on its system at the time of

MISO’s system peak. The model incorporates NIPSCO’s monthly peak demand levels and Cooling Degree Hours at the time of MISO’s system peak. On average the MISO coincident peak level forecast is about 95% of NIPSCO internal peak level.

$$MISO\ Coincident\ Peak = f(NIPSCO\ Internal\ Peak, Cooling\ Degree\ Hours)$$

Table 3-9: MISO Coincident Peak



3.9 Customer Self-Generation

Customer Self-Generation assumes that most of NIPSCO’s large electric customers with self-generation utilize the generation as a by-product of process steam production needs. This type of generation is difficult to predict by NIPSCO, and, therefore, challenging to dispatch by NIPSCO without significant coordination between the customer and utility. Although it is difficult to dispatch or coordinate, NIPSCO does have a currently-effective tariff rider available to such customers that enables the purchase from qualifying cogeneration facilities in the situation where the customer’s generation exceeds load. Any such purchases are made pursuant to Rider 778 - Purchases from Cogeneration Facilities and Small Power Production Facilities - and this Rider allows for the purchases pursuant to a contract between NIPSCO and the customer. To the extent qualified and provided, Rider 778 also provides the ability to purchase capacity from such qualifying facilities.

3.10 Weather Normalization

NIPSCO produces estimates of weather-normalized energy for prior annual periods. Because industrial class energy consumption varies little with weather, NIPSCO weather-normalizes kWh sales for the Residential and Commercial classes only.

The normalization procedure uses the daily baseload, temperature sensitive load (TS) per CDD, TS per HDD, the daily non-temperature sensitive use per customer (NTSUPC), and the daily temperature sensitive use per customer per customer (TSUPC). Several assumptions are made in the normalization procedure. They are:

- May is the base load month and is not normalized for weather
- Heating energy volumes accounted for October through April
- Cooling energy volumes accounted for June through October
- October is accounted for both heating and cooling energy volumes

The general normalization equation is specified on a monthly per day basis and then scaled to a monthly concept by multiplying by days:

$$\text{Normal KWH/Customer} = \text{NTSUPC} + ((\text{TSUPC}/\text{HDD}) * \text{NHDD}) + ((\text{TSUPC}/\text{CDD}) * \text{NCDD})$$

Where

NHDD: Normal Heating Degree Day, NCDD: Normal Cooling Degree Day

NTS UPC factor = May UPC /day

*NTSUPC = NTS UPC factor * billing days*

TSUPC = Total UPC – NTSUPC

TSUPC/HDD for heating months except October

TSUPC/CDD for cooling months except October

TSUPC/HDD for Oct = TSUPC/HDD from previous September

TSUPC/CDD for Oct = Average of TSUPC/CDD June-September of current season

The actual and normal energy sales for Residential and Commercial customers are shown in Figure 3-1 and Figure 3-2, respectively.

Figure 3-1: NIPSCO Residential GWh

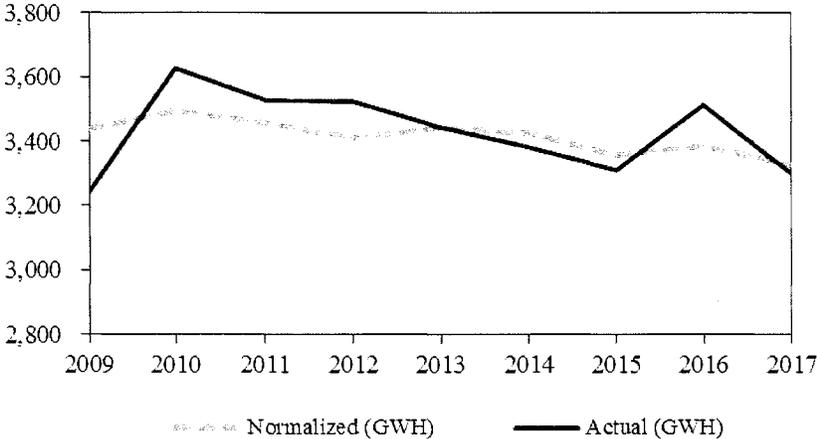
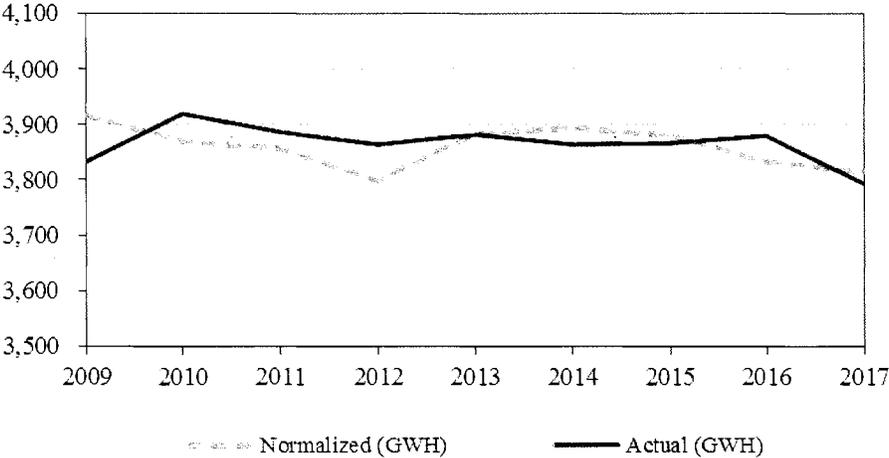


Figure 3-2: NIPSCO Commercial GWh



3.11 Forecast Results – Base Case

Over the forecast period, total energy is projected to remain flat and peak hour demand is projected to grow at 0.2%. NIPSCO expects overall customer growth to increase about 0.6% annually. Table 3-10 illustrates NIPSCO’s electric energy and demand forecast.

Table 3-10: Electric Energy and Demand Forecast

Year	Energies (Gigawatt hour or "GWh")	% Change	Losses	Total Output	% Change	Load Factor	Internal Peak Hour		MISO Coincident Peak Level	
	Total Retail *						MW	% Change	MW	% Change
2008	16,705		897	17,602		65.3%	3,076		2,891	
2009	14,925	-10.7%	858	15,783	-10.3%	66.8%	2,696	-12.4%	2,848	-1.5%
2010	16,191	8.5%	915	17,106	8.4%	62.9%	3,103	15.1%	3,029	6.4%
2011	16,836	4.0%	892	17,728	3.6%	64.8%	3,122	0.6%	3,081	1.7%
2012	16,756	-0.5%	925	17,681	-0.3%	62.0%	3,257	4.3%	3,252	5.6%
2013	16,798	0.2%	839	17,638	-0.2%	63.0%	3,194	-1.9%	3,218	-1.0%
2014	17,467	4.0%	940	18,407	4.4%	66.7%	3,149	-1.4%	2,921	-9.2%
2015	16,563	-5.2%	886	17,449	-5.2%	65.2%	3,055	-3.0%	2,926	0.2%
2016	16,813	1.5%	913	17,726	1.6%	63.8%	3,173	3.9%	3,037	3.8%
2017	16,693	-0.7%	844	17,537	-1.1%	64.8%	3,087	-2.7%	2,927	-3.6%
2018	16,362	-2.0%	889	17,251	-1.6%	64.5%	3,051	-1.2%	2,907	-0.7%
2019	15,582	-4.8%	847	16,429	-4.8%	64.3%	2,916	-4.4%	2,776	-4.5%
2020	15,216	-2.4%	827	16,042	-2.4%	62.5%	2,932	0.6%	2,788	0.4%
2021	15,255	0.3%	829	16,084	0.3%	62.3%	2,949	0.6%	2,801	0.5%
2022	15,287	0.2%	831	16,118	0.2%	62.1%	2,965	0.5%	2,813	0.4%
2023	15,344	0.4%	834	16,178	0.4%	61.9%	2,982	0.6%	2,827	0.5%
2024	15,405	0.4%	837	16,242	0.4%	61.8%	2,999	0.5%	2,839	0.4%
2025	15,471	0.4%	841	16,311	0.4%	61.7%	3,016	0.6%	2,853	0.5%
2026	15,535	0.4%	844	16,379	0.4%	61.7%	3,033	0.6%	2,866	0.5%
2027	15,603	0.4%	848	16,451	0.4%	61.6%	3,048	0.5%	2,877	0.4%
2028	15,677	0.5%	852	16,529	0.5%	61.6%	3,064	0.5%	2,890	0.4%
2029	15,744	0.4%	856	16,600	0.4%	61.6%	3,077	0.4%	2,899	0.3%
2030	15,815	0.4%	859	16,674	0.4%	61.6%	3,091	0.5%	2,910	0.4%
2031	15,870	0.4%	862	16,733	0.4%	61.6%	3,103	0.4%	2,919	0.3%
2032	15,923	0.3%	865	16,788	0.3%	61.6%	3,113	0.3%	2,927	0.3%
2033	15,977	0.3%	868	16,845	0.3%	61.6%	3,123	0.3%	2,934	0.3%
2034	16,037	0.4%	871	16,909	0.4%	61.6%	3,133	0.3%	2,943	0.3%
2035	16,105	0.4%	875	16,981	0.4%	61.6%	3,145	0.4%	2,951	0.3%
2036	16,163	0.4%	878	17,042	0.4%	61.7%	3,152	0.2%	2,957	0.2%
2037	16,213	0.3%	881	17,094	0.3%	61.8%	3,158	0.2%	2,961	0.1%
2038	16,265	0.3%	884	17,148	0.3%	61.9%	3,164	0.2%	2,966	0.2%
2039	16,314	0.3%	887	17,201	0.3%	62.0%	3,169	0.2%	2,970	0.1%
Compound Average Growth Rate 2018-2039										
	0.0%			0.0%			0.2%		0.1%	
* Retail does not include bulk sales										

Table 3-11 illustrates NIPSCO's electric energy by customer class.

Table 3-11: Energies by Customer Class

Year	Residential (GWh)	Commercial (GWh)	Industrial (GWh)	Other (GWh)	Total * (GWh)	Percent Change
2008	3,346	3,916	9,305	138	17,602	
2009	3,241	3,834	7,691	159	15,783	-10.3%
2010	3,626	3,920	8,459	186	17,106	8.4%
2011	3,527	3,886	9,257	166	17,728	3.6%
2012	3,524	3,863	9,250	119	17,681	-0.3%
2013	3,445	3,882	9,340	132	17,638	-0.2%
2014	3,384	3,864	10,071	148	18,407	4.4%
2015	3,310	3,867	9,249	138	17,449	-5.2%
2016	3,514	3,879	9,282	138	17,726	1.6%
2017	3,302	3,793	9,470	128	17,537	-1.1%
2018	3,411	3,871	8,947	134	17,251	-1.6%
2019	3,420	3,910	8,120	131	16,429	-4.8%
2020	3,418	3,949	7,718	129	16,042	-2.4%
2021	3,418	3,992	7,718	127	16,084	0.3%
2022	3,413	4,031	7,718	125	16,118	0.2%
2023	3,430	4,072	7,718	125	16,178	0.4%
2024	3,452	4,109	7,718	125	16,242	0.4%
2025	3,480	4,148	7,718	125	16,311	0.4%
2026	3,507	4,186	7,718	125	16,379	0.4%
2027	3,541	4,219	7,718	125	16,451	0.4%
2028	3,581	4,252	7,718	125	16,529	0.5%
2029	3,624	4,277	7,718	125	16,600	0.4%
2030	3,667	4,305	7,718	125	16,674	0.4%
2031	3,696	4,331	7,718	125	16,733	0.4%
2032	3,728	4,351	7,718	125	16,788	0.3%
2033	3,763	4,371	7,718	125	16,845	0.3%
2034	3,803	4,391	7,718	125	16,909	0.4%
2035	3,849	4,413	7,718	125	16,981	0.4%
2036	3,893	4,426	7,718	125	17,042	0.4%
2037	3,936	4,434	7,718	125	17,094	0.3%
2038	3,979	4,443	7,718	125	17,148	0.3%
2039	4,022	4,450	7,718	125	17,201	0.3%
Compound Average Growth Rate 2018-2039						
	0.8%	0.7%	-0.7%	-0.3%	0.0%	

**Includes Total Retail and Losses*

Table 3-12 displays the NIPSCO forecast by customer counts by class.

Table 3-12: Customer Counts by Class

Year	Residential Customers	Commercial Customers	Industrial Customers	Other Customers	Total Customers
2008	400,640	53,438	2,484	754	457,316
2009	400,016	53,617	2,441	746	456,820
2010	400,522	53,877	2,432	740	457,571
2011	400,567	54,029	2,405	737	457,738
2012	401,177	53,969	2,445	758	458,349
2013	402,638	54,452	2,374	799	460,263
2014	403,272	54,635	2,338	751	460,996
2015	404,889	55,053	2,327	743	463,012
2016	407,268	55,605	2,313	744	465,930
2017	409,401	56,134	2,302	459	468,296
2018	411,114	56,325	2,302	459	470,199
2019	413,090	56,869	2,302	459	472,720
2020	415,157	57,351	2,302	459	475,269
2021	417,318	57,992	2,302	459	478,072
2022	419,577	58,465	2,302	459	480,803
2023	421,883	59,081	2,302	459	483,725
2024	424,236	59,519	2,302	459	486,517
2025	426,636	60,128	2,302	459	489,525
2026	429,083	60,589	2,302	459	492,433
2027	431,569	61,061	2,302	459	495,391
2028	434,147	61,535	2,302	459	498,443
2029	436,719	61,833	2,302	459	501,313
2030	439,303	62,304	2,302	459	504,368
2031	441,836	62,609	2,302	459	507,206
2032	444,249	62,905	2,302	459	509,915
2033	446,620	63,203	2,302	459	512,584
2034	449,029	63,513	2,302	459	515,303
2035	451,458	63,825	2,302	459	518,044
2036	453,890	63,956	2,302	459	520,606
2037	456,306	64,079	2,302	459	523,146
2038	458,698	64,210	2,302	459	525,669
2039	461,083	64,330	2,302	459	528,174
Compound Average Growth Rate 2018-2039					
	0.5%	0.6%	0.0%	0.0%	0.6%

3.12 Discussion of Forecast and Alternative Cases

3.12.1 High/Low Growth Cases

The high and low load growth cases were constructed from the base case forecast models and employed optimistic and pessimistic economic and demographic data from IHS Global Insight. The forecast models are estimated at the 95% confidence level and reflect the high and low model bands. The industrial scenarios are constructed individually for each forecasted customer. The high load growth scenario is created by looking at the customer's previous five years of history and using the peak usage and demand, as well as taking into account current business practices and any other potential growth. The low load growth scenario takes each individual customer's "worst case" scenario, whereas customer's minimum operating levels with major loads are idled, and using Rate limitations and other business protocols as guiding factors. Table 3-13 reflects NIPSCO's base, high and low load forecast scenarios for selected years.

Table 3-13: NIPSCO IRP Scenarios – Selected Year

NIPSCO IRP Scenarios - Selected Year									
	Energy Sales - GWh			Internal Demand - MW			MISO Coincident Peak - MW		
	Base	High	Low	Base	High	Low	Base	High	Low
Year	GWh	GWh	GWh	MW	MW	MW	MW	MW	MW
2018	17,251	17,587	16,909	3,051	3,119	2,982	2,907	2,972	2,842
2023	16,178	17,271	11,568	2,982	3,178	2,446	2,827	3,012	2,319
2028	16,529	18,134	11,770	3,064	3,358	2,500	2,890	3,167	2,358
2033	16,845	18,850	11,869	3,123	3,510	2,513	2,934	3,298	2,362
2038	17,148	19,639	11,960	3,164	3,666	2,509	2,966	3,437	2,352
		v Base			v Base			v Base	
		High	Low		High	Low		High	Low
		GWh	GWh		MW	MW		MW	MW
2018	-	1.95%	-1.98%	-	2.2%	-2.3%		2.2%	-2.3%
2023	-	6.76%	-28.50%	-	6.6%	-18.0%		6.6%	-18.0%
2028	-	9.71%	-28.79%	-	9.6%	-18.4%		9.6%	-18.4%
2033	-	11.90%	-29.54%	-	12.4%	-19.5%		12.4%	-19.5%
2038	-	14.53%	-30.25%	-	15.9%	-20.7%		15.9%	-20.7%

3.13 Evaluation of Model Performance and Accuracy

NIPSCO tracks its forecast in terms of mean absolute error ("MAE"). Data for 2006-2017 show that the MAE of the one-year-ahead peak hour demand forecast is 3.3% (MAE of the one-year-ahead MISO coincident peak hour demand forecast is 0.2%); the two-year-ahead forecast has a 4.2% MAE; and the MAE for the five-year-ahead forecast is 5.9%. These represent total forecast error including the effect of abnormal weather at peak. The comparable MAE GWh sales is 3.2% for the one-year-ahead forecast; 4.7% for the two-year-ahead forecast; and 3.8% for the five-year-ahead forecast. Class comparisons to weather-normalized actual data show variances with residential and commercial of 2.0% and 3.3% MAE for the one-and two-year ahead forecasts. Industrial GWh are not weather normalized because historically they have not fluctuated with

weather and show 5.7% and 8.3% MAE for the one-year-ahead and the two-year-ahead forecast. NIPSCO does not have any firm wholesale power sales.

Table 3-14 and Table 3-15 show data for 2006-2017 for total GWh sales and peak hour MW and compare forecasts to actual data not normalized for weather. Table 3-16 and 3-17 show GWh sales by class. GWh are compared to actual data normalized for weather. Table 3-18 shows the performance of the MISO coincident peak model performance since 2012.

Table 3-14: Internal Peak Hour Demand (MW)

Year	Actual *	1-Year Ahead		2-Year Ahead		5-Year Ahead	
		Forecast	% Var.	Forecast	% Var.	Forecast	% Var.
2006	3,238	3,099	4.3%	3,077	5.0%	3,064	5.4%
2007	3,239	3,154	2.6%	3,134	3.2%	3,146	2.9%
2008	3,076	3,224	4.8%	3,188	3.6%	3,201	4.1%
2009	2,696	3,024	12.2%	3,248	20.5%	3,170	17.6%
2010	3,103	2,965	4.5%	3,088	0.5%	3,232	4.2%
2011	3,122	3,134	0.4%	3,093	0.9%	3,282	5.1%
2012	3,257	3,183	2.3%	3,195	1.9%	3,323	2.0%
2013	3,194	3,172	0.7%	3,306	3.5%	3,233	1.2%
2014	3,149	3,209	1.9%	3,243	3.0%	3,287	4.4%
2015	3,055	3,173	3.9%	3,259	6.7%	3,300	8.0%
2016	3,170	3,118	1.6%	3,187	0.5%	3,419	7.8%
2017	3,100	3,113	0.4%	3,146	1.5%	3,349	8.0%
Average			3.3%		4.2%		5.9%

*Actual peak not adjusted for weather. Forecasted peaks assume normal weather; therefore, variance includes weather effect.

Table 3-15: Total GWh including Losses

Year	Actual *	1-Year Ahead		2-Year Ahead		5-Year Ahead	
		Forecast	% Var.	Forecast	% Var.	Forecast	% Var.
2006	17,500	16,750	4.3%	17,235	1.5%	17,544	0.3%
2007	17,655	17,725	0.4%	16,916	4.2%	17,928	1.5%
2008	17,602	18,355	4.3%	17,938	1.9%	18,374	4.4%
2009	15,783	16,898	7.1%	18,446	16.9%	17,716	12.2%
2010	17,106	15,910	7.0%	17,340	1.4%	17,373	1.6%
2011	17,728	16,715	5.7%	16,931	4.5%	18,389	3.7%
2012	17,681	17,754	0.4%	17,220	2.6%	18,804	6.3%
2013	17,638	17,591	0.3%	18,622	5.6%	18,258	3.5%
2014	18,407	18,275	0.7%	17,786	3.4%	18,367	0.2%
2015	17,449	18,417	5.5%	18,611	6.7%	17,747	1.7%
2016	17,726	18,103	2.1%	18,537	4.6%	18,995	7.2%
2017	17,537	17,647	0.6%	18,175	3.6%	18,118	3.3%
Average			3.2%		4.7%		3.8%

* Actual GWh not adjusted for weather. Forecasted GWh assumes normal weather, therefore, variance includes weather effect.

Table 3-16: Residential and Commercial GWh

	Normal *	1-Year Ahead		2-Year Ahead	
		Forecast	% Var.	Forecast	% Var.
2008	7,328	7,641	4.3%	7,600	3.7%
2009	7,357	7,534	2.4%	7,757	5.4%
2010	7,366	7,431	0.9%	7,659	4.0%
2011	7,313	7,428	1.6%	7,474	2.2%
2012	7,213	7,382	2.3%	7,492	3.9%
2013	7,323	7,414	1.2%	7,427	1.4%
2014	7,320	7,398	1.1%	7,466	2.0%
2015	7,241	7,409	2.3%	7,461	3.0%
2016	7,216	7,323	1.5%	7,476	3.6%
2017	7,140	7,322	2.6%	7,384	3.4%
Average			2.0%		3.3%

* Adjusted for weather

Table 3-17: Industrial GWh

	Actual *	1-Year Ahead		2-Year Ahead	
		Forecast	% Var.	Forecast	% Var.
2008	9,305	9,861	6.0%	9,523	2.3%
2009	7,691	8,579	11.6%	9,833	27.8%
2010	8,459	7,692	9.1%	8,879	5.0%
2011	9,257	8,220	11.2%	8,629	6.8%
2012	9,250	9,243	0.1%	8,632	6.7%
2013	9,340	9,111	2.4%	10,020	7.3%
2014	10,071	9,799	2.7%	9,245	8.2%
2015	9,249	9,923	7.3%	10,055	8.7%
2016	9,282	9,713	4.6%	9,969	7.4%
2017	9,470	9,288	1.9%	9,720	2.6%
Average			5.7%		8.3%

* No weather effect measured for industrial load

Table 3-18: MISO Coincident Peak Demand

MISO Coincident Peak Demand - MW
Absolute % Variance of Forecast v Actual

Year	Actual *	1-Year Ahead	
		Forecast	% Var.
2012	2.0%	1.6%	0.4%
2013	3.6%	3.8%	0.2%
2014	2.8%	2.8%	0.0%
2015	2.3%	2.5%	0.2%
Average			0.2%

*Actual peak not adjusted for weather. Forecasted peaks assume normal weather; therefore, variance include weather effect. Please note: MISO coincident Peak model performance is filed with MISO annually on November 1st.

Section 4. Supply-Side Resources

4.1 Fuel Procurement Strategy

4.1.1 Coal Procurement and Inventory Management Practices

4.1.1.1 Coal Supply Strategy

NIPSCO employs a multifaceted strategy to guide coal procurement activities associated with the fuel supply requirements for its coal-fired units. The goal of this strategy is to maximize reliability while maintaining customer affordability. Key elements include: (1) procuring coal supply from sources that minimize the total cost of fuel, O&M costs, environmental costs, inventory costs and other cost impacts (“total cost of ownership”); (2) hedging customers’ price exposure with forward purchases to protect against price volatility; (3) supporting environmental compliance; (4) maintaining reliable inventory levels; (5) ensuring reliability of coal supply and delivery; and (6) maximizing operational flexibility and reliability by procuring coal types that can be used in more than one unit whenever possible.

4.1.1.2 Coal Procurement

NIPSCO maintains a five-year baseline coal forecast that is used to create a strategy that drives its fuel procurement plan. It estimates coal and related coal transportation procurement requirements needed to maintain reliable and economic coal inventory levels. The strategy and fuel procurement plan are highly dynamic and are updated on a periodic basis in response to energy market conditions. Over the past several years, environmental regulations, a significant influx of highly variable renewable generation (e.g. wind and solar), low natural gas prices, and energy efficiency and other demand side initiatives have made coal-fired generation the marginal supply source. Consequently, this has created an environment with highly variable and nearly unpredictable coal purchase requirements. Therefore, NIPSCO’s fuel procurement plans must remain as flexible as possible while still maintaining reliable supply. Obtaining volume flexibility can be challenging since coal suppliers and transportation providers typically require firm volume commitments.

4.1.1.3 Coal Pricing Outlook

Coal competes for a share of the energy market against other fuels (natural gas, nuclear, and oil), renewable energy sources (biomass, hydro, wind, and solar) and energy efficiency programs. Specifically, energy market supply and demand generally set the market price of these competing sources. Also, coal prices are influenced by the supply and demand balance of coal in domestic, international, and metallurgical coal markets, coal production costs, transport costs, and environmental compliance considerations. Energy market dynamics have been heavily influenced by the increased exploration and production of North American shale oil and gas resources and have fundamentally altered the price spread between coal and natural gas. Lower production costs and highly efficient natural gas extraction processes (horizontal drilling and fracking) have kept natural gas a competitive fuel when used in high efficiency, CCGT units. In addition, increases in wet gas production to gather petroleum liquids further increase natural gas supply when oil prices

rise. Oil prices have risen steadily over the last year helping to spur wet gas production. These dynamics are expected to keep natural gas pricing low in the near term. Longer term natural gas prices are expected to recover somewhat with the addition of new CCGTs and increased natural gas export capacity. These market dynamics continue to displace a significant amount of coal-fired electric generation and are keeping coal prices relatively low. Decreased coal demand and higher mining costs driven by government regulations have adversely impacted coal producers' margins and profits causing a number of producer bankruptcies over the last few years. The restructuring of coal companies' debt and other costs through the bankruptcy process should allow them to produce coal in this competitive environment. Supply has been rationalized and any significant increase in demand could result in coal price volatility. However, several factors may limit the upside for coal prices. The first factor is the cost to produce electricity from coal has increased significantly due to stringent environmental regulations placed on coal-fired electric generation. A second factor is utilities continue to retire older, higher cost coal-fired generation and this has reduced demand. Lastly, low energy prices driven by natural gas pricing and renewables will also limit demand for coal if coal prices spike.

The competitive energy market has also driven a shift in coal supply regions. Specifically, the cost to produce coal in the Appalachian regions and low coal prices have resulted in declining coal production and this has increased market share of the lower cost Illinois Basin ("ILB") region. Even with its higher sulfur content, ILB coal has become an export resource, and its use has increased domestically as utilities have installed flue gas desulfurization systems ("FGDs") to meet tighter sulfur dioxide limits and other emission standards. Southeast utilities have started using ILB coal to replace higher cost Columbian and Central Appalachia coal.

The use of Powder River Basin ("PRB") coal from Wyoming and Montana has increased significantly over the last decade. Although PRB coal has a lower heat content than coals mined in other regions, utilities typically blend PRB coal with Central Appalachian, ILB, or Northern Appalachian ("NAPP") coals to reduce their overall fuel costs. Asian demand for PRB coal has also grown as Japan and China have built new, high efficiency coal units and new coal plants are being built in Korea and Taiwan as well as they prepare to meet their future electricity demand. Historically, Central Appalachian and NAPP coal have been exported into metallurgical coal and some steam coal markets abroad. Since the end of 2016, demand for seaborne coal has increased. It appears that exports will remain resilient with export volumes over the last year at or near the top of the five year range. Coal suppliers need this to continue in order to offset losses in domestic markets.

Overall, these fundamentals are bearish for coal demand. Notwithstanding, NIPSCO will continue to monitor market dynamics and coal prices and incorporate in its procurement strategies.

4.1.1.4 NIPSCO Coal Pricing Outlook

NIPSCO currently procures coal from three geographic regions in the United States: the PRB, the ILB, and the NAPP region. Domestic demand for coal has continued to trend lower over the last two years; therefore, prices have remained relatively low and stable. NAPP coal, used by NIPSCO as a blend fuel in one of its cyclone units, and ILB coal have had relatively strong price increases off of 2016 lows as export demand and prices have trended higher over the last two years.

Pricing for PRB coal has remained low over the last two years and is close to the marginal cost of production.

The export dynamic will likely keep upward pressure on the market in the near term and this would likely lower domestic demand for coal unless domestic energy prices rise. All domestic coal pricing is expected to remain soft as long as energy prices stay low, and will likely keep coal prices flat for the balance of 2018 into 2019.

4.1.1.5 Coal and Issues of Environmental Compliance

Depending on the manner and extent of current and future environmental regulations, NIPSCO's coal purchasing strategy will continue to evolve in a manner that meets current and future environmental requirements.

4.1.1.6 Maintenance of Coal Inventory Levels

NIPSCO has an ongoing strategy to maintain stable coal inventories and reviews inventory target levels annually and may make adjustments in anticipation of changes in supply availability relative to demand, transportation constraints and unit consumption. NIPSCO may modify target inventory levels on a unit-by-unit basis depending on the unit consumption, delivery rates, reliability of coal supply and station coal handling operations. Adequate inventories are essential to maintaining generation reliability. Uncertainty in consumption rates and variability in delivery performance generally require higher levels of inventory to insure reasonably adequate reliability.

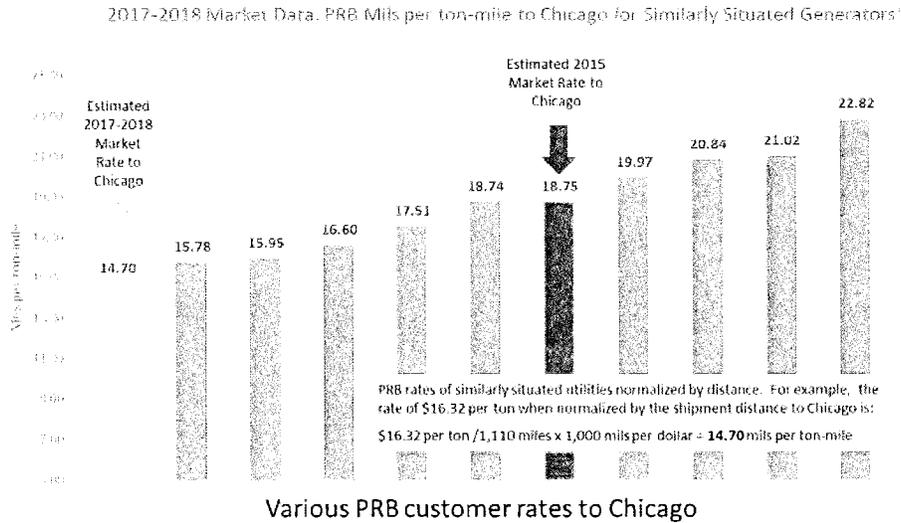
4.1.1.7 Forecast of Coal Delivery and Transportation Pricing

To ensure the delivery of fuel in a timely and cost-effective manner, NIPSCO negotiates and executes transportation contracts that consider current and future coal supply commitments. All fuel procurement options are compared on a delivered cost basis, which includes a complete evaluation of all potential logistical issues.

Coal deliveries, excluding exceptional weather conditions, have been somewhat stable from the various supply regions, particularly shipments originating in the PRB region due to infrastructure improvements. Railroads typically make investment in infrastructure and equipment to support anticipated shipment rates. The cyclical nature of the railroad business can create short term transportation constraints and can impact NIPSCO's coal deliveries. These cycles have been shorter in duration and more volatile over the past several years.

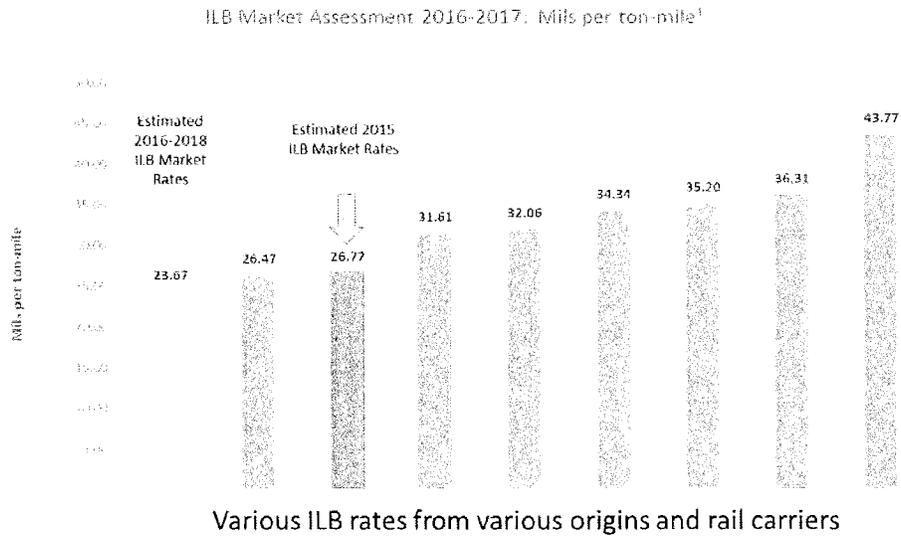
Transportation rates have declined somewhat given the competition in the energy markets. Railroads have been willing to rationalize rail rates, as shown in the market assessment plots below, to keep market share.

Figure 4-1: PRB Customer Rates



¹ Crowley, T. L., L.L. Peabody & Associates, 2017, *PRB Transportation Market Rate and Cost Analysis*

Figure 4-2: ILB Customer Rates



¹ Request for proposal results from August 2014, August 2016 and June 2017 market solicitations for Illinois Basin coal transportation rates.

This pricing trend has improved the competitiveness of NIPSCO's coal-fired generation to a certain extent.

4.1.1.8 NIPSCO Transportation Pricing Outlook

NIPSCO has limited rail options from various supply regions and destination for most of its coal transportation moves, and is further disadvantaged due to its geographical location. Not only are rail transportation options limited, other transport modes (trucking, barging and lake vessels) are not economically or logistically feasible alternatives. NIPSCO's largest generating station, Schahfer, is served by only one railroad. All coal deliveries by this railroad to Schahfer have been transported under agreements that historically escalated transportation rates that also included fuel surcharges indexed to oil prices. However, under this structure, lower power prices lead to a reduction in coal demand. Therefore, NIPSCO and this railroad worked to develop an agreement that lowered rates to improve the station's competitiveness in the market. As stated above, energy markets have forced a rationalization of coal pricing and associated transportation costs. NIPSCO expects this dynamic to continue for the foreseeable future.

As a result, PRB and ILB coal transportation rates have been reduced by nearly 50%. Fuel surcharges continue to fluctuate with the changes in oil prices. The expectation for transportation pricing is also expected to remain soft as long as energy prices stay low, and expect rates to be flat for the balance of 2018 into 2019. Increases in fuel charges could lead to modest transportation cost increases as oil prices trend higher.

4.1.1.9 Coal Contractual Flexibility, Deliverability and Procurement

Contract terms for coal and coal transportation agreements are typically one to five years in duration. Spot purchases are made on an as-needed basis to manage inventory fluctuations. In an effort to minimize variations in inventory levels and accommodate unit maintenance outages, most coal types under contract can be used in more than one unit. The fuel blending strategy can also be adjusted to conserve a particular type of coal if supply problems are experienced. In addition, coal suppliers have been more amenable to providing some volume flexibility. This has supported NIPSCO's inventory management efforts.

4.1.2 Natural Gas Procurement and Management

NIPSCO currently procures natural gas for its CCGT generating station using a natural gas supply contract with an energy manager that delivers to the interstate pipeline interconnect at the station, or other locations along the interstate pipeline upon request of NIPSCO for balancing purposes. NIPSCO currently holds firm capacity on the interstate pipeline, Midwestern Gas Transmission Company, and releases the capacity to the energy manager. The contract has provisions to purchase next day and intraday firm gas supplies to serve the daily needs of the facility. NIPSCO nominates and balances the gas supply needs of the CCGT generating station. A portion of the gas supply for the Sugar Creek Generating Station ("Sugar Creek") is financially hedged with the intention of smoothing out market price swings over a specific time period. The volatility mitigation plan consists of purchasing monthly NYMEX Henry Hub natural gas contracts that settle at expiration.

The coal units and combustion turbines ("CTs") at NIPSCO are located within the NIPSCO natural gas local distribution company service territory. NIPSCO maintains a separate contract for firm delivered natural gas supply and energy management for these units. The contract has

provisions to nominate next-day usage based on the expected usage of each generating station. The actual usage is balanced daily and balancing is the responsibility of the energy manager.

4.2 Electric Generation Gas Supply Request for Proposal Process

NIPSCO conducts two separate RFPs for the electric generation firm natural gas supply, one for the Sugar Creek facility and a separate one for the coal units and CTs. The RFP process may be done on a seasonal or annual basis depending on the current contract length and supplier agreement. The process includes qualifying potential suppliers, customizing the RFP based on near-term system needs, and gas supply trends. Suppliers are chosen based on the overall value of the package and ability to serve the needs of the facility. To date, NIPSCO has entered into electric generation gas supply agreements that extend no longer than one year, but is always evaluating the value and benefits of longer term agreements.

4.3 Existing Resources

NIPSCO has a variety of generation resources to meet its customers' forecast capacity and energy needs. Not only do these resources need to meet the principles set out in Section 1, they must operate within MISO, the Regional Transmission Organization, and subject to NERC standards. NIPSCO has registered with NERC as a Distribution Provider, Generator Owner, Generator Operator, Load Serving Entity, Purchasing-Selling Entity, Resource Planner and Transmission Planner. NIPSCO is registered as a Balancing Authority, Transmission Operator and Transmission Owner in MISO. Each Registered Entity is subject to compliance with applicable NERC and Regional Reliability Organization, ReliabilityFirst, standards approved by the Federal Energy Regulatory Commission ("FERC").

4.4 Supply Resources

NIPSCO owned generating resources consist of coal, natural gas and hydro units. Additionally NIPSCO meets its customer needs with 2 wind purchase power agreements and has an extensive demand response ("DR") program via its large industrial customers. The total Net Demonstrated Capacity ("NDC") of the existing resources is 2,925 MW across multiple generation sites, including the Schahfer (Units 14, 15, 16A, 16B, 17 and 18), Michigan City (Unit 12), Bailly (Units 10), Sugar Creek and two hydroelectric generating sites near Monticello, Indiana (Norway Hydro and Oakdale Hydro). Of the total capacity, 61% is from coal-fired units, 21% is from natural gas-fired units and 18% is from industrial interruptible DR program. Consistent with the 2016 IRP preferred plan NIPSCO retired 2 coal fired units (Units 7 and 8) at the Bailly in May 2018.

Table 4-1 provides a summary of the current generating facilities operated by NIPSCO.

Table 4-1: Net Demonstrated Capacity

Resource	Unit	Fuel	Capacity NDC (MW)
Michigan City	12	Coal	469
Schahfer	14	Coal	431
	15	Coal	472
	16A	NG	78
	16B	NG	77
	17	Coal	361
	18	Coal	361
Sugar Creek		NG	535
Bailly	10	NG	31
Hydro	Norway	Water	4
	Oakdale	Water	6
Wind		Wind	100
			2,925

NG=Natural Gas

4.4.1 Michigan City Generating Station

Michigan City is located on a 134-acre site on the shore of Lake Michigan in Michigan City, Indiana. It has one base-load unit, Unit 12 and is equipped with selective catalytic reduction (“SCR”) and over-fire air (“OFA”) systems to reduce nitrogen oxide (“NO_x”) emissions. A new FGD (“”) system was placed in service in 2015. The individual unit characteristics of Michigan City are provided in Table 4-2.

Table 4-2: Michigan City Generating Station

Unit 12	
NET Output	
Min (MW)	315
Max (MW)	469
Boiler	Babcock & Wilcox
Burners	10 Cyclone
Main Fuel	Coal
Turbine	General Electric
Frame	G2
In-Service	1974
Environmental Controls	FGD, SCR, OFA

4.4.2 R.M. Schahfer Generating Station

Schahfer is located on approximately a 3,150-acre site two miles south of the Kankakee River in Jasper County, near Wheatfield, Indiana. It is the largest of NIPSCO's generating stations. There are four coal-fired base-load units and two gas-fired simple cycle peaking units that came on-line over an 11-year period ending in 1986. The Schahfer units are equipped with significant environmental control technologies, including FGD to reduce sulfur dioxide ("SO₂") emissions and SCR, SNCR, low NO_x burners ("LNB"), and OFA systems to reduce NO_x emissions. Unit 14 burns low and medium sulfur coal blends and Unit 15 burns low-sulfur coals to minimize SO₂ emissions. As part of the Company's Clean Air Interstate Rule (CAIR) Compliance Phase I Strategy, FGD system upgrades to improve SO₂ removal efficiency were completed for Units 17 and 18 in 2010 and 2009, respectively. Installation of a new LNB with OFA system was completed on Unit 15 in 2009. A new FGD plant on Unit 14 was placed in service in 2013. FGD installation on Unit 15 was completed in 2014. The individual unit characteristics of Schahfer are provided in Table 4-3.

Table 4-3: R.M. Schahfer Generating Station

	Unit 14	Unit 15	Unit 17	Unit 18	Unit 16A	Unit 16B
NET Output						
Min (MW)	290	250	125	125	----	----
Max (MW)	431	472	361	361	78	77
Boiler	Babcock & Wilcox	Foster Wheeler	Combustion Engineering	Combustion Engineering	----	----
Burners	10 Cyclone	6 Pulverizers	6 Pulverizers	6 Pulverizers	----	----
Main Fuel	Coal	Coal	Coal	Coal	Gas	Gas
Turbine	Westinghouse	General Electric	Westinghouse	Westinghouse	Westinghouse	Westinghouse
Frame	BB44R	G2	BB243	BB243	D501	D501
In-Service	1976	1979	1983	1986	1979	1979
Environmental Controls	FGD, SCR, OFA	FGD, SNCR, LNB, OFA	FGD, LNB, OFA	FGD, LNB, OFA	----	----

4.4.3 Sugar Creek Generating Station

Sugar Creek is located on a 281-acre rural site near the west bank of the Wabash River in Vigo County, Indiana. The gas-fired CTs and CCGTs were available for commercial operation in 2002 and 2003, respectively. Sugar Creek was purchased by NIPSCO in July 2008, and is its newest electric generating facility. Sugar Creek has been registered as a MISO resource since December 1, 2008. Two generators and one steam turbine generator are operated in the CCGT mode and environmental control technologies include SCR to reduce NO_x, and dry low NO_x (“DLN”) combustion systems. The individual unit characteristics of Sugar Creek are provided in Table 4-4.

Table 4-4: Sugar Creek Generating Station

	CT 1A	CT 1B	SCST
NET Output			
Min (MW)	120	120	120
Max (MW)	156	157	222
Heat Recovery Steam Generator	Vogt Power	Vogt Power	---
Main Fuel	Gas	Gas	Steam
Turbine	GE	GE	GE
Frame	7FA	7FA	D11
In-Service	2002	2002	2003
Environmental Controls	SCR, DLN	SCR, DLN	---

4.4.4 Norway Hydro and Oakdale Hydro (NIPSCO-Owned Supply Resources)

Norway Hydro is located near Monticello, Indiana on the Tippecanoe River. The dam creates Lake Shafer, a body of water approximately 10 miles long with a maximum depth of 30 feet, which functions as its reservoir. Norway Hydro has four generating units capable of producing up to 7.2 MW. However, its output is dependent on river flow and the typical maximum plant output is 4 MW. The individual unit characteristics of the Norway Hydro are provided in Table 4-5.

Table 4-5: Norway Hydro

	Unit 1	Unit 2	Unit 3	Unit 4
NET Output				
Min (MW)	---	---	---	---
Max (MW)	2	2	2	1.2
In-Service	1923	1923	1923	1923
Main Fuel	Water	Water	Water	Water

Oakdale Hydro is located near Monticello, Indiana along the Tippecanoe River. The dam creates Lake Freeman, a body of water approximately 12 miles long with a maximum depth of 45 feet, which functions as its reservoir. Oakdale Hydro has three generating units capable of producing up to 9.2 MW. However, its output is dependent on river flow and the typical maximum plant output is 6 MW. The individual unit characteristics of the Oakdale Hydro are provided in Table 4-6.

Table 4-6: Oakdale Hydro

	Unit 1	Unit 2	Unit 3
NET Output			
Min (MW)	---	---	---
Max (MW)	4.4	3.4	1.4
In-Service	1925	1925	1925
Main Fuel	Water	Water	Water

4.4.5 Barton and Buffalo Ridge Wind (NIPSCO Purchase Power Agreements)

NIPSCO is currently engaged in a 20-year PPA with Iberdrola, in which NIPSCO will purchase generation from Barton. Barton, located in Worth County, Iowa, went into commercial operation on April 10, 2009. The individual unit characteristics of Barton are provided in Table 4-7.

Table 4-7: Barton Wind PPA

Barton PPA	
NET Output	
Per Unit (MW)	2
Number of Units	25
Total Output (MW)	50
In-Service	2009
Main Fuel	Wind

NIPSCO is also engaged in a 15-year PPA with Iberdrola, in which NIPSCO will purchase generation from Buffalo Ridge. Buffalo Ridge, located in Brookings County, South Dakota, went into commercial operation on April 15, 2009. The individual unit characteristics of Buffalo Ridge are provided in Table 4-8.

Table 4-8: Buffalo Ridge Wind PPA

Buffalo Ridge PPA	
NET Output	
Per Unit (MW)	2
Number of Units	24
Total Output (MW)	50
In-Service	2009
Main Fuel	Wind

4.5 Total Resource Summary

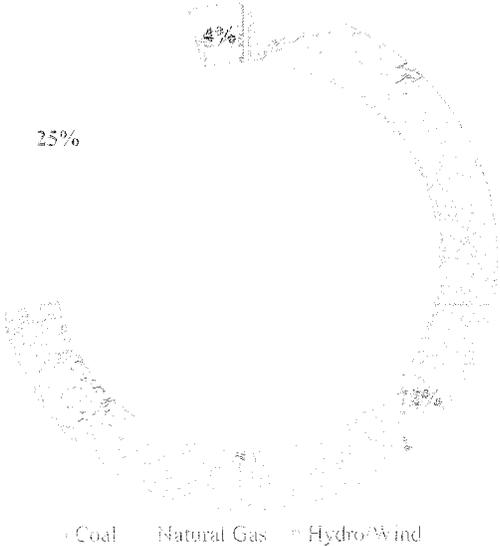
Table 4-9 illustrates various characteristics of NIPSCO's owned and contracted generating units. Figure 4-3 illustrates NIPSCO's existing resources by fuel type.

Table 4-9: Existing Generating Units

Resource	Unit	Fuel	Capacity/NDC (MW)	Year in Service
Michigan City	12	Coal	469	1974
Schahfer	14	Coal	431	1976
	15	Coal	472	1979
	16A	NG	78	1979
	16B	NG	77	1979
	17	Coal	361	1983
	18	Coal	361	1986
Sugar Creek		NG	535	2002
Bailly	10	NG	31	1968
Hydro	Norway	Water	4	1923
	Oakdale	Water	6	1925
Wind		Wind	100	2009
			2,925	

NG=Natural Gas

Figure 4-3: Existing Resources Net Demonstrated Capacity



4.6 Operations Management and Dispatch Implications

The future dispatch of NIPSCO's electric generation fleet will be a function of the cost to market price (or locational marginal price). Many factors will contribute to the dispatch of local units within NIPSCO's service territory. The delivered cost of coal and natural gas, transmission congestion, environmental considerations and the overall generation mix within MISO may affect the level of future dispatch.

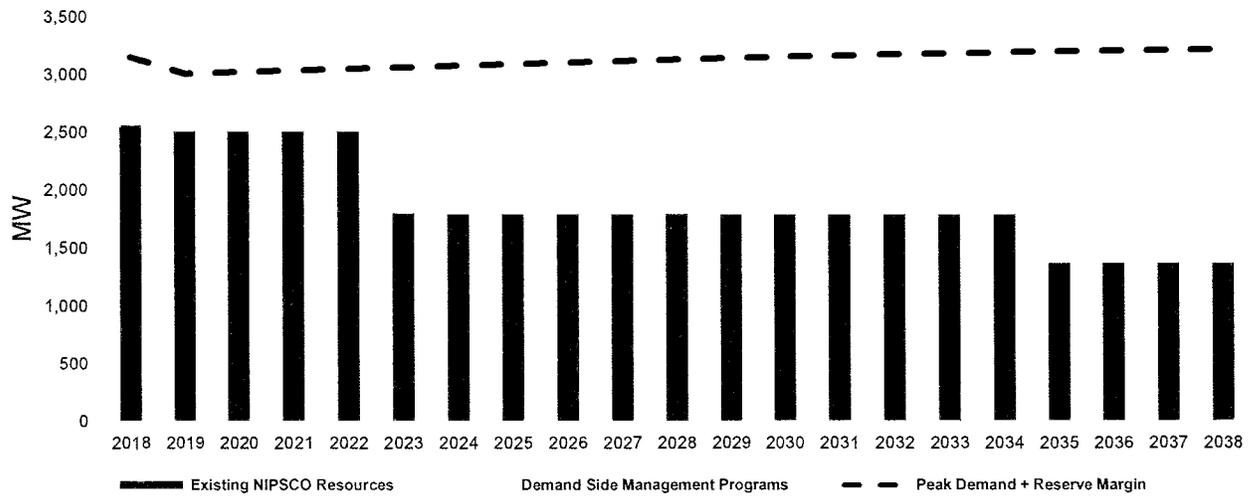
4.7 MISO Wholesale Electricity Market

MISO supplies an important element to NIPSCO's long term plans – ongoing liquidity. MISO provides an enduring, relatively efficient market for marginal purchases and sales of electricity. In 2018, MISO has members from 15 states and one Canadian province with a generation capacity of 200,000 MW and 65,800 miles of high-voltage transmission. MISO manages one of the world's largest energy and operating markets that includes a Day-Ahead Market, Real-Time Market and Financial Transmission Rights Market.

4.8 Resource Adequacy

Consistent with the principles set out in Section 1, NIPSCO is committed to meet the energy needs of its customers with reliable, compliant, flexible, diverse and affordable supply. As part of the Resource Adequacy planning process, NIPSCO is now utilizing the peak demand forecast coincident with the MISO peak demand to determine its capacity requirements. The MISO coincident peak is where NIPSCO demand is projected to be at the time the entire MISO system peaks, which is typically in the summer. The methodology for calculating the coincident peak demand is described in detail in Section 3. NIPSCO's assessment of its existing resources against the future needs of its customers is shown in Table 4-10.

Figure 4-4: Resource Adequacy Assessment (MW)



Based on the 2016 IRP preferred plan, NIPSCO would need additional capacity resources to meet its customer demand starting in 2023 after the retirements of Schahfer Units 17 and 18. NIPSCO has evaluated a range of resource options to meet that need.

4.9 Future Resource Options

New resources may be needed to meet the future electricity requirements of NIPSCO's customers over time, so it is critical that valid cost and operational estimates are developed for such future resource options in the IRP modeling. In the 2018 IRP, NIPSCO developed a two-step process to improve the new resource evaluation process and to respond to feedback received in the 2016 IRP.² This process entailed:

- A review of multiple third-party data sources to assess current and future estimates of resource technology cost, as well as plausible cost ranges, and performance characteristics
- Development of final inputs for IRP modeling based on real bid data that was received from the All-Source RFP.

4.9.1 Third-Party Data Source Review

NIPSCO worked with CRA to perform a screen of third-party sources for new resource cost and operational parameter estimates. The screen included the study NIPSCO commissioned for its 2016 IRP, public sources that develop estimates, such as government forecasts and other

² Note that a discussion of future demand-side resource options is included in Section 5.

utility IRPs, and subscription services which provide data and capital cost estimates over time. Figure 4-5 provides a list of the sources that were relied upon for the third-party screen.

Based on the source review, NIPSCO identified a list of feasible technology options to be assessed in the initial round of review. These included:

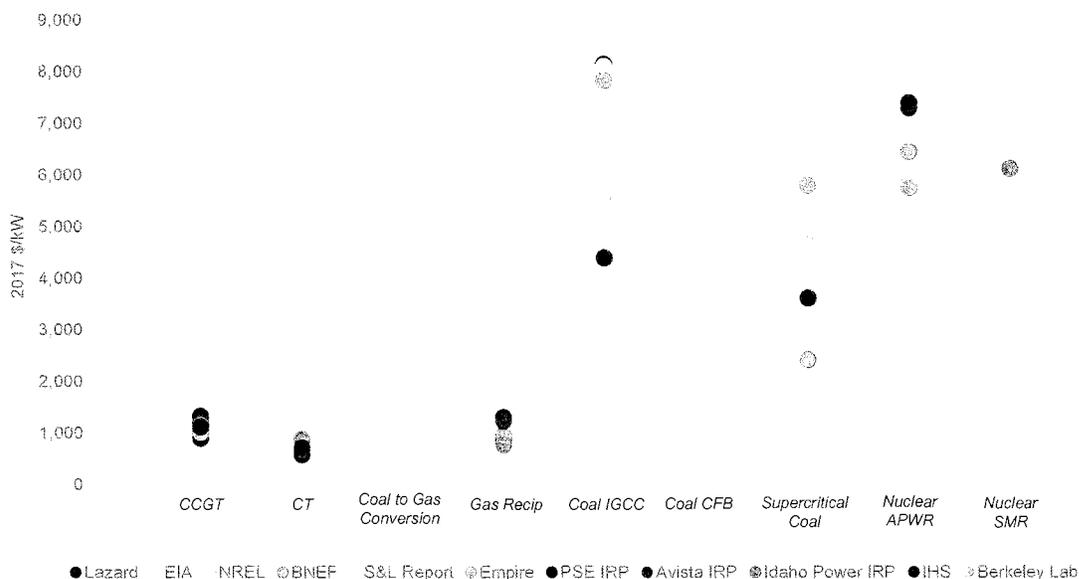
- Coal technologies – integrated gasification combined cycle, circulating fluidized bed, and supercritical pulverized coal
- Natural gas technologies – CTs, CCGTs, reciprocating engines, and coal-to-gas conversion
- Nuclear technologies – small module reactors and advanced pressurized water reactions
- Renewable technologies – onshore wind, offshore wind, distributed wind, utility-scale photovoltaic (“PV”) solar, and distributed PV solar
- Other technologies – combined heat and power, battery storage, microturbines, and biomass

Figure 4-5: Data Sources for Third-Party Resource Review

Data Source	Description
Sargent & Lundy	NIPSCO Integrated Resource Plan Engineering Study Technical Assessment (2015)
Energy Information Administration (EIA)	Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants (2018 Annual Energy Outlook)
Utility Integrated Resource Plans	Empire District Electric Company, Puget Sound Energy, Avista Utilities and Idaho Power (screened for filings with transparent data within the last 6 months to year)
Lazard	Levelized Cost of Energy Analysis Version 11.0 (2017) Lazard Levelized Cost of Storage Version 3.0 (2017) US Solar PV Capital Cost and Required Price Outlook US Wind Capital Cost and Required Price Outlook
IHSMarkit	US Battery Storage: Costs, Drivers, and Market Outlook (2017) North American Power Market Fundamentals: Rivalry, October 2017 – New Capacity Characteristics & Costs Historical and forecast U.S. PV Capex Stack by Segment and Region
Bloomberg New Energy Finance	Key cost input in LCOE Scenarios, 1H 2017 Benchmark Capital Costs for a Fully-Installed Energy Storage System (2017)
National Renewable Energy Technology Laboratory (NREL)	Annual Technology Baseline 2017

NIPSCO then aggregated the cost estimates from all sources by technology type to evaluate current costs on a \$/kilowatt (“kW”) basis. As part of this assessment, average, median, minimum, and maximum costs were recorded. A summary of the results of the survey is presented in Figure 4-6 and Figure 4-7.

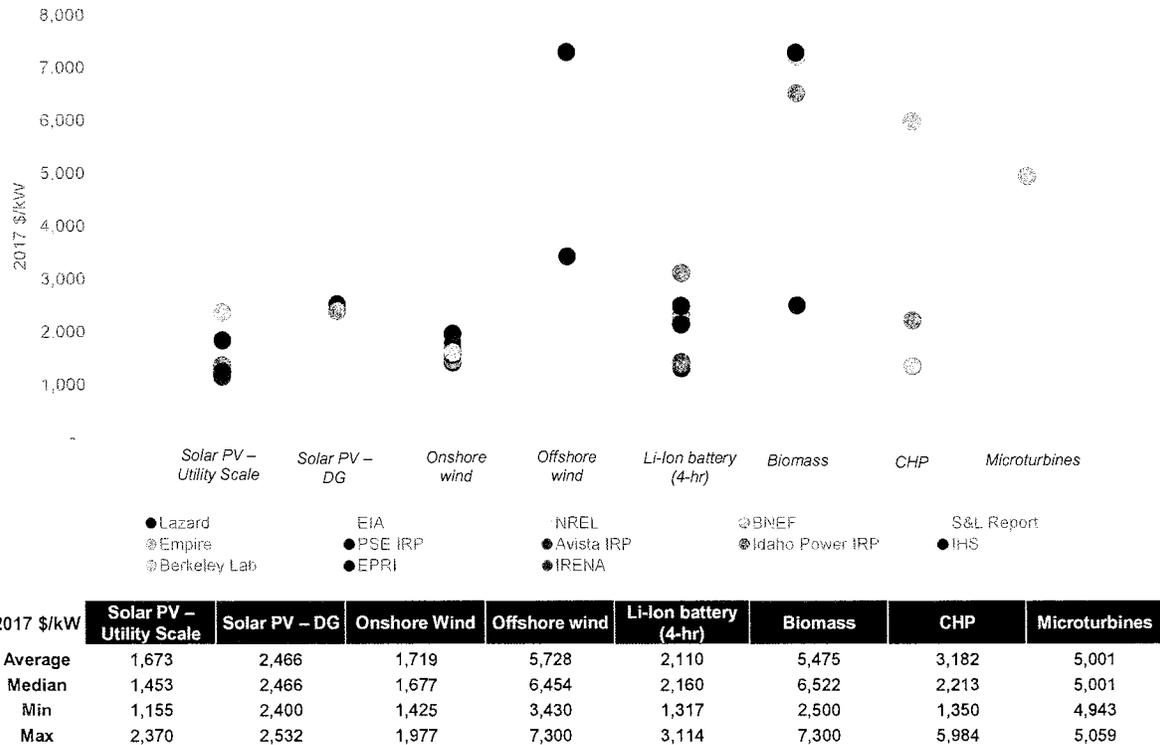
Figure 4-6: Current Capital Cost Summary for Coal, Gas, and Nuclear Technologies (2017\$/kW)



2017 \$/kW	CCGT	CT	Coal to Gas Conversion	Gas Recip	Coal IGCC	Coal CFB	Supercritical Coal	Nuclear APWR	Nuclear SMR
Average	1,113	834	543	1,276	6,824	6,536	4,605	6,437	6,527
Median	1,116	715	543	1,092	7,835	6,536	4,646	6,198	6,527
Min	900	583	543	775	4,401	6,536	2,425	5,752	6,126
Max	1,326	1,485	543	2,519	8,150	6,536	6,482	7,392	6,927

Gas Recip – Gas Reciprocating Engine
 IGCC – Integrated Gasification Combined Cycle
 CFB – Circulating Fluidized Bed
 APWR – Advanced Pressurized Water Reactor
 SMR – Small Modular Reactor

Figure 4-7: Current Capital Cost Summary for Renewable, Storage, and Other Technologies (2017\$/kW)³



Given relatively large uncertainty ranges for certain technologies and given even larger uncertainty regarding future cost trends, NIPSCO determined that it was necessary to conduct an RFP process to collapse the uncertainty and identify transactable projects that could be available for future capacity needs, especially by 2023. In the 2016 IRP, NIPSCO identified several screening criteria to confirm project viability, including technical feasibility, commercial availability, economic attractiveness, and environmental compatibility. In the 2018 IRP, each of these criteria could be tested with actionable data from the RFP process as opposed to solely relying on engineering advice.

4.9.2 All Source Request for Proposals

NIPSCO worked with CRA’s Auctions and Competitive Bidding practice to conduct an All-Source RFP during the spring and early summer of 2018. During NIPSCO’s first Public Advisory meeting, an overview of the All-Source RFP design was provided to stakeholders and comments were solicited and accepted through April 2018. After incorporating stakeholder feedback, NIPSCO and CRA formally launched the All-Source RFP on May 14, 2018 and closed the window for proposals on June 29, 2018.

³ Note that renewable cost data from the S&L summary was excluded in the summaries due to vintage concerns. Old solar PV – Utility Scale data was also excluded from the Berkeley Lab source.

The All-Source RFP provided several guidelines to bidders, which are summarized below:

- **Technology:** The All-Source RFP requested all solutions regardless of technology, including demand-side options and storage
- **Size:** The All-Source RFP defined a minimum total need of 600 MW for the portfolio, but placed no size restrictions on the potential bidders. The All-Source RFP explicitly allowed for resources below 600 MW to offer their solution as a piece of a potential total need. The All-Source RFP also encouraged larger resources offer their solution for consideration.
- **Ownership Arrangements:** The All-Source RFP was open to asset purchases (new or existing) and PPAs. However, it required that resources qualify as MISO internal generation (not pseudo-tied) or load in the form of DR.
- **Duration:** The All-Source RFP requested delivery beginning June 1, 2023, but indicated that it would evaluate deliveries as early as June 1, 2020. The minimum contractual term and/or estimated useful life was requested to be five years, except for DR, which was allowed to offer for a one-year term.
- **Deliverability:** The All-Source RFP required that bidders have firm transmission delivery to MISO Local Resource Zone 6 (“LRZ6”).
- **Participants & Pre-Qualification:** The All-Source RFP required counterparties be credit-worthy to ensure an ability to fulfill future resource obligations.

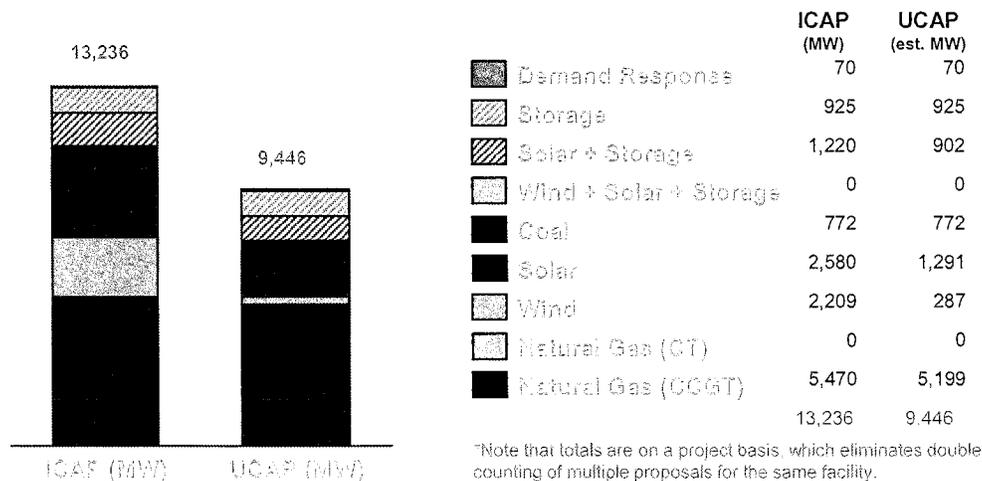
Overall, the All-Source RFP generated a large amount of bidder interest, with 90 total proposals received across a range of deal structures. NIPSCO received bids for 59 individual projects across five states with over 13 GW of installed capacity (“ICAP”) represented. Many of the proposals offered variations on pricing structure and term length, and the majority of the projects were in various stages of development. A summary of the total number of proposals received by technology type is shown in Figure 4-8.

Figure 4-8: Summary of Number of Proposals Received by Technology Type

Technology	CCGT	CT	Coal	Wind	Wind + Solar + Storage	Solar	Solar + Storage	Storage	Demand Resp.	Total Bids
Asset Sale	4	-	-	1	-	1	-	-	-	6
PPA	8	-	3	6	-	26	7	8	1	59
Option	3	1	-	7	1	8	4	1	-	25
Total	15	1	3	14	1	35	11	9	1	90
Locations	IN, IL	IN	IN, KY	IA, IN, IL, MN	IN	IL, IN, IA	IN	IN	IN	

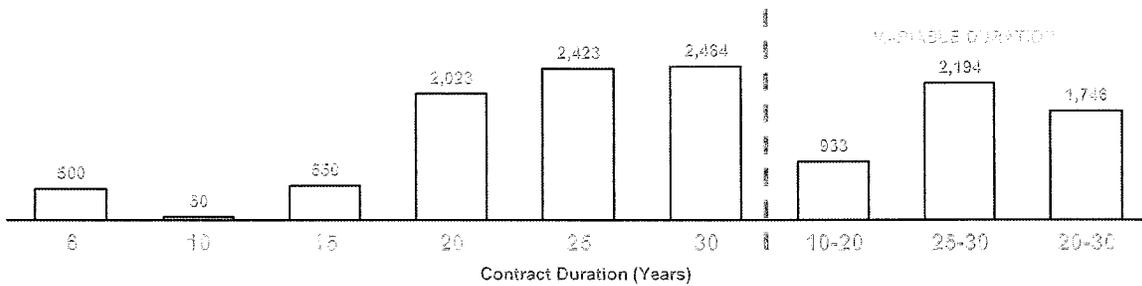
On a total MW basis, the 13 GW of ICAP offered represented just under 10 GW of UCAP, providing a sufficiently large set of candidate options for NIPSCO to evaluate for any capacity need during the All-Source RFP delivery window. Over half of the offered UCAP was in the form of natural gas-fired projects, primarily CCGTs. However, a significant amount of renewable, coal-based, and storage resources were also offered. Figure 4-9 shows a summary of total MW offered in response to the All-Source RFP by type.

Figure 4-9: Summary of Total MW of Proposals Received by Type



Most PPA offers were relatively long in duration, with the majority of proposals offering contracts for 20 year terms or longer. Several bidders offered shorter-term options, including a number that provided NIPSCO with options to select from multiple duration possibilities. Figure 4-10 provides a summary of the total UCAP MW offered by duration.

Figure 4-10: Summary of Proposals Received by Duration (UCAP MW)



Most importantly, the All-Source RFP responses provided transactable cost and price information to be incorporated in the IRP analysis. Overall, much of the cost information was relatively consistent with the third-party data review, but renewable offers were at the low end of the estimates observed in the public literature. This indicated that technology change and developer activity in a competitive process are dynamic forces that influence the costs of resource options for NIPSCO in the future. A summary of the various proposals by type and by price is provided in Figure 4-11. Note that due to confidentiality considerations, individual project prices cannot be disclosed.

Figure 4-11: Summary of Proposals by Price

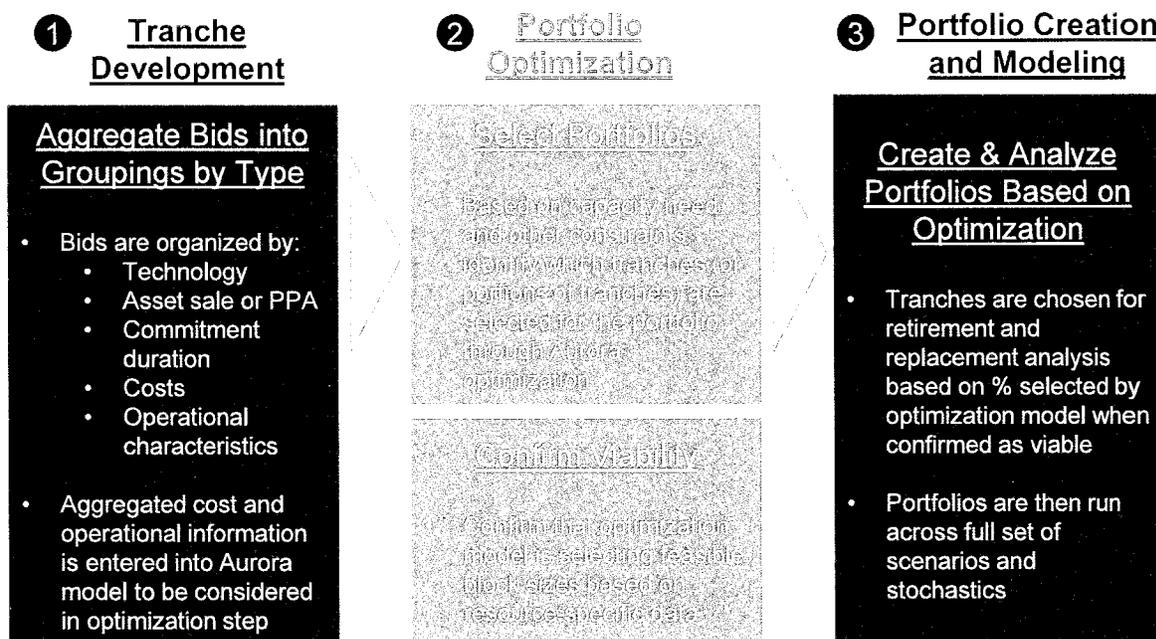
	Technology	# of Bids	Bid MW (ICAP)	# of Projects	Project MW	Average Bid Price	Pricing Units	Comments
Asset Sale or Option	Combine Cycle Gas (CCGT)	7	4,846	4	3,055	\$959.61	\$/kW	
	Combustion Turbine (CT)	1						
	Solar	9	1,374	5	669	\$1,151.01	\$/kW	
	Wind	8	1,807	7	1,607	\$1,457.07	\$/kW	
	Solar + Storage	4	705	3	465	\$1,182.79	\$/kW	
	Wind + Solar + Storage	1						
	Storage	1						
Purchase Power Agreement	Combine Cycle Gas (CCGT)	8	2,715	6	2,415	\$7.86	\$/kW-Mo + fuel and variable O&M	
	Solar + Storage	7	1,055	5	755	\$5.90	\$/kW-Mo + \$35/MWh (Average)	
	Storage	8	1,055	5	925	\$11.24	\$/kW-Mo	
	Solar	26	3,591	16	1,911	\$35.67	\$/MWh	
	Wind	6	788	4	603	\$26.97	\$/MWh	
	Fossil	3	1,494	2	772	N/A	Structure not amenable to price comparison	
	Demand Response	1						
	Total	90	20,585	59	13,247			

4.10 Incorporation of the All-Source RFP Results into the IRP

After gathering the All-Source RFP bidder data, the next step in the process was to organize the information and incorporate the results into the IRP analysis. NIPSCO and CRA developed a three-step process for All-Source RFP-IRP integration, which is outlined in Figure 4-12:

1. Organize the various bids into groupings or tranches according to technology, whether the bid offered a PPA or an asset acquisition, the bid’s commitment duration, and the bid’s costs and operational characteristics.
2. Perform portfolio optimization analysis based on NIPSCO’s potential capacity need and other portfolio design constraints, confirming option viability based on feasible block sizes of All-Source RFP tranche data.
3. Develop comprehensive portfolios with selected tranches from the portfolio optimization step and analyze them across the full set of scenarios and stochastics.

Figure 4-12: Summary of Proposals by Price



4.10.1 Tranche Development

It was determined that a tranche approach would be most effective in aggregating the numerous data points from the All-Source RFP into useable IRP information for three main reasons:

- The IRP is intended to select the best resource mix and future portfolio concept rather than select specific assets or projects. While the IRP analysis can now be highly informed by actionable All-Source RFP data, it is only meant to develop a planning-level recommended resource strategy. NIPSCO determined that asset-specific selection would require an additional level of diligence, including assessment of development risk, evaluation of locational advantages or disadvantages for specific projects, and review of transmission system impacts, to be conducted outside of the standard IRP process.

- The IRP is a highly transparent and public process that requires sharing of major inputs with stakeholders and the public. There would be confidentiality concerns with showing and analyzing asset-level options, which would contain specific cost bids and detailed technology data.
- The IRP modeling is complex, and resource grouping improves the efficiency of the process. Resource evaluation requires organizing large amounts of operational and cost data into IRP models, so a smaller data set would improve the efficiency of setup and run time.

When developing tranches, the CRA All-Source RFP team first organized resources by technology and then sorted them into categories according to whether they were offered as asset sales or PPAs. Projects were screened by the All-Source RFP team to determine conformity with bid requirements, and any non-conforming bids were eliminated. Duplicate projects that were offered multiple times under different structures were consolidated into the lowest-cost option to avoid double-counting. Beyond the initial organization and screening, the bids were then arranged by commitment duration and finally costs and operational characteristics.

For example, the All-Source RFP received multiple CCGT bids, with some being based on the same project. In developing the tranches, the team first separated the PPAs from the asset sales and then sub-divided PPA bids into short and long duration options for evaluation. The sale bids were all long duration, but had meaningfully different costs, so they were organized into two separate tranches for evaluation. This illustrative example is shown in Figure 4-13.

Figure 4-13: CCGT Tranche Development Example

Bid Name	Bid Type	ICAP (MW)	UCAP (MW)	Online Year	PPA Term (Years)
PPA Bid 1	CCGT	250	250	2023	6
PPA Bid 2	CCGT	625	575	2023	30
PPA Bid 3	CCGT	625	625	2023	30
PPA Bid 4	CCGT	725	700	2023	20
PPA Bid 5	CCGT	600	600	2023	30

PPA

Tranche Name	# Of Resources	ICAP (MW)	UCAP (MW)	Online Year	PPA Term (Years)	Cost Range (\$/kWmo)
PPA CCGT #1	1	250	250	2023	6	
PPA CCGT #2	4	2,575	2,500	2023	27	

Bid Name	Bid Type	ICAP (MW)*	UCAP (MW)*	Online Year
Sale Bid 1	CCGT	625	625	2023
Sale Bid 2	CCGT	625	625	2023
Sale Bid 3	CCGT	1,025	925	2023
Sale Bid 4	CCGT	725	700	2023

Sale

Tranche Name	# Of Resources	ICAP (MW)	UCAP (MW)	Online Year	Price Range** (\$/kW)
Sale CCGT #1	2	1,250	1,250	2023	
Sale CCGT #2	2	1,750	1,750	2023	

*Capacity is rounded to the nearest 25 MW.

**Given the small number of projects within each CCGT tranche, PPA costs and asset sale prices are not being shown to preserve confidentiality. Note that PPAs were structured as tolling arrangements with fixed cost capacity payments (in \$/kW-mo) plus certain variable charges (in \$/MWh).

As another example, the All-Source RFP received 26 solar PPA bids. These bids generally all had similar contract structures, duration commitments, and capacity factors. Therefore, PPA price was the major factor that drove development of the tranches. In this instance, five solar PPA tranches were developed, organizing individual bids into groupings with similar pricing. Figure 4-14 provides an illustrative example of how these bids could be grouped together for evaluation.

Figure 4-14: Solar PPA Tranche Development Example

Bid Name	Bid Type	ICAP (MW)*	UCAP (MW)	Online Year	PPA Term (years)	Price*	Capacity Factor	
Bid 1	Solar	-	-	...	2023	20	\$27.xx	-
Bid 9	Solar	275	138	2023	20	\$32.00	24%	
Bid 10	Solar	100	50	2023	20	\$34.00	24%	
Bid 11	Solar	75	38	2023	20	\$34.00	23%	
Bid 12	Solar	25	13	...	2023	20	\$35.00	24%
Bid 13	Solar	500	250	2023	25	\$35.00	25%	
Bid 26	Solar	-	-	2023	20	\$73.xx	-	

Tranche Name	Tranche Type	# of Resources	ICAP (MW)	UCAP (MW)	Online Year	PPA Term (weighted average years)	Price (weighted average)	Capacity Factor (weighted average)
Indiana Solar #3	Solar	5	975	488	2023	23	\$33.93	24.2%

Ultimately, the tranche development process resulted in the production of 17 PPA tranches and 11 asset sale tranches. These are summarized by resource type, size, term, and costs in Figure 4-15 and Figure 4-16 for PPAs and asset sales, respectively.

Figure 4-15: Summary of PPA Tranches Used in Modeling

Tranche	Resource Type	Nameplate Capacity (MW)	UCAP (MW)	Storage Capacity (MW)	PPA Start	PPA Term (yrs)	Pricing (\$/MWh)	Pricing (\$/kW-mo)	Pricing (\$/MW-d)
1	CCGT	250	250	-	2023	6		8.71	
2	CCGT	2,570	2,487	-	2023	27		8.58	
3	CT	685	678	-	2023	30		5.17	
4	Demand Response	70	70	-	2023	1			115.00
5	Solar	500	250	-	2023	20	28.45		
6	Solar	975	488	-	2023	23	33.93		
7	Solar	1,352	676	-	2023	26	37.62		
8	Solar	308	154	-	2022	21	62.87		
9	Solar + Storage	175	92	5	2023	20	24.80		
10	Solar + Storage	295	200	52	2023	20	28.24		
11	Solar + Storage	1,525	1,158	395	2023	22	34.54	2.27	
12	Solar + Storage	25	23	10	2024	20	61.41		
13	Storage	510	510	510	2023	16	12.58	4.31	
14	Storage	400	400	400	2023	20			323.14
15	Wind	945	128	-	2021	19	25.54		
16	Wind	479	72	-	2022	22	38.11		
17	Wind + Solar + Storage	300	95	30	2021	20	28.68		

Figure 4-16: Summary of Asset Sale Tranches Used in Modeling

Tranche	Resource Type	Nameplate	UCAP	Transfer Date	Pricing (\$/kW)
1	CCGT	1,255	1,242	2023	962
2	CCGT	1,750	1,633	2023	1,084
3	CT	685	678	2023	615
4	Solar	265	133	2023	951
5	Solar	639	320	2023	1,125
6	Solar	400	200	2023	1,287
7	Solar + Storage	265	183	2023	1,067
8	Solar + Storage	440	330	2023	1,253
9	Storage	100	100	2023	932
10	Wind	1,099	165	2020	1,486
11	Wind + Solar + Storage	300	95	2021	1,406

4.10.2 Renewable Resource Tax Incentives and Tax Equity Partnership

Federal tax incentives are currently in place for renewable and paired renewable/storage resources. Resources are eligible for a production tax credit (“PTC”) or an investment tax credit

(“ITC”). The PTC provides a credit of \$24/megawatt hour (“MWh”)⁴ for all generation produced by the facility, and the ITC provides a credit as a portion of the total cost of the facility. It is generally advantageous for wind resources to take the PTC, due to their high capacity factors, and solar resources to take the ITC.

The tax incentives are currently in the midst of a phase-out, as summarized in Figure 4-17. In order to qualify for the credits, projects need to begin construction by a certain date and be put into service by a certain date. The start of construction deadline can be met as long as certain equipment purchases and development costs have been “safe harbored” by federal tax authorities. The safe harbor for beginning of construction is investment of at least 5% of the total project cost on or before the specified date.

Figure 4-17: PTC (Wind) and ITC (Solar) Phase-Out Schedule

Wind		
Year During Which Equipment is Safe Harbored	Last Year Project Can Be Placed in Service to Qualify for Continuity Safe Harbor	Credit Percentage
2016	2020	100
2017	2021	80
2018	2022	60
2019	2023	40
2020	n/a	

Solar		
Year During Which Equipment is Safe Harbored	Last Year Project Can Be Placed in Service to Maximize ITC	ITC Rate
2016	2020	30
2017	2021	30
2018	2022	30
2019	2023	30
2020	2023	26
2021	2023	22
2022	n/a	n/a

Given the importance of these tax incentives, NIPSCO preformed a review of their impact on All-Source RFP bids prior to developing final costs for the portfolio modeling. The impact of the tax incentives needed to be treated differently for the different types of All-Source RFP bids:

- For PPAs, no adjustments were needed, since tax incentives flow to the developer and are theoretically reflected in PPA pricing; and

⁴ This value is indexed to inflation.

- For asset ownership, tax benefits flow to the utility and ultimately to the customer in rates, so adjustments needed to be made.

Without proper structuring, the Internal Revenue Code normalization rules stretch the flow of tax benefits to the customers over the regulatory life of the asset, but an alternative tax equity ownership structure can adjust the flow of benefits. In this arrangement, NIPSCO and a tax equity investor would form a partnership to develop a renewable energy project. The tax equity investor would invest to obtain a specified internal rate of return through the receipt of tax benefits in the form of depreciation, tax credits, and cash for a specified timeframe. NIPSCO would place its portion of the investment, which would be a fraction of the total cost, in rate base.

In order to properly account for the rate base reduction impact of partnering with a tax equity investor, CRA worked with NIPSCO’s tax team to develop relevant financial models to estimate the breakdown of capital expenditures. For solar and solar-storage paired projects, the tax equity contribution is estimated to be around 35% of total capital costs, meaning NIPSCO would cover the remaining 65%. For wind assets, the range of tax equity contributions would be between 33 and 60%, depending on the asset’s online date and expected capacity factor. Wind assets are assumed to utilize the PTC, while solar assets are assumed to take advantage of the ITC. The expected range of tax equity partner contributions for renewable resources is summarized in Figure 4-18.

Figure 4-18: Capital Cost Adjustments due to Tax Equity Partnership

Resource Type	Tax Equity Capital Cost Contribution
Solar	35%
Wind	33-60%
Solar + Storage	35%
Wind + Solar + Storage	35%

4.10.3 Self-build

As part of the process of evaluating its resource alternatives, NIPSCO investigated the feasibility of building a CCGT facility to meet its resource needs. The study considered an 800MW combine cycle F class 2x1 configuration and a 635MW advance class 1x1 consideration to be located on land at Schahfer.

For the study, NIPSCO developed conceptual site plans, conducted geotechnical studies, established the design criteria, developed single line studies and cost estimates for the two technologies. The study also considered the electric, natural gas and water interconnection requirements.

From the feasibility study results, NIPSCO determined that a self-build option was a more expensive alternative as compared to the All-Source RFP bid results for similar technology. Consequently, NIPSCO believes that a self-build CCGT is not the best resource alternative to meet customers need at this time.

4.10.4 CCGT Breakeven Analysis

NIPSCO's replacement analysis, as discussed in Section 9.2, found that replacement portfolios with renewable resources from the all source RFP are more cost effective than portfolios without. Furthermore, portfolios with CCGT are higher cost and carry increased risk due to exposure to natural gas prices and dispatch cost volatility. Selection of resource portfolios with new-build CCGT would require criteria other than economics and cost risk to justify.

NIPSCO explored the conditions that could support the inclusion of an additional CCGT into its supply portfolio. A CCGT could be part of a transmission/reliability solution to support renewables but analysis using new-build CCGT costs concludes that other reliability solutions are more cost effective. NIPSCO performed an analysis to identify the purchase price at which CCGT would be economically competitive with renewable resources. NIPSCO's analysis shows that, to be economically competitive with its preferred resource portfolio, CCGT costs would need to be approximately \$284/kW or lower in the Base Scenario. This breakeven price does not appear to be likely for new-builds, but may be a possibility for re-sale of existing CCGT. A breakeven price was not achievable in the Aggressive Environmental Regulation Scenario, was \$589/kW or lower in the Challenged Economy Scenario, \$637/kW or lower in the Booming Economy / Abundant Natural Gas Scenario. Additional details are in Confidential Appendix D.

4.10.5 Coal to Gas Conversion

NIPSCO evaluated the potential to convert one or two units at Schahfer from coal-fired units to natural gas-fired units. As part of this analysis, NIPSCO developed operational assumptions for the potentially converted units as well as cost estimates associated with the conversion. In evaluating the operational parameters for a converted unit, NIPSCO relied on the Sargent & Lundy ("S&L") study conducted as part of the 2016 IRP process. The study concluded that a conversion would result in a 15% capacity de-rate for either Schahfer 17 or 18 when fired by gas instead of coal, as well as a slight efficiency penalty for the plant's heat rate. The key operational parameters for the conversion option are shown on a per-unit basis in Figure 4-19.

Figure 4-19: Coal-to-Gas Conversion Operational Parameters

	Category	NIPSCO Assumption
Operating Parameters	Conversion Capacity(MW) per unit	309.2
	Heat Rate (Btu/kWh)	11,106
	Forced Outage Rate	10%

Separately, NIPSCO developed capital and ongoing maintenance cost assumptions associated with a potential conversion. These costs were developed from the S&L study from 2016, as well as NIPSCO's internal experts in generation, plant operations, and major projects. The key assumptions included:

- The capital cost for conversion, which includes materials, construction labor, contingency, and owners and indirect costs were estimated by S&L .

- Gas interconnection costs were reviewed by S&L and NIPSCO’s operational teams. Based on the data from the S&L study and a preliminary review with NIPSCO Gas Systems Engineering, it would be possible to convert Unit 17 or Unit 18 to natural gas without installing an additional pipeline as long as both Units 14 and 15 are retired. Leaving Units 14 and 15 in operation would likely create operational limitations related to when the units would be available to start up. Conversion of Units 17 and 18 to run simultaneously would require an additional pipeline. The size of the additional line could be smaller than the 30” used in the engineering study, but further detailed engineering analysis would be required to determine the appropriate size. Therefore, to be conservative and to evaluate whether conversion would be economic in the event that gas interconnection costs were minimal, NIPSCO assumed zero cost in its analysis.
- Environmental compliance costs were assumed to be zero.
- Maintenance capital needs were assumed to be 25% lower than current coal operations. This assumption was based on a review of NIPSCO’s last three years of capital expenditures for Schahfer Units 17/18 that showed 25% of maintenance capital expenditures were for coal-specific components.
- Fixed O&M costs were estimated by S&L in the engineering study.

A summary of the assumptions for each of these cost categories is shown in Figure 4-20.

Figure 4-20: Coal-to-Gas Conversion Capital and Maintenance Cost Estimates

	Category	Estimated Cost
Conversion Investment Costs	Conversion (2015\$)	\$43M for 17 \$87M for 17/18
	Gas Interconnection	\$0M
	Environmental Compliance	\$0M
Maintenance Capital	Maintenance Capital (Total 2024-2038) Nominal \$	\$122M for U17 \$298M for 17/18
Ongoing Costs	Fixed O&M Costs (2015\$/KW-yr)	\$39

Ultimately, the analysis showed that converting one unit would cost at least \$230 million more than retirement and replacement with economically optimized selections from the All-Source RFP results and replacing both units would cost customers at least \$540 million more. Based on this, it is not economically feasible to complete the conversion of either unit. This is discussed more in depth in Section 9.1.7.

Section 5. Demand-Side Resources

5.1 Existing Resources

5.1.1 Existing Energy Efficiency Resources

NIPSCO actively promotes energy conservation and efficiency to customers and works with its third party vendors to offer cost-effective energy efficiency programs. To support the continuance of its program offerings for the period 2019 through 2021, NIPSCO worked with its Oversight Board (“OSB”) to develop two DSM RFPs – one for residential programs and one for commercial and industrial (“C&I”) programs. Upon review of the bids and materials presented by the invited bidders, NIPSCO recommended, and its OSB approved, the selection of Lockheed Martin as the vendor to continue implementing both its residential and C&I programs. The OSB also issued a DSMRFP for an evaluation, measurement and verification (“EM&V”) vendor and selected ILLUME Advising, LLC to provide an evaluation of both the residential and C&I vendors for all three program years. On November 22, 2017, NIPSCO filed its request with the IURC for approval of the following energy efficiency programs to become effective for the period January 1, 2019 through December 31, 2021 (the “2019-2021 Plan”):⁵

2019-2021 Residential Programs

Residential Heating, Ventilation and Air Conditioning (“HVAC”) Energy Efficient Rebates Program

The HVAC Energy Efficient Rebates Program is designed to provide incentives to residential customers to replace inefficient HVAC equipment with energy-efficient alternatives. These measures will be paid per-unit installed, reimbursing customers for a portion of their cost. The program’s intent is to help remove the financial barrier associated with the initial cost of these energy-efficient alternatives. The program will promote premium efficiency air conditioners, heat pumps that have high-efficiency, electronically commutated motors, and smart Wi-Fi thermostats.

Residential Lighting Program

The Residential Lighting Program is designed to increase the purchase and use of energy-efficient lighting products among NIPSCO’s residential electric customers. The program will provide instant discounts on lighting products that meet the energy efficiency standards set by the United States Department of Energy’s ENERGY STAR® Program. ENERGY STAR specifications are an important external factor to certify the quality and efficiency of program measures. As the ENERGY STAR specifications change, the program offerings will be adjusted accordingly. These adjustments ensure that the program offers incentives for lighting products that meet the latest standards and highest quality of efficiency.

⁵ The 2019-2021 Plan reflected herein reflects the parties’ agreements set forth in the Stipulation and Settlement Agreement reached among NIPSCO, the Indiana Office of Utility Consumer Counselor, and Citizens Action Coalition of Indiana, Inc. (the “Settling Parties”), was approved in Cause No. 45011 on September 12, 2018.

Residential Home Energy Assessment Program

The Home Energy Assessment Program is designed to help eligible customers improve the efficiency and comfort of their homes, as well as deliver an immediate reduction in electricity (kWh) consumption and promote additional efficiency work. This program will provide homeowners with the direct installation of low-cost, energy-efficient measures followed by the delivery of a Comprehensive Home Assessment report.

Residential Appliance Recycling Program

The Appliance Recycling Program is designed to provide an incentive to residential customers who choose to recycle a qualifying primary or secondary working refrigerator and/or freezer. Lockheed Martin will utilize a qualified subcontractor for the implementation of this program.

School Education Program

The School Education Program is designed to produce cost-effective electric savings by influencing fifth grade students and their families to focus on the efficient use of electricity. It will provide classroom instruction, posters, and activities aligned with national and state learning standards and energy education kits filled with energy-saving products and advice. Students will participate in an energy education presentation at school, learning about basic energy concepts through class lessons and activities. Students will also receive an energy education kit of quality, high-efficiency products and are instructed to install the energy-efficient products at home with their families as well as complete a worksheet. The experience at home will complete the learning cycle started at school.

Residential Multifamily Direct Install (“MFDI”) Program

The MFDI Program is designed to provide a “one-stop shop” to multifamily building owners, managers, and tenants of multifamily units containing three or more residences. With flexible and affordable options, the program will generate immediate energy savings and improvements in two distinct program phases. Phase I is a walkthrough assessment of each property, which is conducted to determine eligibility for direct installation services provided by the MFDI Program, along with complementary incentive offers available through other NIPSCO programs. Property managers will be presented with an Energy Improvement Plan that prioritizes recommendations along with a proposal to provide the direct installation services outlined in Phase II. Phase II is an in-unit direct installation of energy-efficient devices at no-cost or low-cost to the tenant or landlord, such as light emitting diode (“LED”) light bulbs, low-flow showerheads, faucet aerators, pipe wrap, and Wi-Fi or smart thermostats. Educational materials about home operation, maintenance, and behavior factors that may reduce energy consumption, will be provided to tenants in each living unit.

Residential Home Energy Report Program

The Home Energy Report Program is designed to encourage energy savings through behavioral modification. The program will provide customers with home energy reports that contain personalized information about their energy use and provide ongoing recommendations to

make their homes more efficient. Customers will be randomly chosen to participate in the program and may opt-out if they do not wish to participate. The reports engage customers and drive them to take action to bring their energy usage in line with similar homes. The program will empower customers to understand their energy usage better and uses competition through neighbor comparisons to influence customers to act on this knowledge, resulting in changed behavior.

Residential New Construction Program

The Residential New Construction Program is designed to increase awareness and understanding by home builders of the benefits of energy-efficient building practices, with a focus on capturing energy efficiency opportunities during the design and construction of single family homes. This program is designed to produce long-term, cost-effective savings as a result of the training they have received to achieve the various Home Energy Rating System tiers, along with strategies for incorporating the Silver, Gold, and Platinum designations into their marketing efforts to attract home buyers.

Residential HomeLife Energy Efficiency EE Calculator Program

The HomeLife Energy Efficiency Calculator Program is designed to offer NIPSCO's residential customers an online "do-it-yourself" audit and an energy savings kit for carrying out this audit, at no cost to the customer. The goal of the audit tool is to effectively: (1) identify low-cost/no-cost measures that a NIPSCO residential customer can easily implement to manage electric consumption; (2) allow eligible customers to request a free home energy kit; (3) educate customers about the variety of programs available to them through the residential energy efficiency portfolio; and (4) assist customers in finding qualified and experienced contractors through a network of trade allies.

Employee Education Program

The Employee Education Program is designed to offer valuable information to employees of NIPSCO's C&I customers by providing residential energy efficiency training seminars at the place of employment. At these seminars, educational materials will be provided to inform residential customers of energy savings opportunities and methods to proactively manage their energy consumption. These materials will also direct NIPSCO's customers to navigate to a web portal to request a free energy efficiency kit by entering their account information to confirm eligibility.

Residential Income Qualified Weatherization ("IQW") Program

The IQW Program is designed to provide energy efficiency services to qualifying low-income households. In order for a household to be eligible to participate in the IQW Program, the customer will need to be a NIPSCO residential customer with active service and must not have received weatherization services in the past 10 years from the date of application. If the household meets this initial criteria, they will automatically qualify for services regardless of income if the household receives Low-Income Home Energy Assistance (LIHEAP), Temporary Assistance for Needy Families (TANF), Supplemental Security Income (SSI) or Supplemental Security Disability Income (SSDI). Qualifying participants will receive the direct installation of no-cost

energy efficiency measures and a Comprehensive Home Assessment to identify areas of the home where additional energy savings can be achieved to make the home more comfortable and reduce energy costs.

Table 5-1 shows the projected energy savings (MWh) by year for each of the Residential programs.

Table 5-1: 2019-2021 Projected Residential Energy Savings (MWh)

Residential Programs	2019	2020	2021	Total
HVAC	2,396	2,393	2,389	7,178
Lighting	26,172	26,172	26,172	78,516
Home Energy Assessment	2,145	2,143	2,140	6,428
Appliance Recycling	1,647	1,645	1,643	4,935
School Education	2,580	2,577	2,574	7,731
MFDI	1,127	1,126	1,125	3,378
Home Energy Report	9,786	9,774	9,763	29,323
New Construction	854	854	854	2,562
HomeLife Energy Efficiency Calculator	2,064	2,062	2,059	6,185
Employee Education	1,006	1,005	1,004	3,015
IQW	1,197	1,196	1,195	3,588
Total Residential Programs	50,974	50,947	50,918	152,839

Table 5-2 shows the annual total program budget for each of the Residential programs. Program budget includes implementation costs, NIPSCO administration costs, NIPSCO marketing costs, and EM&V costs.⁶

⁶ In the Settlement, the Settling Parties agree that NIPSCO (with Oversight Board (“OSB”) approval) should be authorized to increase any individual program funding by up to 10% of the total program budget, even if this exceeds the overall 2019-2021 DSM Plan budget approved by the Commission.

Table 5-2: 2019-2021 Residential Program Budget

Residential Programs	2019	2020	2021	Total
HVAC	\$531,302	\$530,558	\$529,843	\$1,591,703
Lighting	\$4,919,279	\$4,919,279	\$4,919,279	\$14,757,837
Home Energy Assessment	\$852,009	\$851,003	\$850,040	\$2,553,052
Appliance Recycling	\$431,926	\$431,417	\$430,928	\$1,294,271
School Education	\$638,243	\$637,491	\$636,741	\$1,912,475
MFDI	\$374,314	\$377,243	\$376,817	\$1,128,374
Home Energy Report	\$566,969	\$566,298	\$565,630	\$1,698,897
New Construction	\$312,095	\$312,095	\$312,095	\$936,285
HomeLife Energy Efficiency Calculator	\$487,374	\$486,798	\$486,225	\$1,460,397
Employee Education	\$279,497	\$279,167	\$278,838	\$837,502
IQW	\$424,502	\$424,003	\$423,520	\$1,272,025
Total Residential Programs	\$9,817,510	\$9,815,352	\$9,809,956	\$29,442,818

2019-2021 C&I Programs

C&I Prescriptive Program

The Prescriptive Program is designed to provide incentives for a set list of energy efficient measures and will be paid based on per unit installed, reimbursing the customer for a portion of the cost. The Prescriptive Program will offer incentives to NIPSCO's C&I customers that are making electric energy efficiency improvements in existing buildings.

C&I Custom Program

The Custom Program will be available to C&I customers for installing new energy-saving equipment. Custom incentives are designed for more complicated projects, or those that incorporate alternative technologies. Project pre-approval will be required for all Custom incentives to ensure that only cost-effective projects are approved. Qualifying measures will be required to have a Total Resource Cost ("TRC") test score greater than 1.0, have a simple payback greater than 12 months and not be included as an energy efficiency measure in the Prescriptive Program.

C&I New Construction Program

The C&I New Construction Program is designed to encourage construction of energy efficient C&I facilities within the NIPSCO service territory. This program will offer financial incentives to encourage building owners, designers and architects to exceed standard building practices and achieve efficiency, above and beyond the 2010 Indiana Energy Conservation Code. The goal of the New Construction Program is to produce newly constructed and expanded

buildings that are efficient from the start. New construction projects that may be eligible for incentives under the New Construction Program may include any of the following: (1) new building projects wherein no structure or site footprint presently exists; (2) addition to or expansion of an existing building or site footprint; and (3) a gut rehabilitation for a change of purpose requiring replacement of all electrical and mechanical systems/equipment.

Small Business Direct Install (“SBDI”) Program

The SBDI Program is designed to facilitate participation in the NIPSCO business energy efficiency program of small C&I customers that do not possess the in-house expertise or capital budget to develop and implement an energy efficiency plan. The SBDI Program will offer a variety of ways for small businesses, with billing demands not exceeding 200 kW, to improve the efficiency of their existing facilities. Measures will be paid out on a per unit basis, much the same way as the Prescriptive Program, but with slightly higher incentive rates in an effort to encourage energy efficient investment from these smaller business customers. Incentive payments to the approved trade allies will occur following measure implementation and submission of all required paperwork. If additional incentives are available through other programs, customers will be directed to the appropriate application.

Retro-Commissioning (“RCx”) Program

The RCx Program is designed to help NIPSCO C&I customers determine the energy performance of their facilities and identify energy-saving opportunities by optimizing their existing systems. Projects in the program will examine energy consuming systems for cost-effective savings opportunities. The RCx process will identify operational inefficiencies that can be removed or reduced to yield energy savings. Qualifying measures will be required to have a TRC test score greater than 1.0, have a simple payback of less than 12 months and not be included as an energy efficiency measure in the Prescriptive Program.

Table 5-3 shows the projected energy savings (MWh) by year for each of the C&I programs.

Table 5-3: 2019-2021 Projected C&I Energy Savings (MWh)

C&I Programs	2019	2020	2021	Total
Prescriptive	20,880	23,200	25,520	69,600
Custom	30,240	33,600	36,960	100,800
New Construction	9,360	10,400	11,440	31,200
SBDI	7,920	8,800	9,680	26,400
RCx	3,600	4,000	4,400	12,000
Total C&I Programs	72,000	80,000	88,000	240,000

Table 5-4 shows the total annual program budget for each of the C&I programs. Program budget includes implementation costs, NIPSCO administration costs, NIPSCO marketing costs, and EM&V costs.⁷

Table 5-4: 2019-2021 C&I Program Budget

C&I Programs	2019	2020	2021	Total
Prescriptive	\$2,454,485	\$2,727,206	\$2,999,926	\$8,181,617
Custom	\$3,814,322	\$4,238,137	\$4,661,950	\$12,714,409
New Construction	\$1,155,142	\$1,283,490	\$1,411,838	\$3,850,470
SBDI	\$1,138,860	\$1,265,400	\$1,391,940	\$3,796,200
RCx	\$484,380	\$538,200	\$592,020	\$1,614,600
Total C&I Programs	\$9,047,189	\$10,052,433	\$11,057,674	\$30,157,296

Table 5-5 shows the projected energy savings (MWh) by year for all Residential and C&I programs included in the 2019-2021 Plan.

Table 5-5: 2019-2021 Projected Combined Energy Savings (MWh)

	2019	2020	2021	Total
Total Residential Programs	50,974	50,947	50,918	152,839
Total C&I Programs	72,000	80,000	88,000	240,000
Total 2019-2021 Plan	122,974	130,947	138,918	392,839

Table 5-6 shows the annual total program budget for all Residential and C&I programs included in the 2019-2021 Plan.

Table 5-6: 2019-2021 Combined Program Budget

	2019	2020	2021	Total
Total Residential Programs	\$9,817,510	\$9,815,352	\$9,809,956	\$29,442,818
Total C&I Programs	\$9,047,189	\$10,052,433	\$11,057,674	\$30,157,296
Total 2019-2021 Plan Budget	\$18,864,699	\$19,867,785	\$20,867,630	\$59,600,114

Table 5-7 shows the eligible customer classes and rate schedules for each of the Residential and C&I programs included in the 2019-2021 Plan.

⁷ In the Settlement, the Settling Parties agree that NIPSCO (with Oversight Board (“OSB”) approval) should be authorized to increase any individual program funding by up to 10% of the total program budget, even if this exceeds the overall 2019-2021 DSM Plan budget approved by the Commission.

Table 5-7: Customers

Program	Customer Class	Electric Rate Schedule
Residential HVAC Rebates	Residential	711
Residential Lighting	Residential	711
Residential Home Energy Assessment	Residential	711
Residential Appliance Recycling	Residential	711
School Education	Residential	711
Residential MFDI	Residential	711
Residential Home Energy Report	Residential	711
Residential New Construction	Residential	711
Residential HomeLife Energy Efficiency Calculator	Residential	711
Employee Education	Residential	711
IQW	Residential	711
C&I Prescriptive	C&I	720, 721, 722, 723, 724, 725, 726, 732, 733, 734, 741, or 744
C&I Custom	C&I	720, 721, 722, 723, 724, 725, 726, 732, 733, 734, 741, or 744
C&I New Construction	C&I	720, 721, 722, 723, 724, 725, 726, 732, 733, 734, 741, or 744
SBDI	C&I	720, 721, 722, or 723 who have not had a billing demand of 200 kW or greater in any month during the previous 12 months
RCx	C&I	720, 721, 722, 723, 724, 725, 726, 732, 733, 734, 741, or 744

5.1.2 Existing Demand Response Resources

5.1.2.1 Capacity Resources

The Commission approved Rider 775 – Interruptible Industrial Service Rider in its Rate Case Order in Cause No. 44688, issued July 18, 2016 (“Rate Case Order”). Rider 775 is available

to customers taking service under Rates 732, 733 or 734. Rider 775 balances the needs of all customer groups by securing the ability and willingness of participating customers to curtail or interrupt service upon demand. NIPSCO's participating industrial customers provide a benefit to all customers, and are accordingly compensated through demand credits that are funded by all other customers. The interruptible credits are provided for two reasons, reliability and economic, each of which provides short- and long-term value to all customers.

The Interruptible Contract Demand is the demand that the customer intends to make available for interruptions and/or curtailments from one or more of customers' premises taking service under Rates 732, 733 or 734. Customers electing service under Rider 775 specify a Firm Contract Demand for each affected premise or facility that the Customer intends to exclude from interruptions or curtailments. Customers who contract for this service are required to interrupt or curtail at the stated notice by NIPSCO and the provisions of service under the Rider. Customers are also required to meet the applicable Load Modifying Resource ("LMR") requirements pursuant to MISO Tariff Module E, or any successor. NIPSCO will register all subscribed 527.776 MW of Rider 775 capacity with MISO. The LMR value is grossed-up by the Planning Reserve Margin and the Transmission Losses, since such resources have neither transmission losses, nor forced outages. As such, the 527.776 MW of LMR becomes 586.984 MW of Capacity Resources that NIPSCO can utilize to meet its MISO resource adequacy requirements.

In addition to NIPSCO's Rider 775 – Interruptible Industrial Service Rider, Rate 734 – Industrial Power Service for Air Separation & Hydrogen Production Market Customers, makes available interruptions and/or curtailments of electric demands greater than 276 MW to customers taking service under this Rate. Provisions for interruptions and/or curtailments are similar to that of Rider 775 and thus qualify as a LMR. As such, NIPSCO has registered 31.000 MW of LMRs under Rate 734. The Capacity Resource realized from the registration is 34.477 MW that NIPSCO can utilize to meet its MISO resource adequacy requirements.

On October 31, 2018, NIPSCO filed an electric rate case that revises its industrial service structure by replacing Rider 775 and Rates 732, 733, and 734 with Rates 830 and 831. The new industrial service structure requires NIPSCO's largest industrial customers on Rate 831 to designate their firm service with the remainder of their service requirements being registered as a MISO LMR which is by definition curtailable. NIPSCO expects an increase in registered LMRs as a result of this new industrial service structure unless those Rate 831 customers utilize other options within the rate to acquire capacity from the MISO annual Planning Resource Auction or through a bilateral agreement between NIPSCO and a third party entered on their behalf. In addition, the large industrial customers will continue to be eligible to participate in MISO's Demand Response Resource program discussed below.

5.1.2.2 Energy-Only Resources

NIPSCO offers Demand Response Resource Type 1 ("DRR1") and Emergency Demand Response Resource ("EDR") through Riders 781 and 782, respectively. These Riders are available to a Customer on Rates 723, 724, 725, 726, 732, 733 and 734 that has a sustainable ability to reduce energy requirements through indirect participation in the MISO wholesale energy market by managing electric usage as dispatched by MISO. Through these Riders, the Customer or Aggregator of Retail Customer (ARC) curtails a portion of its electric load through participation

with the Company acting as the Market Participant (MP) with MISO. These Riders are available to any load that is participating in the Company's other interruptible or curtailment Riders, unless MISO rules change and do not permit load used by the Company as a LMR to also participate as a DRR1 or EDR. Although the DRR1 and EDR offered under Riders 781 and 782, respectively, do not qualify as a Capacity Resource, they do offer a means for Customers to offer into the MISO market and to be paid for the portion of their electric load curtailed. This provides economic benefit to the Customers participating in these Riders and for other NIPSCO Customers through an overall lower electric system demand, which can avoid purchased power or the need for higher cost generation resources to be committed through the MISO market. Currently, NIPSCO has two Customers participating in Rider 781 as DRR1. No Customers are participating in Rider 782 as EDR.

5.2 DSM Electric Savings Update

5.2.1 DSM Electric Savings Update – Purpose and Key Objectives

To update the electric DSM resource potential for the 2018 IRP, NIPSCO contracted with GDS to conduct a DSM Savings Update Report (the "DSM Savings Update") (a copy of which is included in Appendix B, Demand Side Management Savings Update and the 2016 Market Potential Study ("MPS"), and Action Plan.⁸ GDS participated in Public Advisory Meeting 2 and provided details of its engagement with the DSM Savings Update. *See* Appendix A, Exhibit 2 (Presentation), Slides 24 through 43.

The DSM Savings Update provides an update of DSM program costs and savings for a 30-year time horizon (2019-2048). The report captures the insights from NIPSCO's prior MPS that was completed in August 2016 as well as NIPSCO's current and planned program offerings for the period 2019 to 2021 described in NIPSCO's testimony filed in Cause No. 45011. The objectives of NIPSCO's DSM Savings Update included:

- Develop a detailed plan identifying recommended cost-effective DSM savings measures and programs, as well as any possible market barriers for each recommended program. Identify best practices and programs and explain how the recommended practices and programs will achieve the desired results in NIPSCO's service territory.
- Place emphasis on innovative energy efficiency and DR programs and technologies.
- Provide detailed budgets for each program and related expenditures.
- Provide a lifetime cost analysis.

⁸ A new MPS and Action Plan will be completed in 2019.

- Provide a cost-effectiveness⁹ comparison or ranking for all technologies (measures) reviewed.
- Complete cost-effectiveness evaluations for each proposed program.

5.2.2 Impact of Opt-out Customers

GDS reviewed the latest information available from NIPSCO related to energy efficiency program participation, measure and program savings data, results of NIPSCO's 2016 MPS, NIPSCO's electric load and customer forecasts, NIPSCO load research data, electric avoided costs, program evaluation reports and NIPSCO's 2019-2021 Plan. NIPSCO requested that GDS prepare its base case DSM Plan update assuming that C&I electric customers that had opted out of NIPSCO's energy efficiency programs prior to January 1, 2017 would be excluded from the DSM Plan Update. These "opt-out" C&I customers represent over 60 percent of NIPSCO's 2017 non-residential kWh sales. It is important to note that the base case energy efficiency forecast for the DSM Savings Update does not include any energy efficiency savings for these opt-out C&I customers.

5.2.3 Modeling Framework

GDS used its Excel-based energy efficiency and DR planning models to prepare the DSM Savings Update. These models allow the user to develop forecasts of measure and program costs, participants, kWh and kW savings, savings of other fuels, and benefit/cost ratios for planning periods ranging from one to thirty years. These GDS models are transparent and all formulas, model inputs and model outputs can be viewed by the model user. The GDS energy efficiency and DR planning models come with a user guide that explains where to input program data, measure data and assumptions relating to the general rate of inflation, the discount rate for financial analysis, avoided costs, line losses, planning reserve margin and other key input assumptions.

5.3 Energy Efficiency and Demand Response Bundles

For purposes of modeling energy efficiency programs in NIPSCO's 2018 IRP, GDS grouped DSM Plan energy efficiency measures into bundles according to each measure's cost of saved energy over its measure life. For energy efficiency measures, the following three bundle categories were created:

Bundle 1	Measures with a utility incentive cost ranging from \$.00 to \$.01 per lifetime kWh saved
Bundle 2	Measures with a utility incentive cost ranging from \$.011 to \$.05 per lifetime kWh saved

⁹ GDS calculated the TRC Test, the Utility Cost Test ("UCT"), the Participant Test and the Ratepayer Impact Measure Test ("RIM") for each measure. GDS used the UCT test to determine measure, program and portfolio cost effectiveness. All of the results may be found in Appendices E and F.

Bundle 3	Measures with a utility incentive cost over \$.05 per lifetime kWh saved
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For purposes of modeling DR programs in NIPSCO's 2018 IRP, GDS grouped DR programs into three bundles by calculating the levelized cost per cumulative kW over the 30-year lifetime of the program. For DR programs, the following three bundles were created:

Bundle 1	\$40/kW-year to \$60/kW-year: includes C&I Direct Load Control ("DLC") of Air Conditioning ("AC") and DLC of Electric Water Heating Equipment
Bundle 2	\$60/kW to \$80/kW-year: includes Residential DLC of Water Heating Equipment and the C&I Third-Party Aggregator program
Bundle 3	Over \$100/kW-year: includes Residential DLC of AC and Interruptible Rider

Both Residential and C&I DLC of space heating programs were found to be not cost-effective and, therefore, were not included in any DR bundles.

5.4 Energy Efficiency Potential Impacts

5.4.1 Changes That Impacted Energy Efficiency Potential

GDS updated several input assumptions during the process of preparing the DSM Savings Update. The changes made for a few of these input assumptions are discussed below.

5.4.1.1 Updated NIPSCO Load Forecast, Avoided Cost Forecast and General Planning Assumptions

In March 2018, NIPSCO sent GDS the latest electric load forecast for 2018 through 2039. CRA then extended the NIPSCO load forecast through the year 2048. GDS used this new load forecast to calculate the percent of electric MWH sales and peak demand saved each year by DSM programs. NIPSCO's new load forecast projects that total MWH sales to ultimate customers will only increase 0.3% a year on average through the year 2048. NIPSCO also provided GDS with updated planning assumptions for the general inflation rate, escalation rates for NIPSCO electric rates, the utility discount rate, line losses by class of service and the planning reserve margin. GDS used these assumptions to develop the DSM Savings Update.

5.4.1.2 NIPSCO DSM Plan Assumptions for Measure Costs, Savings, Useful Lives

GDS reviewed the assumptions for measure costs, savings and useful lives included in the 2019 to 2021 NIPSCO DSM plan and updated these assumptions where appropriate. GDS revised costs and/or savings assumptions for some energy efficiency measures if more recent data was available from NIPSCO evaluation reports or recently published technical resource/reference manuals from Michigan and Illinois.

The largest change for a measure assumption was to the baseline energy efficiency level for residential light bulbs. The NIPSCO 2019 to 2021 DSM plan assumed that the baseline technology for a residential light bulb was a 60-Watt incandescent bulb.

GDS collected information from industry experts and program implementation contractors, showing uncertainty about when the new Energy Independence and Security Act (“EISA”) backstop provisions for lighting efficiency will take effect. The EISA lighting backstop provisions specify 45 lumens per Watt efficacy starting January 1, 2020. Efficiency Vermont, however, decided for planning purposes that LEDs would be the baseline standard in 2020. Efficiency Vermont assumed a one-year phase-in period for this efficacy standard. Other experts recommend allowing a sell-through period to the year 2022, or 2023 at the latest. Another recommendation GDS received was to shorten the useful life of LEDs. GDS previously used a useful life of 15 years for LEDs.

The new efficacy standard for lighting is scheduled by law to go into effect on January 1, 2020. Energy industry news articles have indicated a potential for the delay or cancelation of these new lighting efficacy standards. As of August 2018, there is uncertainty about whether these efficacy standards will go into effect on January 1, 2020. The EISA standard will not allow bulbs to be sold that do not meet the new efficacy requirements. Therefore, the new EISA standard will decrease the achievable potential for lighting savings because the baseline efficiency for most light bulbs will be significantly increased. Based on this, for planning purposes, NIPSCO assumed that the baseline technology after 2021 for general service bulbs would be a compact fluorescent light (CFL) or equivalent bulb that meets the EISA backstop provision efficacy level of 45 lumens per Watt.

5.4.1.3 Federal Appliance and Equipment Efficiency Standards

The U.S. Department of Energy (“DOE”) develops and implements federal appliance and equipment standards to improve energy efficiency that will save consumers energy and money. This DOE program was initially authorized to develop, revise, and implement minimum energy efficiency standards by the federal Energy Policy and Conservation Act (“EPCA”) in 1975. Several subsequent legislative amendments have required regular updates these standards and has expanded the list of products covered by the standards. The DOE is currently required to periodically review standards and test procedures for more than 60 products, representing about 90% of home energy use, 60% of commercial building energy use, and 30% of industrial energy use.

The standards program's predictable rulemaking schedule is driven by statutory deadlines the DOE must meet to comply with EPCA. These are amended by subsequent energy legislation and reflect the program's obligation to review all standards every six years and test procedures every seven years. The DOE encourages all stakeholders, including consumers, manufacturers, trade associations, utilities, energy efficiency advocates, and the general public, to participate in the rulemaking process. The standards program established the Appliance Standards and Rulemaking Federal Advisory Committee ("ASRAC") to facilitate deeper stakeholder engagement by allowing for negotiated rulemakings under the guidelines set forth in the Federal Advisory Committee Act (FACA). The process culminates in a final rule in which the DOE is required to set efficiency standards that maximize energy savings that are technologically feasible and economically justified.

The DOE considers the impact on consumers, manufacturers, and small C&I businesses when determining whether any new or amended standard is economically justified. The DSM Savings Update takes into account the impacts of federal appliance and equipment efficiency standards for those standards that are currently in place or expected to be implemented by the DOE after 2021, including the EISA backstop provisions for general service, reflector and specialty light bulbs discussed above.

5.5 Energy Efficiency Measures & Potential

5.5.1 Residential Energy Efficiency Measures

For the residential sector, there were 249 unique electric energy efficiency measures included in the energy efficiency potential analysis update. Table 5.8 provides a summary of the types of measures included for each end use in the residential sector. The measures included in this analysis are based on 2019-2021 Plan with several new measures added by GDS or suggested by NIPSCO's stakeholders. These new measures were included in the NIPSCO 2016 MPS that were not already included in the 2019-2021 Plan. GDS obtained the majority of data on residential energy efficiency measure costs, kWh and kW savings and costs from the 2019-2021 Plan. GDS reviewed this data and updated these measure assumptions for years after 2021 where necessary.

Table 5-8: Types of Electric Energy Efficiency Measures included in the Residential Sector Analysis

End Use	Measure Types Included
Electronic Equipment	ENERGY STAR Desktop and Laptop Computers, Monitors, Printer/Fax/Copier/Scanner, and Sound Bars ENERGY STAR Smart Power Strips ENERGY STAR Televisions
Appliances	ENERGY STAR Refrigerators ENERGY STAR Freezers ENERGY STAR Washing Machines ENERGY STAR Clothes Dryers ENERGY STAR Dehumidifier Refrigerator Pick-up and Recycling Freezer Pick-up and Recycling Refrigerator Replacement in Low Income Homes
Envelope	Building Insulation Improvements (Attic, Wall, Floor, Etc.) Air sealing (Weatherization) High Efficiency Windows Cool Roofing
HVAC Equipment	High Efficiency Heating Equipment (e.g., Heat Pump with electronically commutated motor) HVAC Filter Whistle Heating & Cooling Duct Sealing and Repair High Efficiency Natural Gas Furnace High Efficiency Natural Gas Boiler Wi-Fi Smart Thermostat
Lighting	Interior LED Bulbs and Fixtures Exterior LED Bulbs and Fixtures LED Nightlights
Pools	Pool Pump Controls High Efficiency Pool Pumps High Efficiency Pool Pump Heaters
Space Cooling	High Efficiency Central Air Conditioning System Air Source Heat Pump ENERGY STAR Room Air Conditioner
Water Heating	High Efficiency Water Heater Heat Pump Water Heater Faucet Aerators & Low Flow Showerheads Hot Water Pipe and Tank Insulation Solar Water Heating System
Other	Home Energy Reports and Other Types of Behavioral Programs Energy Efficiency Education Kits for Employees of NIPSCO's Customers High Efficiency Well Pump High Efficiency Hot Tub Dryer Vent Cleaning Refrigerator Coil Cleaning

5.5.2 Achievable Electric Energy Efficiency Potential

The achievable electric energy efficiency potential for the residential sector includes savings associated with measures that are:

- Included in the 2019-2021 Plan.
- Added to the plan by GDS (included in NIPSCO's 2016 MPS or that were suggested by NIPSCO's stakeholders).

Table 5-9 shows the cumulative annual achievable residential sector energy efficiency potential for the years 2019 to 2048 and estimates of the annual NIPSCO energy efficiency budgets for residential sector programs.

Table 5-9: Achievable Residential Sector Incremental Annual Energy Efficiency Potential and Annual Utility Budgets (Base Case)

Year	Incremental Annual Energy Savings (MWh)	Incremental Annual Demand Savings (MW)	Annual Utility Cost (\$)
2019	50,974	10	\$9,817,510
2020	50,947	17	\$9,815,352
2021	50,918	24	\$9,809,956
2022	46,240	42	\$20,822,174
2023	46,887	61	\$21,039,511
2024	47,503	79	\$21,266,204
2025	48,178	98	\$21,494,687
2026	48,716	117	\$21,714,354
2027	49,287	137	\$21,941,024
2028	49,744	156	\$22,134,851
2029	50,231	175	\$22,347,479
2030	50,686	195	\$22,551,800
2031	51,166	215	\$22,763,349
2032	51,645	234	\$22,980,009
2033	52,173	254	\$23,222,465
2034	52,411	268	\$23,417,367
2035	52,659	281	\$23,617,690
2036	53,050	294	\$23,829,888
2037	53,050	298	\$23,975,771
2038	53,050	301	\$24,124,717
2039	53,050	304	\$24,276,791
2040	53,050	307	\$24,432,059
2041	53,050	310	\$24,590,588

Year	Incremental Annual Energy Savings (MWh)	Incremental Annual Demand Savings (MW)	Annual Utility Cost (\$)
2042	53,050	311	\$24,752,445
2043	53,050	313	\$24,917,702
2044	53,050	314	\$25,086,429
2045	53,050	315	\$25,258,699
2046	53,050	316	\$25,434,587
2047	53,050	317	\$25,614,169
2048	53,050	318	\$25,797,522

5.5.3 Recommended Residential programs

GDS recommends that NIPSCO retain the residential energy efficiency programs that are included in its 2019-2021 Plan, but consider adding a new program such as whole-house retrofit program for qualifying low-income households if such a program can be designed to be administered in an efficient and effective manner. In addition, GDS recommends that NIPSCO add several new energy efficiency measures to its existing programs, including such measures as solar water heating, heat pump water heating, refrigerator coil cleaning brushes, dryer ductwork and vent cleaning, high efficiency clothes washers and other measures that GDS added that were cost effective.

Table 5-10 below provides the UCT benefit/cost ratios for the period 2019 to 2048 for residential programs¹⁰. All twelve residential energy efficiency programs included in the DSM Savings Update have a UCT ratio greater than or equal to 1.0. The overall UCT benefit/cost ratio for the residential portfolio of energy efficiency programs is 2.1. The NPV savings to NIPSCO's residential customers is \$277.1 million for the thirty-year planning horizon.

¹⁰ NIPSCO utilized the UCT as the test for screening measures for inclusion. This is different from prior years when the TRC was utilized.

Table 5-10: Utility Cost Test Benefit/Cost Ratios for Residential Programs (2019 to 2048 Period)

Residential Sector Program	NPV Benefits	NPV Utility Costs	Net Benefits	BC Ratio
HVAC Energy Efficient Rebates	\$20,240,111	\$7,423,449	\$12,816,661	2.7
Residential Lighting	\$38,182,714	\$13,738,788	\$24,443,926	2.8 ¹¹
Home Energy Assessment	\$7,720,421	\$5,194,212	\$2,526,210	1.5
Appliance Recycling	\$7,481,400	\$4,676,459	\$2,804,941	1.6
School Education	\$20,025,721	\$7,765,296	\$12,260,425	2.6
Multifamily Direct Install	\$11,325,004	\$4,749,094	\$6,575,911	2.4
Home Energy Report	\$15,204,076	\$12,735,292	\$2,468,784	1.2
Residential New Construction	\$18,270,532	\$5,017,439	\$13,253,094	3.6
HomeLife Energy Efficiency Calculator	\$18,414,941	\$6,111,400	\$12,303,541	3.0
Employee Education	\$6,151,825	\$2,864,091	\$3,287,734	2.1
IQW	\$7,149,749	\$4,261,258	\$2,888,490	1.7
New Measures	\$332,828,064	\$174,474,645	\$158,353,418	1.9
Total	\$502,994,559	\$249,011,424	\$253,983,135	2.0

5.5.4 C&I Energy Efficiency Measures

For the C&I sector, there were 340 unique electric energy efficiency measures included in the energy efficiency potential analysis. Table 5-11 provides a summary of the types of measures included for each end use in the C&I sector. The measures included in this analysis are based on the 2019-2021 Plan with some new measures added by GDS. These new measures are based on a review of measures included in the 2016 MPS and discussions with stakeholders. A total of 167 additional measures were considered. Although NIPSCO's current Custom Program may technically be able to accommodate many of these measures, most would typically be considered to be prescriptive measures.

¹¹ The NIPSCO 2017 Portfolio Evaluation Reports lists a UCT ratio of 3.4 for the NIPSCO Residential Lighting Program and 2.9 for the Home Energy Analysis Program for calendar year 2017. It is important to note that the 2017 Portfolio Evaluation Report used a nominal discount rate of 6.53%. The DSM Savings Plan Update used a nominal discount rate of 7.65% to be consistent with the IRP modeling.

Table 5-11: Types of Electric Energy Efficiency Measures included in the C&I Sector Analysis

End Use	Measure Types Included
Office Equipment	High Efficiency Servers, Computers and Office Equipment Plug Load Sensors and Smart Power Strips
Compressed Air	Air System Maintenance Variable Frequency Drive Compressed Air Engineered Nozzle Custom Compressed Air Measures Retro-Commissioning
Cooking	Efficient Cooking Equipment Custom Kitchen
Envelope	Building Insulation Improvements High Efficiency Windows Cool Roofing
HVAC Controls	Programmable and Smart Thermostats Custom Energy Management System Installation/Optimization Occupancy Control System Retro-Commissioning
Lighting	Fixture Retrofits Premium Efficiency T8 and T5 lightbulbs High Bay Lighting Equipment LED Bulbs and Fixtures Light Tube Lighting Occupancy Sensors Custom Interior and Exterior Lighting Retro-Commissioning
Pools	Pool Pump Controls High Efficiency Pool Pump Heaters
Refrigeration	Vending Machine Misers Strip Curtains and Auto Door Closers Efficient Refrigerators/Freezers/Ice Machines High Efficiency/Variable Speed Compressors Electronically Commutated Motors Cooler Motors Door Heater Controls Efficient Compressors and Controls Door Gaskets Floating Head Pressure Controls Display Case Lighting and Controls Custom Refrigeration Retro-Commissioning
Space Cooling	Efficient Cooling Equipment Evaporative Pre-Cooler Economizer Air Source Heat Pump Geothermal Heat Pump Chiller/HVAC Maintenance Chilled Water Reset

End Use	Measure Types Included
	Room AC Custom HVAC/Chillers Retro-Commissioning
Ventilation	Enthalpy Economizer Variable Speed Drive Duct Repair and Sealing Controlled Ventilation Optimization Demand Controlled Ventilation Custom Ventilation
Water Heating	Efficient Equipment High Efficiency Hot Water Appliances Faucet Aerator/Low Flow Nozzles Pipe and Tank Insulation Heat Recovery Systems Efficient Hot Water Pump and Controls Solar Water Heating System Pre-Rinse Spray Valves Desuperheater Custom Water Heating
Other	Efficient Point of Sale Terminal Efficient Transformers Custom Motors and Drives Custom Process Custom Pumps/Fans Retro-Commissioning Process Retro-Commissioning Motors and Drives
Agriculture	Engine Block Heater Timer Energy Efficient/Energy Free Livestock Waterer High Volume Low Speed Fans High Efficiency Exhaust Fans Dairy Refrigeration Tune-up

5.5.5 Achievable Electric Energy Efficiency Savings

The achievable electric energy efficiency savings for the C&I sector includes savings associated with measures that are:

- Included in the 2019-2021 Plan
- New energy efficiency measures added to the plan by GDS that pass the UCT.

Table 5-12 shows the cumulative annual achievable energy efficiency savings for the years 2019 – 2048 and estimates of the annual energy efficiency budgets.

Table 5-12: Achievable C&I Sector Energy Efficiency Potential and Annual Budgets

Year	Cumulative Annual Energy Savings (MWh)	Cumulative Annual Demand Savings (MW)	Annual Cost (\$)
2019	72,000	9.4	\$9,047,188
2020	152,000	19.8	\$10,052,432
2021	240,000	31.3	\$11,057,675
2022	325,796	43.1	\$11,839,493
2023	419,550	55.1	\$12,140,734
2024	510,798	66.9	\$12,444,981
2025	602,907	78.9	\$12,775,475
2026	696,948	91.0	\$13,163,727
2027	786,971	102.8	\$13,478,238
2028	873,445	114.6	\$13,798,511
2029	959,682	126.5	\$14,119,573
2030	1,046,587	138.5	\$14,432,594
2031	1,127,019	149.8	\$14,849,184
2032	1,206,636	161.1	\$15,187,942
2033	1,286,733	172.5	\$15,544,398
2034	1,317,466	176.5	\$15,824,693
2035	1,342,307	179.7	\$16,074,726
2036	1,361,070	182.1	\$16,307,510
2037	1,379,659	184.6	\$16,544,828
2038	1,397,364	187.0	\$16,786,479
2039	1,412,165	189.1	\$16,943,342
2040	1,425,373	190.9	\$17,103,500
2041	1,437,179	192.6	\$17,267,020
2042	1,447,692	194.1	\$17,433,974
2043	1,456,960	195.5	\$17,604,435
2044	1,465,211	196.7	\$17,778,475
2045	1,472,341	197.7	\$17,956,170
2046	1,477,839	198.5	\$18,137,597
2047	1,482,283	199.2	\$18,322,833
2048	1,485,725	199.7	\$18,511,960

Table 5-13 shows the cumulative annual energy efficiency savings as a percent of total C&I sector sales, excluding C&I customers that have opted out of NIPSCO's energy efficiency programs.

Table 5-13: Achievable C&I Sector Energy Efficiency Savings as a Percent of Sales (Base Case)

Year	Cumulative Energy Savings (MWh)	C&I Sector Sales Forecast (Excl. Opt-Out) (MWh)	Cumulative Savings Percent of Sales
2019	72,000	4,652,224	1.5%
2020	152,000	4,697,257	3.2%
2021	240,000	4,739,576	5.1%
2022	325,796	4,778,968	6.8%
2023	419,550	4,819,735	8.7%
2024	510,798	4,856,840	10.5%
2025	602,907	4,895,604	12.3%
2026	696,948	4,933,514	14.1%
2027	786,971	4,966,699	15.8%
2028	873,445	5,000,237	17.5%
2029	959,682	5,025,190	19.1%
2030	1,046,587	5,052,855	20.7%
2031	1,127,019	5,078,996	22.2%
2032	1,206,636	5,099,000	23.7%
2033	1,286,733	5,118,796	25.1%
2034	1,317,466	5,139,223	25.6%
2035	1,342,307	5,161,284	26.0%
2036	1,361,070	5,174,258	26.3%
2037	1,379,659	5,181,773	26.6%
2038	1,397,364	5,190,437	26.9%
2039	1,412,165	5,197,508	27.2%
2040	1,425,373	5,209,258	27.4%
2041	1,437,179	5,221,038	27.5%
2042	1,447,692	5,232,850	27.7%
2043	1,456,960	5,244,693	27.8%
2044	1,465,211	5,256,567	27.9%
2045	1,472,341	5,268,473	27.9%
2046	1,477,839	5,280,410	28.0%
2047	1,482,283	5,292,379	28.0%
2048	1,485,725	5,304,379	28.0%

Table 5-14 shows the NPV of benefits, costs, net benefits and the benefit-cost ratio for each program and for the portfolio as a whole.

Table 5-14: Benefit Cost Analysis Results – UCT

Program	NPV Benefits	NPV Costs	Net Benefits	UCT Ratio
Custom	\$340,264,393	\$60,474,877	\$279,789,516	5.6
New Construction	\$98,374,129	\$18,786,751	\$79,587,378	5.2
Prescriptive	\$396,617,207	\$38,748,919	\$357,868,288	10.2
Retro-Commissioning	\$16,901,754	\$7,739,152	\$9,162,602	2.2
Small Business Direct Install	\$87,942,866	\$16,596,204	\$71,346,663	5.3
New Measures Prescriptive	\$23,743,405	\$5,029,889	\$18,713,516	4.7
New Measures Custom	\$9,439,944	\$1,990,940	\$7,449,004	4.7
New Prescriptive Ag Measures	\$2,859,702	\$523,495	\$2,336,207	5.5
New Measures New Construction	\$15,594,391	\$3,778,988	\$11,815,403	4.1
Total	\$991,737,791	\$153,669,216	\$838,068,576	6.5

5.6 Future Resource Options

5.6.1 Energy Efficiency Bundles¹²

GDS converted the measure incentive costs into an equivalent annual payment spread over the life of the measure and divided the equivalent annual payment by the measure's first-year kWh savings to calculate the incentive cost per lifetime kWh saved for each measure. According to the November 2008 National Action Plan for Energy Efficiency guide titled "Understanding Cost Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods and Emerging Issues for Policy-Makers," program administrative costs are typically not included when calculating cost effectiveness at the measure level. Based on this recommendation, program administrative costs were not included in this cost calculation. Tables 5-15 and 5-16 show the cumulative annual MWh savings, MW savings and annual utility budgets for these three bundles for the energy efficiency base case scenario for residential and C&I customers, respectively. Table 5-17 summarizes the total. The cumulative MWh and budget costs are additive for residential and C&I to arrive at the total, but the peaks are not, due to the fact that different programs are not coincident. The total bundles were used in the IRP modeling.

¹² Please note, the MWh, MW and budgets utilized in the IRP were from an earlier draft of the Energy Efficiency Savings Update and may differ slightly from the numbers in the final report included in Appendix B. This was due to the timing of the final report compared to when numbers were required for the model runs. However, the differences are not significant. The tables in this section reflect the numbers utilized by CRA in the IRP modeling efforts.

Table 5-15: Residential Energy Efficiency Base Case Bundles

Year	Bundle 1			Bundle 2			Bundle 3		
	Cumulative		Budget	Cumulative		Budget	Cumulative		Budget
	MWh	MW		MWh	MW		MWh	MW	
2019	23,198	9.8	\$3,120,947	27,435	6.6	\$6,363,684	341	0.2	\$332,842
2020	36,732	12.0	\$3,118,788	55,160	13.1	\$6,363,871	599	0.3	\$332,467
2021	50,064	14.5	\$3,115,234	82,515	19.5	\$6,362,402	856	0.5	\$332,085
2022	70,676	18.9	\$4,169,756	86,004	20.4	\$1,216,278	13,208	3.5	\$15,436,140
2023	91,166	23.8	\$4,300,842	89,310	22.2	\$1,256,494	24,414	6.8	\$15,482,175
2024	112,679	28.3	\$4,429,560	93,419	23.3	\$1,306,866	35,635	9.7	\$15,529,778
2025	133,822	32.8	\$4,569,988	96,910	24.5	\$1,350,188	46,866	12.6	\$15,574,511
2026	155,209	37.4	\$4,699,753	100,720	25.8	\$1,393,143	58,108	15.5	\$15,621,458
2027	176,419	41.8	\$4,836,631	104,348	26.8	\$1,433,990	69,363	18.1	\$15,670,403
2028	199,234	46.6	\$4,970,286	108,790	28.1	\$1,446,694	80,604	21.0	\$15,717,871
2029	217,904	50.9	\$5,106,871	112,422	29.6	\$1,474,239	91,853	24.2	\$15,766,369
2030	237,319	55.2	\$5,247,332	116,343	31.1	\$1,486,926	103,112	27.4	\$15,817,541
2031	254,732	59.2	\$5,394,368	119,996	32.5	\$1,497,348	114,383	30.5	\$15,871,633
2032	274,152	63.3	\$5,544,922	124,489	34.0	\$1,509,677	125,665	33.7	\$15,925,409
2033	290,429	67.5	\$5,698,959	127,935	35.4	\$1,545,193	136,952	36.9	\$15,978,312
2034	300,194	69.8	\$5,823,060	104,480	30.4	\$1,561,017	148,249	40.3	\$16,033,291
2035	309,001	71.9	\$5,952,395	80,860	25.9	\$1,574,207	152,798	42.1	\$16,091,088
2036	320,400	74.4	\$6,099,762	57,323	22.7	\$1,584,608	157,352	44.0	\$16,145,518
2037	323,194	75.3	\$6,198,431	58,462	23.3	\$1,596,027	159,923	44.8	\$16,181,313
2038	326,486	76.2	\$6,299,172	59,653	23.9	\$1,607,685	162,493	45.6	\$16,217,860
2039	328,471	76.6	\$6,402,029	60,152	24.1	\$1,619,588	164,753	46.0	\$16,255,174
2040	332,568	75.3	\$6,507,046	60,938	18.7	\$1,631,741	166,995	42.1	\$16,293,272
2041	333,792	75.9	\$6,614,269	61,276	19.1	\$1,644,149	169,223	43.0	\$16,332,170
2042	335,604	76.4	\$6,723,743	61,617	19.6	\$1,656,818	169,385	43.5	\$16,371,885
2043	336,350	76.8	\$6,835,516	61,761	20.1	\$1,669,753	169,537	44.2	\$16,412,433
2044	338,661	77.1	\$6,949,636	62,046	20.2	\$1,682,960	169,620	44.2	\$16,453,834
2045	338,978	77.4	\$7,066,152	62,014	20.2	\$1,696,443	169,698	44.2	\$16,496,103
2046	340,018	77.6	\$7,185,116	62,077	20.2	\$1,710,210	169,770	44.3	\$16,539,261
2047	340,876	77.8	\$7,306,578	62,112	20.3	\$1,724,267	169,832	44.3	\$16,583,324
2048	342,462	78.0	\$7,430,590	62,240	20.3	\$1,738,618	169,882	44.3	\$16,628,313

Table 5-16: C&I Energy Efficiency Base Case Bundles

Year	Bundle 1			Bundle 2			Bundle 3		
	MWh	MW	Budget	MWh	MW	Budget	MWh	MW	Budget
2019	57,477	13.7	\$7,093,091	14,523	2.9	\$1,954,097	0	0.0	\$0
2020	121,341	28.9	\$7,881,212	30,797	6.1	\$2,171,219	0	0.0	\$0
2021	191,591	45.6	\$8,669,334	48,518	9.7	\$2,388,341	0	0.0	\$0
2022	258,294	62.0	\$9,025,573	67,461	13.5	\$2,703,163	193	0.0	\$110,756
2023	332,676	78.7	\$9,252,548	86,486	17.4	\$2,770,426	387	0.1	\$117,760
2024	408,406	95.7	\$9,484,921	102,260	20.4	\$2,835,287	592	0.1	\$124,773
2025	485,669	113.0	\$9,752,695	116,719	23.3	\$2,890,234	784	0.2	\$132,546
2026	564,928	130.5	\$10,033,029	131,295	26.1	\$2,979,807	1,025	0.2	\$150,891
2027	645,287	148.4	\$10,273,287	140,436	28.0	\$3,046,937	1,249	0.3	\$158,013
2028	722,917	166.1	\$10,524,231	149,709	29.8	\$3,107,737	1,497	0.3	\$166,543
2029	801,264	184.1	\$10,777,543	157,031	31.3	\$3,168,288	1,744	0.4	\$173,742
2030	880,358	202.4	\$11,027,368	164,628	32.9	\$3,224,944	1,975	0.4	\$180,283
2031	953,821	219.3	\$11,348,675	170,945	34.2	\$3,311,363	2,254	0.5	\$189,145
2032	1,026,654	236.3	\$11,619,566	178,316	35.6	\$3,372,494	2,470	0.5	\$195,882
2033	1,099,943	253.4	\$11,900,715	184,506	37.0	\$3,440,787	2,701	0.6	\$202,895
2034	1,126,736	258.8	\$12,151,635	188,173	37.8	\$3,482,137	2,981	0.6	\$190,921
2035	1,148,291	262.9	\$12,362,496	190,812	38.4	\$3,520,890	3,203	0.7	\$191,340
2036	1,164,268	265.7	\$12,559,119	194,251	39.0	\$3,556,600	3,421	0.7	\$191,791
2037	1,180,955	269.5	\$12,759,892	195,605	39.4	\$3,592,662	3,539	0.8	\$192,274
2038	1,196,990	273.1	\$12,964,294	197,155	39.7	\$3,629,416	3,663	0.8	\$192,769
2039	1,210,329	276.2	\$13,090,516	198,060	39.9	\$3,659,638	3,777	0.8	\$193,188
2040	1,222,254	279.1	\$13,219,389	200,104	40.2	\$3,690,495	3,912	0.8	\$193,616
2041	1,232,984	281.7	\$13,350,967	200,623	40.4	\$3,722,000	4,022	0.8	\$194,052
2042	1,242,596	284.0	\$13,485,309	201,428	40.6	\$3,754,167	4,119	0.9	\$194,498
2043	1,251,057	286.0	\$13,622,472	201,699	40.7	\$3,787,009	4,205	0.9	\$194,953
2044	1,258,590	287.8	\$13,762,516	202,762	40.8	\$3,820,541	4,313	0.9	\$195,418
2045	1,265,087	289.4	\$13,905,500	202,854	40.9	\$3,854,778	4,400	0.9	\$195,892
2046	1,270,045	290.7	\$14,051,487	203,301	41.0	\$3,889,733	4,495	0.9	\$196,377
2047	1,274,014	291.7	\$14,200,540	203,681	41.0	\$3,925,422	4,588	0.9	\$196,871
2048	1,277,052	292.5	\$14,352,723	204,442	41.1	\$3,961,861	4,690	1.0	\$197,376

Table 5-17: Total Energy Efficiency Base Case Bundles

Year	Bundle 1			Bundle 2			Bundle 3		
	MWh	MW	Budget	MWh	MW	Budget	MWh	MW	Budget
2019	80,676	20.5	\$10,214,038	41,958	8.4	\$8,317,781	341	0.2	\$332,842
2020	158,073	35.8	\$11,000,000	85,957	16.8	\$8,535,090	599	0.3	\$332,467
2021	241,655	53.2	\$11,784,567	131,033	25.4	\$8,750,744	856	0.5	\$332,085
2022	328,971	71.9	\$13,195,329	153,465	28.9	\$3,919,442	13,401	3.5	\$15,546,896
2023	423,842	91.1	\$13,553,390	175,796	33.5	\$4,026,920	24,801	6.9	\$15,599,935
2024	521,084	110.3	\$13,914,481	195,680	37.1	\$4,142,153	36,228	9.8	\$15,654,551
2025	619,491	129.9	\$14,322,683	213,629	40.5	\$4,240,422	47,650	12.7	\$15,707,057
2026	720,137	149.7	\$14,732,782	232,015	43.9	\$4,372,950	59,132	15.7	\$15,772,349
2027	821,705	169.6	\$15,109,918	244,784	46.3	\$4,480,928	70,612	18.4	\$15,828,416
2028	922,151	189.7	\$15,494,517	258,499	49.0	\$4,554,431	82,101	21.4	\$15,884,414
2029	1,019,167	209.7	\$15,884,414	269,453	51.9	\$4,642,527	93,596	24.5	\$15,940,111
2030	1,117,676	230.0	\$16,274,700	280,971	55.0	\$4,711,870	105,087	27.8	\$15,997,824
2031	1,208,553	248.7	\$16,743,044	290,941	57.8	\$4,808,711	116,638	30.9	\$16,060,778
2032	1,300,805	267.6	\$17,164,488	302,805	60.7	\$4,882,171	128,134	34.2	\$16,121,291
2033	1,390,371	286.6	\$17,599,674	312,441	63.6	\$4,985,981	139,653	37.5	\$16,181,207
2034	1,426,931	293.0	\$17,974,695	292,653	61.6	\$5,043,153	151,229	40.9	\$16,224,212
2035	1,457,292	298.1	\$18,314,890	271,672	59.5	\$5,095,098	156,000	42.7	\$16,282,428
2036	1,484,668	302.1	\$18,658,881	251,574	58.1	\$5,141,208	160,773	44.7	\$16,337,309
2037	1,504,149	306.3	\$18,958,323	254,067	59.0	\$5,188,689	163,461	45.5	\$16,373,587
2038	1,523,475	310.3	\$19,263,467	256,808	59.9	\$5,237,101	166,155	46.3	\$16,410,629
2039	1,538,800	313.7	\$19,492,545	258,212	60.2	\$5,279,226	168,530	46.8	\$16,448,362
2040	1,554,823	315.6	\$19,726,435	261,042	55.2	\$5,322,236	170,907	42.8	\$16,486,888
2041	1,566,776	318.5	\$19,965,236	261,899	55.9	\$5,366,150	173,245	43.8	\$16,526,222
2042	1,578,200	321.0	\$20,209,052	263,046	56.5	\$5,410,985	17,504	44.3	\$16,566,383
2043	1,587,407	323.3	\$20,457,988	263,459	57.2	\$5,456,763	173,742	45.0	\$16,607,387
2044	1,597,250	325.2	\$20,712,151	264,809	57.4	\$5,503,501	173,933	45.0	\$16,649,251
2045	1,604,065	326.9	\$20,971,653	264,868	57.5	\$5,551,221	174,098	45.1	\$16,691,996
2046	1,610,063	328.3	\$21,236,603	265,378	57.6	\$5,599,943	174,265	45.1	\$16,735,637

	Bundle 1			Bundle 2			Bundle 3		
	Cumulative		Budget	Cumulative		Budget	Cumulative		Budget
Year	MWh	MW	Budget	MWh	MW	Budget	MWh	MW	Budget
2047	1,614,891	329.4	\$21,507,118	265,793	57.7	\$5,649,688	174,420	45.1	\$16,780,196
2048	1,619,514	330.2	\$21,783,313	266,682	57.8	\$5,700,478	174,572	45.2	\$16,825,690

5.6.2 Demand Response Program Options

Five DR options were considered, including two options for NIPSCO's Interruptible Tariff. The objective of these options is to realize demand reductions from eligible customers during the highest load hours of the summer or winter as defined by the utility. Each program type provides DR using different load reduction and incentive strategies designed to target different types of customers. From the utility perspective, load reduction events for each of the different program types can be called with different notification time. Using a mix of programs provides load reduction resources that can be called under many different conditions. Table 5-18 lists the DR programs included in this DSM Savings Update.

Table 5-18: Demand Response Program Options

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

5.6.3 Demand Response Load Reduction Assumptions

The per-customer kW electric peak load reduction, multiplied by the total number of participating customers, provides the potential demand savings estimate. Load reduction impact assumptions are based on program performance for current or past NIPSCO programs and on secondary research for new programs. The Interruptible Rider impact was sourced from actual program performance. The percentage was scaled to match current program performance. The

remaining program impacts were developed by taking an average of existing/past program performance from programs in states within the region. Table 5-19 shows the per-customer load reductions used for estimating the potential, along with sources. The majority of load reductions were obtained from the 2016 MPS, with the exceptions noted in the table.

Table 5-19: Demand Response Program Load Reduction Assumptions

Sector	DR Program Option	Load Reduction	Source
Residential	DLC AC	0.972 kW	FERC 2012 Survey adjusted to IN using National Oceanic and Atmospheric Administration temperatures
	DLC Space Heating	0.62 kW	2016 MPS
	DLC Water Heating	0.9 kW	2016 MPS
Business	DLC AC	3.1 kW	2016 MPS
	DLC Space Heating	1.5 kW	PGE Brattle Group 2016 Study
	DLC Water Heating	2.7 kW	2016 MPS
	Interruptible Rider	18% of Coincident Peak Load	2016 MPS
	Third Party Aggregator	18% of Coincident Peak Load	2016 MPS

The DR options for large C&I customers included in the Savings Update are described below:

5.6.4 Interruptible Rider

As described above and under Rider 775, large commercial customers enroll directly with NIPSCO in an agreement to curtail their load during system contingencies.

5.7 Consistency between IRP and Energy Efficiency Plans

Ind. Code § 8-1-8.5-10 (“Section 10”), which became law on May 6, 2015, requires, among other things, that a utility’s energy efficiency goals are (1) reasonably achievable; (2) consistent with the utility’s IRP, and (3) designed to achieve an optimal balance of energy resources in the utility’s service territory. A utility is required to petition the Commission for approval of an energy efficiency plan under Section 10 beginning not later than calendar year 2017, and not less than once every three years.

To remain consistent with the requirements of Section 10, NIPSCO carried out a lengthy analysis of the DSM resources included in its IRP process. As noted above, NIPSCO completed an update to its 2016 MPS to determine the achievable amount of savings. *See Appendix B.* NIPSCO, through the MPS and the DSM Electric Savings Update process discussed above, then conducted an in-depth review of the amount of savings that would be achievable in its service

territory with its current customer base. Following that in-depth review process, NIPSCO incorporated 3 energy efficiency DSM bundles and 3 DR bundles into the model for selection as resources. As defined above, energy efficiency measures were bundled according to each measure's cost of saved energy over its measure life and the DR programs were bundled by calculating the levelized cost per cumulative kW over the 30-year lifetime of the program.

NIPSCO allowed DSM and energy efficiency measures, broadly referred to as DSM resources, to be selected across all six portfolio concepts. As discussed further in this section, three separate DSM bundles were developed by GDS for potential selection in the portfolio optimization model. The bundles were organized according to cost, and all of the resources in the first two bundles were selected by the optimization model across all portfolios.

In accordance with Section 10, NIPSCO intends to request approval in 2020 of an energy efficiency plan for implementation in 2022 ("2020 Filing") that includes:

- energy efficiency goals that are (1) reasonably achievable; (2) consistent with NIPSCO's 2018 IRP, and (3) designed to achieve an optimal balance of energy resources in its service territory;
- energy efficiency programs that are (1) sponsored by an electricity supplier and (2) designed to implement energy efficiency improvements;
- program budgets;
- program costs that include (1) direct and indirect costs of energy efficiency programs, (2) costs associated with the EM&V of program results, (3) recovery of lost revenues and performance incentives. For purposes of this filing, the "direct costs" are those associated with implementing the programs, including any costs associated with program start up, while "indirect costs" are the NIPSCO administrative costs; and
- EM&V procedures that involve an independent EM&V.

NIPSCO intends to develop a DSM Action Plan prior to its 2020 Filing based on the energy efficiency selected by the IRP model. This may be updated depending on the results of the 2019 MPS and/or another mechanism (i.e. DSM RFP results). The DSM Action Plan will take into account the results of the IRP for implementation and evaluation of the Energy Efficiency Plan.

It is important to note that the final program design is determined by the bidder(s) selected by NIPSCO, with consideration of input from its OSB. The selected bidder's(s') predictions of the market into the program design as they determine what may or may not work in the NIPSCO's service territory is important for designing an energy efficiency program. That means that the programs included in the MPS/DSM Savings Update typically change. NIPSCO uses the MPS/DSM Savings Update as a feed into the IRP to develop the Action Plan. This Action Plan allows NIPSCO to take into account not just the results of the IRP, but also the experience of NIPSCO and its vendors with a particular program or measure. For example, electric hot water heating has a great deal of potential, but NIPSCO has not found there to be much interest from

customers in the program. Knowing this means that NIPSCO will either (a) not structure a large amount of savings around a measure which has historically shown little participation or (b) need to increase the incentive to increase participation, which may impact the cost effectiveness of the program.

The benefit of an Action Plan is that it uses various forms of information, including the IRP, to develop the best strategy for an energy efficiency plan. The Action Plan will then be used to develop the DSM RFPs. The results of the winning bids will be utilized to develop the filing, with support from the MPS/DSM Savings Update, IRP and Action Plan. This is the most effective way to ensure NIPSCO has an Energy Efficiency Plan that is based on real-world, achievable results from vendors who are committed to those results. Bidders' responses to the groupings identified in NIPSCO's DSM RFP will vary based on the individual bidder's perception of NIPSCO's customer base and their previous experiences within other service territories, etc. This unique process for development of the DSM RFPs and creation of the Energy Efficiency Plan allows NIPSCO to compensate for the long lead time between the completion of a market potential study and the actual implementation of a program.

That does not mean that the Energy Efficiency Plan will be without change. Until the programs are administered to the customer base and the first-hand experiences with energy efficiency occur, informed judgments must be used to establish the initial estimates of program impacts in NIPSCO's service territory. That is the benefit of utilizing an OSB. It provides an on-going mechanism to adjust to changing market conditions, including codes and standards and new technologies, and to ensure NIPSCO is capturing as much energy efficiency savings as possible for the amount of funding available.

Section 6. Transmission and Distribution System

Consistent with the principles set out in Section 1, NIPSCO continues to invest in its existing Transmission and Distribution (“T&D”) resources to ensure reliable, compliant, flexible, diverse and affordable service to its customers. NIPSCO continually assesses the current physical T&D system resources for necessary improvements and upgrades to meet future customer demand or other changing conditions. As part of this effort, NIPSCO participates in the planning processes at the state, regional, and federal levels to ensure that its customers’ interests are fully represented and to coordinate its planning efforts with others. The goals of the planning process include:

- Adequately serve native customer load and maintain continuity of service to customers under various system contingencies.
- Proactively maintain and increase availability and reliability of the electric delivery system.
- Minimize capital and operating costs while being consistent with the above guidelines

6.1 Transmission System Planning

6.1.1 Transmission System Planning Criteria and Guidelines

NIPSCO Transmission System Planning Criteria requires performance analysis of the transmission system for the outage of various system components including but not limited to generators, lines, transformers, substation bus sections, substation breakers, and double-circuit tower lines. Adequacy of transmission system performance is measured in terms of NIPSCO planning voltage criteria, facility thermal ratings, fault interrupting capability, voltage stability, and generator rotor angle stability as documented in the NIPSCO 2018 FERC Form 715 Annual Transmission Planning and Evaluation Report filing (Confidential Appendix F). When a violation of one or more of these requirements is identified, Transmission Planning develops mitigations that may consist of operating measures and/or system improvements.

6.1.2 North American Electric Reliability Corporation

NIPSCO is subject to the NERC, which is certified by the FERC to establish and enforce reliability standards for the bulk-electric system and whose mission is to ensure the reliability of the North American bulk electric system. NIPSCO is registered with NERC as a Balancing Authority, Distribution Provider, Generator Owner, Generator Operator, Resource Planner, Transmission Owner, Transmission Operator, and Transmission Planner. Together with MISO, in a Coordinated Functional Registration, NIPSCO is registered as a Balancing Authority, Transmission Owner, and Transmission Operator. Each Registered Entity is subject to compliance with applicable NERC standards, and ReliabilityFirst Regional Reliability Organization standards approved by FERC. Non-compliance with these standards can result in potential fines or penalties.

6.1.3 Midcontinent Independent System Operator, Inc.

NIPSCO participates in the larger regional transmission reliability planning process through participation in the MISO, which annually performs a planning analysis of the larger regional transmission system through the MISO Transmission Expansion Plan (“MTEP”). The MTEP process identifies reliability adequacy on a larger regional basis and ensures that the transmission plans of each member company are compatible with those of other companies. It should be noted that while any transmission project NIPSCO wishes to build must generally be timely submitted for planning review by MISO to ensure that there is no harm to other systems in MISO, so long as NIPSCO does not request cost sharing of the project with other MISO members, NIPSCO does not have to obtain MISO Board approval to proceed with a transmission project if NIPSCO deems it necessary. Additionally, under extenuating circumstances, NIPSCO can request expedited review of those cost-shared projects that do require MISO Board approval.

Requests by generation owners to connect new generators to the NIPSCO transmission system, to change the capacity of existing generators connected to the NIPSCO transmission system, or otherwise modify existing generators connected to the NIPSCO transmission system are handled through the MISO Generation Interconnection Process. NIPSCO participates in this effort to review potential impacts on the NIPSCO transmission system and identify improvements or upgrades necessary to accommodate these requests. Requests by generation owners connecting to the PJM Interconnection LLC (“PJM”) transmission system are to be coordinated with NIPSCO by PJM through MISO.

Requests by generation owners in the MISO footprint to retire existing generators are handled through the MISO Attachment Y process. NIPSCO participates in this effort to review potential impacts on the NIPSCO transmission system and identify either operating procedures or improvements and upgrades necessary to accommodate these requests. Requests by generation owners in the PJM footprint to retire existing generators may be reviewed by MISO for impacts on the NIPSCO transmission system, but the generation owners in the PJM footprint are under no obligation to mitigate any resulting constraints on the NIPSCO transmission system.

Requests by generation owners to secure transmission service are handled through the MISO Transmission Service Request process. NIPSCO participates in this effort to review potential impacts on the NIPSCO transmission system and identify improvements or upgrades necessary to accommodate these requests.

Because NIPSCO is situated on a very significant boundary (seam) between MISO and PJM, NIPSCO participates in the coordination of transmission planning efforts between MISO and PJM under the MISO-PJM Joint Operating Agreement.

In addition, MISO may propose transmission system projects or other upgrades that are not reliability based, but are economically based and should relieve congestion. These projects must pass the Benefit Cost Ratio test established by MISO before approval. NIPSCO participates in this effort through the MISO Market Efficiency Planning Study, and the MISO-PJM Interregional Planning Stakeholder Advisory Committee which performs a coordinated system planning study with PJM.

NIPSCO is also an active participant in the Market Efficiency Project (“MEP”) planning processes in both MISO and PJM. The MEP processes focus on evaluating potential future transmission projects to lower the overall production cost and lower delivered energy costs to the end use customer for the MISO and/or PJM footprint. These planning efforts require the benefits of proposed projects to exceed the costs (usually 1.25 or greater benefit to cost ratio) before the RTOs will consider it a viable solution.

6.1.4 Market Participants

MISO has developed a process through which market participants can request voluntary upgrades on the NIPSCO transmission system to better accommodate generation outlet capacity, increases in transmission rights, reduce congestion, address reliability considerations, or other market driven needs. If the Market Participant wishes to pursue these types of upgrades, they must submit their proposal to MISO, and NIPSCO and the Market Participant must negotiate payments for these upgrades as defined in the MISO tariff and corresponding Business Practice Manuals. Market Participant-Funded Projects must be filed in a timely manner with MISO for review in its transmission planning process.

6.1.5 Customer Driven Development Projects

NIPSCO may be contacted to undertake transmission upgrades by individual customers based on the customer’s plans for economic development or expansion. In coordination with the customer, NIPSCO Major Accounts and NIPSCO Economic Development, will determine if identified transmission upgrades are identified necessary to meet the customer’s development or expansion plans.

6.1.6 Transmission System Performance Assessment

In NIPSCO’s 2018 FERC Form 715 Annual Transmission Planning and Evaluation Report filing (Confidential Appendix F), Confidential Part 2 contains the regional power flow cases. The cases include solved real and reactive flows, voltages, detailed assumptions, sensitivity analyses, and model description. Confidential Part 3 contains applicable transmission maps. Part 4 describes the reliability criteria used for transmission planning. Confidential Part 5 presents the assessment practice used.

Confidential Part 6 contains an evaluation of the reliability criteria in relation to the present performance and the expected performance of the NIPSCO transmission system. Performance assessments are conducted annually for the near-term (5 year) and long-term (10 year) planning horizons, for both peak and off-peak load conditions, assuming known or forecasted changes in generation resources and load demand. Sensitivities to baseline forecasts or assumptions may also be considered for performance analysis of the transmission system.

NIPSCO also participates in the MISO and PJM Market Efficiency Project planning processes as discussed in Section 6.1.3: Midcontinent Independent System Operator, Inc. The MISO process includes multiple future scenarios to test future sensitivities against baseline assumptions.

6.1.7 NIPSCO Transmission System Capital Projects

NIPSCO's portfolio of transmission system projects has been identified through its annual transmission system performance assessment to establish base line reliability projects. This portfolio has been expanded to include transmission projects initiated by market participants, by customer driven development projects, and to include regional transmission projects designated through the MISO MTEP planning effort, with the most recent iteration approved by the MISO Board of Directors (MTEP 17) in 2017. NIPSCO's current portfolio includes:

- Multi-Value Project 11: Sugar Creek Substation upgrades to accommodate the new 345 kV circuit from Ameren's Kansas West substation to the NIPSCO/Duke Energy Indiana jointly-owned Sugar Creek substation
- Circuit 13812 Maple Substation upgrade
- Circuit 13854 Aetna Substation line drop upgrade
- LaGrange Substation 138kV Ring bus conversion

In addition to current portfolio, NIPSCO recently completed all transmission system projects approved by MISO (MTEP 11) as part of Multi-Value Project 12. Projects included:

- Reynolds to Burr Oak to Hiple 345kV Lines
- Reynolds to Greentown 765kV Line

6.1.8 Electric Infrastructure Modernization Plan

The Transmission, Distribution, and Storage System Improvement Charge ("TDSIC") is an initiative to modernize infrastructure through upgrades to the NIPSCO electric and natural gas delivery systems. The Commission issued its Order in Cause No. 44733 on July 12, 2016 approving NIPSCO's 7-Year Electric TDSIC Plan (2016-2022). NIPSCO's 7-Year Electric TDSIC Plan is focused on transmission and distribution investments made for safety, reliability, and system modernization. The Plan also makes provision for appropriate economic development projects in the future, although none are proposed at this time.

NIPSCO's 7-Year Electric TDSIC Plan includes necessary investments that enable NIPSCO to continue providing safe, reliable electric service to its customers into the future. The Plan is comprised of two main segments: (1) investments that target replacement of aging assets (Aging Infrastructure) and (2) investments intended to maintain the capability of NIPSCO's electric system to deliver power to customers when they need it (System Deliverability). In developing its Plan, NIPSCO considered the need to maintain a safe and reliable system. The approximate cost of the transmission portion of the TDSIC plan is \$453M over the seven-year period.

6.1.9 Evolving Technologies and System Capabilities

NIPSCO Transmission Planning has provided for the installation of two variable shunt reactors (“VSRs”) at the Hiple 345kV substation as part of the Multi-Value Projects. The VSRs, which will enable better and more precise control of transmission system voltage, are a relatively recent development in the industry.

6.2 Distribution System Planning

As part of the long term view, NIPSCO continues to evaluate the benefits of smart grid and distribution automation (“DA”) technology and to assess deployment of various new technologies based upon corporate investment strategies in infrastructure.

NIPSCO’s distribution system is periodically reviewed for local circuit, substation and source feed adequacy. Normal operating status as well as single element or contingency failure loading and voltage operating characteristics are evaluated along with circuit and system wide reliability metrics (i.e., CAIDI, SAIDI, SAIFI).¹³ Distribution operating and design criteria rely on NIPSCO design maximums in accordance with Company Standards and equipment manufacturer ratings. Voltage operating criteria are based on American National Standards Institute (ANSI) C84.1 and Indiana Administrative Code 170 IAC 4-1-20.

System improvement plans are developed and applied based upon mitigation of identified deficiencies associated with service capacity, service voltage, reliability levels, and load growth patterns. Specific and trending distribution component failures are mitigated through capital and infrastructure improvement processes. Infrastructure upgrade and replacement activities consider system characteristics that include severity of operating deficiencies, likelihood of failure, potential customer impact, current substation and line topology, equipment age and condition. Available new technologies are integrated into improvement and replacement activities where appropriate.

Net metering is an electricity policy for consumers who own renewable (solar, wind, biomass) energy facilities. Its application provides an incentive for customers to install renewable energy systems by reimbursing them for their generation output, at utility retail rates, for energy in excess of their service’s base load electricity purchase from the utility. Typically this represents the aggregate excess power produced that is not utilized internally by the customer but is instead delivered into the utility’s local electric system.

Feed-in tariff (renewable energy payments) is another policy mechanism designed to encourage the adoption of renewable energy sources and to help accelerate the move toward renewable energy sources. This tariff provides power developers with a predictable purchase price for self-generation under a long-term power purchase arrangement, which helps support financing opportunities for these types of projects.

¹³ CAIDI is the Customer Average Interruption Duration Index and represents the average time of an outage during the year. SAIFI is the System Average Interruption Frequency Index and represents the average number of times that a system customer experiences an outage during the year. SAIDI is the System Average Interruption Duration Index and represents the number of minutes a utility’s average customer did not have power during the year.

NIPSCO implemented its renewable feed-in tariff in July 2011 along with its existing net metering program. These programs introduced customer-owned renewable resource based generation onto NIPSCO's electric distribution system. A relatively significant amount of renewable generation projects began coming "on line" in 2012 and that amount has continued to grow. NIPSCO's net metering and feed-in tariff generation interconnection programs provide an incentive and path for customers to integrate their own distributed generation resources into NIPSCO's electric distribution systems. Solar, wind, and biomass fueled generation resources have been deployed by customers in varying amounts across the service territory.

At the end of 2017, the renewable generation data identified 10.7 MWs associated with the net metering program and 33.4 MWs of generation associated with the feed-in Tariff program. An aggregate breakdown by renewable fuel type is provided below. These values represent generation resources that include landfill gas combustion engines, animal waste gas combustion engines, PV solar array farms, small roof mounted and ground mounted residential solar arrays, intermediate sized commercial wind turbines, and small commercial and residential wind turbines.

Net Metering Generation:

- 8.64 MWs - Solar Generation
- 1.92 MWs - Wind Generation
- 0.132 MWs - Solar/Wind Combination Generation

Feed-In Tariff Generation:

- 18.87 MWs - Solar Generation
- 0.16 MWs - Wind Generation
- 14.35 MWs - Biomass Generation

The above biomass related generation value excludes 13.6 MWs of existing landfill based generation interconnected to NIPSCO's distribution system. Although these renewable generation sources feed into NIPSCO's network, the power deliveries are associated with customer PPAs with parties other than NIPSCO. These customers do not participate in NIPSCO's net metering or feed-in tariff programs. In total, approximately 55 MWs of generation is interconnected to NIPSCO's distribution system.

Based on the implementation of the net metering and feed-in tariff programs, Distribution Planning has observed voltage related operating impacts on its electric system due to larger customer-owned generation. Impacts on system operations has yet to be fully determined and will depend upon the demonstrated long term performance and reliability of various installed generating resources including solar, wind, and biomass based generation fueled resources. Differences in operational characteristics, generation penetration, power delivery timing, and location all affect the relative impact on local distribution system operations at any given time. The diverse types of customer-owned generation also have varying effects on the electric system.

NIPSCO has observed that local generation most often varies substantially depending upon individual customer equipment and generation input resources. Fuel resource type affects power delivery in various ways depending upon owner controlled resources as is the case of landfill and animal by-product gas inputs, or external environmental conditions such as wind velocity and solar irradiance. Highly variable outputs have been observed to occur on both solar and wind turbine installations. For instance, rapid changes in solar generation have exhibited swings of 85% of full rated output, within seconds. These conditions represent sizable down-up-down shifts in system operating characteristic on local circuits associated with some of the larger half MW or greater rated customer owned solar fields. These swings can present challenges to maintaining appropriate service voltage stability on distribution circuits. In addition to these more rapid changes relating to industry recognized “cloud affect,” NIPSCO has also observed that more widespread weather patterns such as seasonal rain or snow storms also dramatically influence individual daily peak PV generation outputs on a longer term scale. Longer duration output reductions of 75% to 92% of rated equipment output are observed during seasonal inclement weather conditions. Significantly reduced output levels can be seen extending over several or more days, especially during winter season months. Wind powered generation was also observed to be as much, if not more, unpredictable and variable in power delivered to the distribution system. On the other hand, large biomass fueled combustion turbines appear to be less volatile in generated outputs in comparison to solar and wind associated generation. Landfill based biomass generation facilities tend to be the most predictable followed by animal waste gas associated generation. However, even though biomass fueled resources exhibit a steadier dispatch of power, there were experiences of random events where customer generation dropped completely off line. The impact of lost generation becomes more significant as the generation level increases since the local distribution system needs to adjust and compensate for fast change in power sources.

Based upon several years of operating data for currently installed renewable generation resources, these technologies present a recognized energy resource that can be utilized in supplementing customer electric energy needs. However, at this time, the impact on local electric distribution service infrastructure has not demonstrated to be sufficiently available or stable to be considered an adequate 24 hours a day/seven days a week/365 days a year substitute for NIPSCO’s local electric sources in reliably meeting electric capacity and service needs. Considering that these distributed generation resources have no guarantee of power dispatch, operate in a “take it as we make it” mode, and can permanently cease operations at any time, results in a lower confidence level regarding the availability of power supply at all times, especially during periods of system stress or problems. Consequently, continued traditional capital investment into local distribution infrastructure is necessary to insure that the utility can meet all of its service obligations to its customers.

6.2.1 Evolving Technologies and System Capabilities

NIPSCO Distribution Planning continues the expansion of DA. This can be defined as the coordinated automatic control of substation breakers and interrupting-type line switches within an electric distribution system, along with the centralized retrieval of associated operating data for control and monitoring purposes.

NIPSCO’s DA System enables control and automatic isolation of electric distribution line faults and the restoration of customer services during various system outage conditions. This

action is accomplished through independent sectionalizing of specific circuits through the use of automatic line switches and computer-controlled substation breakers. Built-in algorithms are utilized to analyze operating conditions such as line and substation loading, to determine best response to system disturbances. Automatic restoration increases distribution system reliability by reducing the number of customers experiencing a sustained outage. In addition to the quick restoration of electric service, real-time operating data can also be retrieved and stored on the electric management system. DA Systems provide timely and accurate outage-related information to restoration teams, speeding up problem identification. This action supports quicker overall response time to identify system problems and develop repair procedures. These factors result in further improvements in customer service and system reliability. An added benefit of real-time data retrieval and device remote control is the more effective use of labor resources for operation and maintenance of the electric distribution system.

NIPSCO currently utilizes DA (communications and remote switching) on approximately 25% of its distribution substations and 30% of its distribution circuit population. Approximately two-thirds of all DA associated circuits utilize autonomous contingency switching equipment in their operations. All new and rebuilt distribution substations, and associated circuits, are assessed for need of distribution automation as part of their infrastructure projects. As part of annual system capital investment programs, new and/or rebuilt substation projects are being implemented at an approximate rate of one to two stations per year.

NIPSCO continues to evaluate the benefits of smart grid and DA technology and to assess deployment of various new technologies based upon corporate investment strategies in infrastructure as part of its long term approach.

Section 7. Environmental Considerations

7.1 Environmental Sustainability

NIPSCO is committed to compliance, stewardship, and continuing to provide energy in an environmentally responsible way. NIPSCO's current electric generation portfolio consists of assets that includes coal and natural gas plants, wind contracts, and hydroelectric power plants. Environmental improvement targets were announced in 2017, and this resource plan contemplates a transition of coal generation assets to renewable energy that would result in enhanced environmental improvements in electric generation by 2028 (from 2005 levels), as follows:

- 90% Reduction in Greenhouse Gas (“GHG”) Emissions
- 99% Reduction in Water Withdrawal and Wastewater Discharge
- 99% Reduction in NO_x Emissions
- 99+% Reduction in SO₂ and Mercury Emissions
- 100% Reduction in Coal Ash Generated

7.2 Environmental Compliance Plan Development

NIPSCO operations are subject to environmental statutes and regulations related to air quality, water quality, hazardous waste, and solid waste that protect health and the environment. NIPSCO is committed to complying with all regulatory requirements. This commitment is embodied in the NiSource Environmental, Health & Safety and Climate Change Policies and is implemented through a comprehensive environmental management system. Compliance plans are developed, reviewed, and evaluated for implementation to meet new and changing legislative and regulatory developments.

NIPSCO uses a combination of external and internal resources to develop and adapt environmental compliance plans. Consultants and engineering firms are utilized to assist NIPSCO in developing cost estimates and performing modeling. Compliance plans are drafted to address proposed and final EPA and Indiana Department of Environmental Management (“IDEM”) rules. As rules change, compliance plans are modified to comply with new requirements.

7.3 Environmental Regulations

7.3.1 Solid Waste Management

The EPA finalized a rule regulating the management and disposal of Coal Combustion Residuals (“CCR”) which became effective on October 19, 2015. The CCR rule regulates CCRs under the Resource, Conservation, and Recovery Act (RCRA) Subtitle D as nonhazardous. The CCR rule is implemented in phases establishing requirements related to groundwater monitoring,

CCR management and disposal, reporting, recordkeeping, and document management.¹⁴ The rule allows NIPSCO to continue its byproduct beneficial use program, significantly reducing CCR that must be disposed.

To comply with the rule, NIPSCO is required to incur capital expenditures to modify its infrastructure and manage CCRs. Capital compliance costs for Schahfer Units 14 and 15 and Michigan City Unit 12 are expected to total approximately \$193 million. Schahfer Units 17 and 18 will not incur any capital costs related to the CCR rule. On December 13, 2017, the IURC approved a set of projects related to CCR compliance in Cause No. 44872. NIPSCO continues to assess and monitor groundwater quality at Bailly, Michigan City, and Schahfer to comply with CCR rule requirements and to determine if historic CCR management and disposal practices will require corrective measures.

7.3.2 Clean Water Act

The CWA establishes water quality standards for surface waters as well as a permit program for regulating discharges into the waters of the United States. Under the CWA, EPA created a program to establish wastewater discharge standards for industry, including electric utilities. In addition, the CWA made it unlawful to discharge from a point source into navigable waters without a permit. The National Pollutant Discharge Elimination System (“NPDES”) permit program implements the CWA’s provisions.

7.3.3 Effluent Limitations Guidelines

EPA first promulgated the Steam Electric Power Generating Effluent Guidelines and Standards (“ELG Rule”) in 1974, and has amended the regulation many times, with the latest revision finalized on November 3, 2015, with an effective date of January 4, 2016. The ELG rule regulates wastewater discharges from power plants operating as utilities. The implementing requirements are incorporated into NPDES permits. The ELG Rule imposes new wastewater treatment and discharge requirements on NIPSCO's electric generating facilities to be applied between 2018 and 2023. For example, the Michigan City NPDES permit was renewed in April 2016, and ELG requirements were incorporated effective November 1, 2018. On April 25, 2017, the EPA published notice in the Federal Register stating that the EPA is reconsidering portions of the ELG Rule in response to several petitions for reconsideration. On September 18, 2017, the EPA postponed the earliest compliance dates for FGD wastewater and bottom ash transport water requirements from 2018 to 2020 to potentially consider revisions to technology and numeric limits achievable.

Michigan City Unit 12 is equipped with a dry FGD, which does not require any capital expenditure for ELG rule compliance. The CCR-related infrastructure investment will allow Michigan City to comply with other aspects of the ELG Rule by the November 2018, NPDES permit compliance date. Furthermore, no capital expenditure is expected for ELG compliance on Schahfer Units 14, 15, 17, and 18, which, based on this resource plan, NIPSCO anticipates retiring by 2023.

¹⁴ <https://www.nipsco.com/about-us/ccr-rule-compliance-data-information>

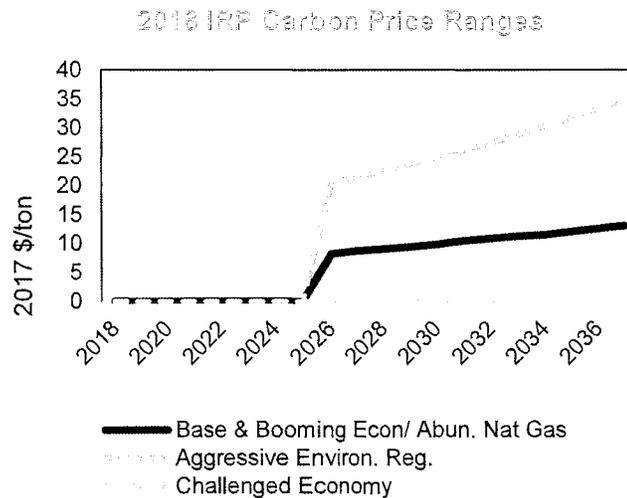
7.3.4 Clean Air Act and Climate Strategy Assessment

Over the last decade, NIPSCO has invested more than \$800 million in new technologies to reduce emissions at its electric generating stations, improve air quality, and comply with CAA requirements. Emissions of NO_x, SO₂, and mercury have been reduced by more than 80% since 2005. All Northern Indiana counties are in attainment of the National Ambient Air Quality Standards with the exception of the ozone standards in Lake and Porter Counties, which are included in Chicago metropolitan area nonattainment.

NIPSCO has reduced GHG emissions by more than 40% since 2005, and emissions reductions are expected to continue with the anticipated retirement of coal generation and transition to renewable energy. Still, climate-related environmental laws and regulations may be developed that could result in significant cost or restrictions on NIPSCO's operations.

On October 23, 2015, the EPA issued a final rule, the CPP, to regulate CO₂ emissions from existing fossil-fuel electric generating units ("EGUs") under authority of the CAA. The CPP establishes national CO₂ emission standards that are applied to each state's mix of affected EGUs to establish either state-specific rate-based or mass-based emission limits. The U.S. Supreme Court has stayed implementation of the CPP until litigation is decided on its merits, and the EPA has proposed to repeal the CPP. On August 31, 2018, the EPA proposed to replace the CPP with the Affordable Clean Energy ("ACE") rule. The timing and cost of compliance with the ACE rule are unknown at this time and are likely dependent on future state rulemaking.

Although the timing and magnitude of required GHG reductions are uncertain, it does not appear likely that a price on carbon emissions will be required by regulation or legislation until the year 2026 or later. In the IRP modeling, NIPSCO assumed three carbon price scenarios as shown in the figure below. The base scenario assumes a new federal rule or legislative action effective by the mid-2020s, the second scenario does not assume any price on carbon, and the Aggressive Environmental Regulation scenario assumes a new stricter federal rule or legislative action effective by the mid-2020s. In the Aggressive Environmental Regulation scenario, price levels are generally consistent with a 50-60% reduction in electric sector CO₂ emissions relative to 2005 by the 2030s.

Figure 7-1: 2018 IRP Carbon Price Ranges

This resource plan considered the framework by Ceres and M.J. Bradley & Associates, *Climate Strategy Assessments for the U.S. Electric Power Industry: Assessing Risks and Opportunities Associated with a 2-Degree Transition and the Physical Impacts of Climate Change*. NIPSCO used scenario analysis to assess the potential implications of climate change and inform its strategy. The plan to transition coal generation assets to renewable energy would reduce NIPSCO greenhouse gas emissions by more than 90% by 2028 compared with 2005 levels.

Retaining Schahfer Units 17 and 18 beyond 2023 would likely require expenditures to reduce NO_x emissions in addition to expenditures for CCR, ELG, and GHG compliance. The IRP modeling assumed compliance with updates to the Cross-State Air Pollution Rule (“CSAPR”) and ozone regulations that have not yet been proposed. Although both Schahfer Units 17 and 18 are already equipped with low-NO_x burners and OFA systems for NO_x reduction, SCR or selective non-catalytic reduction (“SNCR”) could be installed for post-combustion NO_x control. SCR technology allows for greater NO_x reduction rates which leads to better operational flexibility. Therefore, SCR technology was assumed for compliance with the anticipated regulation. Conceptual cost estimates were used in the modeling.

7.4 Emission Allowance Inventory and Procurement

7.4.1 Title IV Acid Rain - SO₂ Emission Allowance Inventory

In conjunction with CSAPR, the Title IV Acid Rain Program will continue to regulate SO₂ emissions. Table 7-1 lists the actual number of SO₂ Acid Rain Program emission allowances held in inventory by NIPSCO as of September 2018 for the period 2018 through 2048. Based on current projections of future emissions, NIPSCO does not need to procure additional allowances to comply with the Acid Rain Program.

Table 7-1: SO₂ Acid Rain Program Emission Allowances

Acid Rain Program SO₂ Allowance Inventory*	
Year	Allowances
Bank**	264,764
2018-2048 Annual Allocation	50,706
Total***	1,836,650

* Allowance inventory available in September 2018
** Reflects emission allowances from 2017 and earlier
***To obtain the total, multiply the annual allocation by 31 and add the bank.

7.4.2 CSAPR Emission Allowance Inventory

Under CSAPR, allowances are allocated to NIPSCO and managed separately from the Acid Rain Program. Table 7-2 lists the annual SO₂, annual NO_x, and ozone season NO_x allowance inventory issued to NIPSCO. Based on current projections of future emissions, NIPSCO does not need to procure additional allowances to comply with the CSAPR rule.

Table 7-2: CSAPR Allowance Inventory

CSAPR Allowance Inventory*			
Year	Annual SO₂	Annual NO_x	Ozone Season NO_x
Bank**	81,347	2,402	444
2018 – 2020 Annual Allocation	23,522	13,178	3,321
Total***	151,913	41,936	10,407

* Allowance inventory available in September 2018.

** Reflects emission allowances from 2017 and earlier.

***To obtain the total, take the annual allocation and multiply by three and add to the bank.

Section 8. Managing Risk and Uncertainty

8.1 Introduction & Process Overview

In the 2018 IRP, NIPSCO has deployed an approach that involved the development of a fundamentals-based set of key Base Case market drivers and assumptions and the use of both scenarios and stochastics to assess risk and uncertainty. NIPSCO developed the major inputs and associated uncertainty ranges for the 2018 IRP through the following process:

- Development of the Base Case set of assumptions through fundamental energy sector and commodity price models and NIPSCO's internal load forecasting models.
- Identification of the key drivers of uncertainty and whether they can be evaluated through scenarios or stochastics.
- Development of distinct scenario themes with accompanying model-based forecast assumptions.
- Development of stochastic distributions for relevant variables.

The major market assumptions for the base case and the scenarios were developed using a set of fundamental market models deployed by CRA and discussed in more detail in Section 2.3. These models include the NGF model for natural gas price projections, the NEEM model for electric sector capacity expansion and retirement decisions and coal pricing, and the Aurora model for granular power price projections.

The following sections provide an overview of the fundamental drivers that underpin the NIPSCO Base Case for gas prices, coal prices, carbon prices, and power market prices, while the remainder of the chapter discusses the scenarios and associated assumptions and the stochastic distributions that have been developed.

8.2 Base Case Market Drivers and Assumptions

8.2.1 Natural Gas Prices

NIPSCO's 2018 Base Case natural gas price forecast is driven by a number of key market assumptions regarding the major supply and demand dynamics in the North American natural gas market. Figure 8-1 summarizes the major drivers, along with CRA's approach and assumptions for each driver, as well as supporting explanations. The remainder of this section provides additional detail related to each driver.

Figure 8-1: Natural Gas Price Drivers – Base Case

Driver	CRA Approach	Explanation
Resource Size	<ul style="list-style-type: none"> Rely on Potential Gas Committee (PGC) 2016 "Most-Likely" unproven estimates 	CRA assumes a starting point of PGC 2016 "Minimum" resource, and grows the resource base to achieved PGC 2016 "Most Likely" volumes by 2050
Well Productivity	<ul style="list-style-type: none"> IP rates based on historic data IP improves as per EIA Tier 1 assumptions Resource base is "Poor Heavy" 	CRA based individual well productivity on historic data for initial mode year, IP rates improve annually in line with EIA assumptions The "Poor Heavy" resource base is conservative, and reflects the fact that sampled data reflects only geology expected to be productive
Fixed & Variable Well Costs	<ul style="list-style-type: none"> Fixed and variable costs based on reported data Costs improve as per EIA assumptions 	CRA based individual well productivity on available historic data, adopted EIA assumptions for cost improvements over time
Domestic Demand	<ul style="list-style-type: none"> Electric demand taken from AURORA base case, RCI demand based on AEO 2017 Reference Case (with CPP) 	The AURORA case assumes "base case" carbon pressure and AEO 2017 Reference assumes CPP, meaning demand estimates are consistent
LNG Exports	<ul style="list-style-type: none"> Under-construction projects completed, ~9 bcf/d exports assumed by 2019, volumes grow another ~5 bcf/d from 2021 to 2031 	Current advanced-stage projects expected to come online and be highly utilized driving 2019 view Low domestic prices drive further international interest for US gas, but no other projects able to complete before 2021
Pipeline Exports	<ul style="list-style-type: none"> Mexican export increase to ~8bcf/d by 2021, 10.5bcf/d by 2030 	CRA expects pipeline export capacity to meet growing gas demand in Mexico will be ~60% utilized by 2021, and 75% utilized by 2031
NGL & Condensate Value	<ul style="list-style-type: none"> Liquids valued at 70% of AEO 2017 Reference Oil Price 	AEO17 for long-term oil price forecast; 70% value for NGLs is consistent with last 5 years of price history

*IP = Initial Production

Resource Size

In developing long-term estimates for natural gas resource size, CRA relied on the Potential Gas Committee ("PGC") 2016 "minimum" value as the starting value for recoverable shale reserves, with the resource base growing over time at a steady rate until the PGC "most likely" value is reached in 2050. The assumed values and ranges are shown in Figure 8-2.

PGC evaluates three categories of potential resource:

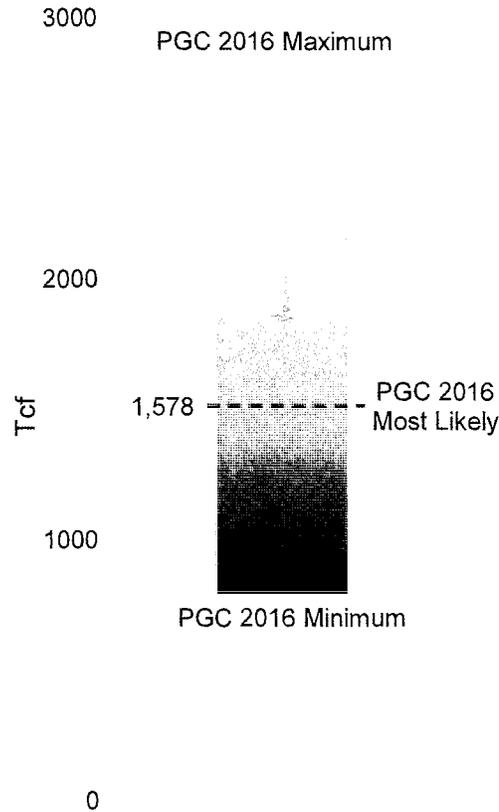
- Probable – gas associated with known fields
- Possible – gas outside of known fields, but within a productive formation in a productive province
- Speculative – gas in formations and provinces not yet proven productive

PGC assigns resource to three probability categories:

- Minimum – 100% probability that resource is recoverable
- Most Likely – what is most likely to be recovered, with reasonable assumptions about source rock, yield factor, and reservoir conditions

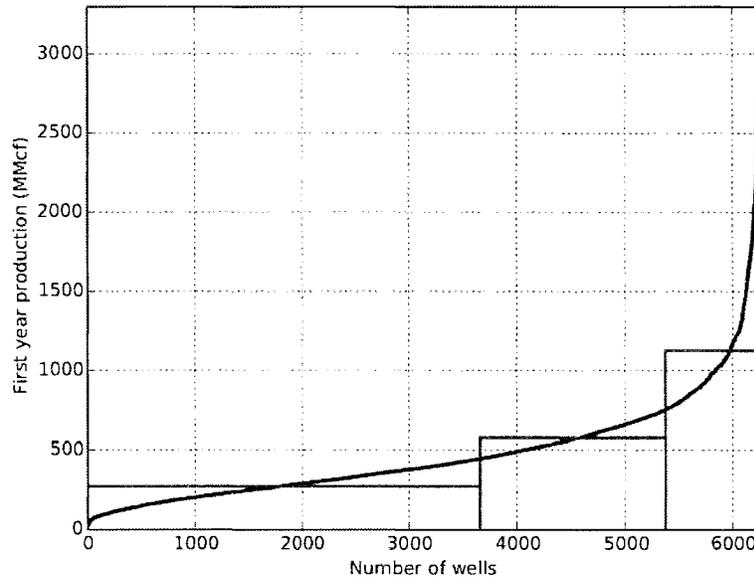
- Maximum – the quantity of gas that might exist under the most favorable conditions, close to 0% probability that this amount of gas is present

Figure 8-2: Uncertainty Range for Shale Resources in PGC 2016



Well Productivity

Natural gas well productivity assumptions are important drivers of ultimate production efficiency, especially since the bulk of gas resource is currently unproven, meaning that the geology of that resource is currently unknown. In developing assumptions for this variable, CRA generated productivity distributions for each production basin based on 2010-2016 drilling data in regions that producers expected to have favorable geology. An example of this distribution is shown in Figure 8-3, with the number of wells shown on the x-axis and the level of first-year production shown on the y-axis. In the Base Case, CRA assumed a “Poor Heavy” productivity distribution (50% poor, 20% prime, 30% average) for future undiscovered resource, as summarized in the graphic.

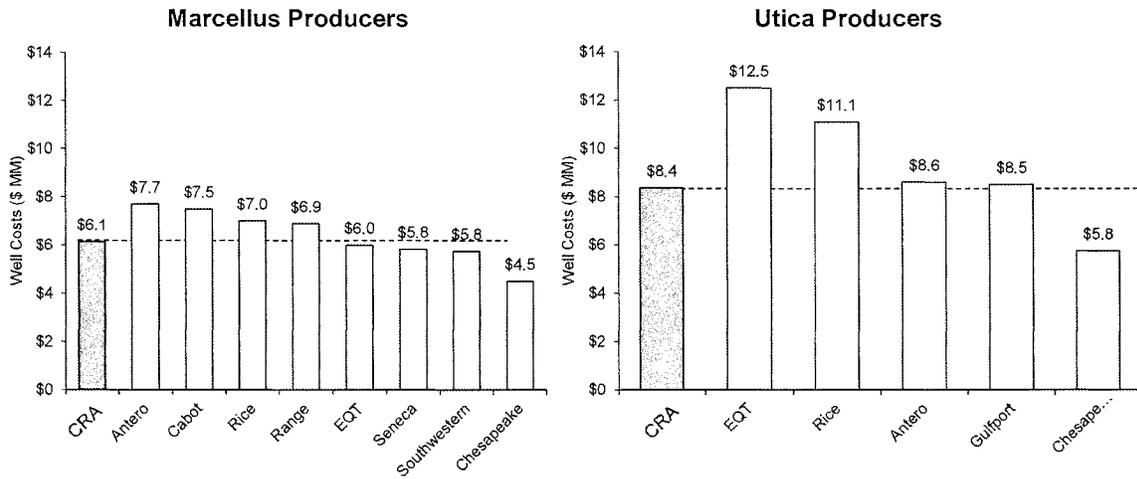
Figure 8-3: Well Productivity Illustration

Well Costs

CRA develops drilling cost assumptions by evaluating reported costs from major producers within a supply region. Figure 8-4 illustrates 2016-2017 reported costs in the Marcellus and Utica basins across major producers. Producers in these regions have been reporting declining costs over the last several years, with some producers (Antero, Seneca, Chesapeake) reporting cost reductions up to 35-37% since 2014.

For going forward costs, CRA relies on the EIA's Annual Energy Outlook ("AEO") projections for productivity improvements, fixed costs, and operations and maintenance costs. EIA's approach incorporates annual improvements to key well inputs that account for ongoing innovation in upstream technologies and reflects the average annual growth rate in natural gas and crude oil resources from historical time periods.

Figure 8-4: Well Costs by Producer with CRA Average



Domestic Demand

In projecting domestic natural gas demand growth, CRA relies on the AEO’s projections for residential, commercial, industrial, and transport demand and develops an independent electric sector demand forecast using its hourly Aurora dispatch model of the entire United States. Figure 8-5 presents historical and forecast domestic demand assumptions through 2040 from these sources. Electric sector demand is expected to be relatively flat in the near-term, but increase substantially after the potential introduction of a carbon price, such that the demand by 2040 is 30% higher than current levels. The AEO’s growth expectations for other sectors are more modest, with some growth expected in the industrial and transportation sectors over time.

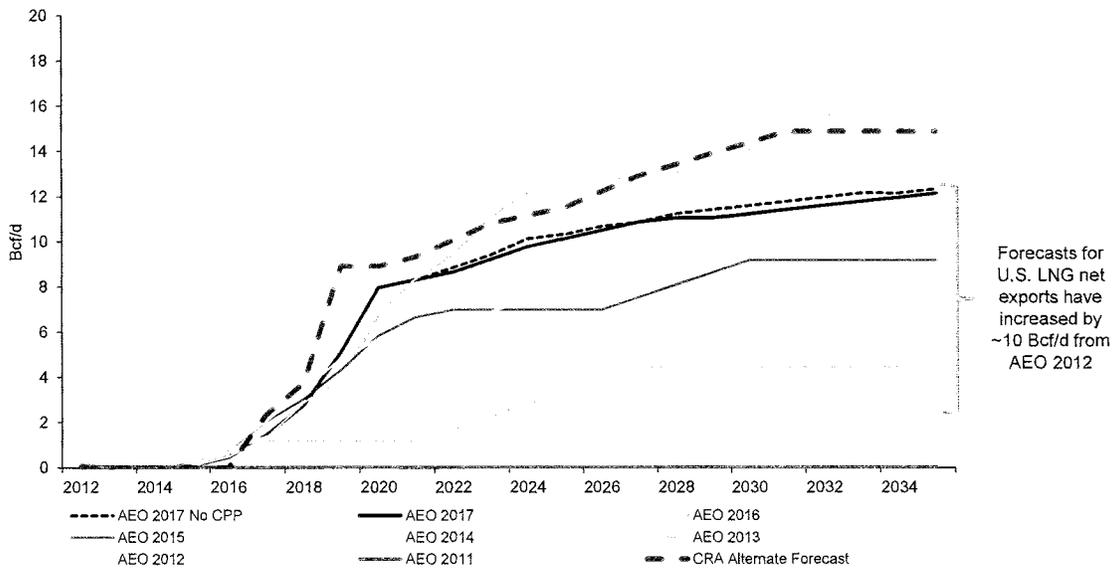
Figure 8-5: Domestic Natural Gas Demand Assumptions



Exports – LNG and to Mexico

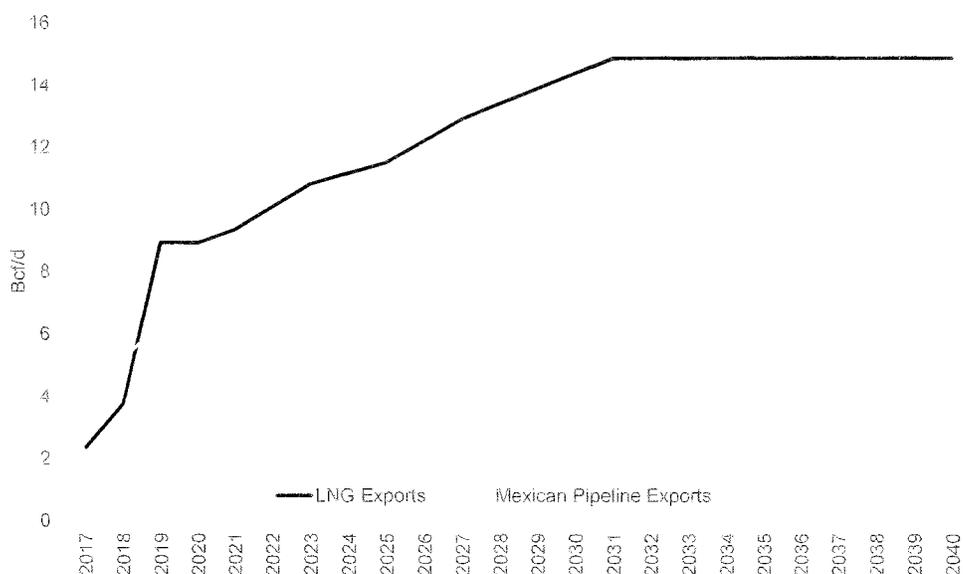
CRA develops projections for natural gas exports to Mexico via pipeline and to other international markets through LNG by reviewing estimates published by sources like the AEO and conducting analysis of specific export projects under development. The AEO has generally increased its outlook in recent years, as LNG exports in the AEO 2017 Reference Case are between 25%-35% higher than those in the AEO 2015, although lower than the more bullish long-term outlook produced in AEO 2016. CRA’s review of current LNG export projects suggests that export levels will be slightly higher than AEO 2017 projects. The Base Case forecast projects about 9 billion of standard cubic feet (“bcf”)/day of LNG exports by 2020, rising to nearly 15 bcf/day by 2030. CRA’s Base Case projection is shown with recent AEO projections in Figure 8-6.

Figure 8-6: LNG Export Volume Projections



In addition, CRA expects that exports to Mexico will also increase, as U.S. production grows and as Mexican demand increases, primarily due to additional demand from the power sector. Mexican exports are projected to increase to around 8 bcf/day by 2021 and 10.5 bcf/day by 2030. These Base Case projections are shown along with the LNG export projections in Figure 8-7.

Figure 8-7: LNG and Mexican Pipeline Export Projections



Base Case Price Forecast

CRA's Base Case price forecast was developed based on each of the supply-demand inputs discussed above and is shown in Figure 8-8. The Base Case projects prices at Henry Hub to increase to around \$3.50/ million per British thermal unit ("MMBtu") in real 2017\$ by the early 2020s and approach \$4/MMBtu by 2030. Recent AEO forecasts are shown with CRA's Base Case for comparison.

8.2.2 Coal Prices

NIPSCO's 2018 Base Case coal price forecast was driven by a fundamental view of the major supply and demand dynamics for each of the four major coal basins in the United States. The forecast was developed through CRA's NEEM model in an integrated fashion with other Base Case assumptions for natural gas prices (discussed above), carbon prices (discussed below), and the expected evolution of the power sector over time.

Overall, U.S. coal prices are expected to be mostly flat in real terms over the study period. The forward prices as of the time of forecast production were generally either flat or slightly backward-dated, indicating that many market participants expected relatively weak coal demand during 2018-2021, consistent with CRA's expectations. Beyond the near-term, CRA's fundamental analysis expects U.S. steam coal demand to fall significantly (~25%) over the next decade as a result of increased renewable generation and the retirement of about 33 GW of coal-fired capacity over the next five years. Increasing production costs offset the impact of declining demand in the Base Case forecast, resulting in a relatively flat price outlook.

Coal Supply and Demand Trends

Figure 8-9 summarizes historical and projected supply and demand for U.S. coals over the period from 2006 through 2037, which shows that coal demand has generally been in decline over the last ten years. Over the last three years, total coal production declined from 897 million tons (or 19%) between 2015 and 2016, but then increased 6.5% (to about 775 million tons) in 2017 as natural gas prices recovered from low levels in 2016. Modest additional declines are expected in the next five years, with more substantial declines expected by 2027 if carbon pricing is implemented, as is projected in the Base Case.

Figure 8-8: Base Case Henry Hub Natural Gas Price Forecast

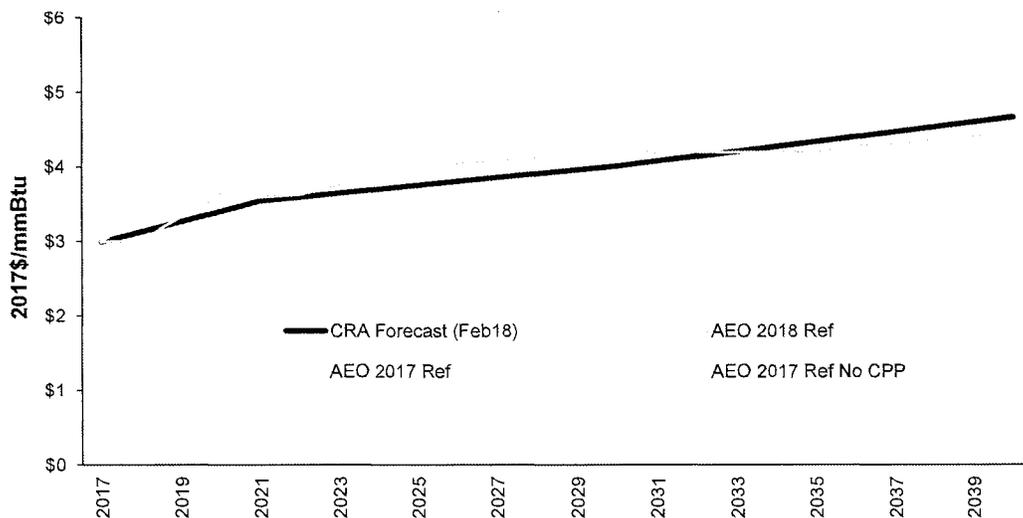
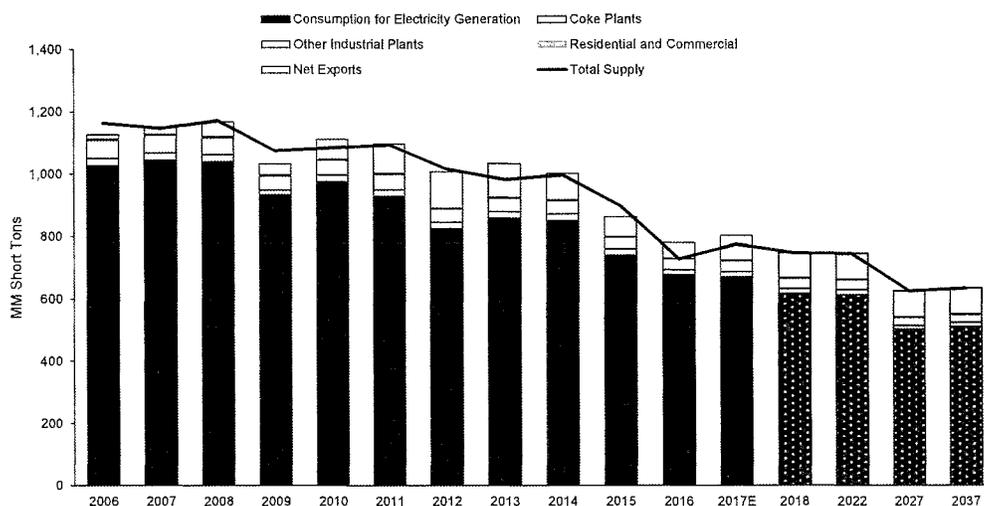


Figure 8-9: Supply-Demand Balance for U.S. Coal – 2006-2037



Regional Coal Production Expectations

While coal demand is broadly expected to decline across the U.S., each of the four major basins faces different dynamics based on regional demand from coal-fired power plants as well as international export demand. Figure 8-10 presents CRA’s Base Case production estimates over the next ten years for each of the four major production basins.

Figure 8-10: Ten-Year Coal Production Expectations by Basin

Coal Type	Current to 2027 Production Forecast (% decline)	Comments
CAPP	-21%	High cost drives decline in electric sector demand; met coal demand sustained
NAPP	-13%	Increased int’l demand and some replacement of CAPP demand
ILB	-9%	Increased int’l demand and some replacement of CAPP demand
PRB	-22%	Domestic steam coal demand declines, especially after CO ₂ pressure

CAPP = Central Appalachian

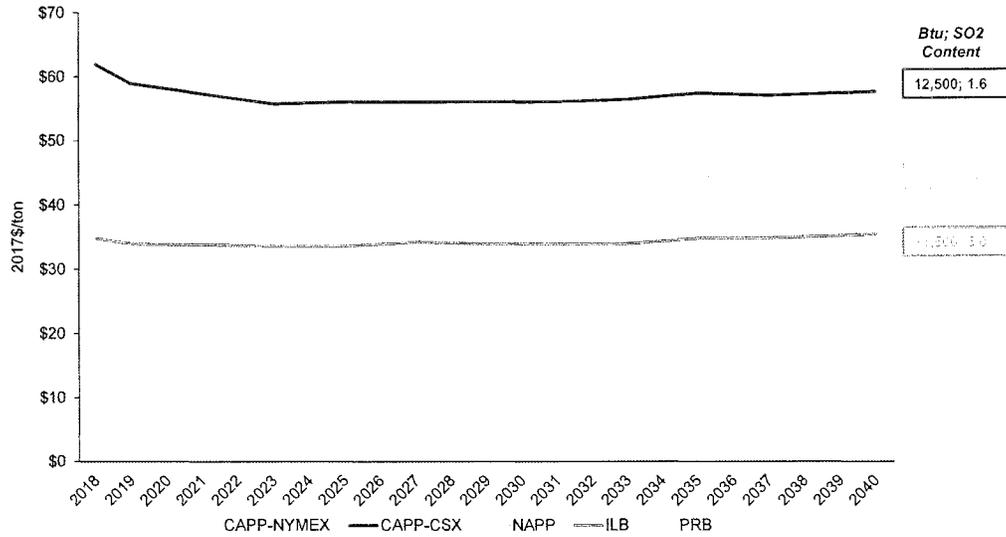
Base Case Price Forecast

CRA’s Base Case price forecast is driven by both the regional production outlook and an assessment of production costs at various demand levels, which are represented as coal supply curves within the NEEM model. Figure 8-11 presents the Base Case price outlook by coal supply region, with additional basin-level commentary provided below:

- Central Appalachia (“CAPP”): Lower demand is expected to drive a price decline (in real dollars per ton) for Appalachian coal through the early-to-mid-2020s. Thereafter, reserve depletion is expected to drive modest increase in real coal price for Appalachian coals.
- NAPP: Prices for NAPP coals trend with CAPP, but reflect the lower production costs in Northern Appalachia. NAPP’s lower cost profile, due to larger longwall mines, allows highly efficient mining of large-block coal reserves.
- ILB: Abundant reserves of ILB coal and low production costs (longwall mines) mitigate depletion effects in the Illinois Basin, leading to relatively flat real prices, with modest long-term growth.

PRB: Prices are expected to increase modestly (in real dollars per ton) at an average rate of 0.8%/year through the forecast period. This price growth is driven by higher production costs due to downward-sloping coal seams and reserve depletion, even as demand is expected to decline.

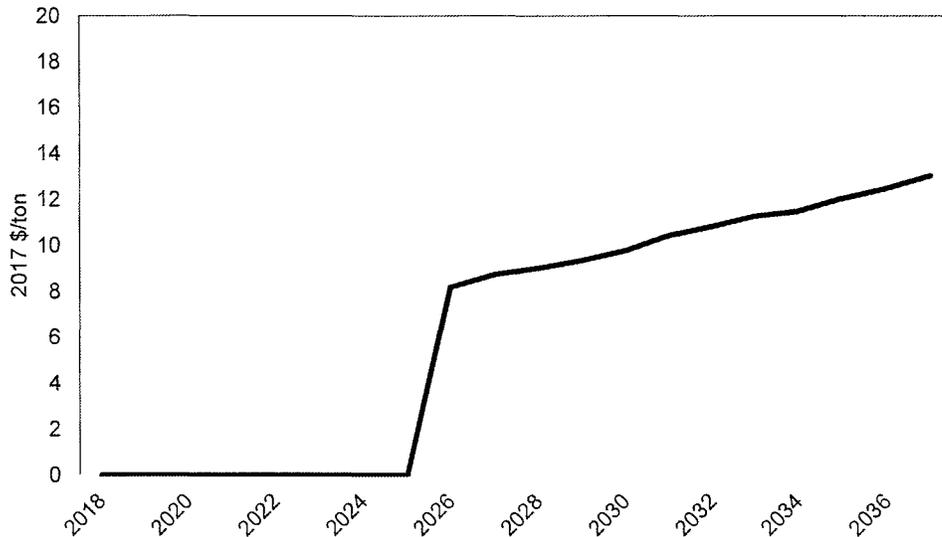
Figure 8-11: Base Case Coal Price Forecast



8.2.3 Carbon Policy and Prices

Although several legislative and executive actions related to carbon emissions have been attempted over the last decade, there is currently no price on carbon and no binding emission limits at the federal level. While the EPA has been given the authority to regulate carbon emissions, the Obama administration’s CPP was held up in the federal courts and eventually withdrawn by the Trump administration. Although regulation that would implement a carbon price does not currently exist, NIPSCO believes that it needs to plan for the potential of such federal regulation to be implemented over the next decade.

As a result, the Base Case forecast includes a price on carbon, premised on a new federal rule or legislative action coming into force by 2026. The Base Case timing implies that a new federal administration after 2020 would need to re-promulgate a rule through the EPA or pursue a legislative solution with a newly constructed Congress. The Base Case expectation is that a new carbon regulation would be in line with the CPP and would aim to achieve 30-40% reductions in emissions from the electric sector versus an historical baseline likely to be set around the time of rule passage. CRA’s analysis suggests that pricing between \$8-14/ton between 2026 and 2037 would achieve such reductions and result in a 20% reduction in U.S. coal demand. The pricing outlook assumed in the Base Case is shown in Figure 8-12 in real dollars per short ton.

Figure 8-12: Base Case Carbon Price Forecast

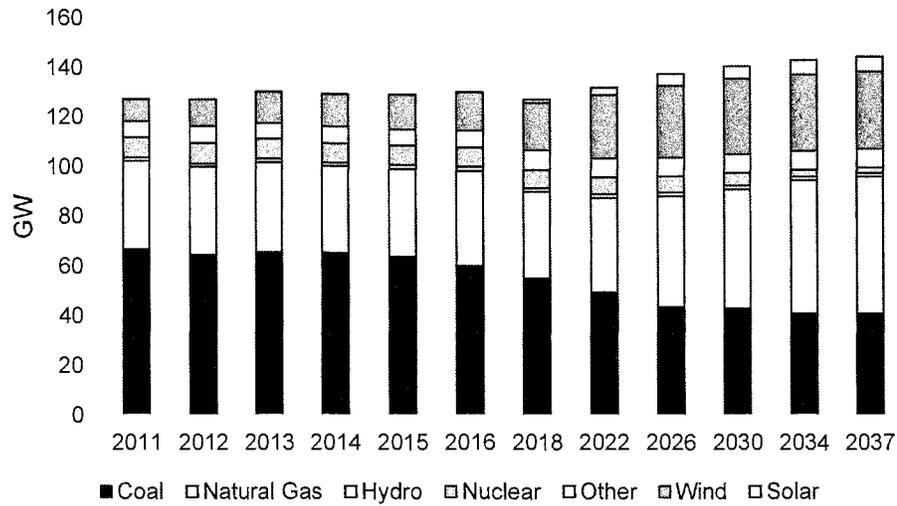
8.2.4 MISO Energy and Capacity Prices

NIPSCO operates within the MISO region, which includes parts of fifteen states throughout the Midwest and South. The traditional MISO North footprint covers parts of Indiana, Michigan, Illinois, Missouri, Kentucky, Iowa, Wisconsin, Minnesota, North Dakota, South Dakota, and Montana. NIPSCO territory and resources fall within LRZ6, covering Indiana and northern Kentucky. In developing the Base Case market price forecasts for energy and capacity, CRA deployed its Aurora market model to represent the entire MISO footprint and produce fundamental, hourly price projections that are internally consistent with the fundamental outlook for natural gas prices, carbon prices, and the future capacity mix in the region.

MISO Capacity Mix

Based on the market inputs from fuel and carbon prices, the Base Case analysis expects a continued shift from coal capacity to natural gas-fired capacity and renewables throughout MISO. Between 2011 and 2016, 7.5 GW of coal capacity retired in the MISO North region, with a net decline of 6.3 GW, due to some additions that came online prior to 2013. The Base Case forecast expects that an additional 10.5 GW of MISO North coal capacity will retire by 2023. Over half of the coal fleet is at least sixty years old, and pressure from potential carbon prices and competition from natural gas-fired and renewable resources, which are realizing lower costs, is likely to result in further retirements over time. CRA's projection of the evolution of the MISO North capacity mix is presented in Figure 8-13.

Figure 8-13: MISO North Net Winter Capacity by Fuel Type – History and Forecast



MISO Electricity Demand Growth

Electricity demand growth in MISO has been relatively modest in recent years, with total net energy for load growing at a compound annual growth rate of 0.4% between 2010 and 2016. While energy demand within the Indiana zone has grown at a rate of around 1% per year since 2010, peak load has been quite flat over the same time period. Going forward, CRA’s Base Case expects MISO peak loads to grow at a 0.24% compound annual growth rate over the next ten years. This outlook is based on MISO Module E filings rather than the Independent Load Forecast, which historically has projected higher growth rates.

Base Case Energy Price Forecast

CRA’s Base Case MISO market analysis uses the load growth projections, expectations for supply mix changes, and fuel and emission price forecasts to develop forecasts for power prices on an hourly basis. Overall, power prices are projected to be relatively flat in real dollars in the near-term, due to flat gas and coal prices and relatively modest load growth. Some upward pressure is expected into the 2020s as a result of higher natural gas price projections, although growing renewable quantities are likely to lower the market heat rate over time. The expectation for a national carbon price, starting in 2026, drives a noticeable price increase in that year. On a seasonal basis, market prices are expected to be highest in the summer months when load is highest, but also to display increases during the winter months when load is elevated and when gas prices are likely to be high as a result of winter heating demand. Figure 8-14 presents the annual Base Case power price projections for the Indiana region, which is LRZ6, while Figure 8-15

presents the same projections on a monthly basis.

Figure 8-14: LRZ6 (Indiana) Base Case Annual Price Projections

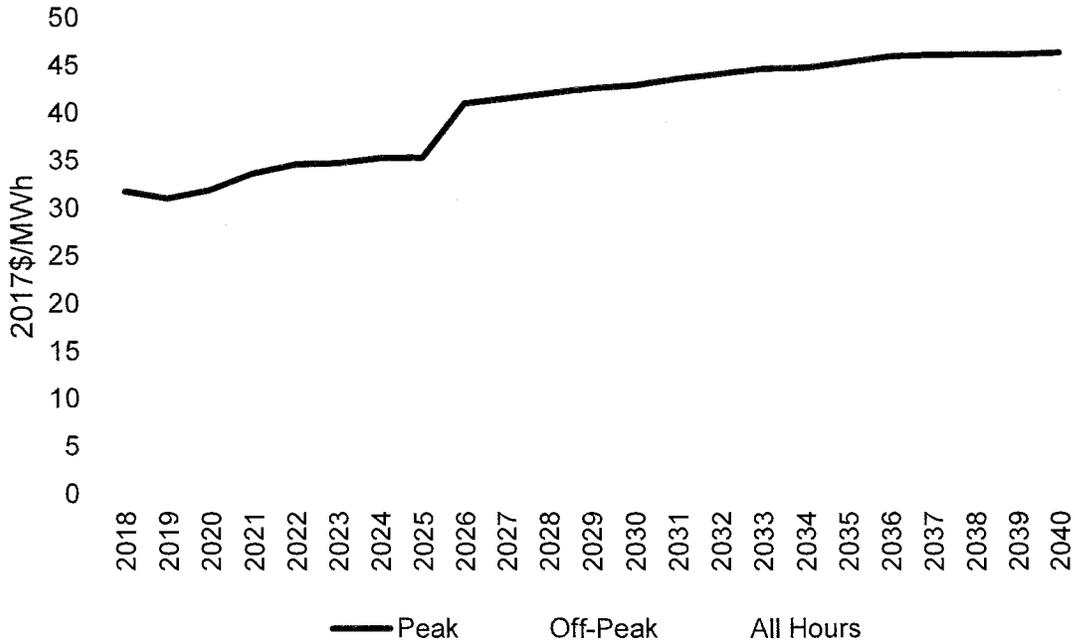
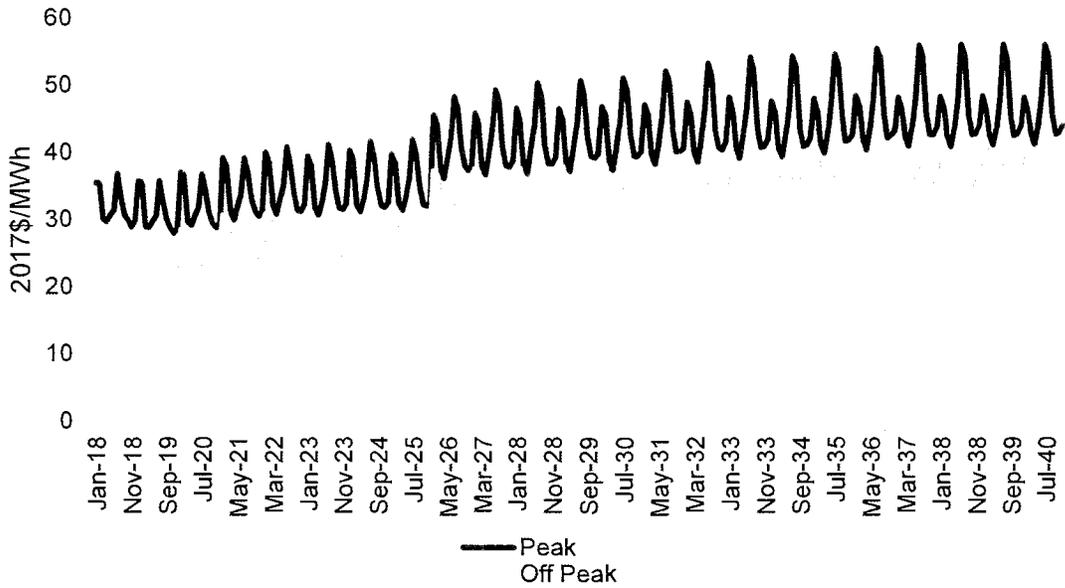


Figure 8-15: LRZ6 (Indiana) Base Case Monthly Price Projections

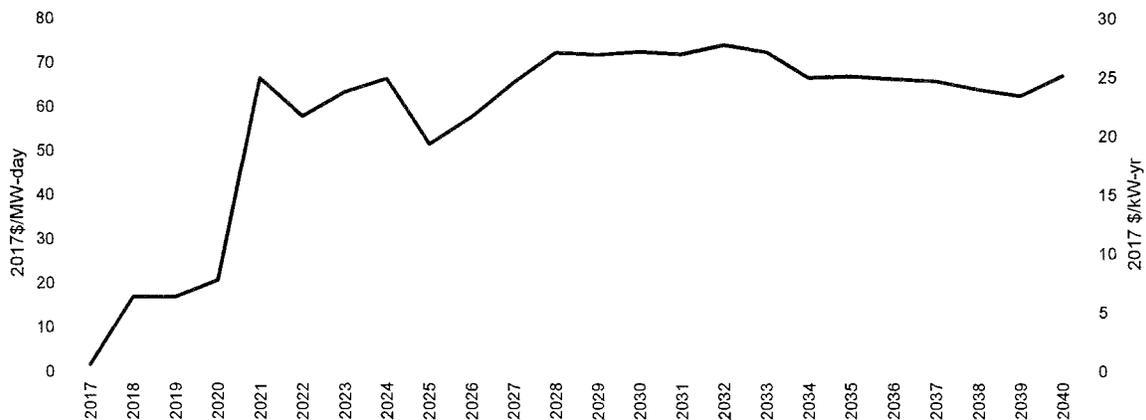


Base Case Capacity Price Forecast

In addition to the energy market, MISO also operates a capacity market which procures capacity in an annual auction. The capacity market is based on an administratively-set demand requirement and supply offers from market participants that are willing to sell capacity. Recent market prices have been relatively low even as coal capacity retires as a result of flat load, increases in renewable capacity, and increases in behind-the-meter, demand response, and energy efficiency supply. Furthermore, recent tariff revisions have impacted reduced supply offer thresholds, resulting in clearing prices around or below \$10/MW-day in recent auctions.

CRA's capacity price forecast includes a fundamental evaluation of supply and demand in the market, as well as the expected offer prices for generators throughout the market. CRA expects low market prices to persist through 2021, when coal and nuclear retirements may drive prices up towards the going-forward costs of existing units. The Base Case does not expect increases in price towards MISO's cost of new entry (CONE) benchmark even as new capacity is needed, since it is likely that electric utility builds, under cost-of-service ratemaking, will enter the market and keep reserve margins in the 17-19% range. Figure 8-16 presents the Base Case capacity price projections over time.

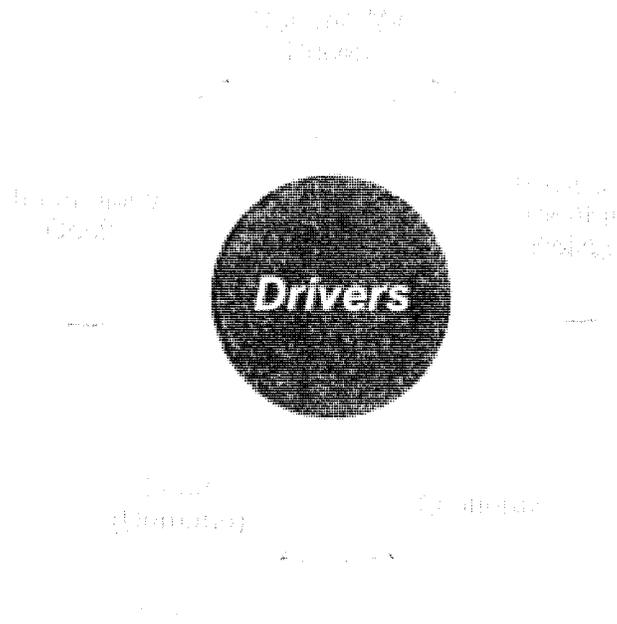
Figure 8-16: MISO Capacity Price Projections



8.2.5 Defining Risk and Uncertainty Drivers and Scenario and Stochastic Treatment

After defining the Base Case market drivers and conditions, NIPSCO worked to identify the key uncertainties and drivers that could impact its business environment and future portfolio performance over the long-term. Drawing on its work from the 2016 IRP, NIPSCO identified five major drivers of uncertainty, as shown in Figure 8-17. These include commodity prices, especially for natural gas, power, and coal; environmental policy, particularly with regard to carbon pricing; economic growth, including its impact on electric sector load growth and commodity prices; NIPSCO load growth, and technology costs for new resources.

Figure 8-17: Major Drivers of Uncertainty



After identifying the major drivers of uncertainty, NIPSCO then assessed whether they should be addressed through scenario or stochastic analysis. In the 2018 IRP, NIPSCO has structured its risk and uncertainty analysis to analyze portfolio decisions across both scenarios and stochastics since the two approaches answer different questions and quantify risk in different fashions. Scenarios can be structured to assess major changes to specific market driver assumptions, along with related feedbacks, while stochastics can evaluate volatility and tail risk, based on observed historical data, particularly in the commodity price markets. Figure 8-18 provides a summary of the primary purposes and benefits of using deploying each approach. Based on NIPSCO's review of the different uncertainty approaches, it was determined that stochastic distributions would be developed for natural gas and power commodity prices and evaluated in concert with the ranges established through a fundamental scenario development process.

Figure 8-18: Scenario and Stochastic Uncertainty Approaches

Scenario	Stochastic
<ul style="list-style-type: none"> Can be used to answer "What if..." Major events can change fundamental outlook for key drivers, altering portfolio performance <ul style="list-style-type: none"> New policy or regulation (carbon regulation) Fundamental gas price change (change in resource base, production costs, large shifts in demand) Loss of a major load Can tie portfolio performance directly to a "storyline" <ul style="list-style-type: none"> Easier to explain a specific reasoning why Portfolio A performs differently than Portfolio B 	<ul style="list-style-type: none"> Can evaluate volatility and "tail risk" <ul style="list-style-type: none"> Short-term price volatility impacts portfolio performance <ul style="list-style-type: none"> Value of certain portfolio assets is dependent on market price volatility Commodity price exposure risk is broader than single scenario ranges Develops a dataset of potential outcomes based on observable data, with the recognition that the real world has randomness <ul style="list-style-type: none"> Large datasets can allow for evaluation of key drivers and broader representation of distribution of outcomes

In the scenario development process, NIPSCO developed narratives to describe possible futures, which were organized around "themes" or "states-of-the-world." The first step in developing the themes was to construct assumptions for key macro drivers, which would ultimately translate into changes for the more detailed drivers impacting NIPSCO's portfolio costs. Ultimately, NIPSCO developed three scenarios to supplement the Base Case, relying on the foundation that was built in the 2016 IRP process, but incorporating recent trends and specific risks related to the 2018 IRP Base Case assumptions. A summary of the scenario themes is shown in Figure 8-19.

Figure 8-19: Scenario Theme Overview

Theme	Drivers			
	Technology	Policy	Load	Economy
Base Case	Expected continued declines in solar/storage costs; base case nat. gas production costs	National carbon price expected in 2026 with new federal policy; current regulations on CCR/ELG	Base load forecast	Long-term growth trends in line with historical averages
Aggressive Environmental Regulation	Renewable (wind and solar) and storage costs decline significantly, supported by policy push	Policy forces drive stricter carbon controls and stronger renewable targets	Base load forecast	Reference case macroeconomic factors persist
Challenged Economy	Base technology assumptions	No national carbon policy	Loss of industrial load; remaining customer load growth stagnates	Economic downturn with growth stalling
Booming Economy & Abundant Natural Gas	Continued efficiency gains in NG extraction drive lower operations costs and focus on most productive plays	Base environmental policy; strong support for gas extraction	Greater load growth, maintenance of industrial customers	Low-cost energy paradigm prevails and economic growth greater than expected

NIPSCO then assessed the themes for diversity and robustness and translated the scenario themes into specific assumptions for the key inputs of load, carbon price, natural gas price, coal price, and power price based on additional rounds of modeling with CRA’s fundamental market tools. Given that NIPSCO’s All-Source RFP resulted in a range of resource technology costs to use in the IRP analysis, this variable was not specifically evaluated in the scenario development phase. Figure 8-20 summarizes the directional movement of the key input assumptions relative to the Base Case, while the subsequent section of this chapter outlines the detailed inputs that were developed as part of the scenario analysis process.

Figure 8-20: Summary of Four Major Scenarios

Scenario Theme	NIPSCO Load	CO ₂ Price	Natural Gas Price	Coal Price	Power Price
Base	Base	Base	Base	Base	Base
Aggressive Environmental Regulation	Base	High	High (CO ₂)	Low (CO ₂)	High (CO ₂)
Challenged Economy	Low	Low	Low (No CO ₂)	High (No CO ₂)	Low (No CO ₂)
Booming Economy & Abundant Natural Gas	High	Base	Low	Low (Low Gas)	Low (Low Gas)

8.3 IRP Scenarios

8.3.1 Aggressive Environmental Regulation Scenario

Description

The Aggressive Environmental Regulation Scenario represents a future in which environmental regulations will be more stringent than currently anticipated for power sector emissions, particularly related to carbon dioxide. As a result, carbon environmental compliance costs will be greater for NIPSCO than in the Base Scenario, starting at about \$20/ton in real dollars in 2026, escalating to about \$35/ton (real dollars) by 2037. Natural gas prices will be greater as a result of greater demand from gas in the power sector as coal generation declines. In the scenario, natural gas prices are projected to trend towards \$5.50/MMBtu in real dollars over time. Coal prices are expected to be lower due to reduced coal demand. Power prices will be greater as a result of both higher carbon prices and higher natural gas prices, even though there is a faster shift in the MISO supply mix from coal to natural gas and renewables. The key directional assumptions changes are summarized in Figure 8-21.

Figure 8-21: Summary of Aggressive Environmental Regulation Scenario

Scenario Theme	NIPSCO Load	CO ₂ Price	Natural Gas Price	Coal Price	Power Price
Aggressive Environmental Regulation	Base	High	High (CO ₂)	Low (CO ₂)	High (CO ₂)

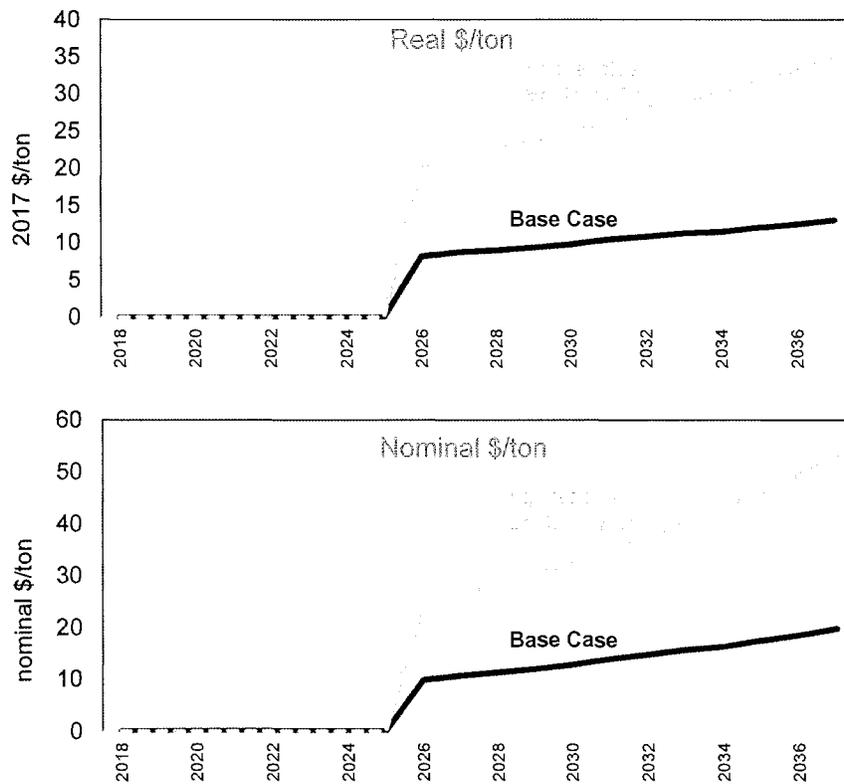
Risks Addressed

The Aggressive Environmental Regulation Scenario addresses the risk that carbon environmental regulations will be more stringent than expected in the Base Scenario. This scenario addresses the risk of higher carbon prices after 2026, which will tend to favor renewable generation and, to a lesser extent, natural gas-fired generation over coal capacity. The scenario also addresses the risk of higher prices for natural gas and power, which are correlated. Assumptions regarding load growth remain unchanged from the Base Scenario.

Detailed Scenario Assumptions

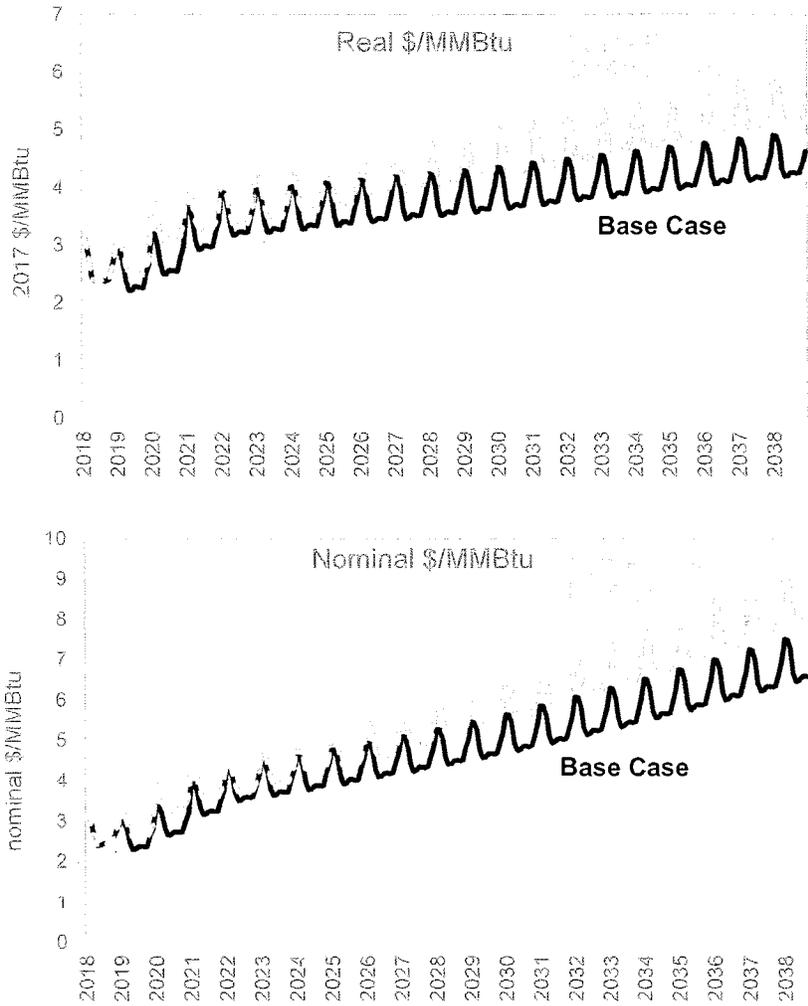
The Aggressive Environmental Regulation Scenario assumes a stricter new federal rule or legislative action on carbon dioxide emissions coming into force by the mid-2020s. Based on CRA's analysis, price levels are generally consistent with a 50-60% reduction in electric sector carbon emissions relative to 2005 by the 2030s. The scenario's timing is the same as the Base Case's, based on the fact that program implementation prior to 2026 is unlikely, given the required changes in executive administration or Congressional control, as well as the potential for legal challenges. This type of policy, however, would represent an initial pathway towards aggressive carbon reduction goals. The carbon prices over time are shown in both real and nominal dollars per ton in Figure 8-22.

Figure 8-22: Carbon Prices in Aggressive Environmental Regulation Scenario



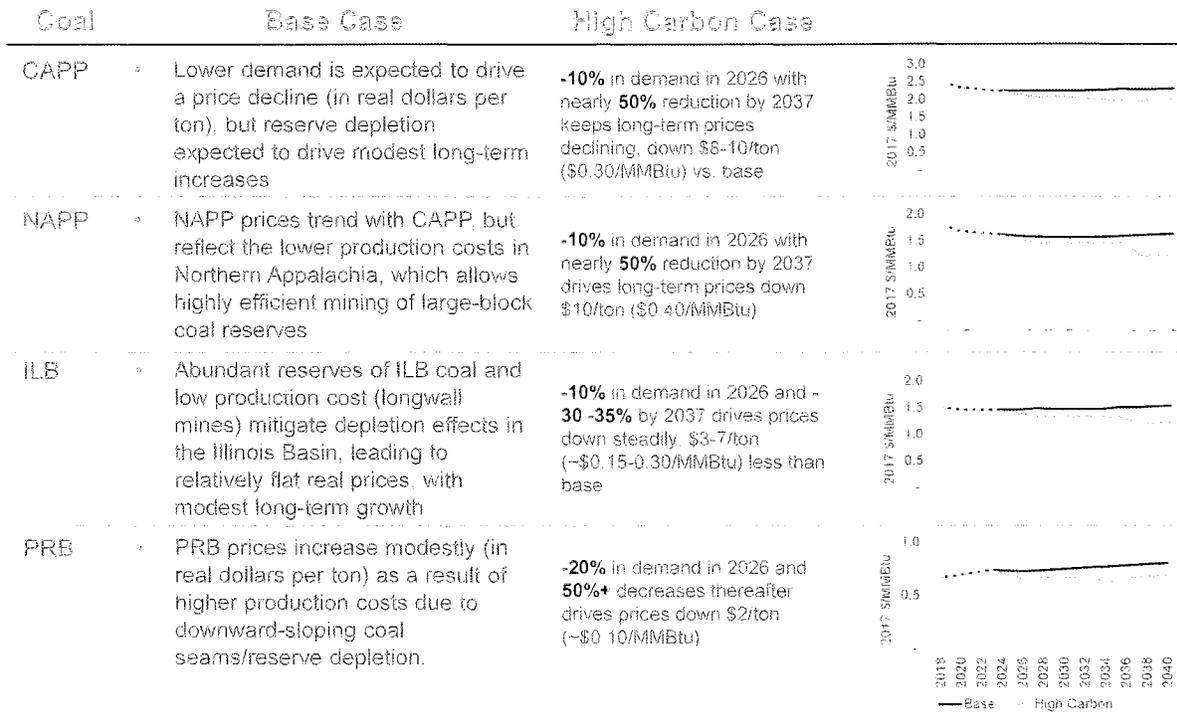
Such high carbon prices are likely to result in additional coal retirements and less coal generation in the electric power sector. Over the long-term, this is projected to result in higher demand for natural gas, even as renewable generation also expands significantly. The long-term increase in natural gas demand in the power sector is projected to be around 15%. CRA’s NGF modeling projects that such an increase in gas demand will result in upward pressure on long-term gas prices on the order of about \$1/MMBtu (real). The natural gas prices over time are shown in both real and nominal dollars per MMBtu in Figure 8-23.

Figure 8-23: Natural Gas Prices in Aggressive Environmental Regulation Scenario



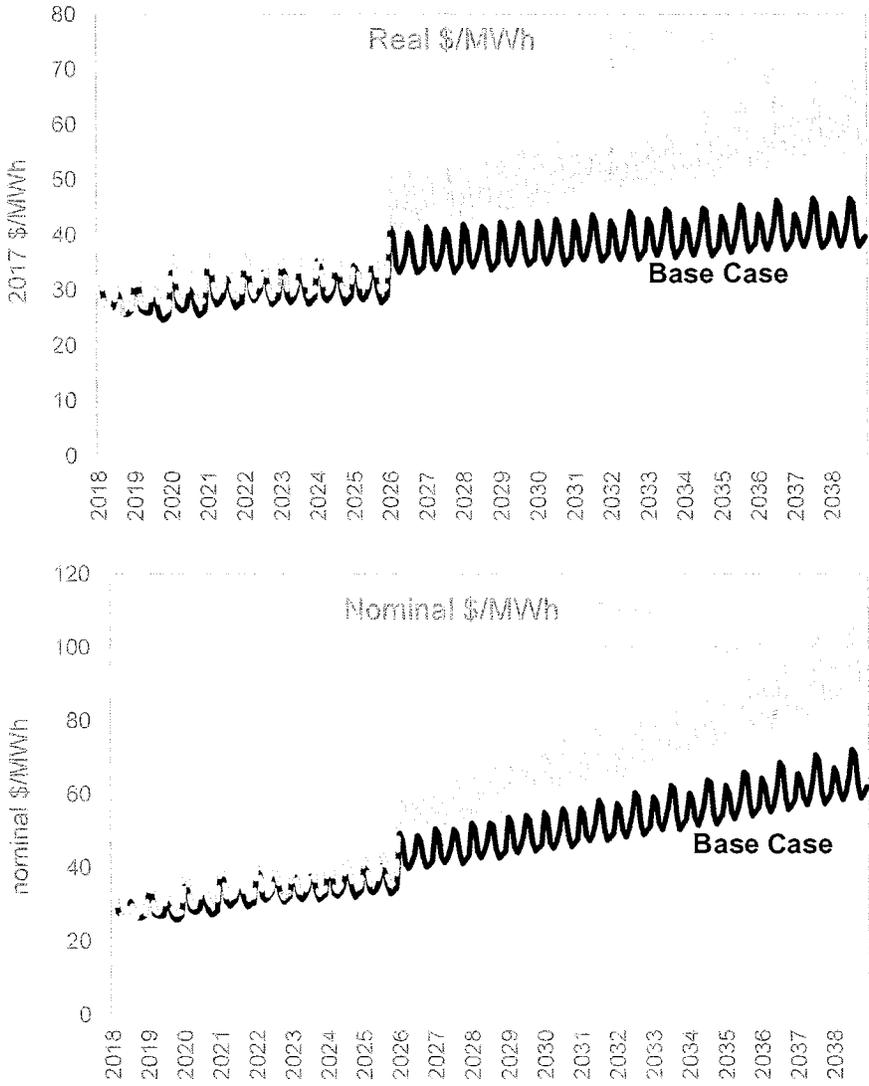
While demand for natural gas is projected to increase, demand for coal is likely to decline in the Aggressive Environmental Regulation Scenario due to reduced coal plant dispatch and additional coal retirements. In this scenario, coal demand is broadly expected to be around 10-20% lower than the Base Case in 2026 (the first year of the carbon price) and 30-50% lower over the long-term. The impacts vary based on coal production basin, but such demand declines are projected to result in price that are \$0.10-\$0.40/MMBtu lower than those in the Base Case. Figure 8-24 presents a summary of the projected impacts for each coal basin as well as the projected prices for the Aggressive Environmental Regulation Scenario in real 2017 dollars.

Figure 8-24: Coal Demand and Prices in Aggressive Environmental Regulation Scenario



The projected changes in fuel prices and carbon prices, along with expected impacts on capacity additions and retirements in the MISO market, lead to different power price outcomes in the Aggressive Environmental Regulation Scenario. Over a twenty-year period, coal generation in MISO is expected to decline by nearly 70% in this scenario, while natural gas and renewable generation are expected to make up the difference. Although renewable generation is significantly higher than in the base case, higher gas and carbon prices result in higher variable costs for the type of plant most often setting the market price in MISO. Over time, this drives average, around-the-clock (“ATC”) LRZ6 power prices up by about \$20/MWh (in real dollars) by the late 2030s. The ATC LRZ6 power price projections over time are shown in both real and nominal dollars per MWh in Figure 8-25.

Figure 8-25: LRZ6 Power Prices in Aggressive Environmental Regulation Scenario



8.3.2 Challenged Economy Scenario

Description

The Challenged Economy Scenario represents a future where economic growth is stagnant and environmental policy is focused on maintaining low energy prices through limited federal regulation of carbon emissions from the power sector. The scenario is premised on the assumption that federal regulation that would result in increased energy costs would be unlikely if economic growth is low. Thus, this scenario has no price on carbon and assumes that any future emission regulation is based on plant-specific efficiency measures or other rules without a specific cap or tax on emissions. As a result of weaker economic growth and no price on carbon, demand for

natural gas is expected to fall over time, keeping natural gas prices stable at around \$3.50/MMBtu (real dollars) over time. Stronger coal demand is expected to result in modestly increasing coal prices versus the Base Case. Under these scenario assumptions, fewer coal retirements and fewer renewable additions are expected when compared to the Base Case. Natural gas resources are expected to remain marginal during most hours, and lower gas prices and no carbon price result in a relatively flat power price forecast in real terms over time. Finally, under the assumption that economic growth impacts demand for electricity, including industrial demand, the Challenged Economy Scenario includes a lower load growth outlook for NIPSCO. The key directional assumptions changes are summarized in Figure 8-26.

Figure 8-26: Summary of Challenged Economy Scenario

Scenario Theme	NIPSCO Load	CO ₂ Price	Natural Gas Price	Coal Price	Power Price
Challenged Economy	Low	Low	Low (No CO₂)	High (No CO₂)	Low (No CO₂)

Risks Addressed

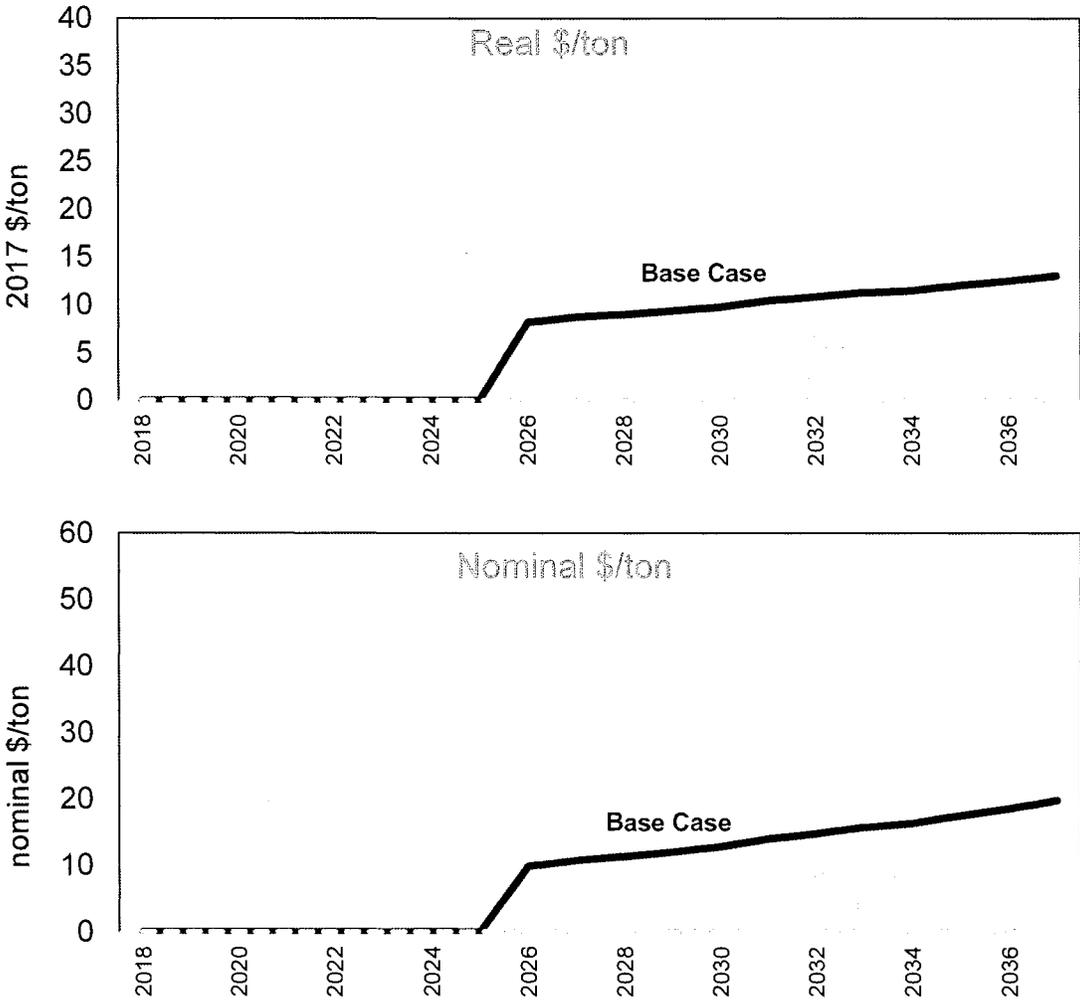
The Challenged Economy Scenario addresses the risk of an economic downturn as well as the risk of no carbon price coming into effect over the study horizon. The scenario addresses the combined risks of very low load growth, no carbon price, and low commodity prices for gas and power. Given the large amount of uncertainty related to federal action to control carbon emissions, the scenario specifically develops a future where carbon emissions are never priced, testing the robustness of portfolios against this important risk.

Detailed Scenario Assumptions

The Challenged Economy Scenario assumes no federal price on carbon, as shown in

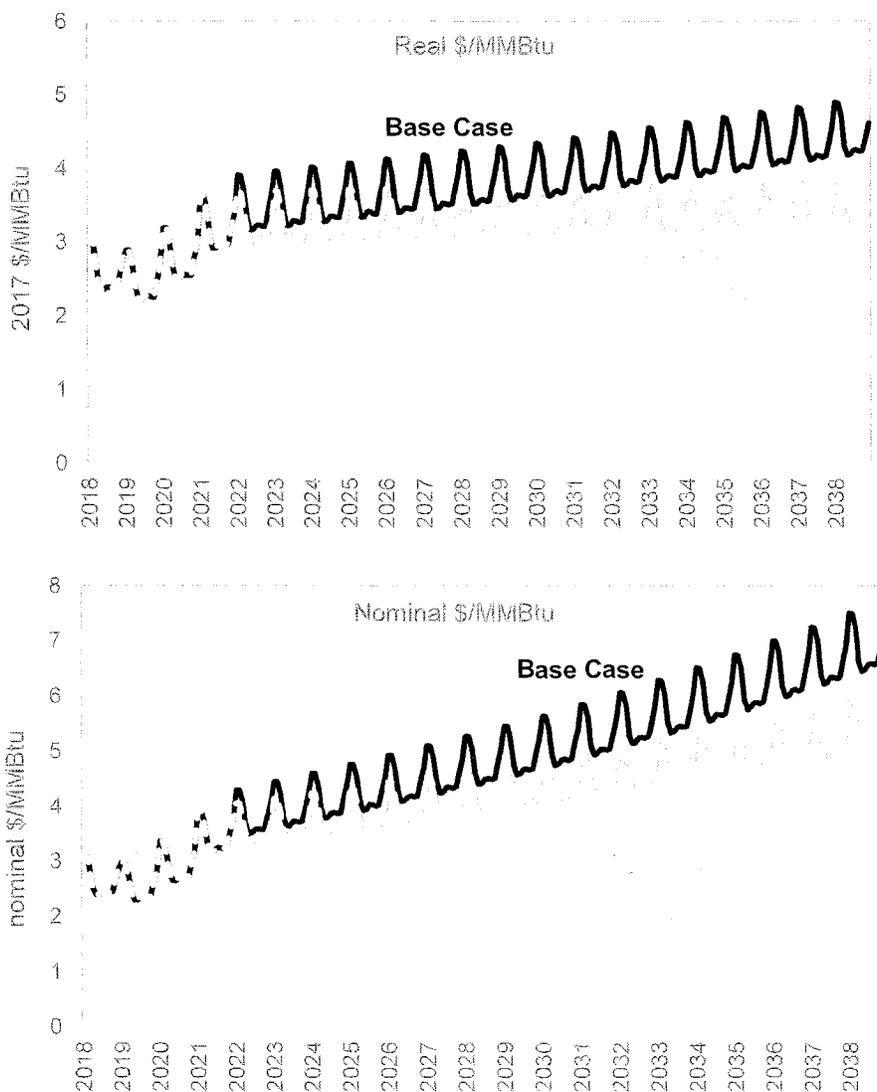
Figure 8-27 versus the Base Case. This scenario assumes that EPA regulation is broadly consistent with the recently proposed ACE rule, which focuses on heat rate efficiency improvements for existing coal plants. This proposed rule and other future regulations under this scenario would avoid specific tax-based costs or an emission cap requirement.

Figure 8-27: Carbon Prices in Challenged Economy Scenario



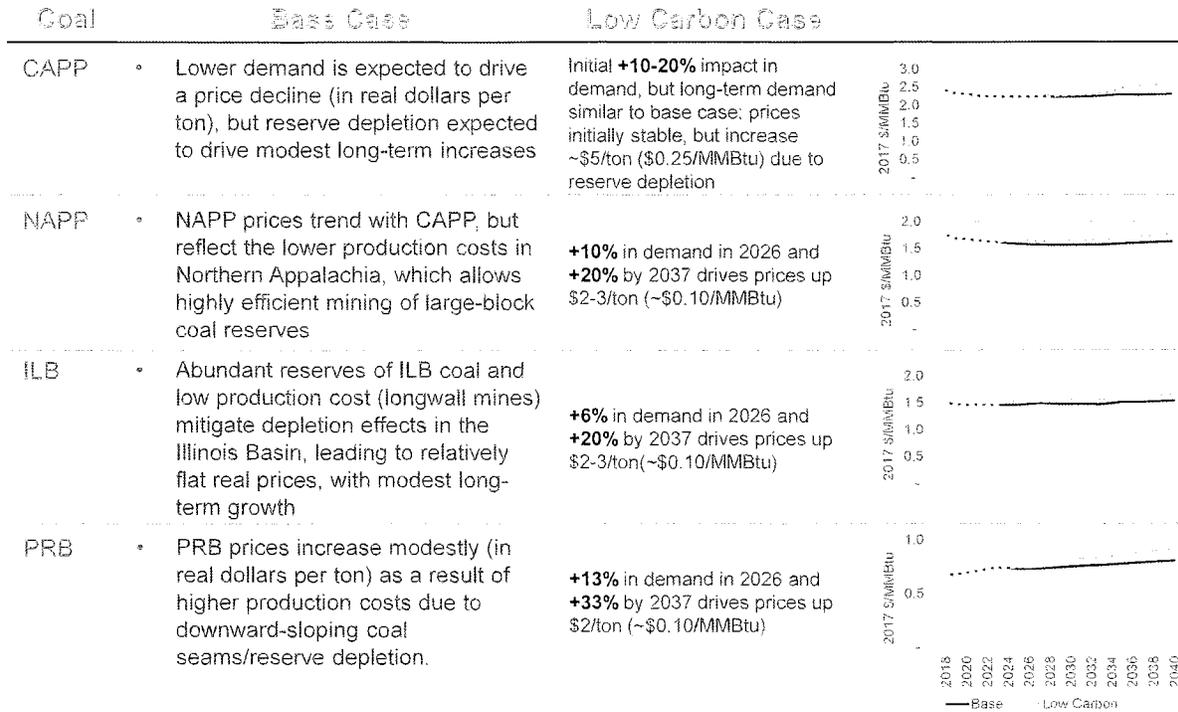
Lower carbon prices and lower overall electric demand growth are expected to reduce natural gas demand over time. CRA’s modeling has found that, rather than increasing like in the Base Case, power sector natural gas demand is projected to be relatively flat over the next twenty years in the Challenged Economy Scenario. This is due to higher levels of coal generation, as well as continued renewable additions, driven by state-level policy. These expected power sector dynamics result in 15-20% lower natural gas demand than in the Base Case, flattening the natural gas price outlook at around \$3.50/MMBtu (real dollars). This results in long-term prices that are about \$0.90/MMBtu (real dollars) lower than those in the Base Case. The natural gas prices over time are shown in both real and nominal dollars per MMBtu in Figure 8-28.

Figure 8-28: Natural Gas Prices in Challenged Economy Scenario



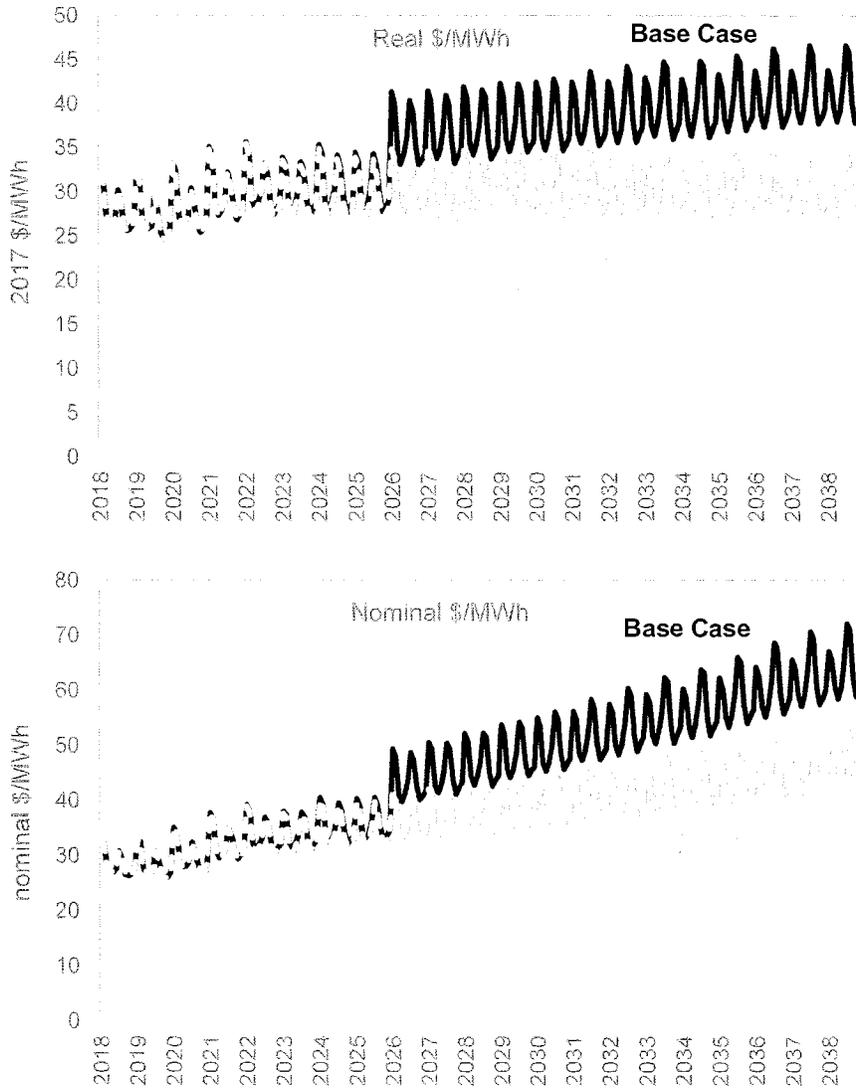
While demand for natural gas is projected to decrease, demand for coal is likely to increase in the Challenged Economy Scenario due to increased coal plant dispatch and fewer coal retirements without the influence of a carbon price. In this scenario, coal demand is broadly expected to be around 10% higher than the Base Case in 2026 (the first year of the carbon price in the Base Case) and 0%-30% higher over the long-term. The impacts vary based on coal production basin, but such demand increases are projected to result in price that are \$0.10-\$0.25/MMBtu higher than those in the Base Case. Figure 8-29 presents a summary of the projected impacts for each coal basin as well as the projected prices for the Challenged Economy Scenario in real 2017 dollars.

Figure 8-29: Coal Demand and Prices in Challenged Economy Scenario



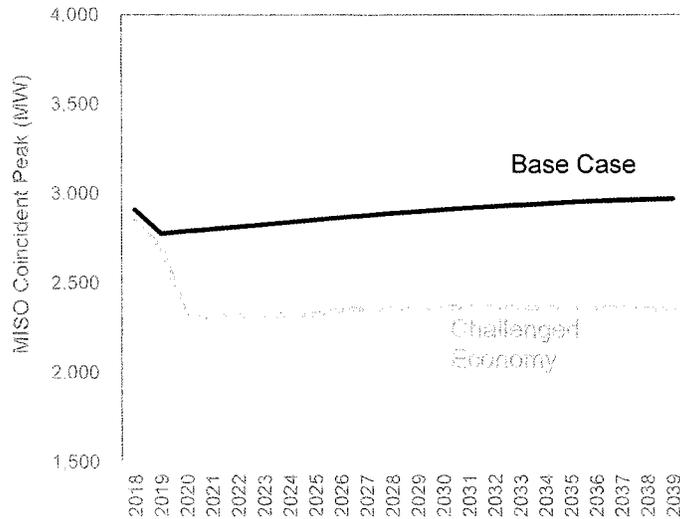
The projected changes in fuel prices and carbon prices, along with expected impacts on capacity additions and retirements in the MISO market, lead to different power price outcomes in the Challenged Economy Scenario. In this scenario, coal generation is expected to stabilize after 2026, especially as coal retirements are reduced and as variable costs of operation for coal-fired plants are lower without the presence of a carbon price. The lack of a carbon price and the flatter natural gas price forecast drive power prices down, such that average, ATC prices remain around \$30/MWh (in real dollars) over the long-term. This represents a decrease of about \$10-15/MWh (real dollars) versus the Base Case. The ATC LRZ6 power price projections over time are shown in both real and nominal dollars per MWh in Figure 8-30.

Figure 8-30: LRZ6 Power Prices in Challenged Economy Scenario



As part of the Challenged Economy Scenario, NIPSCO developed a lower load forecast that included the loss of significant industrial demand and lower load growth that is associated with lower regional economic growth. The load forecast chapter includes additional information on the detailed assumptions and methodology, while Figure 8-31 summarizes the peak load forecasts for the Base Case and the Challenged Economy Scenario. The compound annual growth rate for the high load trajectory is -0.9% versus 0.10% in the Base Case, primarily due to the significant loss of load assumed by 2020. Note that these forecasts are shown for MISO coincident peak and not NIPSCO’s internal peak.

Figure 8-31: NIPSCO Peak Load Growth Forecast in Challenged Economy Scenario



8.3.3 Booming Economy/ Abundant Natural Gas Scenario

Description

The Booming Economy & Abundant Natural Gas Scenario represents a future where natural gas production costs remain low and the resource base remains highly productive, keeping natural gas prices low and flat in real terms over the next decade. Low natural gas costs are a contributing factor to higher economic growth, as low energy prices contribute to higher levels of industrial and commercial economic activity. As a result of the flat forecast for natural gas prices, coal demand is projected to erode, which leads to lower coal prices over time. Power prices remain correlated to natural gas and carbon prices and remain relatively flatter for longer in real terms in this scenario when compared to the Base Case. A spike in power prices is still projected to occur in 2026 with the introduction of a carbon price, which is the same as in the Base Case. Fewer renewables and significantly more coal retirements are projected in the MISO supply mix as a result of very cheap gas over the next ten years. Finally, under the assumption that economic growth remains robust, the Booming Economy/ Abundant Natural Gas Scenario includes a higher load growth outlook for NIPSCO. The key directional assumptions changes are summarized in Figure 8-32.

Figure 8-32: Summary of Booming Economy/ Abundant Nat. Gas Scenario

Scenario Theme	NIPSCO Load	CO ₂ Price	Natural Gas Price	Coal Price	Power Price
Booming Economy & Abundant Natural Gas	High	Base	Low	Low (Low Gas)	Low (Low Gas)

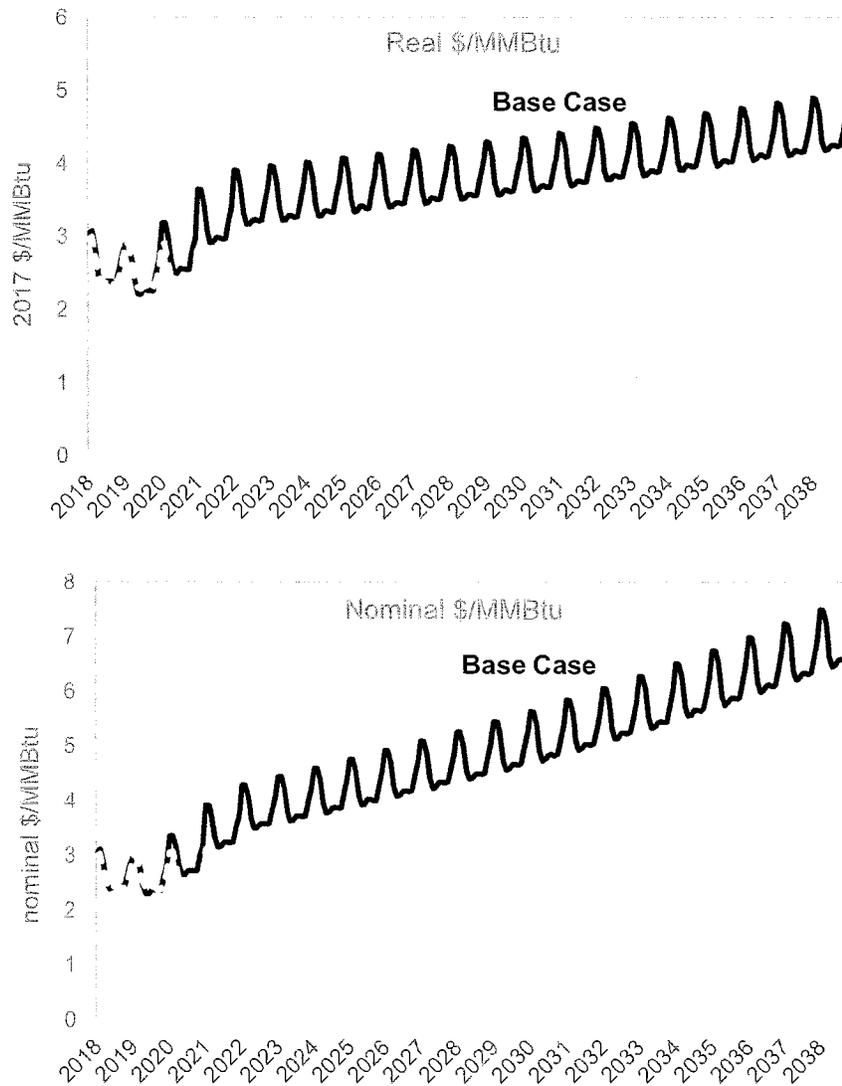
Risks Addressed

The Booming Economy/ Abundant Natural Gas Scenario addresses the risk of higher load growth for NIPSCO versus the Base Case. Higher load growth could result in higher exposure to the MISO market for NIPSCO depending on its portfolio selection. In addition, this scenario addresses the risk of persistently low natural gas prices, which would generally have the impact of favoring the economics of natural gas capacity and harming the economics of coal-fired and renewable generation. Assumptions regarding carbon prices remain unchanged from the Base Scenario.

Detailed Scenario Assumptions

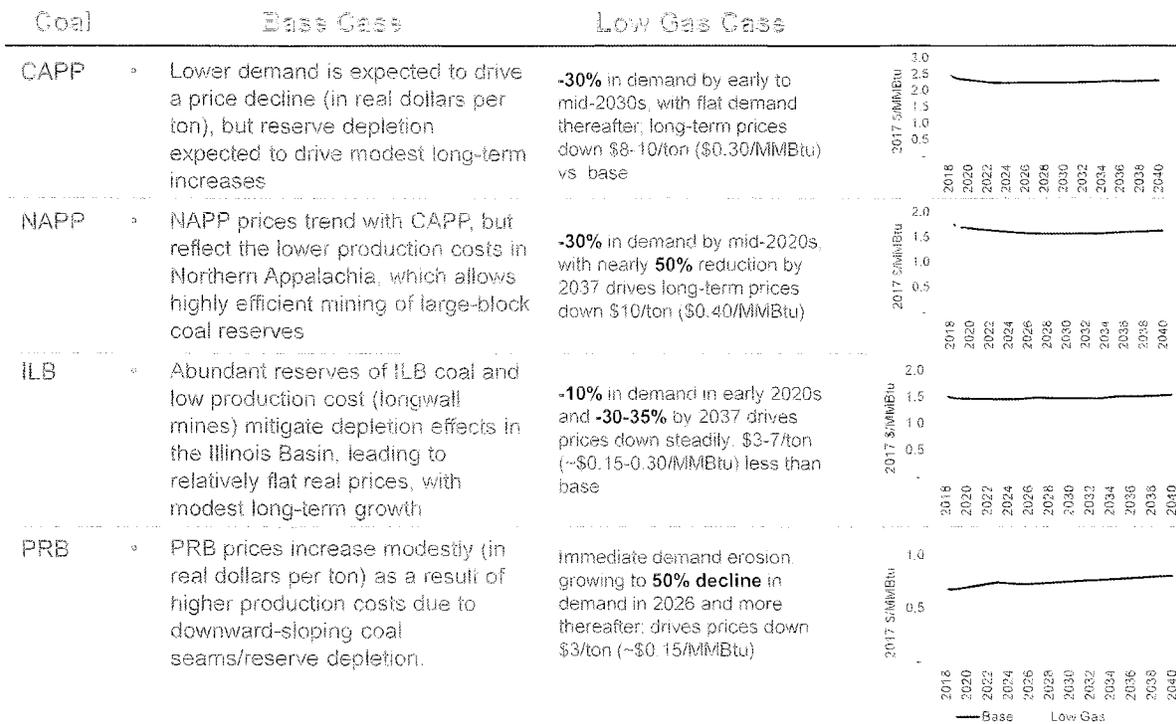
The Booming Economy/ Abundant Natural Gas Scenario assumes that natural gas prices stay relatively low for a longer period of time, primarily as a result of lower production costs. This could be the result of continued expansion of the resource base, producers continuing to effectively hold operations costs down, and producers focusing on the most productive plays for a longer period of time. In order to develop natural gas price projections for this scenario, CRA adopted the long-term forward strip for natural gas for a ten-year period. As of the time of the development of the 2018 IRP assumptions, natural gas forwards at Henry Hub were relatively flat in real dollars at around \$2.60/MMBtu for the next ten years. In 2028 and beyond, CRA's fundamental modeling suggested that modest increases in real prices to above \$3/MMBtu by the late 2030s were likely in this case. The natural gas prices over time are shown in both real and nominal dollars per MMBtu in Figure 8-32.

Figure 8-33: Natural Gas Prices in Booming Economy/ Abundant Nat. Gas Scenario



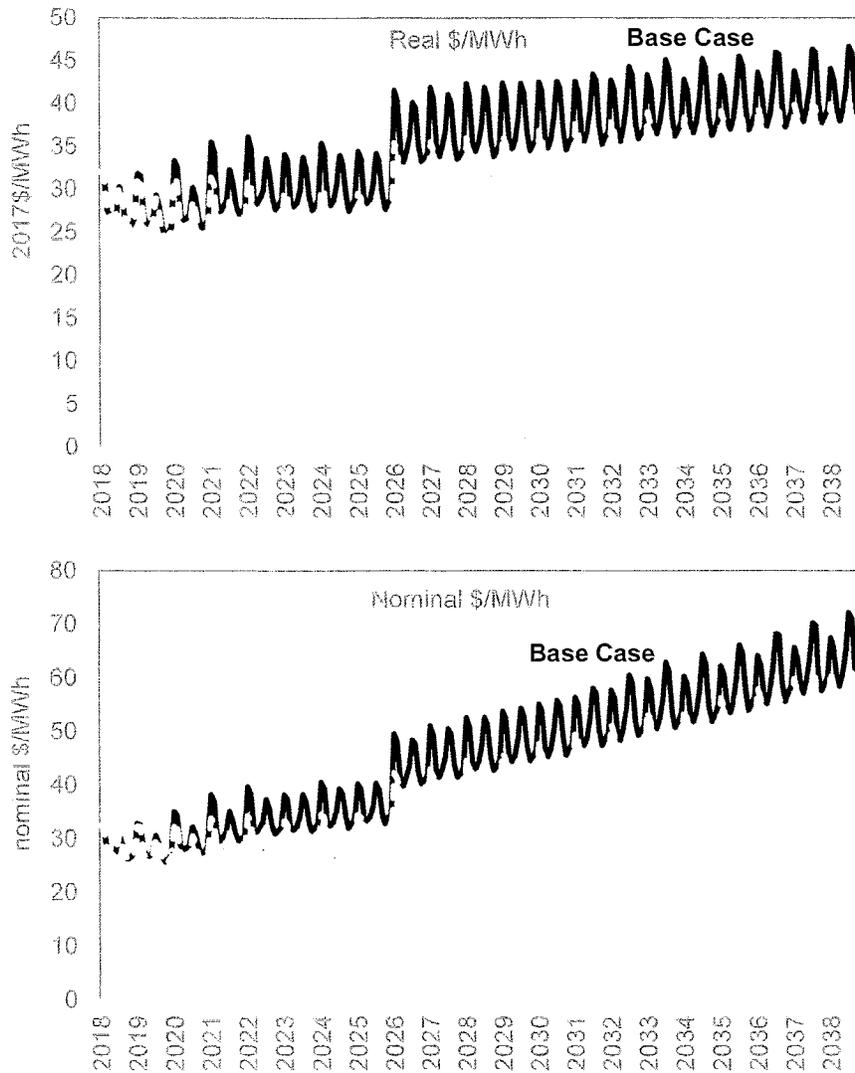
With significantly lower natural gas prices in the Booming Economy/ Abundant Natural Gas Scenario, coal demand is expected to decrease significantly as the variable costs of coal generators remain higher than those of gas plants. In this scenario, coal demand is expected to be significantly lower than the Base Case, with 30-50% lower coal demand expected across most basins, especially with the implementation of a carbon price in 2026. The impacts vary based on coal production basin, but such demand declines are projected to result in price that are \$0.15-\$0.40/MMBtu lower than those in the Base Case. All coal price forecasts in this scenario are flat or declining in real dollars versus currently market prices. Figure 8-34 presents a summary of the projected impacts for each coal basin as well as the projected prices for the Booming Economy/ Abundant Natural Gas Scenario in real 2017 dollars.

Figure 8-34: Coal Demand and Prices in Booming Economy/ Abundant Nat. Gas Scenario



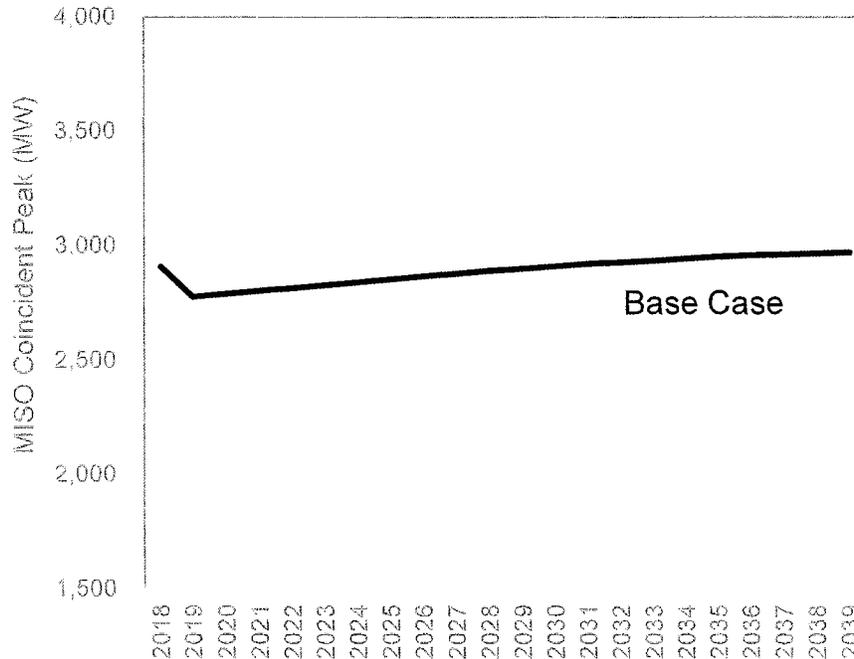
The projected changes in fuel prices, along with expected impacts on capacity additions and retirements in the MISO market, lead to different power price outcomes in the Booming Economy/ Abundant Natural Gas Scenario. Similar to the Aggressive Environmental Regulation Scenario, coal generation in MISO is expected to decline by nearly 70% in this scenario over a twenty-year period. The decline in coal generation, however, is more significant in the early years in the Booming Economy/ Abundant Natural Gas Scenario. With gas generation being marginal during more hours with lower gas prices and more coal retirements, the low gas price projections result in power prices remaining very flat in real dollars and below \$30/MWh on average through 2025. Although a carbon price is still incorporated in 2026, lower gas prices drive MISO power prices about \$5-6/MWh lower than prices in the Base Case after 2030. The ATC LRZ6 power price projections over time are shown in both real and nominal dollars per MWh in Figure 8-35.

Figure 8-35: LRZ6 Power Prices in Booming Econ/ Abundant Nat. Gas Scenario



As part of the Booming Economy/ Abundant Natural Gas Scenario, NIPSCO developed a higher load forecast that is associated higher lower regional economic growth. The load forecast chapter includes additional information on the detailed assumptions and methodology, while Figure 8-36 summarizes the peak load forecasts for the Base Case and the Booming Economy/ Abundant Nat. Gas Scenario. The compound annual growth rate for the high load trajectory is 0.73% versus 0.10% in the Base Case. Note that these forecasts are shown for MISO coincident peak and not NIPSCO’s internal peak.

Figure 8-36: NIPSCO Peak Load Growth Forecast in Booming Economy/ Abundant Nat. Gas Scenario



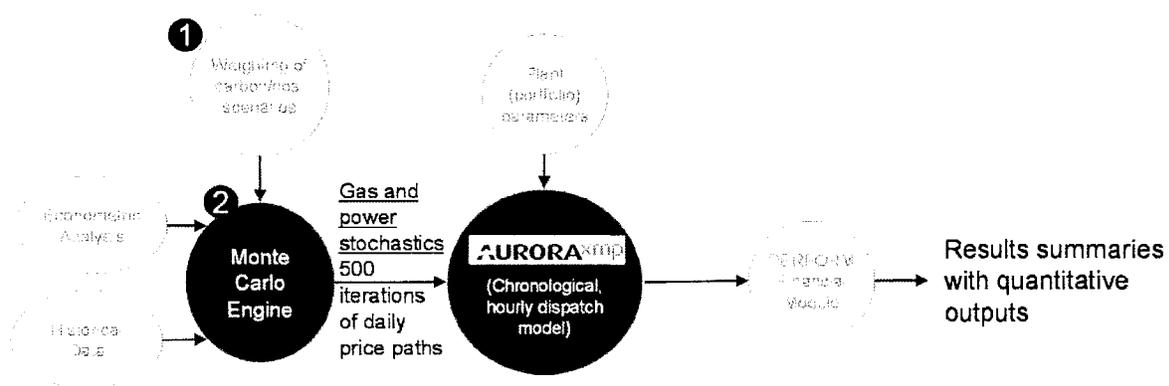
8.4 IRP Stochastics Development

The development of stochastic inputs was a separate, but complementary part of NIPSCO's assessment of risk and uncertainty. As discussed above, NIPSCO determined that stochastic analyses would be performed for key commodity prices with sufficient price history, with the full stochastic distribution of outcomes also including probability weightings for other relevant drivers like carbon prices. Overall, scenario development supported the stochastic parameter definition, with granular distributions of major commodity price inputs developed with CRA's Monte Carlo engine. The major elements of the stochastic input distribution development process included:

1. Establishment of probability weightings for major discrete variables like carbon prices and coal prices, based on the scenario assumptions.
2. Deployment of CRA's Monte Carlo engine to produce daily and hourly price paths for natural gas and power prices for each weighted scenario, based on historical data analysis, which incorporated:
 - Daily price spikes for gas; and
 - Power price volatility on a daily and hourly level, implicitly based on historical data observations that include market load shocks, fuel price changes, and plant outages.

Figure 8-37 summarizes the stochastic input development process and how the stochastic inputs were deployed in the IRP models to assess risk and uncertainty for potential portfolio options. As is shown, CRA's Monte Carlo engine relies on econometric analysis of historical price data, as well as weightings for major discrete variables based on the scenario development process. The Monte Carlo engine itself develops 500 iterations of daily and hourly price paths for gas and power prices which are fed into the Aurora model. The Aurora model is then run 500 times, incorporating each set of price paths, along with other market assumptions and portfolio parameters for NIPSCO. The 500 runs are then each analyzed within CRA's PERFORM financial model to estimate revenue requirements and total portfolio costs.

Figure 8-37: Overview of Stochastic Input Development Process



Stochastic Input Development Methodology

The development of stochastic inputs within the Monte Carlo engine incorporated several steps, which are described in more detail below:

- Step 1: Historical Data Analysis – CRA first analyzed historical commodity prices at the liquid commodity price points most relevant to NIPSCO, which included Chicago Citygate for natural gas prices and the Indiana Hub, representative of LRZ6, for power prices. The historical data analysis was performed to find a stochastic (or econometric) model that best captured the observed behavior of prices in the modeled regions. Key statistical parameters were developed from the data analysis in order to define the stochastic price processes. These included:
 - volatility levels (a measure of the price randomness);
 - mean-reversion rate (a measure of the convergence to long-term price trends and forecasts); and
 - the correlation between power and natural gas prices in the regions.
- Step 2: Parameter Estimation – Based on this analysis, CRA then fit the historical data to an econometric model by running regressions and estimating stochastic process parameters.
- Step 3: Monte Carlo Simulations – Based on the parameter estimation, CRA then deployed its Monte Carlo engine to simulate future spot prices for both natural gas and

power. The simulation included the development of 10,000 price paths for each commodity, using antithetic draw techniques to ensure fast convergence and a balanced and risk-adjusted coverage of the full spectra of positive and negative price jumps in the simulated price time series.

- Step 4: Final Probability Distributions for Each Scenario – Given the range of scenario-based inputs for key discrete variables (such as carbon prices), CRA performed the Monte Carlo simulations across multiple fundamental market scenarios and probability-weighted them to develop the full set of stochastics that preserve internal consistency with the fundamentals-based carbon and coal price inputs. In order to develop a set of inputs that could feasibly be run through the Aurora and PERFORM IRP models, 500 draws were sampled for the full portfolio dispatch analysis.

Stochastic Input Distributions

The stochastic input development process results in 500 daily or hourly price paths for the major commodities, which can be summarized with distribution plots showing monthly confidence intervals over time. Probability distribution plots for the twenty-year forecast period for natural gas prices, including historical price data, and power prices are shown in Figure 8-38 and Figure 8-39, respectively. These graphics show, on a monthly level, the broad range of the individual price paths (in gray) along with representations of the monthly confidence intervals at the 5th, 25th, 50th, 75th, and 95th percentiles.

The confidence intervals do not represent specific price trajectories, but instead indicate the probability of the price being at or below the specified level at any given point in time. For example, the top orange line in Figure 8-38 represents the monthly 95th percentile for natural gas prices, which means that 95 percent of the data set is below this price at any given point in time. In other words, five percent of the price observations in any given month across the full distribution would be expected to be above this value. These observations can come from different price paths over time, since each path is likely to be relatively volatile, moving up and down. In fact, it is highly unlikely that a single path would be at the 95th percentile for a sustained period of time. Overall, the stochastic inputs allow for evaluation of portfolio performance against extreme price outcomes on the high side and on the downside, including at the daily and hourly price levels, which are not shown in these graphics.

Figure 8-38: Stochastic Distribution for Natural Gas Prices

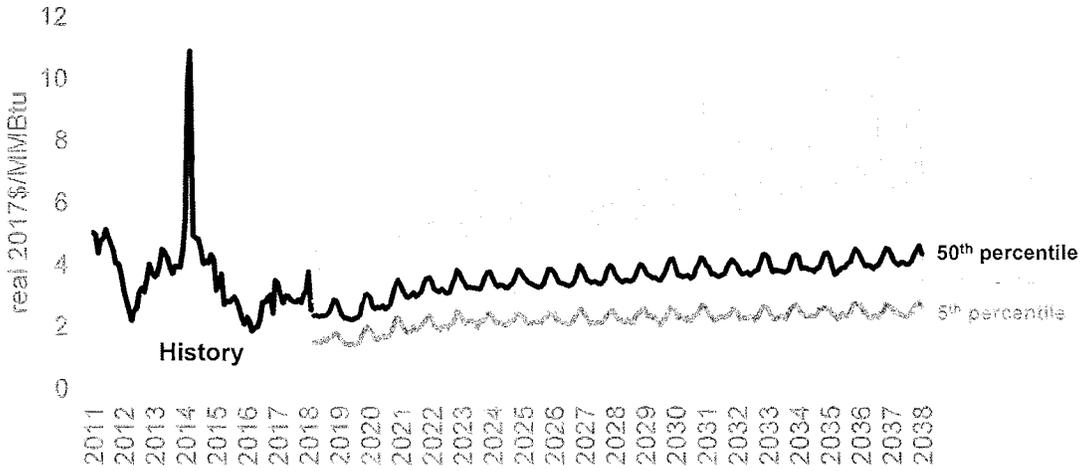
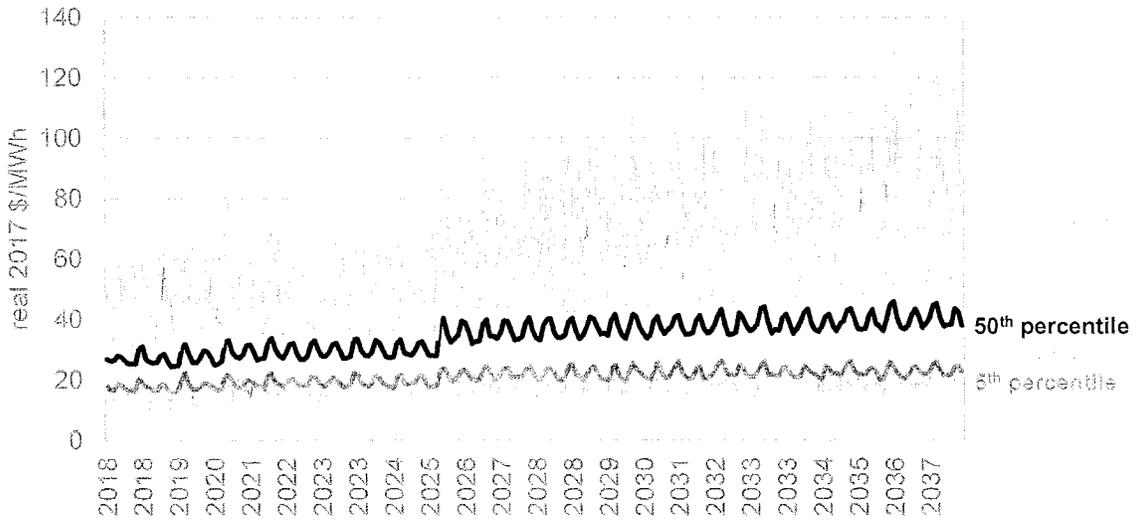


Figure 8-39: Stochastic Distribution for Power Prices



Section 9. Portfolio Analysis

9.1 Retirement Analysis

9.1.1 Process Overview

As in the 2016 IRP, NIPSCO performed a retirement analysis in its 2018 IRP to evaluate the preferred coal retirement strategy over time. Given the number of permutations around the magnitude and timing of potential retirements, NIPSCO determined that it was most efficient and effective to evaluate retirement decisions on a stand-alone basis, while performing an additional replacement analysis to assess a number of replacement resource strategies. Although performed in two steps, the retirement and replacement analyses are both based on the same major inputs and assumptions, which are described in earlier parts of Section 8 and below.

NIPSCO believes that performing a retirement analysis requires careful planning and consideration of several factors in addition to the cost of generation. To that end, NIPSCO has used an integrated scorecard methodology to evaluate retirement portfolios. In addition to the net present value of revenue requirements in the Base Case, NIPSCO has also considered cost certainty and cost risk metrics based on a full stochastic analysis, the ability to confidently transition resources and maintain system and customer reliability, and the effect of unit retirements on NIPSCO's employees, the local economies of the communities it serves, and the environment.

9.1.2 Retirement Analysis Methodology and Results

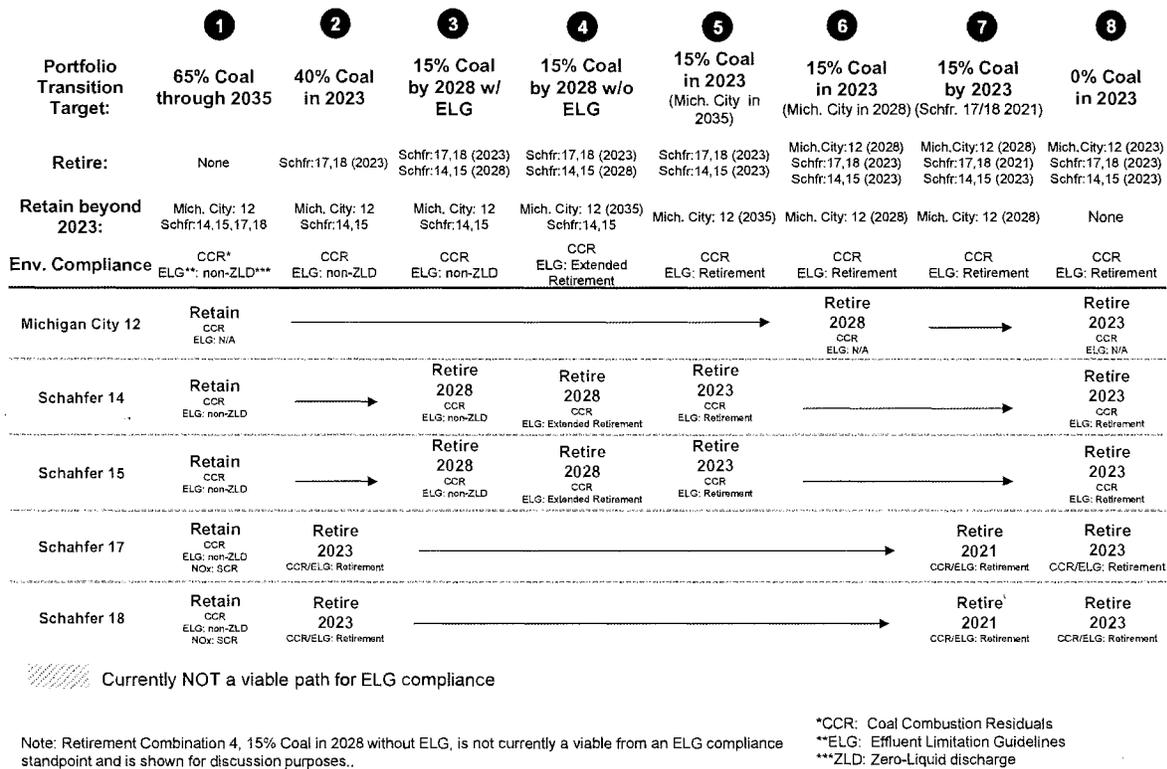
The retirement analysis has been conducted according to the following steps:

- Identify plausible retirement plans and specify individual retirement combinations or “portfolios”
- Identify the least-cost replacement capacity to fill the resulting capacity gap for each retirement portfolio based on the results from the All-Source RFP conducted by NIPSCO (*See* Section 4.9.2 for additional information on the details of the All-Source RFP.).
- Evaluate each retirement portfolio, including its associated least-cost capacity replacement, in the IRP tools for each scenario and across the full stochastic distribution of major market inputs (as discussed earlier in this section). The evaluation includes a full accounting of the ongoing operations of each existing plant (including any additional environmental compliance requirements) and the costs of alternatives.
- Record costs, risks, and other metrics in the integrated scorecard to arrive at a preferred retirement portfolio.

9.1.3 Identification of Retirement Portfolios

All five of NIPSCO’s coal-fired units were evaluated for retirement. This includes Michigan City Unit 12 and Schahfer Units 14, 15, 17 and 18. The operational dependency as well as technology and vintage similarity of the Units at Schahfer would make Unit-level retirement impractical. As a result, the analysis created Unit pairs (14&15, and 17&18) that would be jointly considered for retention or retirement. NIPSCO identified eight retirement portfolios for analysis based on different combinations of unit retirements at different points in time. The plans range from one that keeps all existing coal units in service through end-of-life to one that retires all coal in 2023. In between, the portfolios evaluate different levels of retirement at different dates over time. Figure 9-1 provides a summary of the eight portfolios, including the timing of the various retirement permutations and the assumed environmental compliance investments.

Figure 9-1: Overview of Retirement Combination Portfolios



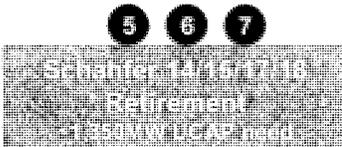
9.1.4 Identification of Least-Cost Replacement Capacity

While NIPSCO’s 2016 IRP relied on market price benchmarks for replacement capacity and energy, the All-Source RFP conducted in 2018 provided insight into the supply and pricing of alternatives available to NIPSCO. Thus, for the 2018 IRP, data from this process was used to develop detailed cost and operational estimates for the least-cost replacement capacity that was available for each of the eight retirement portfolios.

As discussed further in Section 4, representative replacement resource tranches were constructed from the All-Source RFP results based on technology, ownership structure, cost, and other operational characteristics. Then, all of the resource tranches, along with the bundles developed in the DSM assessment (See Section 5.), were available to the portfolio optimization model in Aurora. A portfolio optimization was then performed under each of the eight retirement portfolios to identify a least-cost set of replacement resources for each. The portfolio optimization modeling was performed to minimize the net present value of revenue requirements, with certain constraints for minimum and maximum reserve margins and maximum off-system energy sales.

Overall, the economic optimization model selected a combination of DSM and renewable resources across all retirement portfolios. Along with a small amount of flexible MISO capacity market purchases, the optimization model selected 125 MW of total DSM by 2023, approximately 150 MW of wind (UCAP), and a combination of solar and solar plus storage resources, depending on the capacity gap that was required to be filled. Figure 9-2 provides a summary of the type of capacity that was selected under the various retirement portfolios. Note that this does not represent NIPSCO’s preferred replacement strategy, but only a least-cost optimization that is used to evaluate retirement implications.

Figure 9-2: Summary of Least-Cost Replacement Capacity by Retirement Portfolio

						
	TECHNOLOGY	MW	TECHNOLOGY	MW	TECHNOLOGY	MW
Higher	MISO Market Purchase	50	MISO Market Purchase	50	MISO Market Purchase	50
	DSM	125	DSM	125	DSM	125
	Wind	150	Wind	150	Wind	150
	Solar, Solar + Storage	390	Solar, Solar + Storage	1,070	Solar, Solar + Storage	1,500
Lower		<u>715</u>		<u>1,395</u>		<u>1,825</u>

9.1.5 Evaluation of Each Retirement Portfolio - Assumptions

Analyses were performed for each of NIPSCO’s coal-fired units that evaluated the ongoing operations versus retirement and replacement of the units with an alternative under various potential future states of the world. NIPSCO used a number of factors in analyzing the retirement timing of the coal units including economics, cost risk, reliability risk and impacts to NIPSCO’s employees, and the local economy. The evaluation of each retirement portfolio was performed through a full portfolio analysis that included dispatch in Aurora and financial accounting in PERFORM. Market assumptions were consistent with those outlined earlier in Section 8 for the Base Case, the three deterministic scenarios, and the full range of stochastic inputs. In addition to the major market inputs and the costs of replacement resources from the All-Source RFP results, several relevant assumptions were made regarding the ongoing costs of the existing coal fleet.

Ongoing costs include fuel, fixed O&M costs, maintenance capital, costs associated with future environmental controls, as well as the recovery of remaining book value associated with each plant as of December, 2017. This recovery includes return of (depreciation), return on, and income and property taxes associated with the remaining net book value of NIPSCO's existing fleet.

Fixed O&M costs included all labor, materials, engineering and support services, and overhead costs necessary to operate the plant. For all units, nine-year projections of incremental O&M budgets were obtained. The average of these budgets was then escalated at 2% per year for the remaining years. Additional detail is provided in Confidential Appendix D.

Maintenance capital costs included the projected capital expenditures necessary to keep the units running through the analysis period at the projected level of operations. For all units, nine-year projections of incremental O&M budgets were obtained. The average of these budgets was then escalated at 2% per year for the remaining years. Additional detail is provided in Confidential Appendix D. As coal units' projected retirement dates move up, the relative capital spend decreases during the years leading up to retirement. This is different than expected fixed O&M costs leading up to a retirement, which stay relatively constant over time, regardless of retirement expectation.

Capital for environmental controls and the associated O&M expenditures that are projected to be required for future environmental compliance are additive to the ongoing capital and O&M expenditures. These incremental capital estimates were provided by NIPSCO's Major Projects department based on outside engineering studies. The most recently available capital estimates, escalated by 2% for inflation, were used in the analyses as specified in the unit retirement studies. For each of the units analyzed, environmental control requirements and dates included in the analyses were based on the expected compliance requirements of final, proposed, and/or expected environmental rules and regulations.

A unique environmental capital and O&M spending schedule was developed for each retirement portfolio, with compliance retrofits required for the coal combustion residuals (CCR) and ELG rules. In Retirement Portfolio 1, NIPSCO also assumed that Schahfer Units 17 and 18 would require additional environmental upgrades associated with a selective catalytic reduction system, a de-watering system, and stack lining. NIPSCO also developed a hypothetical portfolio (Retirement Portfolio 4) that retains Schahfer 14 and 15 through 2028 with no ELG compliance spending, though this is not currently a viable ELG compliance pathway.

NIPSCO also included estimated costs to mitigate transmission related issues that would arise as a result of the various retirement combinations at Schahfer. An additional \$79.8 million of capital expenditures was incorporated for transmission upgrades at the time of the Schahfer 17 and 18 retirement in any retirement portfolio. When all of Schahfer is retired, a total of \$147 million in additional capital expenditures related to transmission upgrades has been incorporated. These estimates developed by NIPSCO transmission planning group are based on NERC transmission planning standards and incorporate the impact of the MISO retirement study process (Attachment Y)

Recovery of remaining depreciation expenses by 2030 has also been incorporated in the retirement analysis. NIPSCO has prudently ensured that each of its facilities has been ready and available to meet customer needs over the past several decades through appropriate capital investment and O&M expenditures. Upon retirement, due to this continued capital investment, there will be a remaining net book value associated with the generation assets. The retirement analysis assumes that when a unit is retired prior to end of life, it still recovers the return on and return of its net book value.

NIPSCO assumes that each unit continues to depreciate at the same blended rate of 4.60%, regardless of whether the unit has been retired or not. The unit continues to depreciate until its book value is equal to the negative “cost of removal” for each asset. The cost of removal was estimated by John J. Spanos, an expert witness supporting NIPSCO electric depreciation studies. In addition to the “return of” (depreciation) the existing net book value, NIPSCO continues to earn a “return on” the net book value equal to NIPSCO’s assumed weighted average cost of capital, or “WACC.”. Additionally, NIPSCO assumes that property and income tax will *not* be collected on the remaining net book value of the plant if it is retired.

9.1.6 Evaluation of Each Retirement Portfolio – Scorecard Metrics

NIPSCO developed a set of decision criteria objectives and metrics against which to evaluate the full set of retirement portfolios. The analysis was then conducted to quantify the performance of each portfolio against each scorecard metric. The following section describes each of the key objectives and metrics in more detail:

- Cost to Customer is measured by the overall net present value of revenue requirements (“NPVRR”).
- Cost Certainty measures the certainty that the net present value of revenue requirements falls within the most likely range of the distribution of outcomes. It is quantified by the 75th percentile of cost to customer in the stochastic analysis.
- Cost Risk measures the risk of unacceptable, high-cost outcomes and is quantified by the by 95th percentile of cost to customer in the stochastic analysis.
- Reliability Risk assess NIPSCO’s ability to confidently transition its portfolio of resources and maintain customer and system reliability. Reliability Risk considers the activities, timelines and risks of the MISO retirement process, transmission system and reliability upgrades, remaining unit dependencies, outstanding fuel and other contracts, future resource procurement, and the percent of NIPSCO’s supply resources turning over at once. Reliability risk is a qualitative assessment made by NIPSCO of how orderly the transition would be from its current portfolio. It considers NIPSCO’s ability to analyze, plan for and execute any transmission system upgrades and/or other equipment needed to ensure that customers’ needs for reliability met.
- Other factors, such as the loss of work for employees, and the reduction of property tax base for surrounding communities also factored into NIPSCO’s decision

making process. While these do not directly impact power supply costs to customers, they are factors that should be included in the analyses. The employee metric is represented by the net impact on NiSource jobs at existing facilities, and the local economy metric is represented by the expected impact on local property taxes as compared to NIPSCO's 2016 IRP.

A summary of the decision criteria metrics is provided in Figure 9-3.

Figure 9-3: Scorecard Metrics for Retirement Analysis

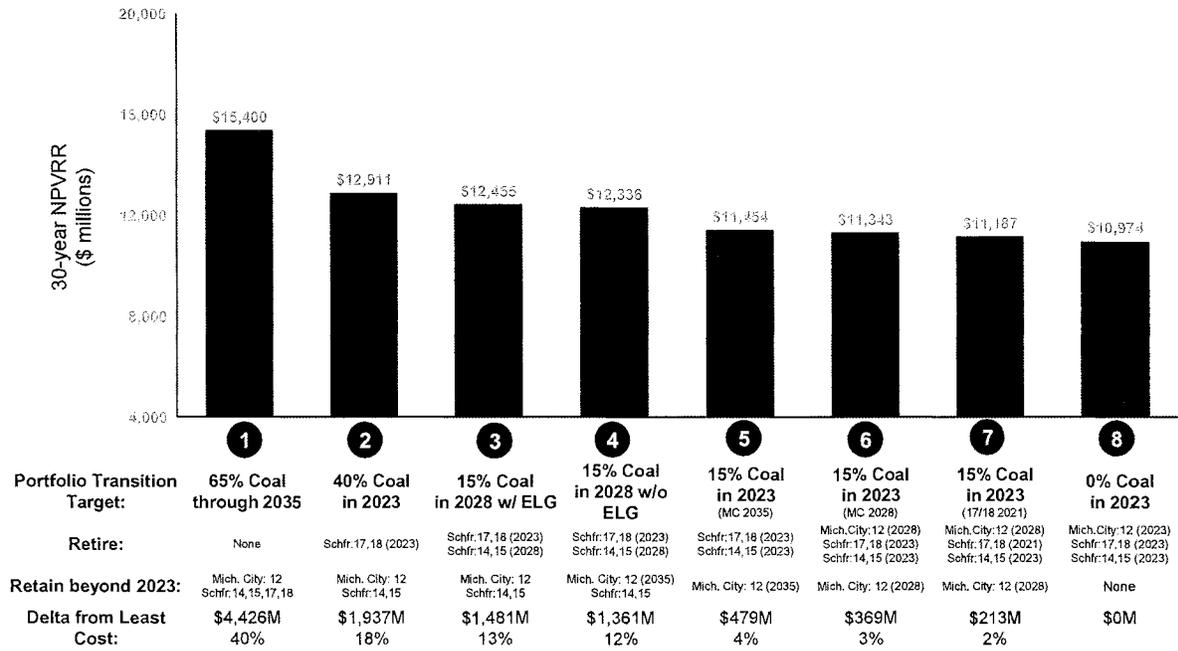
2018 Retirement Scorecard	
Criteria	Description
Cost to Customer	<ul style="list-style-type: none"> Impact to customer bills 30-year net present value ("NPV") of revenue requirement (Base scenario deterministic results)
Cost Certainty	<ul style="list-style-type: none"> Certainty that revenue requirement falls within the most likely range of distribution of outcomes (75% certainty that cost will be at or below this level) 75th percentile of cost to customer
Cost Risk	<ul style="list-style-type: none"> Risk of extreme, high-cost outcomes 95th percentile of cost to customer
Reliability Risk	<ul style="list-style-type: none"> Assess the ability to confidently transition the resources and maintain customer and system reliability Qualitative assessment of orderly transition
Employees	<ul style="list-style-type: none"> Net impact on NiSource jobs by 2023 Approximate number of permanent NiSource jobs affected
Local Economy	<ul style="list-style-type: none"> Property tax amount relative to NIPSCO's 2016 IRP Difference in NPV of estimated modeled property taxes on existing assets relative to the 2016 IRP

9.1.7 Evaluation of Each Retirement Portfolio – Results

Base Case Cost Results

The eight retirement portfolios were all evaluated within the core IRP modeling tools (See Section 2 for more detail.) to estimate revenue requirements for each over time. The assessment was first performed across the Base Case set of market assumptions and inputs in order to calculate baseline projections of the NPVRR over the thirty-year planning horizon. Under the Base Case market conditions, Retirement Portfolio 8 (retiring all coal in 2023) was the least cost option, with a thirty-year NPVRR of just over \$11 billion, while Retirement Portfolio 1 (keeping all existing coal units until 2035) had the highest costs, with an NPVRR of nearly \$15.4 billion. Generally speaking, retiring more coal earlier resulted in a lower NPVRR. Figure 9-4 summarizes the cost results for each retirement portfolio under the Base Case, along with a summary of the cost premium for each option relative to Portfolio 8, which is least cost.

Figure 9-4: Cost to Customer Impacts – Retirement Portfolios



Scenario Cost Results

In addition to the analysis under Base Case conditions, NIPSCO also evaluated each retirement portfolio against each scenario described earlier in Section 8. The NPVRR for each retirement portfolio across each scenario is summarized in 9-5, with additional details regarding the scenario results described below.

Figure 9-5: Cost to Customer across All Scenarios – Retirement Portfolios (30-year NPVRR – millions of \$)

Retirement Portfolio	Base	Aggressive Env Reg	Challenged Econ	Booming Econ/ Abund Nat Gas
1	15,400	17,557	11,598	15,030
2	12,911	14,271	9,642	12,758
3	12,455	13,304	9,479	12,291
4	12,336	13,184	9,359	12,171
5	11,454	12,298	8,474	11,245
6	11,343	12,084	8,428	11,125
7	11,187	11,820	8,351	11,023
8	10,974	11,688	8,079	10,745

Under the Aggressive Environmental Regulation scenario, higher carbon prices drive higher portfolio costs, especially for those retirement portfolios that retain more coal capacity. The NPVRR of Retirement Portfolio 1 increases to about \$17.5 billion, and the difference in cost between retaining all coal and retiring all coal in 2023 grows to about \$6 billion. In addition, the

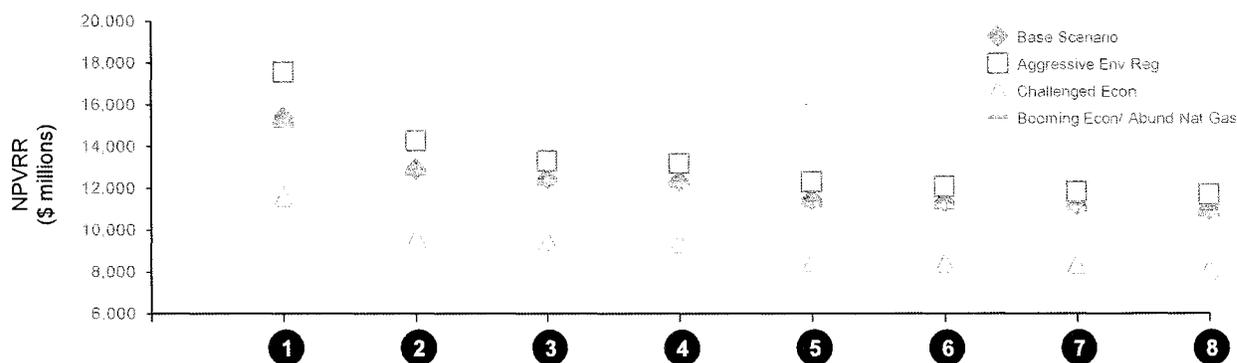
costs associated with keeping Schahfer Units 14/15 beyond 2023 (Retirement Portfolio 2) rise considerably relative to the other options.

Under the Challenged Economy scenario, all portfolio costs decline due to no carbon price and lower gas and power prices. Larger NPVRR declines are observed for the portfolios that retain more coal, but the overall costs are still lowest for Retirement Portfolio 8 (retiring all coal in 2023). While the savings associated with retiring coal are lower than those in the Base Case, the difference in cost between retaining all coal and retiring all coal in 2023 is still around \$3.4 billion.

Under the Booming Economy & Abundant Natural Gas scenario, cost savings associated with coal retirements are similar to those under Base Case conditions, as low natural gas prices impact the coal units and the replacement renewable options similarly. The difference in cost between retaining all coal (Retirement Portfolio 1) and retiring all coal in 2023 (Retirement Portfolio 8) is about \$4.2 billion, which is similar to the difference in the Base Case.

Overall, while coal retirement economics are relatively sensitive to carbon prices, the performance of the different retirement portfolios is less impacted by changes in natural gas prices, since the lowest-cost replacement option primarily comprises renewable resources. Thus, the relative savings associated with retiring coal grow under high carbon price conditions and fall when there is no price on carbon. However, under all market scenarios that were evaluated, there is significant savings associated with retiring more coal capacity. These results are summarized for each portfolio and each scenario in Figure 9-6.

Figure 9-6: NPVRR Summary across All Scenarios – Retirement Portfolios



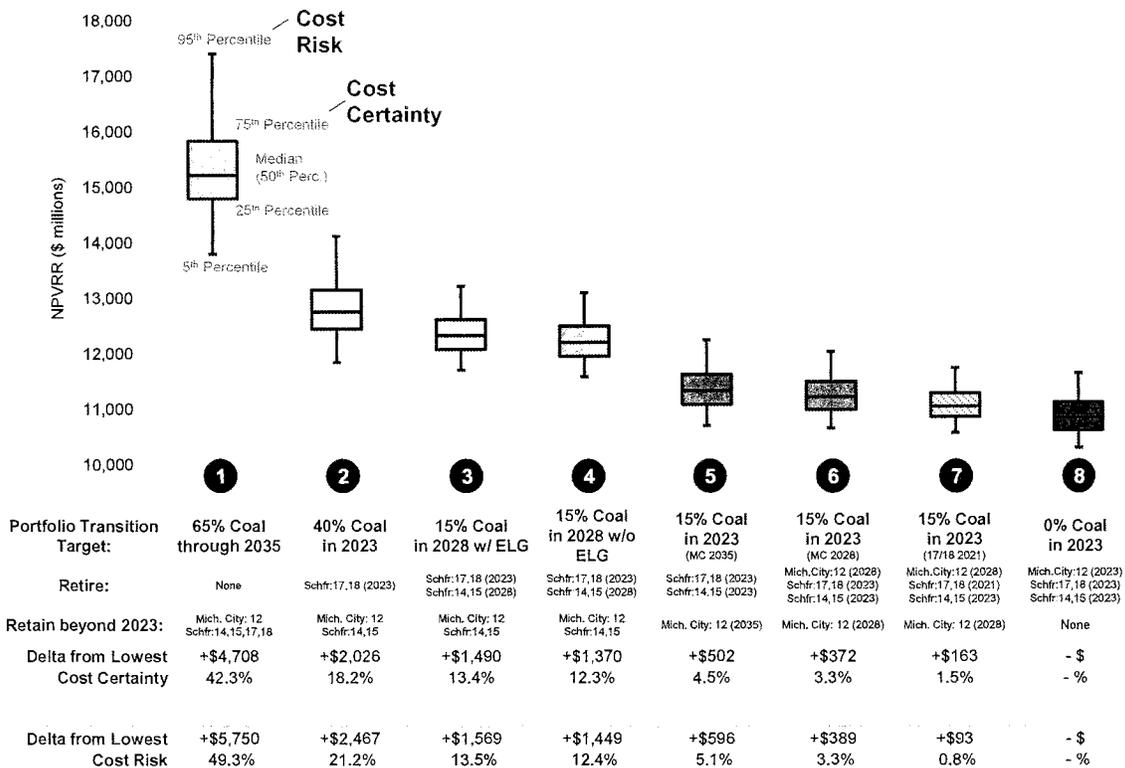
Stochastic Analysis Results

In addition to assessing each retirement portfolio against each market scenario, NIPSCO has also evaluated the retirement options against the full stochastic distribution of potential market outcomes, as described earlier in this Section. The stochastic analysis is used to further evaluate the risk of each of the retirement portfolios against a broad range of commodity price conditions for natural gas and power prices and against the potential for market price volatility on a granular daily or hourly basis. Overall, the results of the stochastic analysis suggest that retaining more

coal in the portfolio increases risk, given that portfolios with more coal generally have a higher range of cost outcomes and higher NPVRR costs at the 75th percentile and the 95th percentile of the stochastic distribution.

Figure 9-7 presents a summary of the stochastic results for each of the retirement portfolios. This plot displays the distribution of outcomes for each retirement portfolio across the full 500 iterations that were analyzed in the stochastic analysis. The median value (or 50th percentile) is represented by the center line of each box, with the top and bottom of the box indicating the 75th and 25th percentiles, respectively. The lines above and below each box end at the 95th and 5th percentiles, respectively. NIPSCO’s cost certainty metric is represented by the 75th percentile NPVRR value, while the cost risk metric is represented by the 95th percentile NPVRR value.

Figure 9-7: Summary of Stochastic Results – Retirement Portfolios

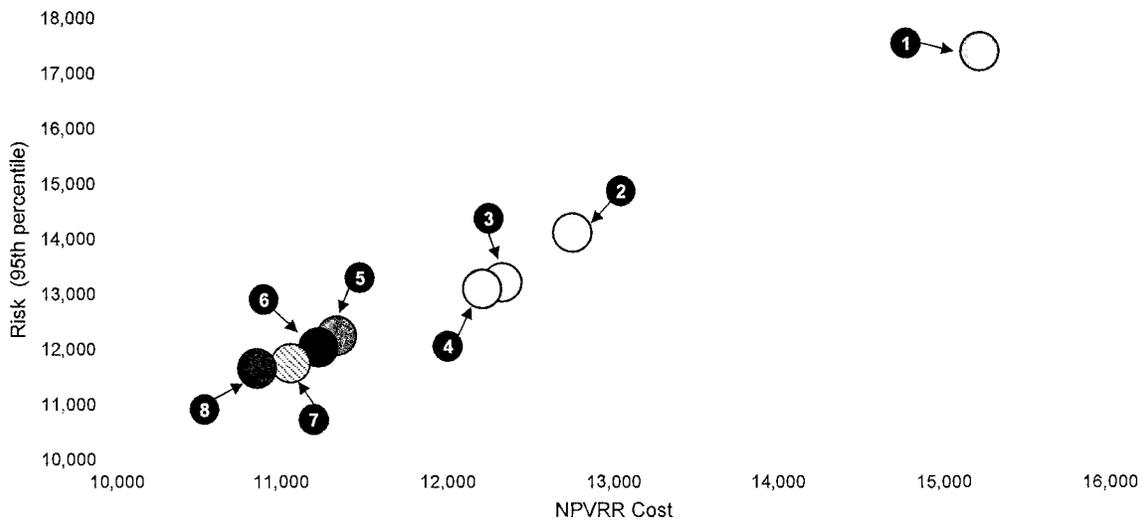


Overall, portfolios that hold more coal not only tend to be higher in median cost, but also have a broader range of outcomes due to uncertainties associated with future coal plant dispatch and relatively significant carbon and commodity price uncertainty. Meanwhile, the portfolios that retire more coal and replace that capacity with fixed-price renewable resources are less subject to market price and dispatch uncertainties. Retirement Portfolio 1 (keeping all existing coal units until 2035) has a cost certainty value that is around \$4.6 billion higher than that of Portfolio 8 (retiring all coal in 2023), and a cost risk value that is around \$5.7 billion higher. Generally

speaking the portfolios that replace more coal with more DSM and renewables result in lower NPVRR for both risk metrics.

Another way to examine the cost and risk performance of the various retirement portfolio options is to plot the median cost expectation against the cost projection at the 95th percentile. This is done in Figure 9-8, which shows that higher costs are generally associated with higher risks, as measured through the 95th percentile outcome. At the 95th percentile, portfolios that hold more coal are exposed to the risk of higher carbon prices, as well as potentially low power prices and reduced dispatch in the market. Thus, they are considered riskier than the retirement portfolios that limit such exposure with resources that have more certain dispatch and no variable costs (renewables) over the long-term.

Figure 9-8: Summary Cost and Tail Risk – Retirement Portfolios



Scorecard Summary

Figure 9-9 presents a summary of all scorecard metrics for each of the eight retirement portfolios. This includes the cost metrics associated with the Base Case NPVRR and the risk metrics associated with the stochastic analysis, as well as the impacts of each option on portfolio flexibility, NIPSCO employees, and the local economy, as described above.

Figure 9-9: Retirement Portfolio Scorecard

	1	2	3	4	5	6	7	8
Portfolio Transition Target:	65% Coal through 2035	40% Coal in 2023	15% Coal by 2028 w/ ELG	15% Coal by 2028 w/o ELG	15% Coal in 2023 (Mich. City 2035)	15% Coal in 2023 (Mich. City 2028)	15% Coal by 2023 (Schfr: 17/18 2021)	0% Coal in 2023
Retire:	None	Schfr:17,18 (2023)	Schfr:17,18 (2023) Schfr:14,15 (2028)	Schfr:17,18 (2023) Schfr:14,15 (2028)	Schfr:17,18 (2023) Schfr:14,15 (2023)	Mich. City: 12 (2028) Schfr:17,18 (2023) Schfr:14,15 (2023)	Mich. City: 12 (2028) Schfr:17,18 (2021) Schfr:14,15 (2023)	Mich. City: 12 (2023) Schfr:17,18 (2023) Schfr:14,15 (2023)
Retain beyond 2023:	Mich. City: 12 Schfr:14,15,17,18	Mich. City: 12 Schfr:14,15	Mich. City: 12 Schfr:14,15	Mich. City: 12 Schfr:14,15	Mich. City: 12 (2035)	Mich. City: 12 (2028)	Mich. City: 12 (2028)	None
Env. Compliance	CCR ELG: non-ZLD	CCR ELG: non-ZLD	CCR ELG: non-ZLD	CCR ELG: Extended Retirement	CCR ELG: Retirement	CCR ELG: Retirement	CCR ELG: Retirement	CCR ELG: Retirement
Cost To Customer	\$15,400 <small>+54.4%</small> <small>49.1%</small>	\$12,911 <small>+37.0%</small> <small>17.7%</small>	\$12,455 <small>+35.4%</small> <small>13.5%</small>	\$12,336 <small>+35.1%</small> <small>17.4%</small>	\$11,454 <small>+33.7%</small> <small>4.4%</small>	\$11,343 <small>+33.5%</small> <small>1.4%</small>	\$11,187 <small>+33.1%</small> <small>1.1%</small>	\$10,974 <small>+32.7%</small> <small>0%</small>
Cost Certainty	\$15,840 <small>+56.7%</small> <small>42.5%</small>	\$13,158 <small>+38.0%</small> <small>15.7%</small>	\$12,622 <small>+36.4%</small> <small>13.6%</small>	\$12,502 <small>+36.2%</small> <small>13.2%</small>	\$11,634 <small>+35.0%</small> <small>4.3%</small>	\$11,504 <small>+34.7%</small> <small>1.3%</small>	\$11,295 <small>+34.3%</small> <small>1.3%</small>	\$11,132 <small>+33.9%</small> <small>1%</small>
Cost Risk	\$17,406 <small>+72.7%</small> <small>49.3%</small>	\$14,123 <small>+49.4%</small> <small>21.4%</small>	\$13,225 <small>+41.5%</small> <small>13.5%</small>	\$13,105 <small>+41.3%</small> <small>13.1%</small>	\$12,252 <small>+35.9%</small> <small>5.1%</small>	\$12,045 <small>+35.8%</small> <small>1.3%</small>	\$11,750 <small>+35.7%</small> <small>1.0%</small>	\$11,656 <small>+35.6%</small> <small>0%</small>
Reliability Risk	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable
Employees	0	125	125	125	276	276	276	426
Local Economy	+\$118M <small>+47%</small>	\$0M <small>0%</small>	(\$23M) <small>(9%)</small>	(\$31M) <small>(12%)</small>	(\$65M) <small>(25%)</small>	(\$74M) <small>(28%)</small>	(\$74M) <small>(28%)</small>	(\$94M) <small>(37%)</small>

Coal-to-Gas Conversion

As part of the retirement analysis, NIPSCO also evaluated the cost-effectiveness of converting one or two units at Schahfer to natural gas. The key assumptions for this analysis, including the operational parameters for the converted units and the costs associated with conversion and ongoing operations, are documented in Section 4. In developing this analysis, NIPSCO started with the Retirement Portfolio 6 and evaluated whether converting Schahfer 17/18 instead of replacing the capacity with the lowest-cost resources from the optimized All-Source RFP analysis was higher or lower cost. This analysis was performed for the conversion of both Units 17 and 18 and for just Unit 17 across all four market scenarios.

Across all scenarios coal to gas conversion is not a viable capacity alternative., Converting both Units 17 and 18 was projected to cost customers between \$540 million to \$1.04 billion more on a 30-year NPVRR basis than retirement and replacement of the units with economically optimized selections from the All-Source RFP results. This is shown in Figure 9-10. Converting a single unit was projected to cost customers between \$230 million and \$450 million more than retirement and replacement with economically optimized selections from the All-Source RFP results, as shown in Figure 9-11. While the conversion portfolio’s economics improved under lower natural gas price and CO2 price conditions (the Challenged Economy and Booming Economy/ Abundant Natural Gas scenarios), it was still significantly higher cost across all scenarios.

Figure 9-10: Coal-to-Gas Conversion Analysis Results – Two Units

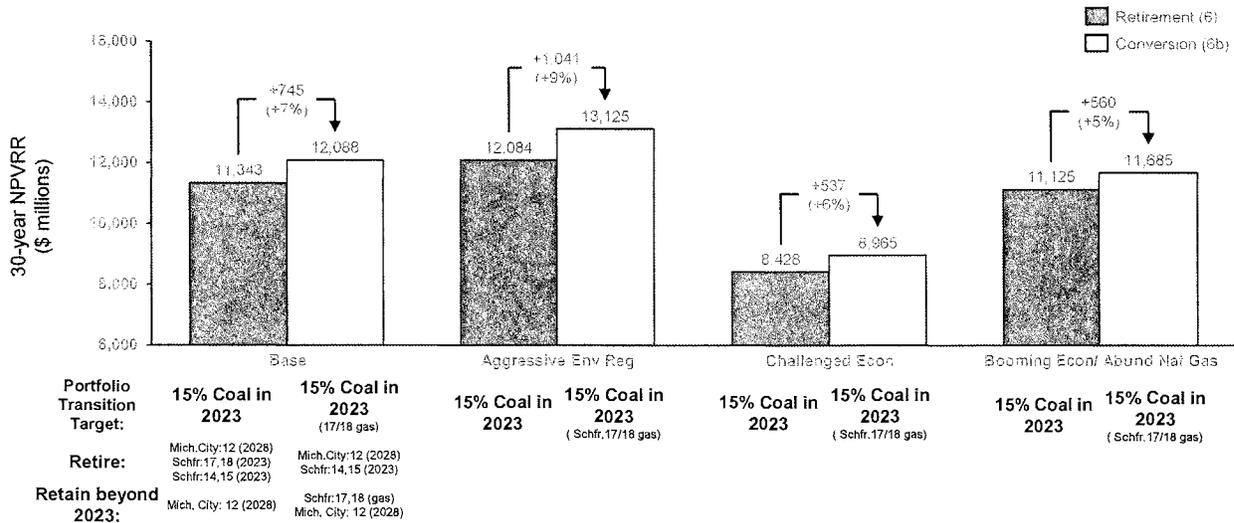
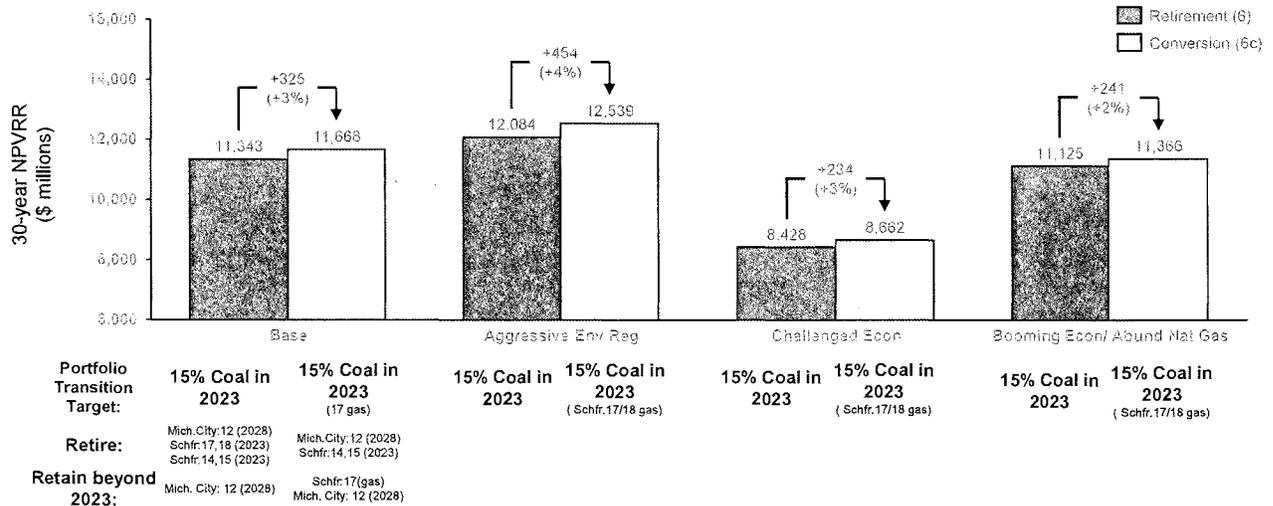


Figure 9-11: Coal-to-Gas Conversion Analysis Results – One Unit (Schahfer 17)



9.1.8 Preferred Retirement Portfolio

Retirement Portfolio 6 has been determined to be the most viable retirement pathway for NIPSCO, providing significant cost savings versus the status quo and offering an acceptable outcome for portfolio flexibility and with regard to the impact on employees and the local economy. This retirement portfolio retires all four units at Schahfer in 2023 and retires Michigan City in 2028.

Combination 6 was selected because it was the lowest cost option that held acceptable reliability risk for customers and the system. The analysis shows that Combination 6 saves customers over \$1.5 billion relative to NIPSCO's 2016 IRP preferred plan. From a reliability risk standpoint, it provides enough time to reasonably erect the necessary transmission upgrades that are critical for system and customer reliability. Additionally, the replacement resources can be reasonably secured and constructed by 2023. While the transition still encompasses roughly 60% of NIPSCO's physical generation, it maintains Michigan City through 2028 and Sugar Creek, a CCGT, even longer. Both are dispatchable units that can be used to support the transition while we implement the replacement path. Another benefit of staggering the retirements is that it allows NIPSCO to continue to assess customer, technology and market changes over the next decade and adjust as appropriate versus locking the entire transition in at once.

It is anticipated that NIPSCO's 2018 IRP preferred retirement path will require certain upgrades to the transmission system in order to maintain system reliability and remain compliant with NERC TPL standards, NIPSCO Planning criteria, and MISO requirements. This assumption will be validated once NIPSCO proceeds with filing the required forms with MISO (Attachment Y). As part of the retirement analysis, NIPSCO transmission planning group performed preliminary studies to evaluate the impact of the 2018 IRP preferred retirement path that calls for the retirements of Schahfer units 14,15,17,18 and replacement with primarily wind and solar/storage resources in central and southern Indiana by 2023. The studies identified a number of circuits on the NIPSCO transmission system that will likely violate NERC planning standards requirements. Once NIPSCO files its Attachment Y, making the retirement of Schahfer's units 14, 15, 17, 18 official with MISO, any violations found in MISO's analyses in the Attachment Y process and in NIPSCO's subsequent annual transmission planning analyses would need to be mitigated prior to the units' retirement in 2023. The mitigation of those issues consist of 5 separate projects to rebuild over 47 miles of transmission lines and to add a reactive power source to support system voltage. The initial high level estimated cost of the projects is \$150 million, which is included in the retirement analysis.

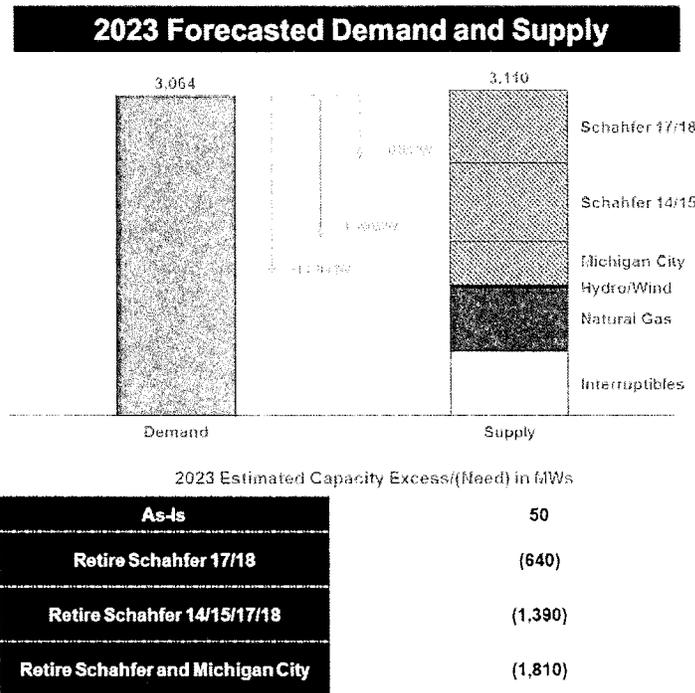
Initial estimates indicated that construction of these projects is anticipated to take until late 2022, early 2023 to complete. The projects are complex to engineer and construct because they require planned outages that need to be coordinated with MISO and PJM, as all of the projects impact PJM's system operation (reliability and markets). Furthermore, some of the rebuild projects are in urban areas or environmentally sensitive terrain like wetlands which carry additional environmental and other risks. There could also be potential outage conflicts with previously planned infrastructure improvement projects not associated with retirements.

Starting in early 2019, NIPSCO will begin engineering the projects and will begin initial construction and outage planning activities. Construction is expected to begin in early 2020. All of the projects are anticipated to be placed in service prior to the units being retired.

With its preferred retirement combination, NIPSCO has balanced customer cost and cost risk, with portfolio flexibility and the ability to successfully and reliability transform its supply resources to meet its customers' needs. Although not the least expensive solution, in all modeling analyses, the preferred portfolio results in savings to customers, greater cost certainty and lower cost risk over alternatives that hold more coal capacity. This option balances other non-economic considerations such as portfolio flexibility, employee and property tax impacts.

Under such a portfolio, a capacity gap of around 1,300 MW will open up in 2023, as shown in Figure 9-12, which summarizes current capacity resources against NIPSCO’s Base Case load forecast, inclusive of reserve margin requirements. This capacity gap is the subject of the replacement analysis that is described next.

Figure 9-12: Future Capacity Need under Preferred Retirement Portfolio



9.2 Replacement Analysis

9.2.1 Process Overview

NIPSCO has evaluated a range of potential resource replacement options to fill the capacity gap that would develop under Retirement Portfolio 6. The replacement analysis was performed in a similar manner to the retirement analysis, with the following major steps:

- Identify replacement resource concepts for NIPSCO, primarily around considerations for ownership and commitment duration and portfolio diversity captured via the emissions profile of resources.
- Develop specific replacement portfolios within each concept using IRP optimization tools and data from the All-Source RFP.

- Evaluate each replacement portfolio in the IRP tools for each scenario and across the full stochastic distribution of major market inputs (as discussed earlier in this Section).
- Record costs, risks, and other metrics in the integrated scorecard to arrive at a preferred replacement portfolio.

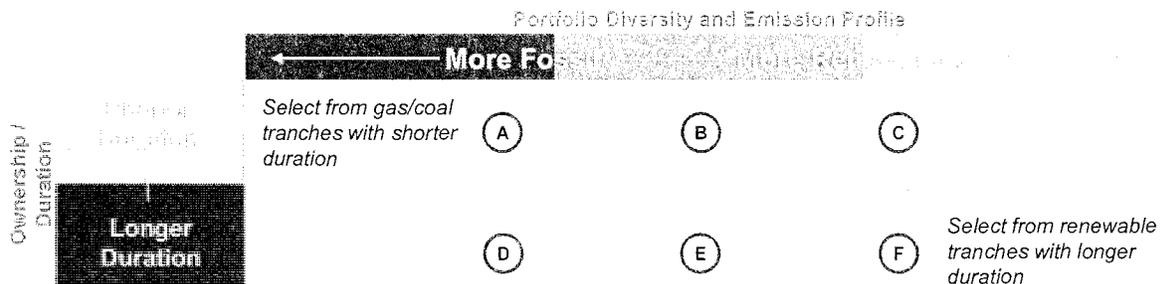
9.2.2 Identification of Replacement Resource Concepts

NIPSCO developed a matrix of replacement resource concepts based on several key planning considerations. The first consideration was structured around the commitment duration being assumed by NIPSCO under each potential portfolio option. Duration is defined as the length of time commitment to a specific resource; shorter duration resources, generally in the form of short-term PPAs, can partially mitigate industrial risk since they do not lock-in a commitment over the very long term. Longer duration resources, on the other hand, generally in the form of longer-duration PPAs or owned assets, tend to have commitments of twenty years or more. By developing portfolios across a range of duration commitments, NIPSCO was able to evaluate the costs and risks associated with different resource procurement strategies.

The second consideration was structured around the potential portfolio’s diversity, specifically related to carbon dioxide emission intensity. NIPSCO currently has a portfolio with a high concentration of coal generation, and portfolio concepts were developed with varying levels of fossil and renewable resource replacements in order to evaluate the costs and risks associated with strategies that align with NIPSCO’s environmental targets and various stakeholder interests.

After reviewing the type of replacement resources available from the All-Source RFP (See Section 4.9.2 for more detail.), NIPSCO determined that portfolio concepts could feasibly be developed across two duration levels (shorter and longer) and three diversity levels (all fossil replacements, a mix of fossil and renewable replacements, and all renewable replacements). Thus six difference concepts were identified for more detailed portfolio development, as shown in Figure 9-13. These portfolios are referred to as Portfolios A-F throughout the rest of this Section.

Figure 9-13: Replacement Consideration Matrix



9.2.3 Development of Specific Replacement Portfolios

Based on the six replacement concepts, NIPSCO then developed specific portfolios that met the desired considerations. This was done through the Aurora model's portfolio optimization capability, which allows the user to specify a set of options and portfolio constraints that drive towards a least cost revenue requirement solution.

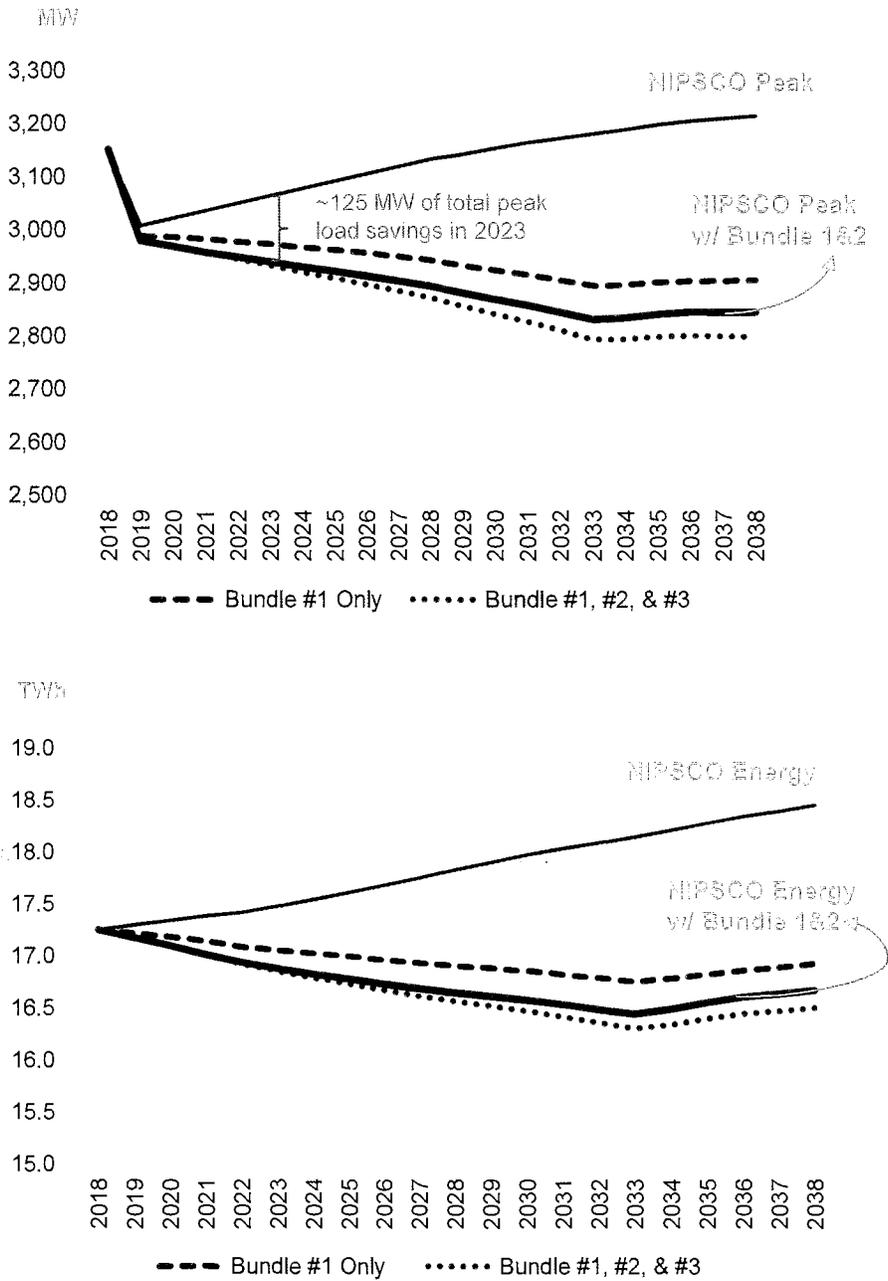
DSM Portfolio Selection

NIPSCO allowed demand side management (DSM) and energy efficiency measures, broadly referred to as DSM resources, to be selected across all six portfolio concepts. As discussed further in Section 5, three separate DSM bundles were developed by GDS Associates for potential selection in the portfolio optimization model. The bundles were organized according to cost, and all of the resources in the first two bundles were selected by the optimization model across all portfolios. Figure 9-14 summarizes the peak and average DSM MW that were selected by bundles in 2023 (the year of the capacity gap under Retirement Portfolio 6) and in 2038 (the final year of the fundamental modeling horizon). Figure 9-15 summarizes the impacts of the various DSM bundles over time, indicating the expected savings for peak load and total energy sales with Bundles 1 and 2 selected.

Figure 9-14: DSM Selection in 2023 and by 2038

DSM Bundle #	Weighted Avg. Cost (\$/MWh)	MW Selected by 2023 (Peak / Average)	MW Selected by 2038 (Peak / Average)
1	17	91 / 48	310 / 174
2	23	34 / 20	60 / 29
3	159	0 / 0	0 / 0

Figure 9-15: Selected DSM Resources across Replacement Portfolios (Peak and Energy)



All-Source RFP Resource Selection

Beyond DSM selection, NIPSCO then evaluated the candidate resource options from the All-Source RFP to be selected for each of the six replacement portfolio concepts. In performing this analysis, the Aurora optimization model was constrained differently for each portfolio in order to meet the duration and diversity targets. Along the duration axis, for Portfolios A, B, and C, 400 MW of short-term MISO market purchases were assumed for each portfolio to offer a minimal

duration commitment that could protect against industrial load loss. After that, short-term contract options were available first, followed by longer-term contracts when shorter-term resources were exhausted. For Portfolios D, E, and F, long-term contracts and asset ownership options were available, with no short-term PPAs eligible to be selected. Along the diversity axis, Portfolios A and D only had access to fossil-fired resources, while Portfolios C and F only had access to renewable and storage resources. Portfolios B and E were allowed to select a portion of the lowest cost fossil resources within the relevant duration concept, with the remaining capacity gap filled with renewables.

Figure 9-16 summarizes the UCAP MW selected by All-Source RFP tranche (See Section 4 for more detail on All-Source RFP tranche development.) across all six portfolio concepts, and Figure 9-17 summarizes the total incremental resource replacement additions in 2023 by type. The preferred fossil resources were CCGT, along with a small, fossil-based system power contract, while the preferred renewable resources were wind projects, followed by solar and solar plus storage options. Although the replacement portfolio selection process is not reflective of a specific, preferred action plan, it was able to construct a range of portfolio strategy concepts to be fully evaluated with the IRP analysis tools and against the full scorecard of key criteria metrics. A summary of NIPSCO’s potential capacity position by fuel type across all of the six replacement portfolios is shown in Figure 9-18.

Figure 9-16: Selected Resource Tranches by Replacement Portfolio

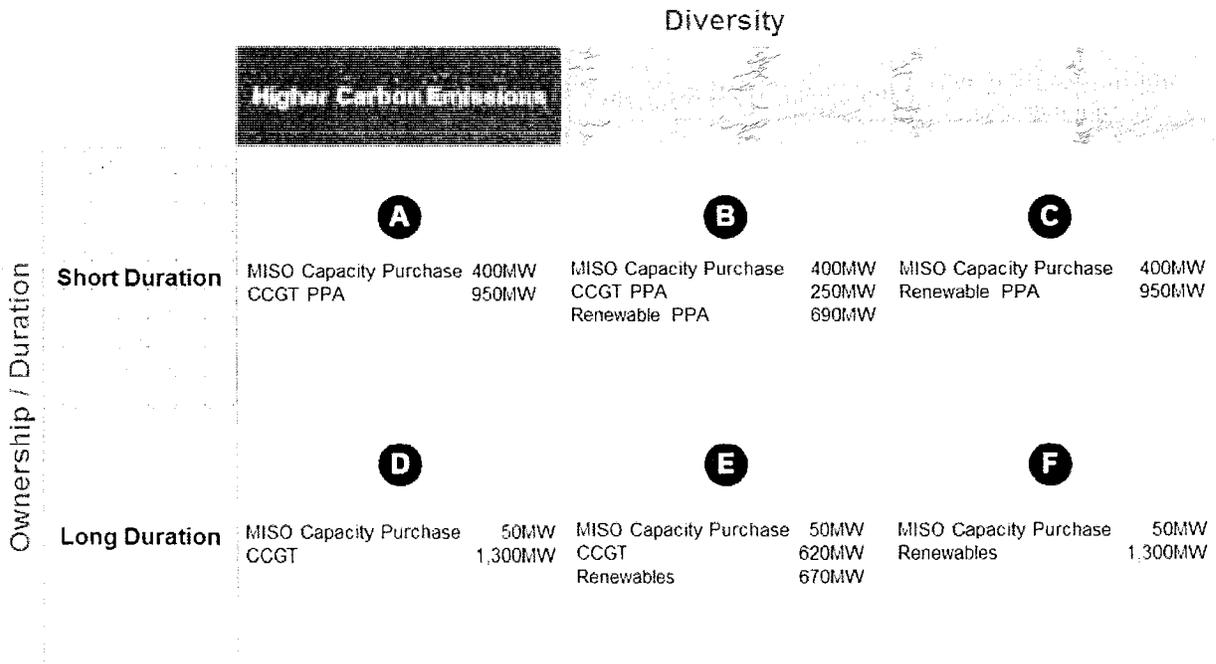


Figure 9-17: 2023 Incremental Replacement Resources by Portfolio (UCAP MW)

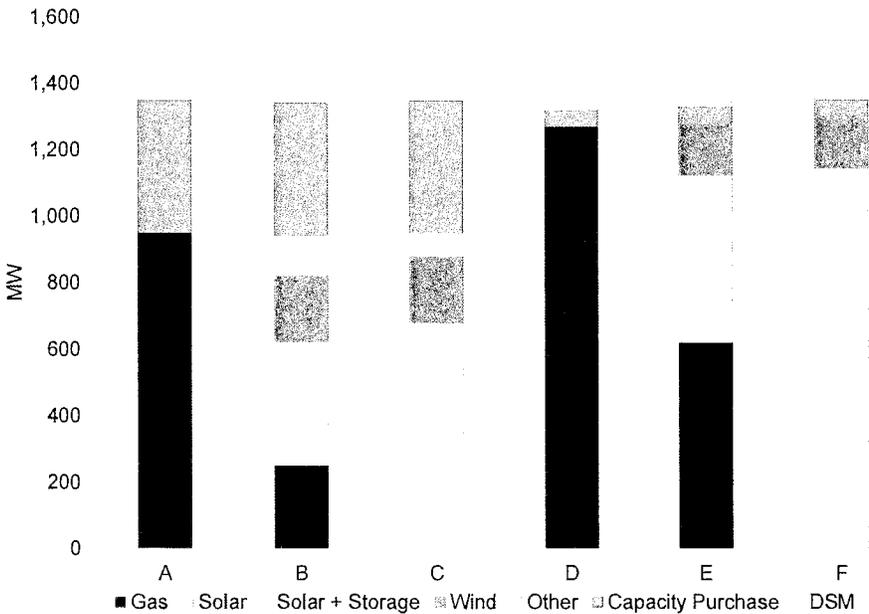
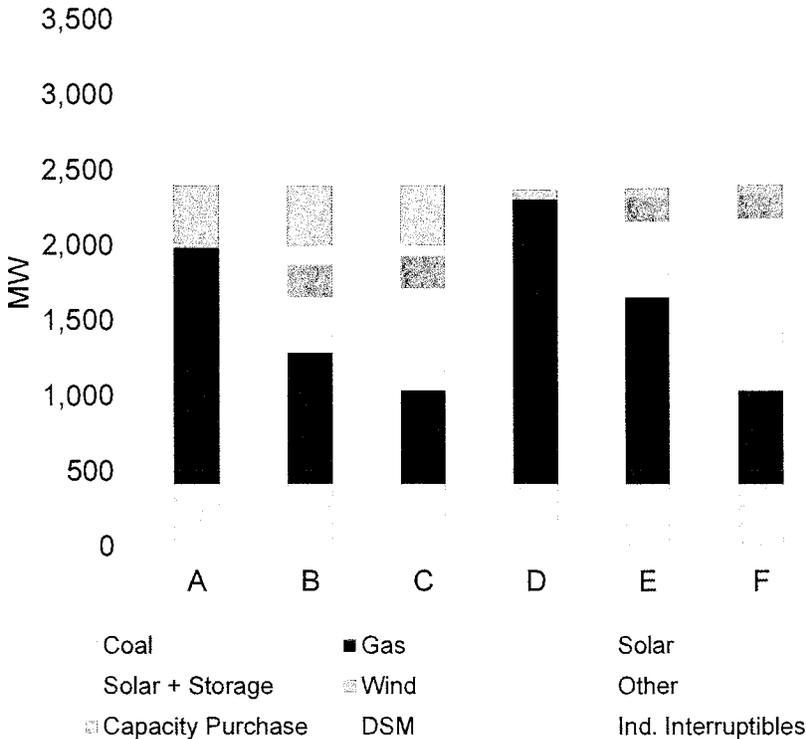


Figure 9-18: 2023 Total Projected Capacity Mix by Portfolio (UCAP MW)



9.2.4 Evaluation of Each Replacement Portfolio – Scorecard Metrics

Similar to the scorecard developed for the retirement analysis, NIPSCO developed a scorecard of criteria and key metrics associated with the replacement analysis. Many of the metrics are the same, with two additions: fuel security, defined as the percentage of capacity sourced from resources other than natural gas, and environmental emission intensity, defined as the total carbon emissions in 2030 from the full generation portfolio. A summary of the decision criteria metrics for the replacement analysis is provided in Figure 9-19.

Figure 9-19: Scorecard Metrics for Replacement Analysis

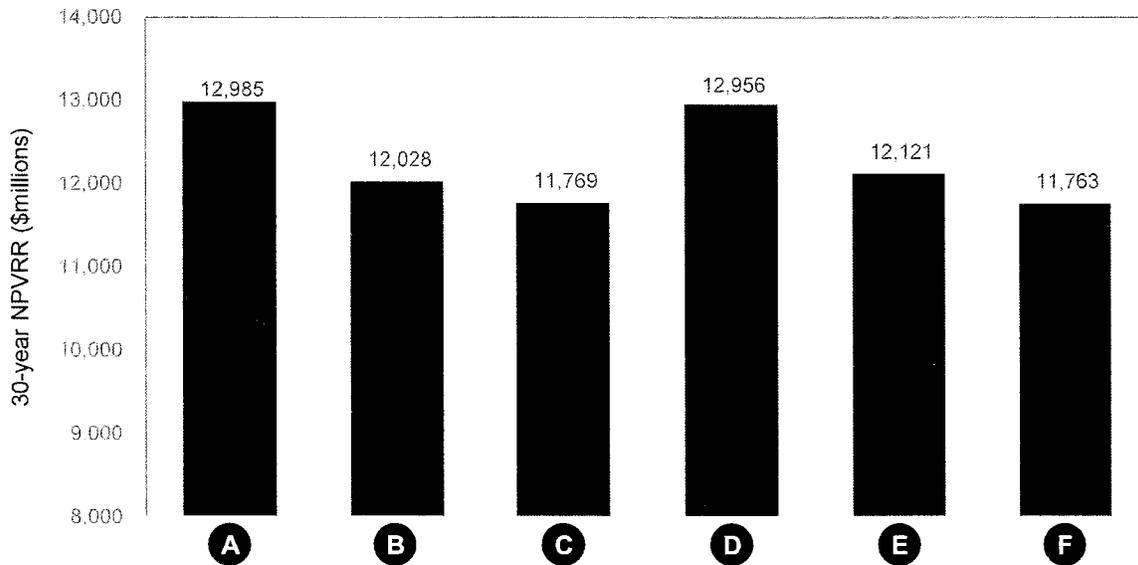
2018 Replacement Scorecard

Criteria	Description
Cost to Customer	<ul style="list-style-type: none"> Impact to customer bills Metric: 30-year NPV of revenue requirement (Base scenario deterministic results)
Cost Certainty	<ul style="list-style-type: none"> Certainty that revenue requirement falls within the most likely range of distribution of outcomes (75% certainty that cost will be at or below this level) Metric: 75th percentile of cost to customer
Cost Risk	<ul style="list-style-type: none"> Risk of extreme, high-cost outcomes Metric: 95th percentile of cost to customer
Fuel Security	<ul style="list-style-type: none"> Power plants with reduced exposure to short-term fuel supply and/or deliverability issues (e.g., ability to store fuel on-site and/or requires no fuel) Metric: Percentage of capacity sourced from resources other than natural gas (2025 ICAP MW sourced from non-gas resources)
Environmental	<ul style="list-style-type: none"> Annual carbon emissions from the generation portfolio Metric: Total annual carbon emissions (2030 metric tons of CO₂) from the generation portfolio
Employees	<ul style="list-style-type: none"> Net impact on NiSource jobs Metric: Approximate number of permanent NiSource jobs added
Local Economy	<ul style="list-style-type: none"> Property tax amount from entire portfolio Metric: 30-year NPV of estimated modeled property taxes from the entire portfolio

9.2.5 Evaluation of Replacement Portfolios – Results

Base Case Cost Results

The six replacement portfolios were all evaluated within the core IRP modeling tools (*See* Section 2 for more detail.) to estimate revenue requirements for each over time. The assessment was first performed across the Base Case set of market assumptions and inputs in order to calculate baseline projections of the NPVRR over the thirty-year planning horizon. Under the Base Case market conditions, Replacement Portfolio F (long-duration renewables) was the least cost option, with Replacement Portfolio C (short-duration renewables) only \$6 million higher on an NPVRR basis. The portfolios with only natural gas and other fossil resource additions (Replacement Portfolios A and D) are highest cost, while portfolios with a mix of gas and renewable additions (Replacement Portfolios B and E) have a cost premium of between \$250 and \$350 million when compared to Portfolio F. Figure 9-20 summarizes the results for the each replacement portfolio under Base Case conditions.

Figure 9-20: Cost to Customer Impacts – Replacement Portfolios*Scenario Cost Results*

In addition to the analysis under Base Case conditions, NIPSCO also evaluated each replacement portfolio against each scenario described earlier in Section 8. The NPVRR for each replacement portfolio across each scenario is summarized in Figure 9-21, with additional details regarding the scenario results described below.

Figure 9-21: Cost to Customer across All Scenarios – Replacement Portfolios (30-year NPVRR – millions of \$)

Retirement Portfolio	Base	Aggressive Env Reg	Challenged Econ	Booming Econ/ Abund Nat Gas
A	12,985	14,476	9,496	12,167
B	12,028	12,948	8,985	11,699
C	11,769	12,675	8,740	11,475
D	12,956	14,426	9,463	12,097
E	12,121	12,970	9,102	11,756
F	11,763	12,424	8,905	11,585

Under the Aggressive Environmental Regulation scenario, higher carbon prices and higher natural gas prices drive higher portfolio costs overall, but more so for the portfolios with significant natural gas capacity additions (Portfolios A and D). Meanwhile, the renewable dominant portfolios (Portfolios C and F) see change in costs to a lesser degree, given that most costs associated with the renewable resource additions are fixed in nature. For example, the NPVRR for Portfolio D increases by nearly \$1.5 billion versus the Base Case, while the NPVRR for Portfolio F increases by less than \$700 million. In addition, the shorter-duration portfolios with

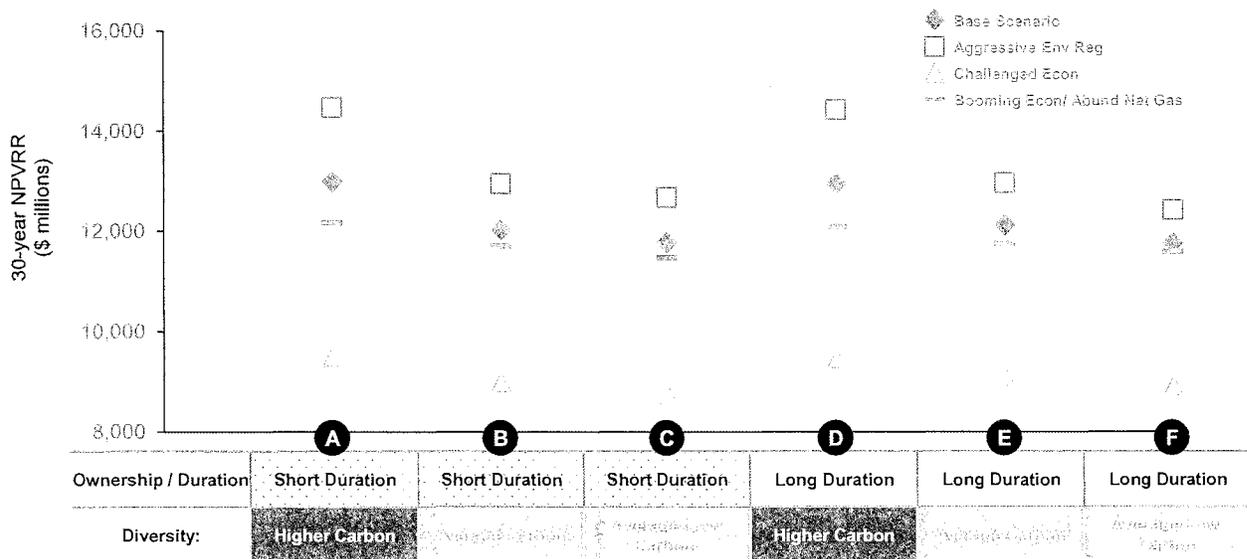
more exposure to the market perform relatively worse under the Aggressive Environmental Regulation scenario due to the fact that market prices are significantly higher. While Portfolios F and C are nearly identical in cost in the Base Case, Portfolio F has an NPVRR that is \$250 million lower than Portfolio C's in this scenario.

Under the Challenged Economy scenario, all portfolio costs decline due to no carbon price and lower gas and power prices. Larger NPVRR declines are observed for the portfolios that include more natural gas capacity, but the renewable-only portfolios are still lowest cost. Furthermore, given that market prices are low and given that NIPSCO load is lower, the short-duration renewable concept (Portfolio C) performs best in this scenario, since its market exposure is significantly reduced. In fact, Portfolio C has a lower NPVRR than Portfolio F by about \$160 million.

Under the Booming Economy & Abundant Natural Gas scenario, low natural gas prices improve the relative position of the portfolios with more natural gas capacity, as fuel costs are lower and natural gas combined cycle dispatch is higher. For example, the NPVRR of Portfolio D (long-duration natural gas) declines by about \$860 million relative to the Base Case in this scenario, while the NPVRR of Portfolio F (long-duration renewables) declines by only about \$180 million. However, although Portfolios D and E are much closer in Cost to Portfolio F, the all-renewables options are still the least expensive alternative. Portfolio C is slightly lower cost overall, due to lower market prices reducing its MISO market exposure relative to Portfolio F.

Overall, while the relative economics of fossil and renewable resource replacement options are impacted by changes in carbon prices, natural gas prices, and MISO market power prices, the lowest-cost replacement option is always dominated by renewable resources. When market prices are low and when NIPSCO load is low, a shorter-duration renewable strategy is lower cost, while a longer-duration renewable portfolio performs best in the Base Case and when market prices are higher. These results are summarized for each portfolio and each scenario in Figure 9-22.

Figure 9-22: NPVRR Summary across All Scenarios – Replacement Portfolios

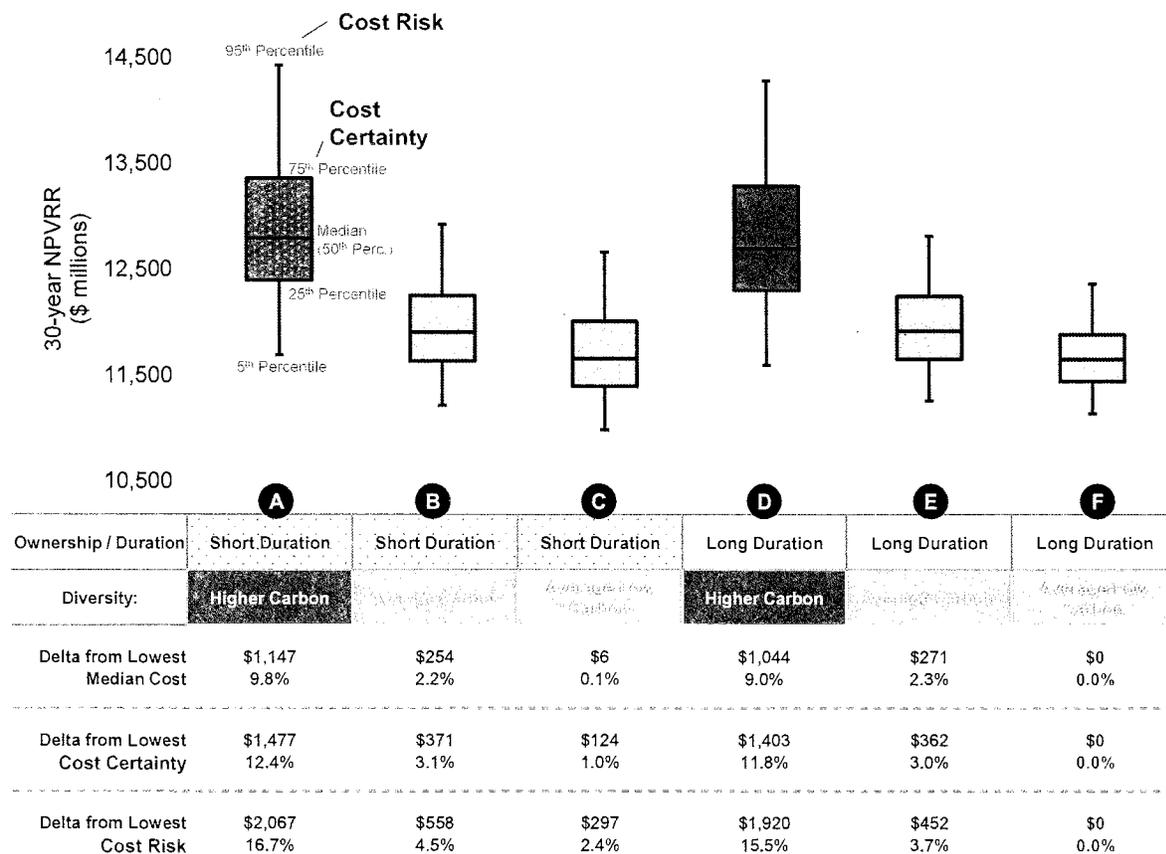


Stochastic Analysis Results

In addition to assessing each retirement portfolio against each market scenario, NIPSCO has also evaluated the replacement options against the full stochastic distribution of potential market outcomes, as described earlier in this Section. As in the retirement analysis, the stochastic assessment is used to further evaluate the risk of each of the portfolios against a broad range of commodity price conditions for natural gas and power prices and against the potential for market price volatility on a granular daily or hourly basis.

Figure 9-23 presents a summary of the stochastic results for each of the replacement portfolios. Overall, although the introduction of stochastic price volatility impacts the natural gas and renewable resource elements in each portfolio differently, Portfolio F (long-duration renewables) has the lowest median cost, and also the lowest cost at the 75th and 95th percentiles.

Figure 9-23: Summary of Stochastic Results – Replacement Portfolios



On average, the median difference in NPVRR between the renewable-only portfolios and those that have some natural gas capacity goes down, meaning that natural gas options look relatively better in the stochastics when compared to their performance in deterministic Base Case.

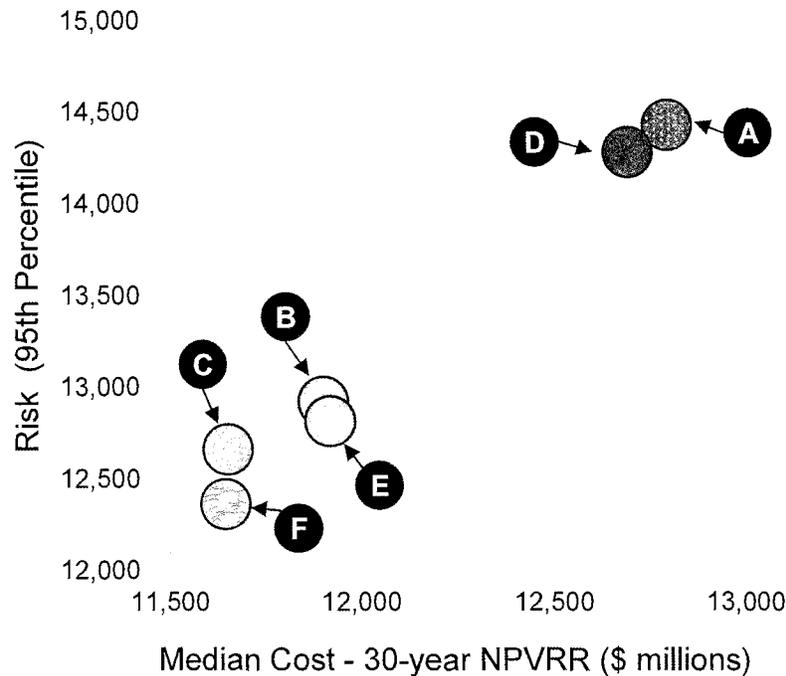
This is because natural gas plants can take advantage of potential low gas price outcomes and can flexibly dispatch in response to changing prices in a volatile market, while renewable costs and dispatch are generally fixed. However, this small improvement in NPVRR for natural gas portfolios across the stochastic distribution does not outweigh the overall cost benefits associated with incorporating fixed price renewable assets into the portfolio.

Although more favorable market conditions for gas resources are incorporated into the stochastic assessment, as more natural gas capacity is added to the portfolio, costs and risks increase. This is due to the fact that natural gas capacity is more exposed to gas price volatility on the upside, which impacts both dispatch and the costs of operation. Although gas-dominant portfolios perform better when gas prices are low, they become heavily exposed to conditions with higher gas and carbon prices, resulting in significantly higher portfolio costs than those options that include more renewables. Portfolio F (long-duration renewables) has a cost certainty value that is around \$1.4 billion lower than that of Portfolio D (long-duration CCGT) and \$360 million lower than that of Portfolio E (long-duration mix), and a cost risk value that is around \$1.9 billion lower than Portfolio D and \$450 million lower than Portfolio E.

The longer-duration renewable portfolio (F) also performs better on the risk metrics than the shorter-duration renewable portfolio (C). This is due to the fact that Portfolio C includes 400 MW of MISO market purchases, resulting in higher costs under conditions with higher carbon, fuel, and power prices. This drives the width of Portfolio C's distribution higher. Although Portfolio F and Portfolio C have nearly identical NPVRRs at the median cost level, Portfolio F is about \$125 million lower in cost at the 75th percentile and nearly \$300 million lower in cost at the 95th percentile.

Another way to examine the cost and risk performance is to plot the median cost expectation against the cost projection at the 95th percentile. This is done in Figure 9-24, which shows that higher costs are generally associated with higher risks, as measured through the 95th percentile outcome. At the 95th percentile, portfolios with more natural gas capacity are exposed to the risk of higher gas prices and higher carbon prices, as well as potentially reduced dispatch in the market. More fixed-price renewable resources generally result in lower tail risk overall. The difference in risk profile between Portfolios C and F is also evident in this figure. Although both portfolios have nearly the same median cost (x-axis), F has significantly lower 95th percentile risk (y-axis).

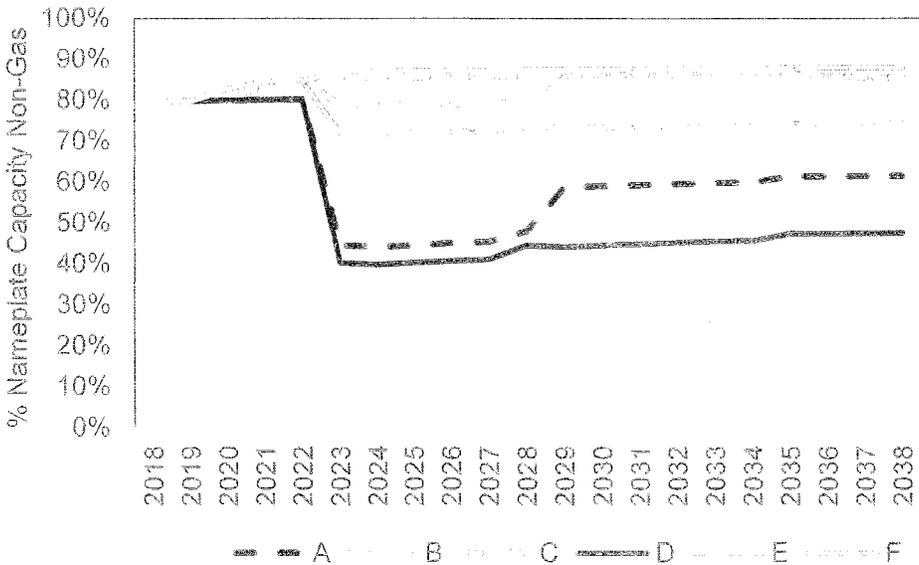
Figure 9-24: Summary Cost and Tail Risk – Replacement Portfolios



Additional Scorecard Metric Results

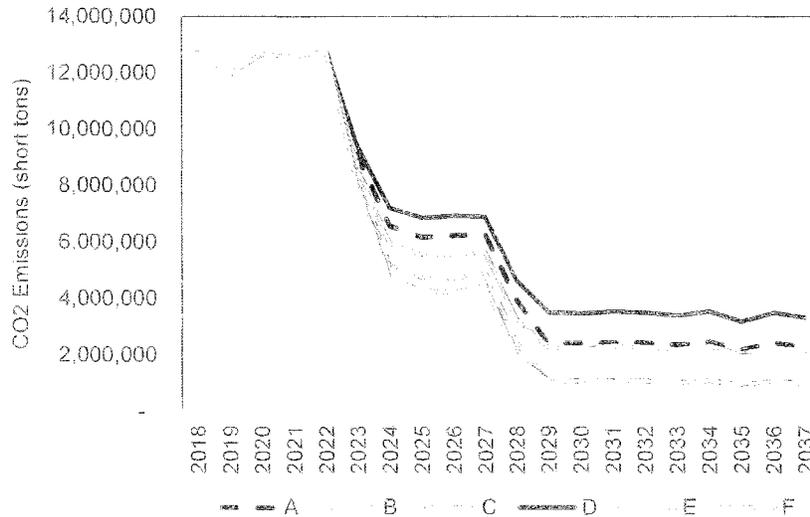
NIPSCO has identified fuel security as an important metric in its integrated scorecard assessment. Fuel security has been defined as the percentage of total nameplate capacity that is sourced from non-natural gas resources. A summary projection of this metric over time for each of the six replacement portfolios is shown in Figure 9-25. As is shown, after the potential retirement of coal capacity in 2023, Portfolios A and D would have less than 50% of their capacity comprised of non-gas resources, while Portfolios C and F would be closer to 90% for this metric. For purposes of the scorecard, 2025 is used as the benchmark year.

Figure 9-25: Percent of Nameplate Capacity that is Non-Gas for Replacement Portfolios



As an environmental stewardship benchmark, NIPSCO has identified CO2 emissions as an important scorecard metric. While all replacement portfolios would expect to realize significant CO2 emission reductions with the retirement of coal capacity in 2023 and 2028, differences in long term emissions are dependent on whether the resource replacements are renewable or natural gas-fired. Figure 9-26 summarizes the projected CO2 emissions over time for all six replacement portfolios, showing that the renewable-only options are lower over the long-term.

Figure 9-26: Projected CO2 Emissions over Time for Replacement Portfolios



Scorecard Summary

Figure 9-27 presents a summary of all scorecard metrics for each of the six replacement portfolios. This includes the cost metrics associated with the Base Case NPVRR and the risk metrics associated with the stochastic analysis, as well as the impacts of each option on fuel security, carbon emissions, NIPSCO employees, and the local economy.

Figure 9-27: Replacement Portfolio Scorecard

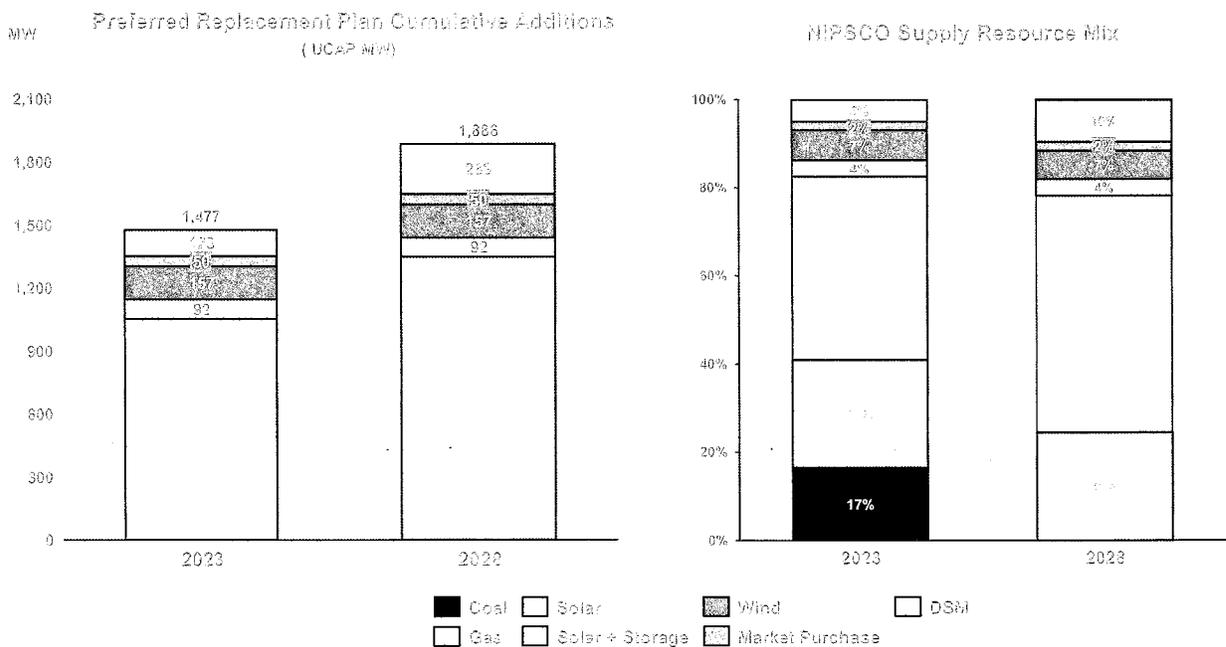
	A		B		C		D		E		F	
Ownership / Duration	Short Duration		Short Duration		Short Duration		Long Duration		Long Duration		Long Duration	
Diversity:	Higher Carbon		Average Carbon		Average Carbon		Higher Carbon		Average Carbon		Average Carbon	
Cost to Customer <small>Delta from base</small>	\$12,985 \$1,322 10.4%	\$12,028 \$765 6.3%	\$11,769 \$0 0%	\$12,956 \$1,192 9.4%	\$12,121 \$362 3.0%	\$11,763 \$0 0.0%	\$12,985 \$1,322 10.4%	\$12,028 \$765 6.3%	\$11,769 \$0 0%	\$12,956 \$1,192 9.4%	\$12,121 \$362 3.0%	\$11,763 \$0 0.0%
Cost Certainty <small>Delta from base</small>	\$13,360 \$1,477 12.4%	\$12,254 \$571 4.7%	\$12,007 \$124 1.0%	\$13,286 \$1,403 11.2%	\$12,245 \$382 3.0%	\$11,883 \$0 0.0%	\$13,360 \$1,477 12.4%	\$12,254 \$571 4.7%	\$12,007 \$124 1.0%	\$13,286 \$1,403 11.2%	\$12,245 \$382 3.0%	\$11,883 \$0 0.0%
Cost Risk <small>Delta from base</small>	\$14,431 \$2,067 16.7%	\$12,922 \$559 4.3%	\$12,661 \$497 3.9%	\$14,284 \$1,926 13.5%	\$12,815 \$492 3.7%	\$12,364 \$0 0.0%	\$14,431 \$2,067 16.7%	\$12,922 \$559 4.3%	\$12,661 \$497 3.9%	\$14,284 \$1,926 13.5%	\$12,815 \$492 3.7%	\$12,364 \$0 0.0%
Fuel Security <small>Oil and gas capacity</small>	45%	79%	86%	40%	72%	87%	45%	79%	86%	40%	72%	87%
Environmental <small>2030 CO2 emissions 2030 baseline = 18.2M</small>	2.18M	0.97M	0.97M	3.13M	2.03M	0.97M	2.18M	0.97M	0.97M	3.13M	2.03M	0.97M
Employees	0	0	0	<30	<30	<30	0	0	0	<30	<30	<30
Local Economy	Dependent on project selection and location; currently under evaluation											

9.3 Preferred Replacement Portfolio

The replacement scorecard shown in Figure 9-27 shows that replacement portfolios with renewables are more cost effective than portfolios without renewables. Additionally, portfolios with more renewables provide greater amounts of CO2 emissions reduction and provide the greatest amount of fuel security.

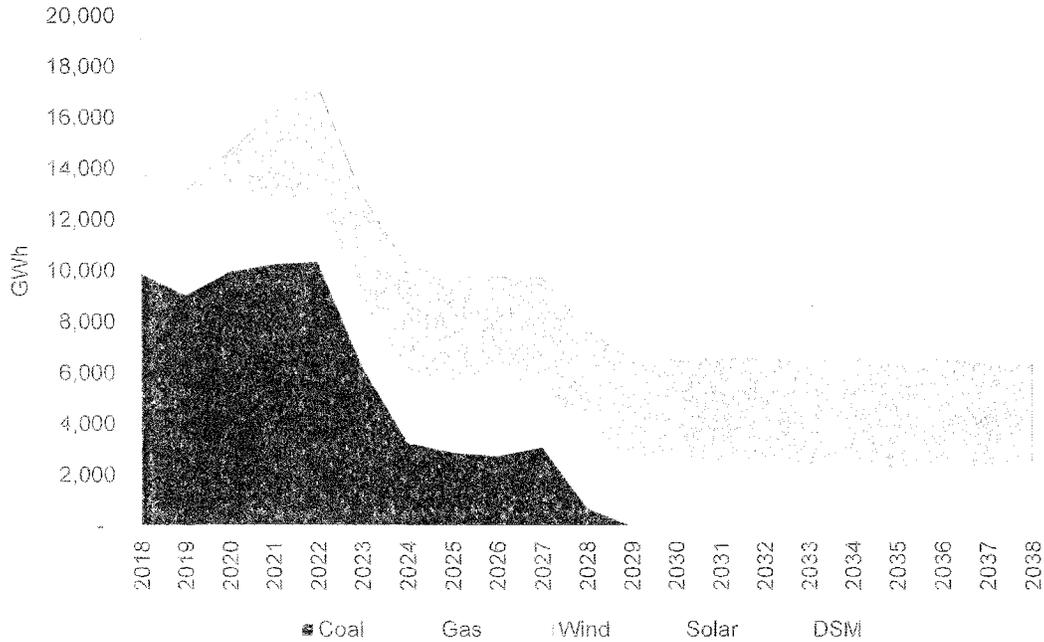
NIPSCO has selected replacement Portfolio F as the preferred plan. This portfolio calls for the addition of a mix of wind, solar, battery storage, market purchases and DSM resources over time. Figure 9-29 shows the NIPSCO preferred plan *incremental* additions and NIPSCO’s overall projected capacity supply mix at the end of 2023 and 2028.

Figure 9-28: Preferred Plan Capacity Mix over Time



Over the twenty-year planning horizon, NIPSCO’s generation mix is projected to shift significantly from coal to renewables. As shown in Figure 9-29, renewable generation is expected to increase with the acquisition of wind resources between 2020 and 2022 and solar resources thereafter. During this time period, coal generation is expected to decline to zero, while gas generation is projected to be relatively stable. Under this portfolio, NIPSCO will be supplied primarily by renewable resources (wind and solar) over the long-term, with meaningful natural gas and DSM contributions. Market purchases would be expected to meet the remainder of the requirements, but are dependent on renewable operations and the details of future resource decisions that are to be made by NIPSCO in the coming years.

Figure 9-29: Preferred Portfolio Energy Mix

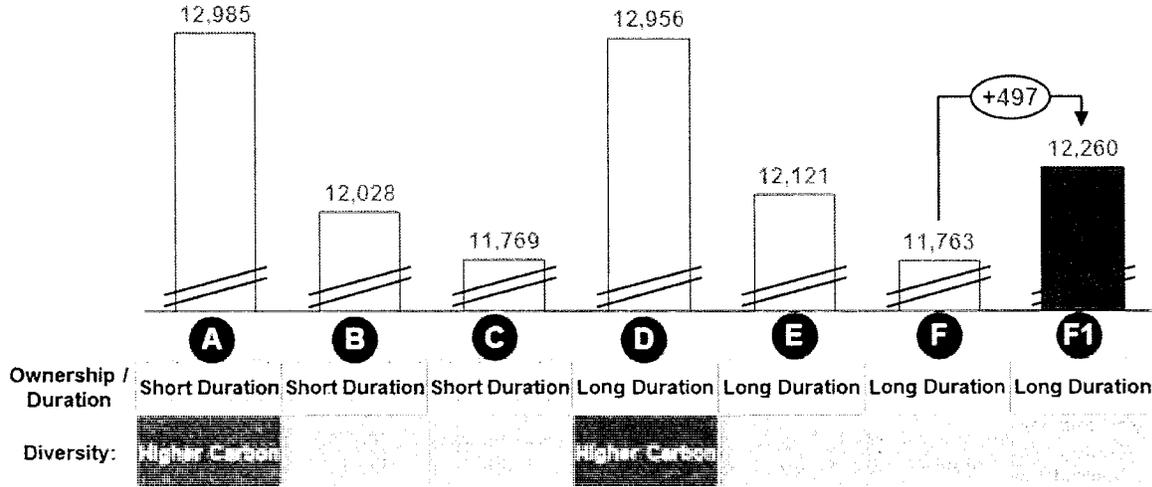


9.3.1 Procuring Wind in 2020

As discussed in Section 4.10.2, tax incentives currently available for renewable energy resources are currently in the midst of a phase out, and projects need to begin construction by a certain date and be in service by a certain date in order to receive the benefits. For wind resources to qualify for 100% of the production tax credit (PTC), projects need to be placed in service by the end of 2020. Solar resources are eligible to receive the investment tax credit (ITC), but do not need to enter into service until the end of 2023 to qualify.

NIPSCO has found that wind resources provide significant value to the portfolio from a cost perspective, and that procuring wind resources in 2020 to realize the full benefits of tax credits is important to achieve the lowest portfolio costs for customers. In order to evaluate the impact of the best-performing All-Source RFP wind resources on the costs of the portfolio, NIPSCO evaluated a variation of Portfolio F that relies solely on solar and solar plus storage resources in place of wind. This portfolio is nearly \$500 million more expensive than Portfolio F on a 30-year NPVRR basis, as shown in Figure 9-30. This is due to the fact that the alternative portfolio removes the lowest-cost resources (wind) and replaces them with higher-cost solar resources and a larger amount of higher-cost market purchases.

Figure 9-30: Base Case Replacement Cost NPVRR with No Wind Portfolio



9.3.2 Preferred Plan Summary

From a customer perspective, NIPSCO’s preferred plan was developed to ensure that a reliable, compliant, flexible, diverse and affordable supply is available to meet future customer needs. NIPSCO also carefully planned and considered the impacts to its employees, the environment, system reliability and impacts on the local economy as the plans were developed. It is important to remember that the integrated resource plan is a snapshot in time and while it establishes a direction for NIPSCO, it is subject to change as the operating environment changes. In addition, the submission of this plan and its resulting preferred portfolio does not stop the transparency of the process or engagement with stakeholders.

The major components of the NIPSCO supply strategy for the next 20 years are expected to:

- Lead to a lower cost, cleaner, diverse and flexible portfolio by accelerating the retirement of over 75% of NIPSCO’s current coal capacity by the end of 2023 and 100% by 2028
- Continue the Company’s commitment to energy efficiency and demand response by executing the current filed DSM plan
- Replace retired coal generation resources with lower cost renewables, including wind, solar and battery storage
- Identify and implement required reliability and transmission upgrades resulting from retirement of the units

- Reduce customer and Company exposure to customer load, market and technology risks by intentionally allocating a portion of the portfolio to shorter duration supply;
- Continue to actively monitor technology and MISO market trends, while staying engaged with project developers and asset owners to understand landscape
- Continue to invest in infrastructure modernization to maintain safe and reliable delivery of energy services
- Continue to comply with NERC and EPA standards and regulations

9.3.3 Financial Impact

Figure 9-31 shows NIPSCO's financial impact of the preferred plan over the planning period. The 30-year NPVRR is broken down into operating and capital costs. The operating costs include the fixed and variable costs associated with both existing units and future resources, as well as contract costs and net market purchases. The capital costs include all capital related costs for existing units and costs related to the acquisition of new resources in the preferred portfolio. These costs include depreciation expenses, capital charge, and taxes. In order to present a levelized net present value rate summary, the total energy forecast for NIPSCO is also discounted over the 30-year period at the same rate.

Figure 9-31: Financial Impact Summary

Financial Impact Summary	
Operating Costs (\$000)	7,357,588
Capital Costs (\$000)	4,405,775
Total Revenue Requirement (\$000)	11,763,363
Total Energy Requirement (GWh)	203,994
Cents/kWh	5.77

Note that Total Energy Requirement is the discounted value of 30 years of energy forecasts, rather than a total sum. This is done to allow for the cents per kWh summary to be reflective of a levelized net present value calculation.

NIPSCO expects that existing cash balances, cash generated from operating activities and funding through inter-company loan arrangements with its parent company will meet anticipated operating expenses and capital expenditures associated with NIPSCO's short term action plan.

In the long term, future operating expenses as well as recurring and nonrecurring capital expenditures are expected to be obtained from a number of sources including: (i) existing cash balances; (ii) cash generated from operating activities; (iii) inter-company loan arrangement; (iv) additional external debt financing with unaffiliated parties; (v) new equity capital and (vi) tax equity financing. NiSource, Inc. procures external funding from the bank and capital markets (debt and equity). NiSource's long-term debt ratings are currently BBB at Fitch and Baa2 at Moody's. NIPSCO intends to fulfill its commitment in Cause No. 44688, in regard to electric related projects,

to “finance, in aggregate, any project, or set of projects in an approved plan, estimated to cost more than \$100 million for which it receives a Certificate of Public Convenience and Necessity pursuant to Ind. Code Chapters 8-1-8.4, 8-1-8.5, 8-1-8.7, 8-1-8.8, or 8-1-39 with at least 60% debt capital.

9.3.4 Capacity Resource Planning With Non Dispatchable Resources

Reliable system planning fundamentally requires having enough resources available to meet customer needs at all times. As discussed in Section 4.8, the NIPSCO plans supply resources to meet its peak demand coincident with MISO system peak demand plus the required reserve margin. NIPSCO recognizes that system planning with renewable resources is more complex than with dispatchable resources and that assumptions based on today’s market constructs may ultimately change. NIPSCO believes the plan outlined in the IRP is a ‘low regrets’ path that provides flexibility to adjust to these potential changes while managing customer cost.

Renewable resource capacity credit assumptions used in the IRP depend on the resource. The 2018 IRP modeling uses resource capacity credit roughly based on current MISO rules and are fixed over the planning horizon. For new MISO Load Resource Zone (“LRZ”) 6 wind resources, the IRP modeling uses a fixed 15.6% capacity credit which is based on MISO effective load-carrying capability (“ELCC”) from Planning Year 2017. ELCC is a measure of the additional load that the system can supply with an additional generator; it is ultimately a derating factor applied to the nameplate capacity of a resource in order to determine how many megawatts can be counted towards meeting the local resource adequacy requirements of a load serving entity like NIPSCO.

For new LRZ 6 solar resources, the IRP modeling uses a fixed 50% capacity credit assumption. This assumption is based in part on current MISO methodology which sets annual UCAP based on the 3-year historical output for hours ending 15, 16, and 17 EST. Solar resources without historical data currently receive the 50% class average. NIPSCO uses this placeholder value set by MISO for 1st year operations throughout the entire modeling horizon. NIPSCO understands that MISO intends to move to an ELCC methodology for solar similar to the one used for wind when sufficient data is available.

For new LRZ 6 storage resources, the IRP modeling assumes 4 hour storage required to firm renewables (i.e. 4MWh storage creates 1MW capacity). NIPSCO understands that MISO is currently working through the stakeholder process for storage credit in response to FERC Order 841. Recent work points towards a 5% EFORD assumption and capacity credit based on 4-hour duration.

Although not modeled, renewable capacity credit is likely to change over time. NIPSCO’s IRP modeling uses a UCAP assumption and renewable project size is “grossed up” to account for capacity credit. A renewable generator’s contribution to meeting peak load is dynamic and depends on multiple factors including:

- Renewable generation profile –when is the unit producing energy?
- Load profile –when do customers demand energy?

- Renewable penetration levels –how much of the system is comprised of renewables?
- ISO-specific policies / methodologies

Capacity credit value and methodology is not fixed and may change. Current capacity credit methodology in MISO matches unit availability with peak load hours during the summer to arrive at a capacity credit.

However, MISO is exploring a Resource Availability and Need (“RAN”) methodology that expands resource adequacy from a single summer peak view to look at seasonal needs with greater emphasis on the ability of resources to provide energy all year around. Initial solar capacity credit of 50% will likely change with Effective Load Carrying Capability analysis; both wind and solar capacity credit will change over time with increased renewable penetration levels. MISO has identified a number of available levers to mitigate reductions in resource availability including: resource diversity; geographic diversity; southwest-facing solar; solar tracking; energy storage; demand control and energy efficiency¹⁵.

Notably, the 2018 NIPSCO IRP Preferred Plan portfolio includes many of these mitigation levers, including resource diversity through coal, natural gas, wind, solar and energy storage; geographic diversity with current and planned resources spread across and beyond NIPSCO’s electric footprint; demand control; energy efficiency. Furthermore, NIPSCO will consider southwest facing solar and solar tracking in its planned procurement. NIPSCO will continue to monitor how the market evolves and incorporate it into future planning

If capacity credit rules or methodologies change, NIPSCO’s IRP path can be cost-effectively scaled to adjust. If additional capacity is required, NIPSCO’s modeling, based on RFP data, shows that procuring additional renewable resources is the lowest cost option. As discussed in Section 9.2, the optimization model economically selects a renewable (or renewable + storage) resource over alternatives. By not committing to any single, large asset for the majority of UCAP needs, NIPSCO can flexibly adapt as rules and technologies change.

Preferred Plan Provides Opportunities to Track Drivers that are Difficult to Quantify Today

Congestion and nodal price risk is one such driver. Energy delivery to the grid is critical to realize benefits from renewables. As part of the selection process for replacement resources identified through the RFP, NIPSCO plans to evaluate system delivery risks (market congestion impacts) associated with each project. For projects shortlisted, NIPSCO will conduct economic planning studies based on transmission congestion and variable fuel cost adjusted for purchase costs and sales revenues using the MISO Transmission Expansion Plan (MTEP) model under the Accelerated Fleet Change planning future.¹⁶ This future assumes 26 GW of coal and natural gas retirements, 22 GW of new wind, and 14 GW of new solar in MISO by 2027. The studies will help

¹⁵ MISO “Renewable Integration Impact Assessment”. June 5, 2018. Available at <https://cdn.misoenergy.org/20180605%20RIIA%20Workshop%20Presentation213125.pdf>

¹⁶ MISO MTEP18 Futures Summary of definitions, uncertainty variables, resource forecasts, siting process and siting results. Available at <https://cdn.misoenergy.org/MTEP18%20Futures%20Summary111488.pdf>

identify potential system issues with delivering the energy from multiple wind and solar installations throughout Indiana under normal and contingent operating conditions.

Forecasting is not an exact science and NIPSCO recognizes that the current analysis may not capture all potential future states of the world and is committed to tracking market evolutions and will update and incorporate into future IRPs as appropriate. Examples of potential changes include MISO evolution on ancillary services, renewable resource availability/ capacity credit forecasts, seasonal constructs, etc.

As discussed in Section 9.4, NIPSCO's short-term action plan does not commit to immediately filling the entire 2023 capacity gap but leaves room to evaluate market and technology changes on a dynamic basis.

9.4 Short-Term Action Plan

NIPSCO's short term action plan covering the period 2019 to 2022 is focused mainly on initiating the planning process for the retirement of the Schahfer 14,15,17,18 units and beginning the procurement of replacement resources. In this period, NIPSCO will make the required notifications to MISO, NERC and other relevant organizations of its intention to retire the Schahfer coal units by the end of 2023. NIPSCO will also identify and implement reliability and transmission upgrades resulting from the retirements of the units.

NIPSCO will select replacement resources identified through the 2018 All-Source RFP evaluation process, prioritizing resources with expiring federal tax incentives to achieve lowest customer cost. For the projects selected, NIPSCO will pursue the required approvals from the commission to acquire those projects. To fill any short term capacity needs during this period, NIPSCO will rely on MISO market purchases or short term PPA(s). NIPSCO will also continue to implement the filed DSM plan for 2019 to 2021

Lastly, NIPSCO will conduct a subsequent All-Source RFP solicitation to identify preferred resources to fill the remainder of the 2023 capacity need. Figure 9-32 summarizes the short term actions for the 2018 NIPSCO IRP.

Figure 9-32: Short-Term Action Plan Summary

Initiate retirement of Schahfer units 14,15,17,18 by making required notifications to MISO, NERC and other organizations
Identify and implement required reliability and transmission upgrades resulting from retirement of the units
Select replacement projects identified from the 2018 All-Source RFP evaluation process, prioritizing resources that have expiring federal tax incentives to achieve lowest customer cost
File CPCN(s) and other necessary approvals for selected replacement projects
Procure short-term capacity as needed from the MISO market or through short-term PPA
Continue to actively monitor technology and MISO market trends, while staying engaged with project developers and asset owners to understand landscape
Conduct a subsequent All-Source RFP to identify preferred resources to fill remainder of 2023 capacity need (likely renewables and storage)
Continue implementation of filed DSM Plan for 2019 to 2021
Comply with NERC, EPA and other regulations
Continue planned investments in infrastructure modernization to maintain the safe and reliable delivery of energy services

9.4.1 Procurement of Preferred Resources

NIPSCO recognizes that the amount of projects that need to be acquired to support its preferred replacement plan will require much time, effort and planning. NIPSCO will utilize a multi-phase approach for acquiring those resources. As discussed in the Short Term Action Plan, in the early phases, NIPSCO will look to primarily acquire tax advantaged wind projects, with solar and solar plus storage targeted for later phases. NIPSCO will use the early phases to build the organization capabilities, repeatable processes and procedures to support later procurement phases for the need identified. NIPSCO will also seek to engage with counterparties from the 2018 all source RFP that have extensive demonstrated development, construction and operational experience with wind, solar and storage projects. Lastly, NIPSCO will look to find process efficiencies by standardizing terms and conditions in agreements with counterparties and standardizing construction oversight procedures across all projects.

9.5 Conclusion

The NIPSCO Integrated Resource Plan seeks to ensure reliable, cost effective electric service for customers while maintaining a robust and diverse pool of supply-side generation and demand-side options. This IRP quantifies changes associated with the emerging energy market place to best accommodate risks associated with customer cost and service. No longer is it

possible to view the world in terms of choosing a simple least cost option; it is now necessary to think it terms of minimizing future environmental impacts and maximizing resource diversification all the while ensuring affordable service to customers.

The IRP process and document are ever evolving and no filed document is ever up-to-date with the world as it stands the day after filing. Rather than trying to model our future world with exact precision, this IRP seeks to utilize a broad set of scenarios assumptions in combination with advanced risk treatment using stochastics to understand and develop resource plans and portfolios that perform best under multiple potential futures.

Section 10. Customer Engagement

10.1 Enhancing Customer Engagement

NIPSCO is focused on enhancing how it serves and interacts with its customers. Whether upgrading the energy infrastructure to make sure it's prepared to meet future needs, providing more convenient options to connect with the Company in-person, online or via telephone or expanding energy efficiency programs, customers are the central focus.

10.1.1 Leveraging Stakeholder Feedback

NIPSCO relies on customer feedback to uncover service improvement opportunities. Those feedback mechanisms include the J.D. Power Customer Satisfaction Surveys, MSR Group Surveys, online customer panels, comments and complaints that are emailed or called into NIPSCO's call center, as well as the IURC's Consumer Affairs Division. The Company also researches best practices that have been demonstrated by those within the utility sector, as well as those outside of the industry. This data is the primary driver behind many of the operational changes, improvements in customer communications, enhancements to services and added programs and other offerings that have been instituted in recent years.

For example, recent J.D. Power Electric Customer Satisfaction survey results have highlighted the need to expand how NIPSCO communicates with customers during power outages. As a result, the Company launched NIPSCO Alerts, which enables customers to receive updates regarding power outages, including estimated restoration time via text, email, or telephone. As part of this, NIPSCO also added the option for customers to text to report a power outage. With this new offering, NIPSCO customers can now choose the option that is most convenient for them – telephone, online (desktop and mobile) and text. These enhancements were part of why NIPSCO was recently awarded with Chartwell's top award for 2018 Outage Communications Best Practices among all utilities nationally.

10.1.2 NIPSCO's Customer Workshop Series

NIPSCO recently kicked off the 7th season of its Customer Workshop Series in partnership with Purdue University. Since 2011, hundreds of NIPSCO Transmission and C&I customers from all over northern Indiana have attended the various workshops. With topics ranging from technical (Understanding HVAC, Fundamentals of Compressed Air, Energy Savings 101, etc.) to interpersonal (Six Sigma, Managing Time & Stress, Becoming a Leader, etc.), customers are able to pick which workshops are valuable to their business and reserve openings for themselves and/or their colleagues.

Attendees are able to interact with industry experts, representatives from the NIPSCO Major Account team, as well as their peers at other companies, learning best practices and voicing their current challenges and solutions in an open, classroom setting. Each season, customers are surveyed and feedback is used to improve the subsequent season. Changes for the 2018 season included additional workshops in the South Bend area, as well as a class geared towards navigating generational changes in the workplace.

10.1.3 New Business Department

The New Business Department was formed in July of 2015 to add value for customers and stakeholders by providing a focus on new business activities for all customers (residential, and C&I). The goals include:

- Continuous improvement of the new business process “from first call to install”
- Single source accountability for policy maintenance
- Enhancing relationships with builder/developer community
- Improving metrics to inform on efficiency and effectiveness
- Supporting capital budget methodology to increase clarity
- Managing growth programs including Electric Vehicle, Feed-In Tariff, Green Power, Compressed Natural Gas

The New Business Department has responsibility for any customer that requests new service, upgrade of service, retirement of service, or relocation of service. NIPSCO’s new business representatives are specifically trained in the details of these transactions and provide a resource for customer issues. Since its inception, the New Business Department has undertaken initiatives to:

- Create a single Site Readiness policy for NIPSCO
- Provide automated emails to customers with project status updates
- Revise key performance indicators to better inform on execution levels
- Simplify agreements for all customer classes
- Establish new accounting codes to provide clarity into new service costs

The New Business Department expanded in 2016 and now includes external, customer facing representatives and internal support to assist customers with their new service connections. The New Business Department continues its efforts to evaluate the new business process to determine opportunities for increased efficiency and improved customer service. An end-to-end process map has been completed, which has helped to identify additional areas of opportunity.

10.1.4 Customer Feedback

Customer feedback is essential in NIPSCO’s development of customer support and service offerings to provide for an exceptional customer experience. NIPSCO utilizes an on-line group of customers to provide feedback on project offerings and channel options. NIPSCO utilized this on-line group, along with an additional in-person focus group, in the redesign of its customer bill that

launched in the spring of 2016. NIPSCO also surveys customers to determine customer satisfaction with the call center and interactions with field personnel, as well as with on-line experiences such as mobile, integrated voice response and web. Customer surveys are also used to capture specific customer issues and to gain immediate feedback on the quality of NIPSCO's customer service. NIPSCO uses the results of these surveys, as well as the information obtained through the J.D. Power Customer Satisfaction Surveys, to identify potential ways to improve the overall customer experience including training and development for customer service representatives and field personnel.

In addition to the J.D. Power Customer Satisfaction Surveys, NIPSCO also relies on customer feedback obtained through MSR Group Surveys, online customer panels, comments and complaints that are emailed or called into NIPSCO's call center, as well as the Commission's Consumer Affairs Division to discover service improvement opportunities. NIPSCO also researches best practices that have been demonstrated by those within the utility sector, as well as those outside of the utility industry. Customer feedback is the primary driver behind many of the operational changes, improvements in customer communications, enhancements to services and additional programs and other offerings that have been instituted in recent years.

10.1.5 Community Partnerships - Community Advisory Panels

Another avenue used by NIPSCO to engage with its customers and stakeholders is the use of Community Advisory Panels ("CAPs"), which serve as a forum to discuss new company initiatives and programs as well as to educate and facilitate feedback regarding service and other NIPSCO-related matters in their communities. NIPSCO has five regions across the Company's footprint for the CAPs. CAPs are comprised of individual customers as well as local government and community leaders representing a diverse, broad cross-section of NIPSCO customers. NIPSCO senior management meets with each of the regional CAPs three times a year to share the Company's strategic direction and to ask members of the CAPs for insight on emerging issues. This year, as part of the development of the IRP, the CAPs were asked to design a portfolio to meet NIPSCO's electricity needs. The activity led to a great deal of discussion around the best portfolio and provided insight for NIPSCO and CAP members.

10.2 Customer Programs

10.2.1 Feed-in Tariff – Rate 765

NIPSCO's Renewable Feed-in Tariff ("FIT") Phase I was approved on July 13, 2011 in Cause No. 43922. Implementation began immediately as a three-year pilot program with a 30 MW capacity cap. Phase I offered a rate greater to participants selling electricity than the retail electric rate in the current approved sales tariffs and provided an incentive to encourage development of renewable generating resources. The pilot program was designed to help maximize the development of renewable energy in Indiana, which welcomed biomass, wind, hydro and solar resources. The FIT provides the customer a sell-back opportunity to NIPSCO at a predetermined price for up to 15 years through a Renewable Power Purchase Agreement ("RPPA"). Participating customers receive payment from NIPSCO for the amount of electricity generated and delivered to NIPSCO through an approved interconnection and metering point.

Additional program details:

- The participating generator must be an existing NIPSCO electric customer.
- An Interconnection Agreement (“IA”) and RPPA are required to reserve capacity or enter the queue.
- The customer is responsible for interconnection fees and installation costs in accordance with the Indiana Administrative Code.
- The customer is responsible for maintenance and proper operation of the generating device in a safe manner consistent with the IA.

Phase I concluded in March of 2015 with a total subscription of 29.7 MW and is summarized in the Table 10-1.

Table 10-1: FIT Phase I In-Service

Technology	Total FIT (kW)
Biomass	14,348
Solar (large)	14,500
Solar (small)	690
Wind (large)	150
Wind (small)	10
New Hydro	0
Total	29,698

NIPSCO’s FIT Phase II was approved on February 4, 2015 in Cause No. 44393. NIPSCO released Phase II, Allocation I of the FIT program in March of 2015 and Phase II, Allocation II in March of 2017. Phase II allows for an additional 16 MW of renewable capacity, bringing the total FIT capacity cap up to 46 MW. Table 10-2 shows the subscription for Phase II as of July, 2018.

Table 10-2: FIT Phase II Project Totals

Technology	In-service (kW)	Queue (kW)	Total FIT (kW)
Micro Solar	110	74	184
Intermediate Solar	3,576	4,380	7,956
Micro Wind	20	0	20
Intermediate Wind	0	1,000	1,000
Biomass	0	0	0
Total	3,706	5,454	9,160

With over 37 MW currently interconnected in the FIT program, as of December 31, 2017, NIPSCO has a total metered generation from customers selling electricity of 473,379,090 kWh.

Table 10-3 shows the annual production and growth by technology segment.

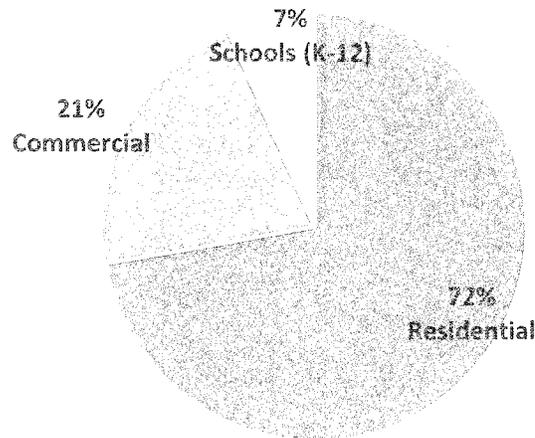
Table 10-3: Annual Production by Technology – Generation (kWh)

Technology	2011	2012	2013	2014	2015	2016	2017	Total
Biomass	6,219,791	19,152,432	31,602,728	49,916,700	81,369,723	83,552,339	89,486,440	361,300,153
Large Solar	-	433,758	15,789,457	21,665,115	22,436,103	22,696,839	24,391,349	107,412,621
Small Solar	-	118,895	471,806	718,758	818,332	825,066	848,789	3,801,646
Large Wind	-	-	90,113	165,880	217,949	165,593	167,807	807,342
Small Wind	-	3,588	15,721	12,051	9,462	8,019	8,487	57,328
Total	6,219,791	19,708,673	47,969,825	72,478,504	104,851,569	107,247,856	114,902,872	473,379,090

10.2.2 Net Metering – Rider 780

NIPSCO's Net Metering Rider allows customers to install renewable energy generation to offset all or part of their own electricity requirements. Net metering is the measurement of the difference between the electricity that is supplied by NIPSCO and the electricity that is supplied back to NIPSCO by an eligible net metering customer. Production is measured on a kWh basis. To be eligible, a customer must be in good standing and operating a solar, wind, biomass or hydro generating facility that has a nameplate capacity less than or equal to 1 MW. NIPSCO follows the rules and guidelines set forth in the Indiana Administrative Code with respect to Net Metering and the interconnection process. Customers with a fully executed Net Metering Agreement and Interconnection Agreement receive a credit for each kWh provided to NIPSCO above their own usage requirement. NIPSCO's Net Metering program capacity cap is limited to 45 MW and total subscription is as of December 31, 2017 was 10.69 MW. The total measured generation by the Net Metering customers for 2017 was 3,667,721 kWh. The current classification of NIPSCO's 270 Net Metering customers is shown in Figure 10-1.

Figure 10-1: Classification of Net Metering Customers



10.2.3 Electric Vehicle Programs (Phase I and Phase II) – Rider 785

10.2.3.1 NIPSCO IN-Charge Electric Vehicle Program – At Home (Phase I)

NIPSCO's IN-Charge Electric Vehicle ("EV") Pilot Program was approved on February 1, 2012 in Cause No. 44016 through January 31, 2016. NIPSCO launched its IN-Charge Electric Vehicle Program - At Home on April 2, 2012. On October 29, 2014, the Commission approved NIPSCO's 30-day filing to extend its EV Program an additional two years through January 31, 2017. Under the extended EV Program, the incentive of up to \$1,650 per customer continued for a period through January 31, 2017 or until such time as the funds were depleted, which occurred earlier. As of June 30, 2016, 250 customers had received program incentives, exhausting the funds available for customer incentives. On January 11, 2017, in Cause No 44828, the Commission approved NIPSCO's request for a modification of its EV Program to provide that participants of record as of January 31, 2017 would be subject to an energy charge of \$070894 per kilowatt hour for all kilowatt hours used per month in the PEV Off-Peak Hours, plus all applicable Riders for a period of 23 months. This program expires on December 31, 2018.

As of January 31, 2018, NIPSCO had received 382 customer enrollment requests. Estimates for installation costs, including the cost of a home EV charger, ranged from \$667 to \$6,325 with an average of \$2,062. The average incentive amount used by customers with completed installations was \$1,629.

The Bureau of Motor Vehicle registrations that show registrations in counties that NIPSCO has electric service in are as follows:

Table 10-4: NIPSCO's Electric Vehicle Customer Request Breakdown

Row Labels	2014	2015	2016	2017
BENTON	1	1	1	3
DEKALB	1	4	18	18
ELKHART	33	45	63	78
FULTON	4	5	5	4
JASPER	4	7	11	18
KOSCIUSKO	12	17	22	32
LAKE	116	154	185	250
LAPORTE	17	30	40	62
MARSHALL	7	8	9	14
NEWTON	2	2	2	7
PORTER	68	84	107	140
PULASKI		1	2	4
SAINT JOSEPH	50	71	87	148
STARKE	1	3	3	5
STEUBEN	3	6	10	18
WHITE	2	5	5	7
Grand Total	321	443	570	808

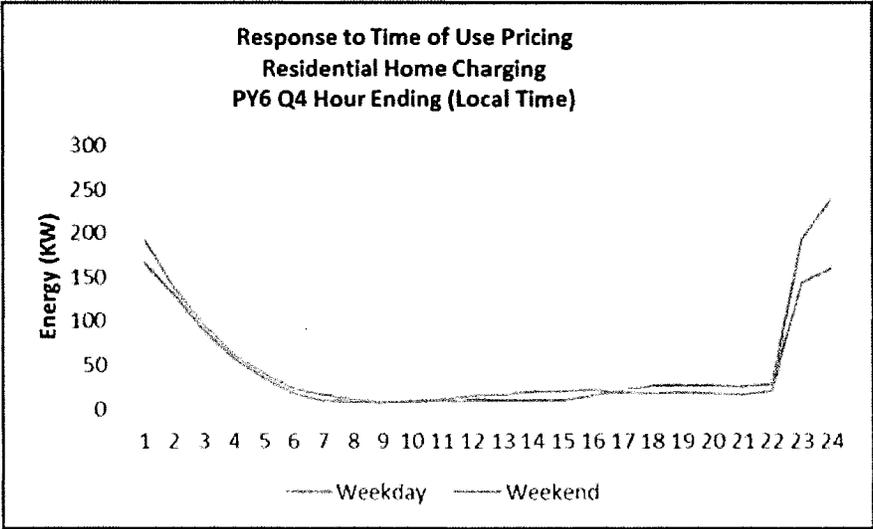
On average, EV customers that were a part of NIPSCO's pilot program used approximately 220 kWh per month to charge their electric vehicle. The actual amount of consumption will vary by individual customer. Customer vehicle type will impact the consumption significantly as well as the demand on the grid. A Tesla Model S charging demand is 10 kW, while a Chevrolet Volt charging demand is only 3.3 kW. The Nissan Leaf charging demand ranges from 3.3 kW to 6.6 kW depending on the options installed in the car. To put demand in perspective, an average size residential home has approximately 33 kW in connected load of which, on average, 18 kW might be on during coincidental peak time. For comparison, typical residential demand breakdown by appliance is listed below:

- Water Heater – 4.5 kW
- Range / Oven – 8.0 kW
- Central Air Conditioner – 6.0 kW
- Clothes Dryer – 5.0 kW
- Dishwasher – 2.0 kW
- Lighting, Fans, Appliances, Other – 7.5 kW

NIPSCO's Rate Case Order indicates that its typical residential electric customer used 698 kWh per month on average during the weather normalized test year. The average EV consumption during the pilot period was approximately 220 kWh or approximately 31 percent of the average home consumption. The type of vehicle purchased and the number of miles driven by the customer will directly impact the average consumption of the vehicle for each individual customer.

NIPSCO found that the “free” energy and discounted energy during the off-peak times of 10 p.m. to 6 a.m. (local time) had a significant impact on charging behavior during the pilot. The typical usage by hour over the recent three month period analyzed (November 2017 through January 2018) is shown in Figure 10-2. The vast majority of the time, EV residential customers began their charging session at 10 p.m. when the energy discounted period began and their vehicles were fully charged by 6 a.m. when the energy discounted period ended. As predicted, the total energy consumption was higher during the work week, when owners typically drove their vehicles more than they did on weekends. The analysis indicates that time of use rates do have an impact on pushing 80% of EV loads to more preferred off-peak time for utilities.

Figure 10-2: Response to Time of Use Pricing



10.2.4 NIPSCO IN-Charge EV Program – Around Town (Phase II)

NIPSCO partnered with South Shore Clean Cities to expand opportunities for alternative fuel, through the launch of a public charging station incentive program in February 2014. The NIPSCO IN-Charge EV Program – Around Town made it easier and more affordable for businesses and organizations to install public charging infrastructure. The In-Charge – Around Town program was available to commercial / industrial electric customers across northern Indiana and was offered until program funds were exhausted in June 2016.

For every unit of electricity used by IN-Charge Around Town charging stations during the program, NIPSCO bought an equivalent amount of renewable energy certificates (“RECs”) – the environmental attributes associated with electricity that is generated from renewable sources, such as wind power.

As of June 30, 2016, NIPSCO had installed 80 public charging stations providing 159 charging ports at 69 locations. Figure 10-3 shows a map of the station locations and application status:

Figure 10-4: Residential Customer Count

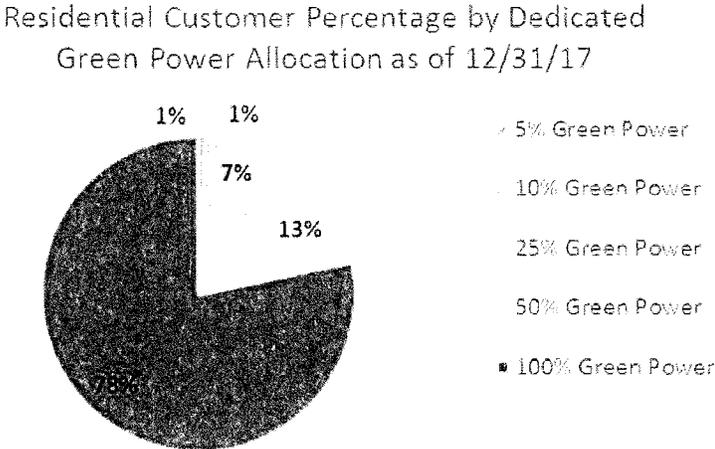
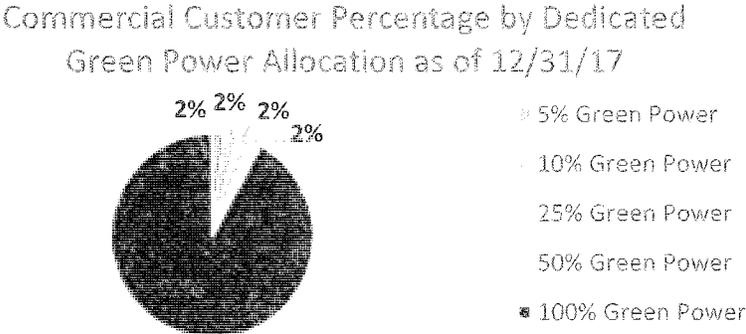


Figure 10-5 shows the breakdown of commercial and industrial customers as of December 31, 2017.

Figure 10-5: Commercial Customer Count



NIPSCO’s GPR Program for the period of January 1 through December 31, 2017 accounted for 18,274,702 kWh energy consumption designated as Green Power. Residential customers accounted for 6,973,682 kWh of energy consumption and commercial and industrial customers accounted for 11,301,020 kWh of energy consumption of designated Green Power. For both residential and commercial customers, the majority of the GPR Program enrollments designate 100% of their energy as Green Power. Table 10-5 shows the energy consumption designated as Green Power for participating customers by rate for the period January 1 through December 31, 2017.

Table 10-5: 2017 Green Power Customers by Rate (kWh)

Rate	Participation %	17-Jan	17-Feb	17-Mar	17-Apr	17-May	17-Jun	17-Jul	17-Aug	17-Sep	17-Oct	17-Nov	17-Dec	TOTAL
760	100%	986	856	796	808	644	669	639	520	770	771	904	722	9,185
711	5%	455	364	294	256	219	305	387	390	320	293	241	267	3791
	10%	833	689	594	581	616	886	986	941	745	665	625	600	8,761
	25%	13,075	12,096	11,807	10,064	9,510	14,579	17,815	17,464	14,349	12,998	10,762	11,936	156,455
	50%	48,352	39,945	37,771	37,629	33,844	51,781	62,997	61,220	49,347	44,746	38,478	41,564	547,674
	100%	574,872	483,575	431,576	427,760	372,190	540,691	677,110	673,250	570,611	519,354	465,081	520,931	6,257,001
721	5%	-	-	-	-	-	173	183	174	143	149	115	109	1,046
	10%	1,959	1,515	1,651	1,667	1,681	1,968	1,720	1,888	1,696	1,728	1,496	1,408	20,377
	25%	182	126	169	213	146	223	264	275	177	116	88	96	2,075
	50%	718	569	629	639	961	1,013	1,413	1,451	960	602	382	470	9,807
	100%	91,908	80,847	73,865	65,371	59,997	58,862	65,804	72,766	72,342	72,219	70,681	78,300	862,952
723	5%	3,360	-	-	-	-	-	-	-	-	-	-	-	3,360
	100%	50,800	54,040	52,280	40,640	47,320	46,000	42,280	49,520	49,280	43,960	48,600	44,640	569,360
724	100%	363,168	408,176	465,600	450,080	471,808	530,784	523,024	532,336	412,832	445,424	394,208	388,000	5,385,440
726	100%	337,152	341,632	354,160	356,064	397,232	453,792	421,904	418,400	398,128	370,656	299,568	288,720	4,437,408
TOTAL		1,487,820	1,424,430	1,431,192	1,391,772	1,396,168	1,701,726	1,816,526	1,830,695	1,571,700	1,513,681	1,331,229	1,377,763	18,274,702

Participating customers are billed under their current applicable rate, with a separate line item showing the premium to participate in the GPR Program. This premium is calculated by multiplying the GPR Rate by the kWhs the customer specifies to be subject to the GPR. Table 10-6 shows the Green Power premiums applicable during the period January 1, 2017 through December 31, 2018.

Table 10-6: Green Power Premiums

January 2017 through December 2017	January 2018 through June 2018	July 2018 through June 2019
\$0.001640	\$0.002940	\$0.001805

10.3 Corporate Development and Community Support

10.3.1 Supporting Economic Growth

NIPSCO partners with community leaders and state, regional, and local economic development organizations to attract and support the expansion of new and existing businesses and to help create more jobs across the NIPSCO's service territory. In addition to being one of the largest employers in the region, NIPSCO spends \$1.1 million in economic development efforts each year, which has resulted in 67 new businesses or expansions and 7,500 local jobs in the last 10 years.

NIPSCO's Rider 777 – Economic Development Rider (“EDR”) offers discounts on existing tariff services for qualifying projects that bring new jobs and investment from outside its

service territory. When coupled with local and state incentives, a powerful package is created with often positive results.

Even with the continued growth, NIPSCO's transmission and distribution system is designed to provide all customers with reliable energy services, and NIPSCO's resource plans focus on maintaining and developing resources in NIPSCO's service territory. Additionally, the investments NIPSCO is making to modernize and upgrade its energy infrastructure continue to have a positive, direct impact on local businesses.

10.3.2 Supplier Diversity

Cultivating a diverse pipeline of suppliers helps innovate ideas and processes, gain a competitive advantage and benefit NIPSCO's communities. NIPSCO has created a supplier diversity program that strengthens and widens the playing field for qualified suppliers that are typically underutilized in the supply chain of a large corporation.

In 2017, NIPSCO's direct supplier spend in Indiana was \$155 million, and the direct supplier spend with diverse Indiana businesses was \$40 million.

10.3.3 Workforce Development

NIPSCO continues to lead efforts and partnerships focused on workforce development – both for the current and future workforce generations. Some of the highlights include:

- **Ivy Tech Partnership for Energy Industry Training Program:** Program began in 2009 and provides training in electric-line, power plant technology and gas technology areas. NIPSCO has hired more than 50 students from the program and graduates are guaranteed an interview opportunity. Additionally, NIPSCO provides instructors for these training classes and recently provided a full-scale electric distribution system for training purposes built within the Ivy Tech Valparaiso campus energy technology lab – the only such facility in an educational setting in Indiana.
- **NIPSCO Energy Academy:** Started in 2014, the NIPSCO Energy Academy program is a partnership designed to prepare area students for high-demand jobs in the electronics, energy and utility industries. It is the first initiative of its kind in Indiana, and it will serve students from Michigan City High School, LaPorte High School, New Prairie High School, South Central High School, LaCrosse High School and Westville High School. Participants have entered the Ivy Tech program and are in the Apprentice Program at the International Brotherhood of Electrical Workers (IBEW), with more than 100 students that have gone through the program.
- **IN-Power Youth Mentoring Program:** IN 2010, NIPSCO introduced the IN-POWER Youth Mentoring Program – a unique mentoring program for local high school students that takes a holistic approach to developing a more highly skilled future workforce in the energy sector. The program was expanded with IN-

POWER STEM PLUS, designed to give 7th and 8th grade students a firsthand experience on gas and electric safety, while teaching them about the various aspects of science, technology, engineering and math needed in the energy sector. NIPSCO employees and American Association of Blacks in Energy (AABE) Indiana members serve as mentors and instructors. Participants receive college credits, unique mentoring and internships among other opportunities.

- **Junior Achievement Support:** NIPSCO provides annual support for classroom business education programs through both contributions and volunteer instructors across NIPSCO's service area. For the last several years, NIPSCO has supported a "JA Day" in a local Hammond school.
- **City of Gary Summer of Opportunity Job Program:** The Summer of Opportunity places youth in meaningful work opportunities throughout the City of Gary, with Lunch & Learn workshops featuring local professionals with every other session focusing on financial literacy. Local youth staff six summer program sites that offer summer meals and learning. Mayor Karen Freeman-Wilson, NIPSCO, Gary Youth Services Bureau, Urban League of NWI and the Gary Chamber of Commerce have partnered to create a set of supports that enable strong transitions from school year to school year and from high school to college and career.
- **Girl Scouts Engineering Day:** For more than 5 years, NIPSCO has hosted more than 125 girls from kindergarten to fourth grade for the annual Introduce a Girl to Engineering Day. The girls come from local Girl Scout troops along with some young relatives of NIPSCO and NiSource employees. The four hour event is part of the company's efforts to help build the next generation of female leaders, support local communities and provide opportunities for local students interested in Stem related careers. The event was organized by the employee resource group Developing and Advancing Women at NiSource (DAWN).

10.3.4 Corporate Citizenship

NIPSCO believes that reinvesting in the communities where its employees live and work will enhance the quality of life for everyone. Each year, NIPSCO and its employees donate time, money, and other resources to hundreds of local philanthropic programs and organizations across its 30-county service area, focusing on:

- Basic Human Needs
- Education
- Public Safety & Emergency Response
- Environmental Stewardship

- Economic Development

Through these programs and partnerships, NIPSCO is working hard with its communities to build a brighter future for years to come. In 2017, NIPSCO and the NiSource Charitable Foundation contributed more than \$1.78 million to local organizations throughout its service territory.

A highlight of those effort is NIPSCO's annual Charity of Choice campaign, where employees select one nonprofit organization or an area of need to support. Fundraisers, volunteerism and other activities are planned throughout a summer-long, employee-led campaign. Recent benefactors and causes selected by employees have included autism, veterans, Boys and Girls Clubs, the American Heart Association, the American Red Cross and more.

10.3.5 Volunteerism

NIPSCO employees have a passion for volunteering and giving back to their local communities. Through a program called "Dollars for Doers," cultivated by NiSource, employees translate their community service into financial support for organizations they care about most. The program contributes up to \$500 per employee to an organization in return for volunteer time. In 2017, NIPSCO employees contributed 5,535 volunteer hours, equating to \$110,700 donated to charities of their choice. Additionally, NIPSCO employees volunteer their personal time and resources with more than 100 local nonprofit boards, associations and other local community efforts each year.