2018 INTEGRATED RESOURCE PLAN

2018 INTEGRATED RESOURCE PLAN

SECTION

1

EXECUTIVE SUMMARY

Lake Winds® Energy Park near Ludington.

EXECUTIVE SUMMARY

A New Energy Future for Michigan

Solar Gardens power plant at Grand Valley State University.

Consumers Energy is seizing a once-in-a-generation opportunity to redefine our company and to help reshape Michigan's energy future.

We're viewing the world through a wider lens — considering how our decisions impact people, the planet and our state's prosperity.

At a time of unprecedented change in the energy industry, we're uniquely positioned to act as a driving force for good and take the lead on what it means to run a clean and lean energy company.

This Integrated Resource Plan (IRP) details our proposed strategy to meet customers' long-term energy needs for years to come.

We developed our IRP by gathering input from a diverse group of key stakeholders to build a deeper understanding of our shared goals and modeling a variety of future scenarios.

The plan we've proposed aligns with our Triple Bottom Line strategy (people, planet, prosperity) and a new set of Clean Energy Breakthrough Goals announced in February 2018.

If approved and implemented, the IRP would place us on a path to achieve these overarching clean energy goals by 2040 in an affordable and reliable manner:

- Zero coal use to generate electricity.
- 80 percent carbon emissions reduction from 2005 levels.

This is a pivotal moment in our company's long, proud history. And this IRP charts a course for Consumers Energy to embrace the opportunities and meet the challenges of a new era, while safely serving Michigan with affordable, reliable energy for decades to come.

This IRP charts a course for Consumers Energy to embrace the opportunities and meet the challenges of a new era, while safely serving Michigan with affordable, reliable energy for decades to come.

THE IRP PROCESS

We developed the IRP for 2019–2040 considering people, the planet and Michigan's prosperity by modeling a variety of assumptions, such as market prices, energy demand and levels of clean energy resources (wind, solar, batteries, demand response, energy efficiency).

As part of the filing process, we implemented a comprehensive stakeholder engagement plan that included a series of widely promoted public forums to give stakeholders an opportunity to provide input.

Forums were open to the general public and designed as basic informational sessions with the chance to ask wide-ranging questions about topics such as renewable energy, energy efficiency and emerging technology.

Technical conferences hosted at our corporate headquarters in Jackson were tailored to meet the needs of stakeholder groups with deeper knowledge of the energy issues and the IRP process.

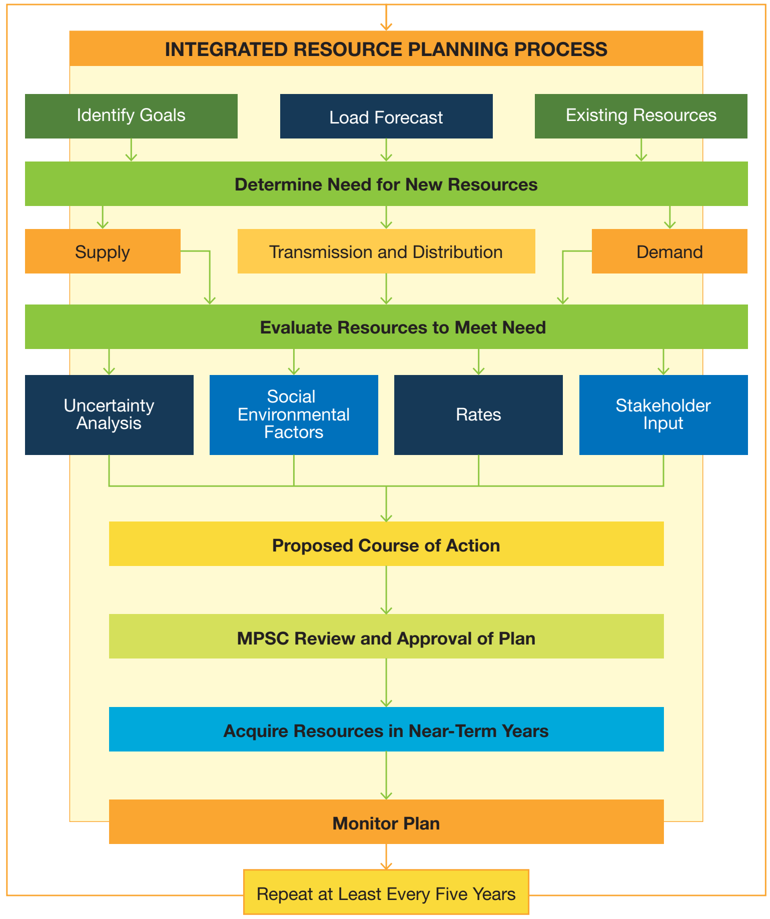
We spent significant time and effort listening to our customers and key stakeholders during the process.

Prior to filing, we engaged closely with key stakeholders from government, customer groups, environmental groups and non-utility energy providers with a variety of positions, opinions and energy-related goals.

At those meetings, we sought to better understand what stakeholders believed would make the best IRP for Michigan and communicated our desire to work collaboratively in the best interests of the state and our customers.

We spent significant time and effort listening to our customers and key stakeholders during the process. In many ways, this IRP is a response to businesses and residential customers concerned with affordable, competitive energy costs, and those who care deeply about how we handle environmental issues such as air quality, water management and greenhouse gas emissions.

Figure 1.1: Consumers Energy's IRP planning process



Public forums in East Lansing and Grand Rapids provided the opportunity to share information, answer questions and gather input from customers and other key stakeholders throughout Michigan.

What's in the IRP?

TRANSITION TO ZERO COAL

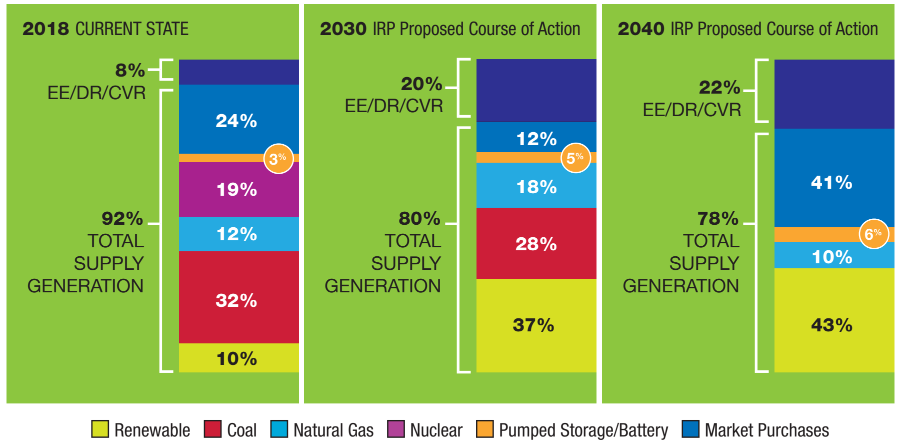
We propose retiring the Karn 1 and 2 coal-fired generating units in 2023.

The remaining coal-fired units, Campbell 1 and 2, would retire at the end of their design lives in 2031, along with Karn 3 and 4 (which run on natural gas and fuel oil and generally are used to meet peak demand).

Campbell 3, the youngest unit in our fleet and equipped with state-of-the-art air quality control systems, would continue to serve customers until 2040.

Ending coal use by 2040 provides an opportunity to leverage demand-side options and transform our supply portfolio toward renewable energy, enabling us to achieve our Clean Energy Goal.

Figure 1.2: Future generation supply



The IRP would meet about 65 percent of Michigan's energy needs with renewable energy, energy efficiency and demand response by 2040.

MORE DEMAND REDUCTION

Demand response, more energy efficiency, battery storage and grid modernization tools will play an even more significant role in serving our customers' energy and capacity needs.

These virtual "power plants" will help us reduce energy demand and manage customer load efficiently and effectively. They also will help us keep residential customers' costs low and benefit the environment by giving them the option to voluntarily reduce their energy use during a few peak times during the year.

These are typically hot summer days when high use by residential air conditioning competes for available power with commercial and industrial customers.

MORE RENEWABLE ENERGY

We plan to add 550 megawatts of wind to help us reach Michigan's 15 percent renewable energy standard by 2021.

We plan to add capacity on incremental basis, allowing flexibility in planning and resource type to adapt to changing conditions. We're proposing 5,000 megawatts of solar energy with a ramp-up throughout the 2020s to prepare for the retirement of the Campbell units and the Karn 3 and 4 peaker units, as well as the end of our power purchase agreement with the Midland Cogeneration Venture. The additional solar capacity may be a mix of owned and purchased.

The plan forecasts renewable energy levels of:

- 25 percent by 2025.
- 37 percent by 2030.
- 43 percent by 2040.

This would help the company achieve our Clean Energy Breakthrough Goal to reduce carbon emissions by 80 percent from 2005 levels by 2040.

What's not in the IRP?

CONSTRUCTION OF A NEW FOSSIL FUEL POWER PLANT

The coal-fired units at Campbell and the natural gas-fired Jackson and Zeeland generating stations would continue to help serve our customers. We also would purchase additional electricity from the Filer City plant, a facility in the process of converting from coal to natural gas.

LONG-TERM CAPACITY PLAN

ENDING AN ERA

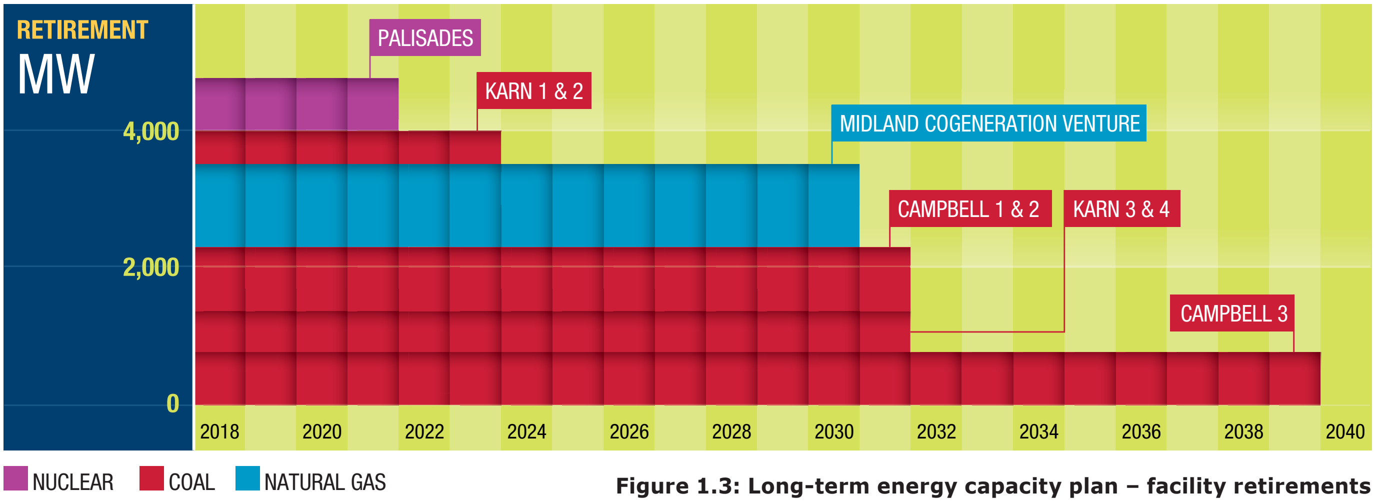


Figure 1.3: Long-term energy capacity plan – facility retirements

In the coming decades, more than 4,000 megawatts of electric capacity will come off our system due to plant retirements and expiring power purchase contracts.

We plan to replace that capacity by reducing demand for power with tools such as energy efficiency and demand response, generating electricity from cleaner renewable sources such as solar and wind. The incremental nature of the plan allows flexibility to adapt to customer needs and changing conditions.

POWERING THE FUTURE

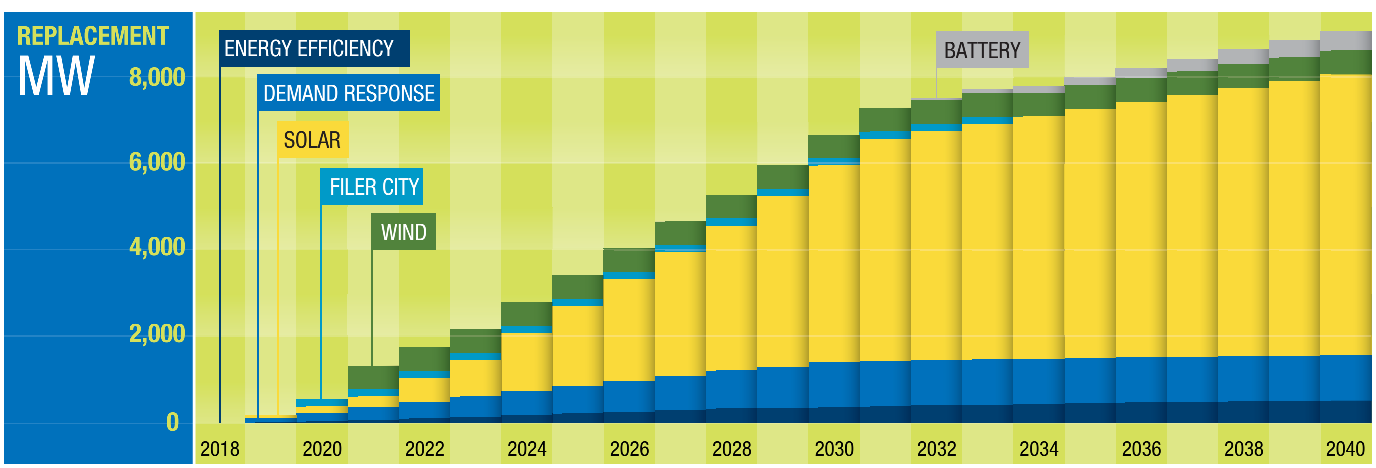


Figure 1.4: Long-term energy capacity plan – energy replacement

CLEAN ENERGY BREAKTHROUGH GOALS

In February, our company announced plans to stop using coal to generate electricity and to cut carbon emissions by 80 percent from 2005 levels by 2040. Consumers Energy is embracing a cleaner, leaner vision focused primarily on reducing energy use and adding additional renewable energy sources, such as wind and solar. The IRP is our proposed strategic road map for reaching our clean energy goals by 2040 while maintaining affordability and reliability.

2005: DIFFERENT TIME, DIFFERENT COMPANY

The world has changed dramatically since 2005 and so has Consumers Energy. At that time:

- Just 2 percent of the energy we supplied to customers came from renewable sources.
- More than 70 percent of the electricity we generated was fueled by coal.
- We emitted nearly 22 million tons of carbon dioxide. That's compared to just over 14 million tons in 2017.

COAL GENERATION PERCENTAGE

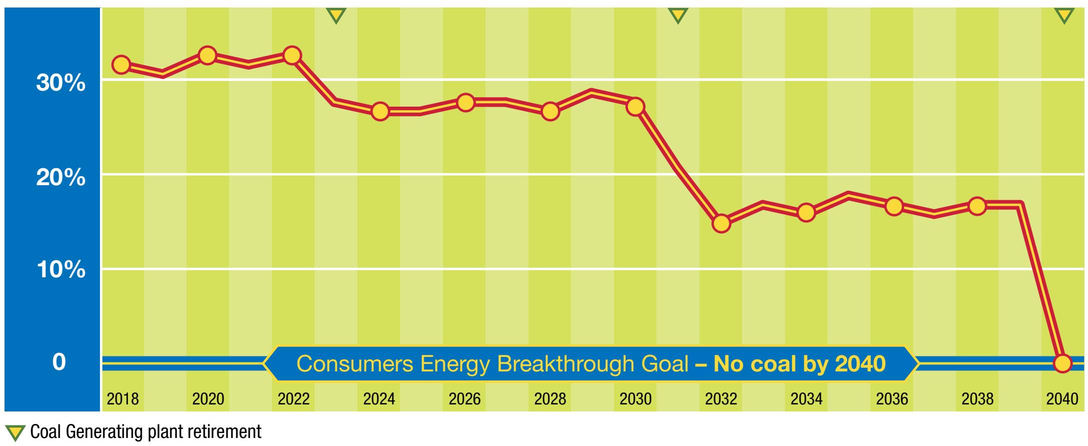


Figure 1.5: Breakthrough goal — coal generation percentage

The retirement of Karn 1 and 2 in 2023 would be the next major step in moving away from coal, followed by the scheduled phaseout of our remaining three coal-fired units at the Campbell generating complex.

CARBON EMISSIONS REDUCTION

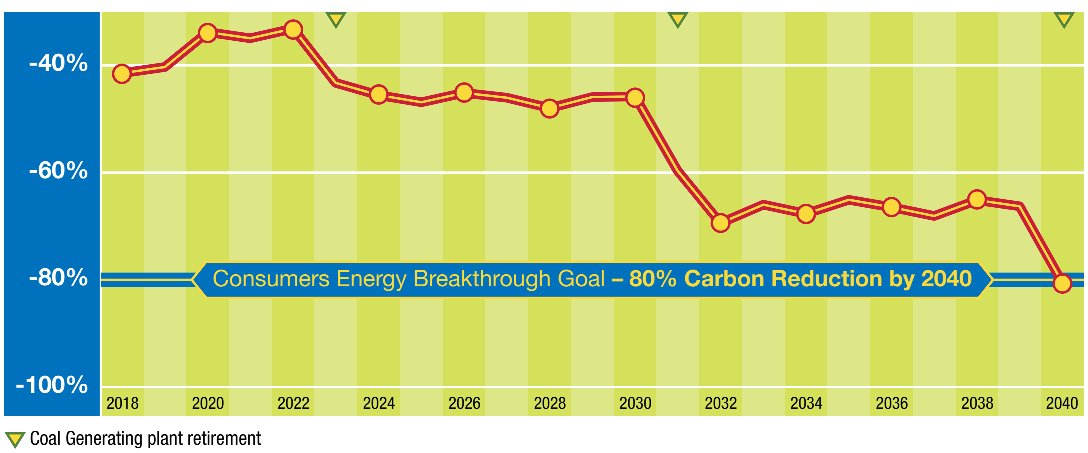


Figure 1.6: Breakthrough goal — carbon emissions reduction percentage

Consumers Energy already has reduced carbon emissions by 38 percent. Transitioning to cleaner, renewable fuel sources and retiring coal plants will dramatically reduce our carbon emissions in the coming decades.

PERCENT OF RENEWABLE ENERGY

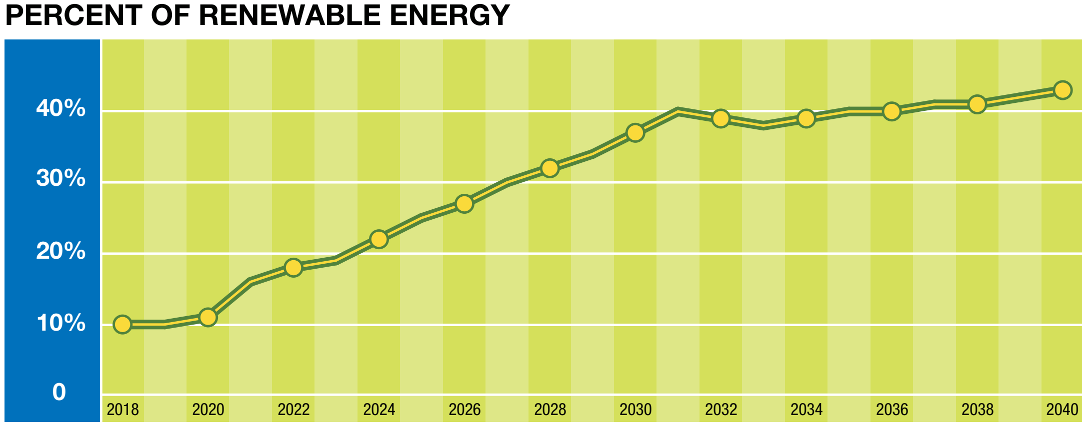


Figure 1.7: Renewable energy percentage

Our plan would add 5,000 megawatts of solar energy during a ramp-up throughout the 2020s. By 2040, about 43 percent of the energy we supply to customers would come from renewable sources such as wind and solar.

CUSTOMER AFFORDABILITY

Consumers Energy is committed to maintaining affordable, competitive energy costs for our residential and business customers. Accordingly, we are continually weighing the cost-benefit analysis of new energy investments to ensure our customers receive maximum value for their energy dollar.

That made the search for affordable solutions a top priority as we forecasted Michigan's future energy needs and how to meet them.

The proposed course of action in our IRP maintains affordability while providing customers with the energy they need to light their homes and power their businesses for decades to come.

Here are just a few ways our IRP will help ensure affordability:

- Current residential electricity bills are about 9 percent below the national average. The projected annual rate increases in this plan through 2040 are well below the projected rate of inflation over that same time period, meaning our electric rates should continue to remain affordable.

- The increased use of demand management tools such as energy efficiency and demand response programs will give customers more control over their monthly energy bills, equipping them to save energy and money over the long term.

- Relying more heavily on renewable energy is increasingly affordable. Studies show the cost of renewable energy sources such as wind and solar have dropped significantly over the last decade. That means we can continue to tap renewable fuels to serve customers.

- Our incremental and flexible strategy allows us to adapt to needs and changes in the energy landscape.

- We propose to competitively bid new electric generation supply to ensure the best value for our customers.

PROPOSED RETIREMENT OF KARN 1 AND 2 DETAILS

Karn units 1 and 2, located in Hampton Township near Bay City, came online in 1959 and 1961, respectively, and are capable of generating 515 megawatts of electricity.

We're grateful for the power these plants have provided for Michigan over the decades and proud of the employees who've operated and maintained them so faithfully.

Our in-depth IRP modeling analysis shows with declining costs in renewables and obtaining higher potential levels of energy efficiency and demand response programs, the best strategy to meet our customers' energy needs is with more energy efficiency, demand response programs and renewable energy.

The retirement of Karn 1 and 2 would continue a move away from coal as a generation fuel source that began in April 2016 with retirement of our "Classic Seven" units located at the Whiting, Cobb and Weadock sites.

We plan to support Hampton Township and the Bay region as they reimagine the local economic landscape after the plant is retired. We would work closely with stakeholders to identify and meet challenges related to the plant closure through the economic transition.

About 300 people work at or directly support Karn 1 – 4. About half of those employees are operating, maintenance and construction (OM&C) workers and members of the Utility Workers Union of America. Their union contract contains provisions to determine how, where and in what role the impacted employees would be placed within the company.

Company human resources policies will determine how, where and in what role exempt employees would be placed within the company.

We plan to continue operating Karn units 3 and 4, which run on natural gas and fuel oil and are generally used to meet peak demand, through their design lives of 2031.

We plan to evaluate redevelopment options for the site to care for the Michigan communities we serve.

Karn units 1 and 2, located near Bay City, came online in 1959 and 1961. Karn units 3 and 4 run on natural gas and fuel oil and are generally used to meet peak demand.

The retirement of Karn 1 and 2 would continue a move away from coal as a generation fuel source that began in April 2016 with retirement of our "Classic Seven" units located at the Whiting, Cobb and Weadock sites.

ABOUT CONSUMERS ENERGY

We are Michigan's largest energy provider, the principal subsidiary of CMS Energy, providing natural gas and/or electric service to 6.7 million of the state's 10 million residents in all 68 Lower Peninsula counties.

Headquartered in Jackson since its 1886 founding, we have served Michigan with clean, affordable, reliable energy for more than 130 years.

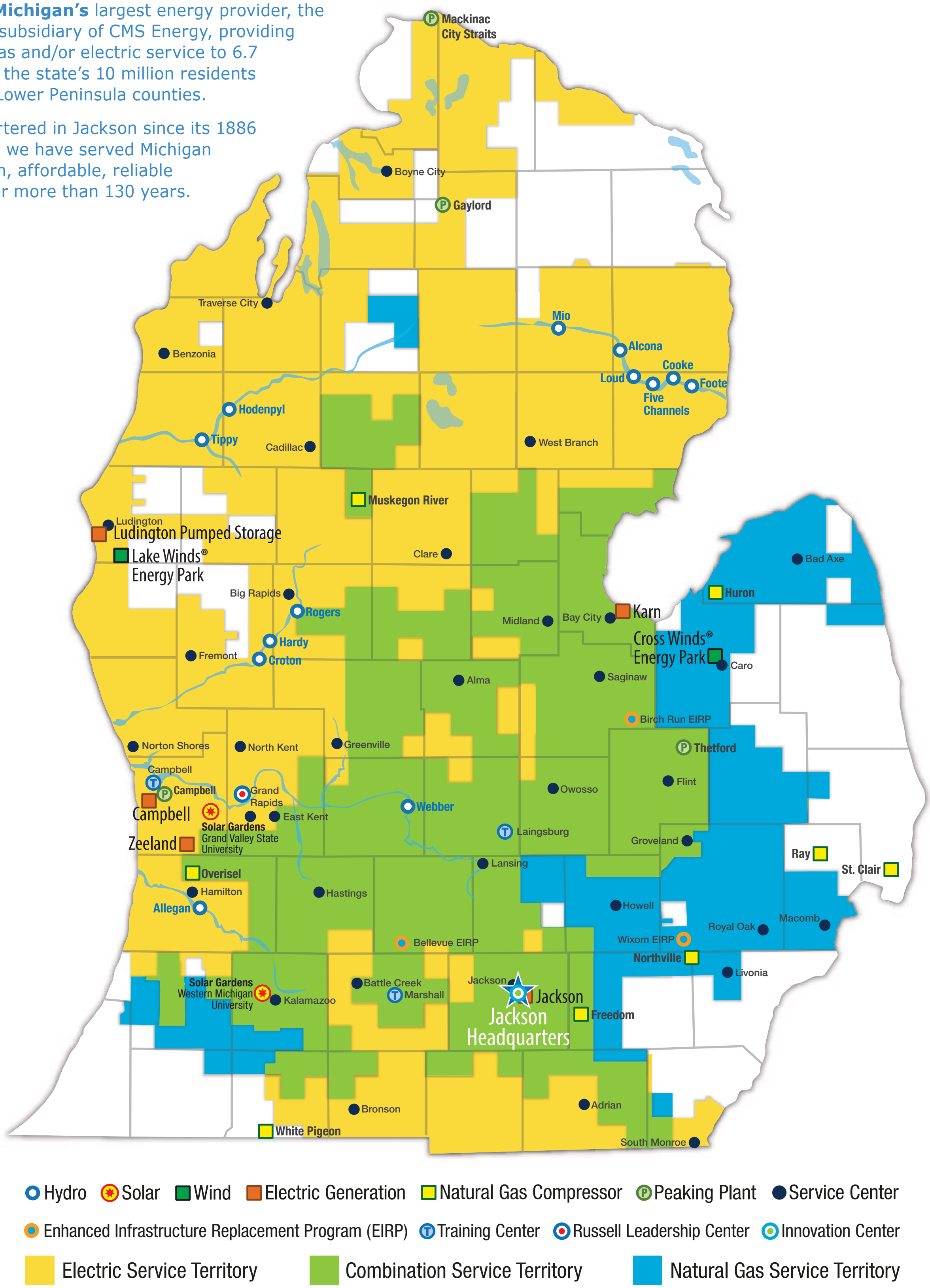


Figure 1.8: Consumers Energy map

EXISTING GENERATION FACILITIES

Since the early 1900s, Consumers Energy has been producing the energy its customers require in a reliable, flexible and cost-effective manner. The number and type of generating assets for Consumers Energy has fluctuated over the company's history in order to address a variety of changes. Such changes include increases in demand as Michigan's industrial economy grew substantially during the 20th century and a more recent shift in the types of fuel sources utilized in order to reflect the clean and lean energy our customers want.

As of 2018 and the filing of this Integrated Resource Plan, Consumers Energy's generating fleet is diverse, flexible and balanced. From hydroelectric plants that have been in operation since the turn of the century to solar gardens that are only a few years old, Consumers Energy maintains a portfolio of supply side resources that were used in the planning, modeling and decision making of this IRP. That portfolio and key characteristics of each asset are detailed in the following tables.

Fossil-Fueled Generating Unit

Table 1.1: Fossil-fueled generating unit key characteristics

Resource	Location	In-Service Date	Age (Years)	Retirement Date	Remaining Est. Time Of Operation (Years)	Licensing Status	Generating Capacity (MW)
COAL FIRED							
JH Campbell 1	West Olive, MI	1962	56	2031	13	Active	259
JH Campbell 2	West Olive, MI	1967	51	2031	13	Active	348
JH Campbell 3	West Olive, MI	1980	38	2040	22	Active	780
DE Karn 1	Essexville, MI	1959	59	2031	13	Active	255
DE Karn 2	Essexville, MI	1961	57	2031	13	Active	260
OIL OR GAS FIRED							
DE Karn 3	Essexville, MI	1975	43	2031	12	Active	600
DE Karn 4	Essexville, MI	1977	41	2031	12	Active	608
Zeeland CC	Zeeland, MI	2002	16	2030	12	Active	527
Zeeland 1A	Zeeland, MI	2002	16	2030	12	Active	159
Zeeland 1B	Zeeland, MI	2002	16	2030	12	Active	157
Jackson	Jackson, MI	2002	16	2030	12	Active	542
Campbell A	West Olive, MI	1968	50	2019	1	Active	12
Gaylord 1	Gaylord, MI	1966	52	2019	1	Active	12
Gaylord 2	Gaylord, MI	1966	52	2019	1	Active	12
Gaylord 3	Gaylord, MI	1966	52	2019	1	Active	11
Straits 1	Mackinaw City, MI	1969	49	2019	1	Active	6

*The company owns 93 percent of the JH Campbell 3 coal fired unit. Other entities own the remaining 7 percent. MW capacity shown reflects the company's share of ownership.

Nuclear Generating Units

Consumers Energy does not own or operate any nuclear generating units as of the filing of this IRP. Consumers Energy does maintain a contract with Entergy Nuclear Power Marketing, LLC to purchase capacity and energy from the Palisades Power Plant located in Covert, Mich. The Palisades Power Plant is described in more detail in this report under the discussion of the company's purchase power agreements.

Hydroelectric Generating Units

Table 1.2: Hydroelectric generating unit key characteristics

Resource	Location	In-Service Date	Age (Years)	Retirement Date	Remaining Est. Time Of Operation (Years)	Licensing Status	Generating Capacity (MW)
HYDROELECTRIC							
Alcona	Alcona County, MI	1924	94	n/a	n/a	Active	3
Allegan	Genesee County, MI	1936	82	n/a	n/a	Active	1
Cooke	Iosco County, MI	1911	107	n/a	n/a	Active	7
Croton	Newaygo County, MI	1907	111	n/a	n/a	Active	4
Five Channels	Iosco County, MI	1912	106	n/a	n/a	Active	6
Foote	Iosco County, MI	1918	100	n/a	n/a	Active	3
Hardy	Newaygo County, MI	1931	87	n/a	n/a	Active	32
Hodenpyl	Wexford County, MI	1925	93	n/a	n/a	Active	5
Loud	Iosco County, MI	1913	105	n/a	n/a	Active	5
Mio	Oscoda County, MI	1916	102	n/a	n/a	Active	2
Rogers	Mecosta County, MI	1906	112	n/a	n/a	Active	3
Tippy	Manistee County, MI	1918	100	n/a	n/a	Active	6
Webber	Ionia County, MI	1907	111	n/a	n/a	Active	7

Renewable Generating Units

Table 1.3: Renewable generating unit key characteristics

Resource	Location	In-Service Date	Age (Years)	Retirement Date	Remaining Est. Time Of Operation (Years)	Licensing Status	Generating Capacity (MW)
RENEWABLES							
Lake Winds	Mason County, MI	2012	6	n/a	n/a	n/a	101
Cross Winds	Tuscola County, MI	2014	4	n/a	n/a	n/a	155
Solar Gardens- GVSU	Grand Rapids, MI	2016	2	n/a	n/a	n/a	4
Solar Gardens- WMU	Kalamazoo, MI	2016	2	n/a	n/a	n/a	1

Energy Storage Facilities

Table 1.4: Energy storage facility key characteristics

Resource	Location	In-Service Date	Age (Years)	Retirement Date	Remaining Est. Time Of Operation (Years)	Licensing Status	Generating Capacity (MW)
ENERGY STORAGE							
Ludington Units 1-6	Ludington, MI	1973	45	2049	31	Active	1,097

*The company owns 51 percent of facility, with DTE Energy owning the remaining 49 percent. MW capacity shown reflects the company's share of ownership.

POWER PURCHASE AGREEMENTS

In addition to generating electricity from company-owned resources, Consumers Energy also holds a variety of power purchase agreements (PPAs) with independent power producers throughout Michigan. These agreements ensure a sufficient amount of energy and capacity at prudent and reasonable costs and prices and support Michigan's economy and residents. Below is a summary of the PPAs the company currently holds.

Table 1.5: Power purchase agreements characteristics

Resource	Location	Current Contract Expiration	Remaining Time Of Contract (Years)	Contract Status	Zonal Resource Credits (ZRCs) Purchased
NATURAL GAS					
Ada Cogeneration LP	Ada, MI	2025	7	Active	29
Michigan Power LP	Ludington, MI	2030	12	Active	123
Midland Cogeneration	Midland, MI	2030	12	Active	1,206
TES Filer City Station LP	Filer City, MI	2034	16	Active	60/225*
NUCLEAR					
Entergy Nuclear Power Marketing, LLC (Palisades Power Plant)	Covert, MI	2021	3	Active	813
HYDROELECTRIC					
Boyce Hydro Power	Sanford, MI	2022	4	Active	11
STS Hydropower Ltd	Ada, MI	2022	4	Active	2
STS Hydropower Ltd	Kalamazoo, MI	2019	1	Active	1
RENEWABLES					
Beebe Renewable Energy	Gratiot County, MI	2033	15	Active	82
Geronimo Huron Wind LLC	Huron County, MI	2033	15	Active	100
Harvest II Wind Farm LLC	Pigeon, MI	2033	15	Active	59
Heritage Garden Wind Farm I, LLC (Wind Portion)	Garden, MI	2033	15	Active	20
Heritage Stoney Corners Wind Farm I, LLC (Phase 2)	McBain, MI	2032	14	Active	12
Heritage Stoney Corners Wind Farm I, LLC (Phase 3)	McBain, MI	2032	14	Active	8
Michigan Wind 1 LLC	Ubly, MI	2028	10	Active	12
Michigan Wind 2 LLC	Bad Axe, MI	2032	14	Active	90
EARP Solar (Original)	Various	2023	5	Active	2
EARP Solar (Expansion)	Various	2030	12	Active	4
LANDFILL GAS					
Adrian Energy Associations LLC	Adrian, MI	2029	11	Active	3
Gas Recovery 1 and 2 (C&C 1, 2)	Marshall, MI	2029	11	Active	6
Granger Electric	Various	2025–2030	7 to 12	Active	16
North American Natural Resources	Various	2030–2031	12 to 13	Active	8
WM Renewable Energy	Various	2026–2032	8 to 14	Active	16
BIOMASS					
Cadillac Renewable Energy	Cadillac, MI	2028	10	Active	34
Genesee Power Station LP	Flint, MI	2030	12	Active	35
Grayling Generating Station	Grayling, MI	2027	9	Active	37
ANAEROBIC DIGESTOR/SOLID WASTE					
EARP Anaerobic Digester	Various	2035	17	Active	2
Fremont Community Digester	Fremont	2033	15	Active	3
Kent County	Grand Rapids, MI	2021	3	Active	16

*Power Purchase Agreement purchases 60 MW through 2019, then increases to 225 MW.

DEMAND-SIDE RESOURCES

Consumers Energy offers a suite of demand-side management programs targeting residential, commercial and industrial customer classes to deliver significant peak load reductions. Demand-Side Management (DSM) programs benefit customers and the company by managing loads and stresses on the electrical system when needed most and channeling wholesale generation dollars back to Michigan customers and businesses.

These programs do much more than help solve capacity needs, they also:

- Provide rewards to customers who use energy more efficiently
- Boost Michigan's economy
- Help manage costs for customers through lower power supply cost; and
- Make use of otherwise idle customer-owned backup generators.

Our programs include a combination of residential and commercial & industrial programs that include the following existing programs:

- Residential Demand Response Programs
  - Peak Power Savers® AC Peak Cycling
  - Peak Power Savers® Dynamic Peak Pricing Program
- Business Demand Response Programs
  - Emergency/Economic
  - Energy Intensive Primary Rate
  - Interruptible Rate (GI Provision)
- Energy waste reduction
  - Comprehensive Business Solutions
  - Multi-family
  - Small Business

For more information, see Section 8: Demand-Side Resources

2018 INTEGRATED RESOURCE PLAN

SECTION

2

TABLE OF CONTENTS

Table of Contents

2018 INTEGRATED RESOURCE PLAN

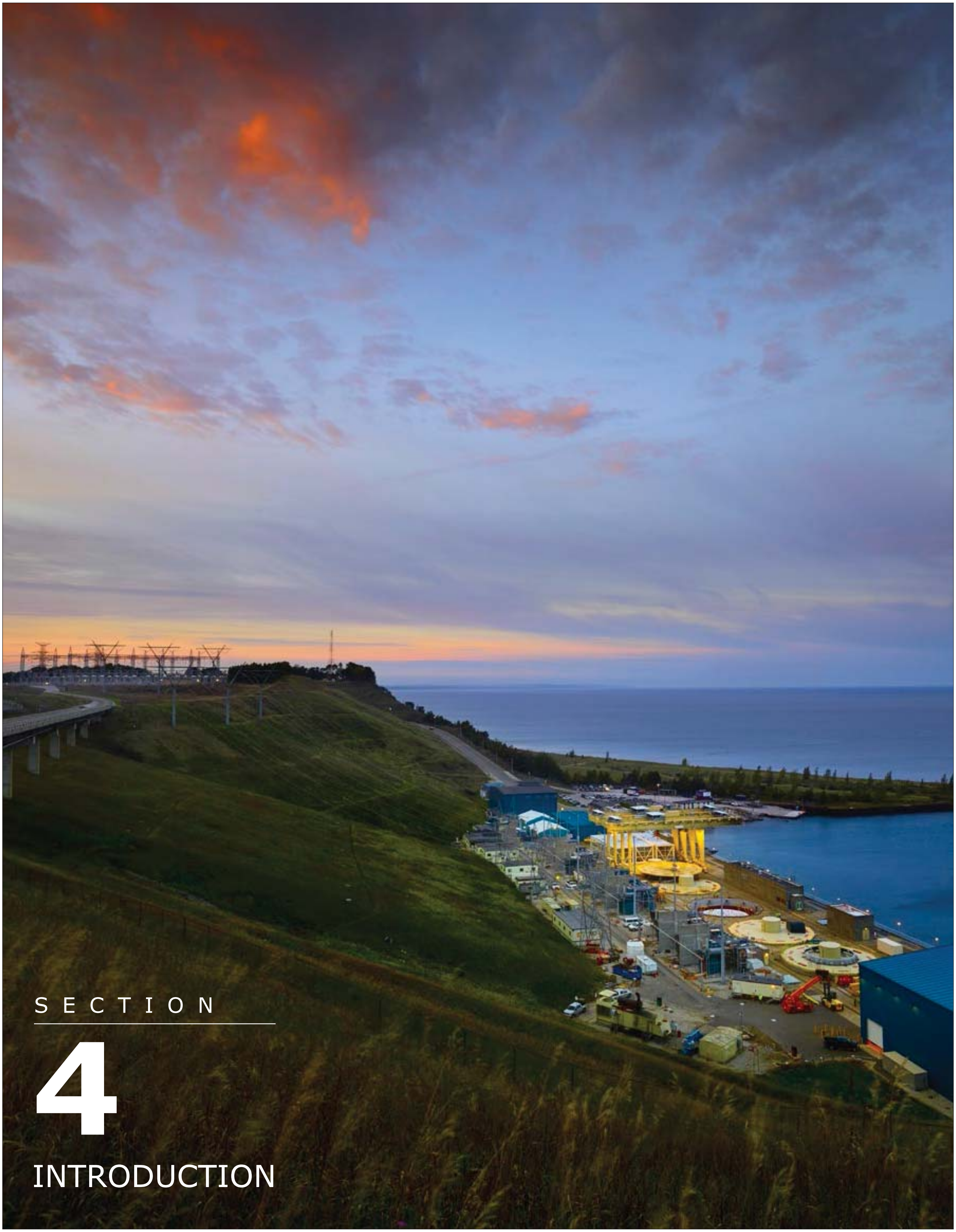
SECTION

3

INDEX OF TABLES AND FIGURES

Index of Tables and Figures

2018 INTEGRATED RESOURCE PLAN



SECTION 4
INTRODUCTION

SECTION 4

Introduction

COMPANY VISION

The company strives to provide world-class performance, delivering hometown service. The IRP is a valuable tool for our major strategic decisions and laying the foundation for how we serve customers for decades to come. The company's assessment seeks to provide Michigan customers with more affordable and reliable options for sustainable and renewable generation resources. A comprehensive IRP that takes into account core principles and planning objectives, stakeholder feedback, modeling and analysis represents the most reasonable and prudent course of action for the company to deliver reliable and affordable electricity now and into the future.

The proposed course of action (PCA) gives the company greater agility to react to future changes and empower customers through energy waste reduction programs to manage their energy usage. The use of renewables and energy-reducing resources creates a modular and modern system — versus a centralized generation resource —able to minimize cost risk to customers while maintaining affordability and reliability.

BUSINESS OBJECTIVES

The IRP is a roadmap to meeting our customers' long-term energy needs guided by a set of business objectives and customer vision for the utility's supply portfolio. These are identified and are utilized to help guide technical experts and leadership in the development of the analysis and the decision to pursue a proposed course of action. The business objectives, Figure 4.1, for this IRP are consistent with MCL 460.6t(8), and include:

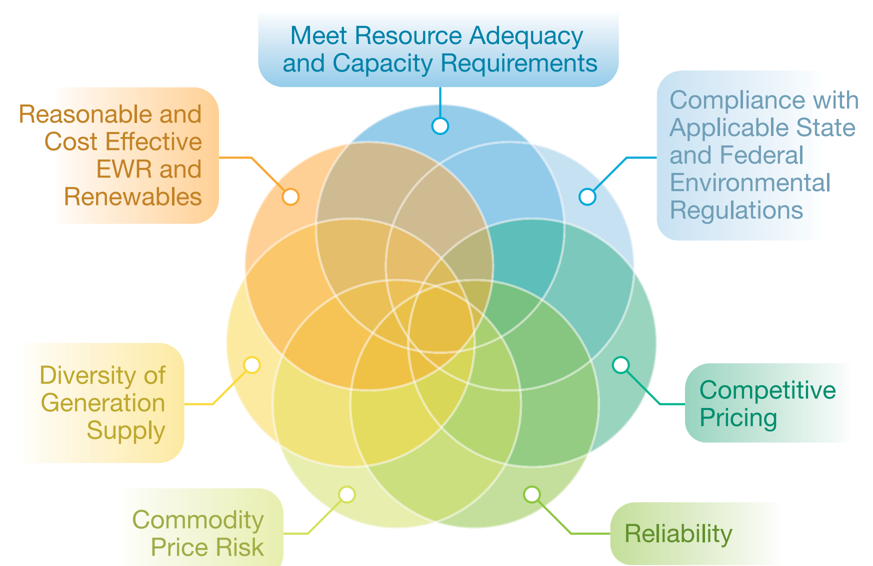


Figure 4.1: Consumers Energy core principles

RELIABILITY: RESOURCE ADEQUACY AND CAPACITY REQUIREMENTS

The company provides customers with sufficient energy and capacity to satisfy their anticipated peak electric load so that our customers do not experience outages due to lack of generation supply. We meet requirements under state and federal law to ensure we are providing our fair share of reliable generation capacity for Michigan.

COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

Consideration of compliance requirements for existing and future resources is factors in determining the type of future generating resources to build.

COMPETITIVE PRICING

Resources used to satisfy customer demand come at a cost. The price of these resources should be minimized to keep rates low, bills affordable and support economic development in Michigan.

RELIABILITY

The system should be reliable not only from a resource adequacy requirements perspective, but also from a performance perspective. Providing energy to customers when needed must be achieved through the resources planned. Performance of a resource and enhanced performance of combined resources are avenues for maintaining or enhancing reliability of the energy provided.

COMMODITY PRICE RISK

A key cost driver for customers is variable costs, which include fuel prices. Natural gas prices pose a risk due to their volatility in the market. A resource plan should consider and minimize the level of risk associated with volatility in pricing of commodities. Our use of the MISO market to purchase energy helps to improve affordability and lower risk by purchasing the most cost-effective resources every day.

DIVERSITY OF GENERATION PORTFOLIO

A variety of supply-side and demand-side resources help to ensure fuel and operational diversity, which insulates customers from commodity price risk and provides customers with reliable supply of capacity needs.

REASONABLE AND COST-EFFECTIVE ENERGY WASTE REDUCTION AND RENEWABLES

Cleaner energy resources utilizing wind, the sun and cost-effective technology advancements that optimize how the system provides energy to customers are benefits to customers and to Michigan.

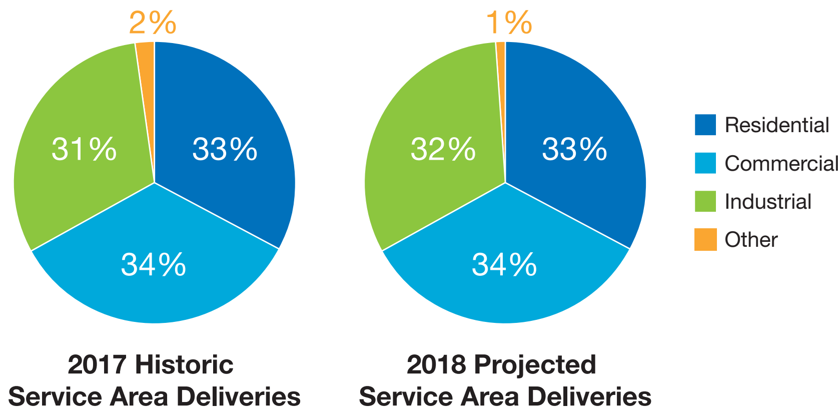
CLEAN AND LEAN STRATEGY

Using the business objectives in combination with the analysis in the IRP, the company's goal was to identify a PCA that supports the company's clean, modular and incremental strategy and produce the best plan for Michigan. The company strives to eliminate coal and reduce carbon emissions by 80 percent by 2040. Cleaner resources such as wind, solar, batteries and natural gas are important components to achieving this goal.

CUSTOMERS

The company delivers energy and gas to approximately 1.8 million customers in 68 counties in the Lower Peninsula of Michigan. Our customer base is diverse in type, size and energy needs (See Figure X). The company's electric utility customer base consists of a mix of primarily residential, commercial and diversified industrial customers in Michigan's Lower Peninsula. Over the past decade, these customers have been provided affordable and reliable energy and capacity from a mix of supply and demand resources. Customer rates have not increased above the inflation rate and the company remains committed to maintaining this level of performance[1]. From 2009 to 2017, participating customers in our energy waste reduction programs totaled $1.4 billion in energy savings. With the PCA the company projects an additional $17 billion in energy savings through the planning period when energy efficiency savings are held at 1.5 percent and increased to 2.25 percent by 2040.

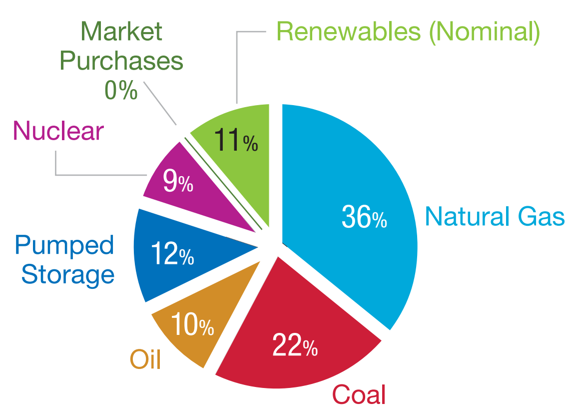
Figure 4.2: Historical and projected customer service area deliveries



CURRENT SUPPLY RESOURCES

The company draws on a diverse portfolio of supply and demand resources to meet expected peak demand plus reserves. Those resources include utility-owned generation, long-term supply contracts, energy efficiency and demand response resources.

Figure 4.3: Capacity fuel mix chart



UTILITY-OWNED GENERATION

The company currently owns and operates 5,982 MW of installed capacity equivalent to 5,212 zonal resource credits (ZRCs). The company-owned resources serving customer needs in 2018 (see Figure 4.2 above right) shows the level of diversity in resources the company relies upon. The fuel types used by these resources include: coal, natural gas, hydroelectric, wind, solar, and demand-side management programs. Further details can be found in Section 7 Existing Supply-Side Resources and Section 8 Demand-Side Resources.

LONG-TERM POWER SUPPLY CONTRACTS

The company has long-term contracts with non-utility generators (NUGs) for 2,947 MW of installed capacity in January of 2018, at 2,485 ZRCs for planning year 2018. The power supply contracts are entirely within the Lower Peninsula of Michigan, with the exception of the Heritage Garden Wind Farm located in the Upper Peninsula. These resources are listed in Section 7 Existing Supply-Side Resources.

DEMAND-SIDE MANAGEMENT

The company offers many programs to customers to help reduce peak demand. Demand-Side Management (DSM) programs benefit customers and the company by managing loads and stresses on the electrical system when needed most and paying customers to reduce demand rather than needing even more in new supply. These programs help keep Michigan energy costs affordable for all customers, even those who do not participate. But they provide cost savings through smart rewards for Michigan customers and businesses.

Collectively, the company's DSM programs deliver significant peak-load reductions. This peak demand reduction is reached with programs targeting residential, commercial and industrial customer classes. The primary programs offered by the company include demand response and energy efficiency.

CUSTOMER DEMAND

The load forecast has total electric deliveries expected to increase at a marginal 0.3 percent in 2018 and remain relatively flat through the next five years (2018 – 2022) at a 0.05 percent Compound Annual Growth Rate (CAGR). Projecting to the end of the IRP forecasting period, total deliveries are expected to grow at a modest 0.2 percent annually. An accurate load forecast for the planning period is the starting point of the analysis in an IRP and a key component in determining whether existing resources satisfy customer demand or additional resources are required to serve the customer need. The use of regression modeling, statistical factors, etc. assist in making accurate projections of future customer demand. The company consistently monitors for potential changes that affect the peak demand to make adjustments and provide a quality load forecast to support long-term resource planning. This load forecast was used as a starting point for all scenarios and sensitivities.

The forecasted peak system demand includes servicing demand associated with the following:

- Bundled service.
- Retail open access (ROA) customers.
- Demand reductions by use of interruptible service and demand-response programs.
- Demand reduced through energy efficiency programs.
- Transmission losses.

The 2018 peak demand and energy forecast is utilized as the basis or reference point for each scenario and sensitivity analyzed in the IRP.

This customer demand is forecasted to be met by our current generation mix until the year 2023 when the Karn 1 and 2 units are proposed to retire, and the years 2030 and 2031 when contractual agreements and existing resources reach their expiration dates and design lives, respectively. Our plan to expand our DSM programs reduces the forecasted demand in 2023 to around 200 MW, thus replacing about half of the Karn 1 and 2 units offered today. A constructive regulatory model that provides incentives to aggressively reduce our sales is cheaper for all customers.

ENERGY AND CAPACITY PRICE FORECASTS

The energy price forecast used in the company's IRP is an output of the production cost model simulation and represents a projection of marginal energy costs.

The capacity price forecast is used to understand the capacity value a resource provides to customers and the company. Capacity is related to zonal resource credits authorized by MISO to ensure electric reliability in the zone and within MISO. A zonal resource credit is based on the MWs a resource provides, not necessarily the energy delivered by the resource. Insufficient capacity resources for either the MISO footprint (when there are inadequate resources to meet the Planning Reserve Margin Requirement) or for a specific local resource zone when inadequate resources are available to meet a local clearing requirement, will result in the annual Planning Resource Auction clearing at Cost of New Entry (CONE). CONE is a price signal indicating the market is deficient of capacity resources and new entry or new capacity resources are needed to ensure electric reliability in MISO. The projected capacity price used in the IRP is based upon the company's September 2017 capacity price forecast of 75 percent of CONE.

FUEL PRICE FORECASTS

The company develops and uses fuel forecasts for coal, natural gas and oil-fired generating units. The fuel forecasts in the IRP vary depending upon scenario and sensitivity. The oil and coal price forecasts are utility-based for all scenarios and sensitivities and use a set of public and private short- and long-term forecasts. The natural gas price forecast is utility-based for the three utility specific scenarios developed for this IRP to provide a more reasonable natural gas price forecast when compared to the price forecast required in the MIRPP-required scenarios. It assumes a blend of public and private forecasts to develop a short-, mid- and long-term forecast. The natural gas price forecast used in the MIRPP-required scenarios was the Energy Information Administration – Annual Outlook published in 2017. The following table identifies the fuel forecasts used in each scenario and sensitivity. Further details on fuel forecasts can be found in Section 8 Fuel Supply.

Table 4.1: Fuel forecasts by scenario and sensitivity

FUEL FORECAST	MIRPP Scenarios			CE Scenarios		
	BAU	ET	EP	BAU	ET	EP
CE Coal Prices Forecast	X	X	X	X	X	X
CE Oil Prices Forecast	X	X	X	X	X	X
CE Natural Gas Prices				X	X	X
2017 EIA AEO Natural Gas Prices	X	X	X			
200 percent of 2017 EIA AEO Natural Gas Prices	X	X	X			

Note: BAU is Business as Usual, ET is Emerging Technologies and EP is Environmental Policy

INFLUENCES OF MARKET AND REGULATORY ENVIRONMENT

RTO Capacity Market

MISO SEASONAL CAPACITY MARKET

In 2015, the MISO developed a draft proposal to change from a one-season market (June 1 through Sept. 31) to a two-season capacity market. In a two-season capacity market, MISO would obtain capacity on a four-month summer season (June 1 through Sept. 31) and eight-month winter season (Oct. 1 through May 31). Each season would have its own resource accreditations, reserve margins and capacity import/export limits. The impacts of this are still unknown and yet to be determined.

MISO AND THE CAPACITY CREDIT FOR SOLAR ENERGY

The current effective load-carrying capability (ELCC) assumed for a solar build in the IRP model is 50 percent with a capacity factor of 19.9 percent. The ELCC factor determines the level of ZRCs that MISO credits for a certain level of solar MW build. For example, a 200 MW solar facility provides 100 ZRCs the company can count towards meeting customer demand and the Planning Reserve Margin Requirements. The ELCC prescribed by MISO is intended to ensure electric reliability on the system. The MISO is planning to re-evaluate the ELCC in September 2018. If adjustments in ELCC are downward, the resulting effect is the need to develop additional MWs of solar, or another economic resource, to fill future capacity needs and vice versa for adjustments made upward.

ELECTRIC CUSTOMER CHOICE (ECC)

Historically, resource planning has been challenging because of Michigan's unique "hybrid" energy market that allows retail energy marketers to serve 10 percent of the company's retail electric load under the existing retail open access (ROA) construct. The customers comprising that 10 percent can return to utility service at any time, making it difficult for the company to know precisely how much electric capacity it will need. With the strategy to provide smaller and modular resources, the company is better situated to handle ROA customers wishing to return to the utility or to mitigate risks associated with a further deregulated market.

TRANSMISSION EXPANSION

The company is a transmission customer of MISO, which provides Network Integration Transmission Service (NITS) under its FERC-approved tariff. Michigan Electric Transmission Company (METC) owns the majority of the transmission system interconnected to the company's transmission and distribution facilities. MISO is the independent operator of all transmission facilities within the MISO footprint. Consistent with their respective NERC registrations, MISO and all transmission owners are responsible for ensuring reliable operation of the transmission system. Based on these NERC obligations, there should be little risk regarding transmission availability, because MISO and all transmission owners are obligated to maintain the transmission system in a manner for sufficient imports.

In 2016, the company became a transmission owner under the MISO Tariff. Notwithstanding this change, the company has limited power to increase the transmission system's capability to handle imports into Zone 7. Likewise, METC is restricted in its ability to build transmission to facilitate further imports into Zone 7, unless such a project will have a sufficient benefit-to-cost ratio to qualify as a market efficiency project. However, the transmission system will likely not hinder the company's ability to meet its capacity requirements, as the system is capable of importing more power into Zone 7 than currently needed to meet its Planning Reserve Margin Requirement while meeting Zone 7's local clearing requirement. Zone 7 would fail to meet its local clearing requirement well before constraints on the transmission system would physically limit imports. Therefore, new transmission will not need to be built in the near future to facilitate imports.

ENVIRONMENTAL REGULATIONS

Consumers Energy has been committed to protecting the environment for decades, using various approaches including fuel switching and installing pollution control equipment. The company has prudently ensured compliance with all applicable state and federal environmental regulations. The company has made investments to achieve such compliance in a manner that has minimized, to the extent reasonably possible, the associated costs for customers. In addition to maintaining compliance, these investments also ensure continued supply reliability, while having a positive impact on the environment by achieving significant reductions of pollutants. The applicable regulations for the company's existing generation resources fall into three main categories: air quality, water quality and waste management.

Air quality compliance with the Mercury Air Toxics Standards (MATS), Michigan Mercury Rule (MMR), and the Cross-State Air Pollution Rule (CSAPR) has been achieved through the retirement of the Classic Seven units and installation of air quality control systems at the remaining coal units. The company has also evaluated the potential impact of the Clean Power Plan (CPP), currently stayed by the Supreme Court of the United States. However, we cannot predict the outcome of relevant legal and/or administrative actions but will continue to monitor regulatory activity regarding the CPP. Regardless, the company is well positioned to comply with the CPP, as finalized by EPA, with the closure of the Classic Seven units and our increased utilization of lower and non-emitting generating sources such as natural gas, wind and solar. In addition, the passage of new energy legislation in Michigan in 2016 continues to support this transition to cleaner generation through demand-side management and increased clean and renewable energy sources.

Water quality regulations such as the Steam Electric Effluent Guidelines (SEEG) and Clean Water Act §316(b) (316(b)) have the potential to significantly impact the company. Beginning Nov. 1, 2020, compliance with new SEEG effluent limitations are required "as soon as possible", but no later than Dec. 31, 2023. It is anticipated that 316(b) compliance may also align with the Dec. 31, 2031, date. Ultimate compliance requirements associated with these water quality regulations are yet to be determined by the regulating authority.

Lastly, under subtitle D of the Resource Conservation Act (RCRA), the EPA finalized the Disposal of Coal Combustion Residuals from Electric Utilities. The rule establishes technical requirements for coal combustion residual landfills and surface impoundments. Consumers Energy will complete investments necessary for compliance with RCRA by 2020. However, there are additional closure activities required by Michigan landfill rules under Part 115.

RENEWABLE ENERGY CREDIT PORTFOLIO STANDARDS

Public Act 342 requires the utility meet a 15 percent renewable energy credit portfolio standard (RPS) by the year 2021 and work toward a goal of 35 percent combined renewables and energy waste reduction programs by 2025 to serve customers' energy needs. To ensure compliance with the 15 percent RPS, the company aligned its IRP assumptions with the company's proposed renewable energy plan covering years 2019 through 2029. During the IRP process, consideration was given as to whether the proposed plan maintained 15 percent cost effectively beyond the compliance period and to what extent the proposed plan would meet or exceed the 35 percent goal in the year 2025. When renewable energy is combined with EWR programs, the company would reach the 35 percent goal by 2025 and reach 50 percent by the year 2030. If regulatory decisions are made to increase goals or requirements, the company is well positioned to address this type of regulatory change.

PUBLIC UTILITY REGULATORY POLICIES ACT (PURPA)

In response to the energy crisis of the 1970s, Congress enacted the Public Utility Regulatory Policies Act of 1978 (PURPA), which sought to encourage the development of renewable and alternative domestic energy sources by mandating that electric utilities purchase power from qualifying cogeneration facilities and small power producers referred to as qualifying facilities (QFs). This IRP proposes a new approach to determining the company's avoided costs pursuant to PURPA that better protects customers by implementing a competitive bidding process. Under the company's competitive bidding proposal, QFs and other independent developers are provided with an opportunity to bid for future supply needs as proposed by the company.

The company has also made reasonable assumptions around existing and new PURPA-based contracts. QFs that sell energy and capacity to the company pursuant to existing PURPA-based contracts are assumed to receive new contracts once their current contracts expire. Furthermore, as required by the commission in Case No. U-18090, the company assumed 150 MW of new PURPA-based contracts.

IRP PLANNING PROCESS

The process for developing the IRP requires months of planning and expertise both internal and external to the company to identify a long-term resource plan that is able to perform well in future worlds related to supplying and delivering energy to customers. The multi-step process is show in Figure 4.4 and encompasses the major steps within the IRP Planning process.

Figure 4.4: IRP planning steps

The initial starting point is the development of planning objectives. These help focus the analysis and guide the company in determining the most reasonable and prudent PCA. To supplement the planning objectives, the company sought stakeholder feedback from technical experts and the general public on objectives, study design and their desire for what constitutes the best supply plan for Michigan. Further details on the company's stakeholder engagement process can be found on page 196 .

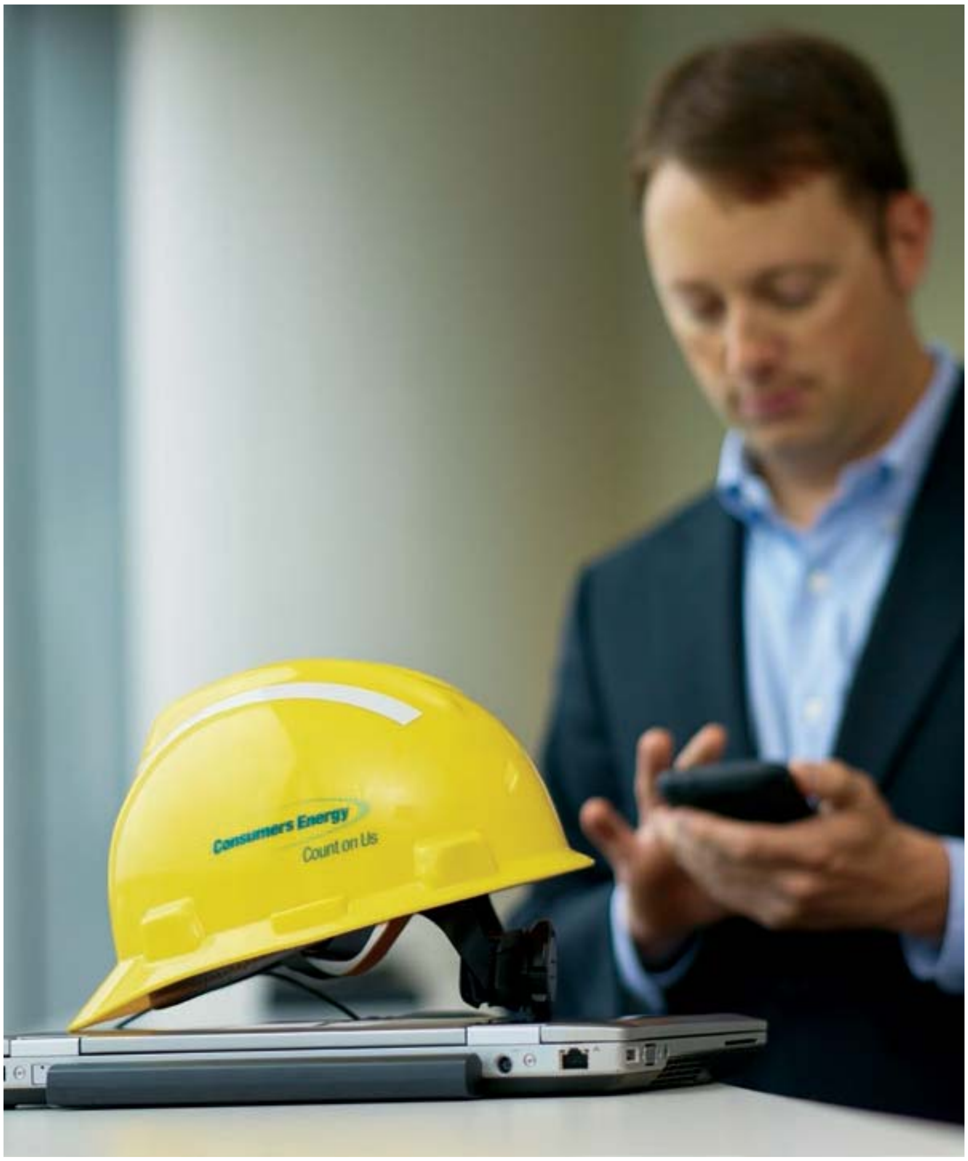
The next step is to develop future worlds or scenarios that cause changes to how we see the world today. For example, today's world is viewed as a "business as usual" scenario where key factors such as fuel projections, cost assumptions and regulatory environment follow current trends. A future world different than this would be one where costs of renewables decline significantly and environmental regulations drive retirement of coal- and natural gas-fired units. Evaluation of these future worlds is completed by use of a software model evaluating multiple possibilities for fulfilling customer demand. Modeling results are assessed for the level of risk to which the company and its customers could be exposed.

The final step and result is developing a PCA that is used as a roadmap to meet planning objectives, while considering stakeholder feedback obtained through the entire process.

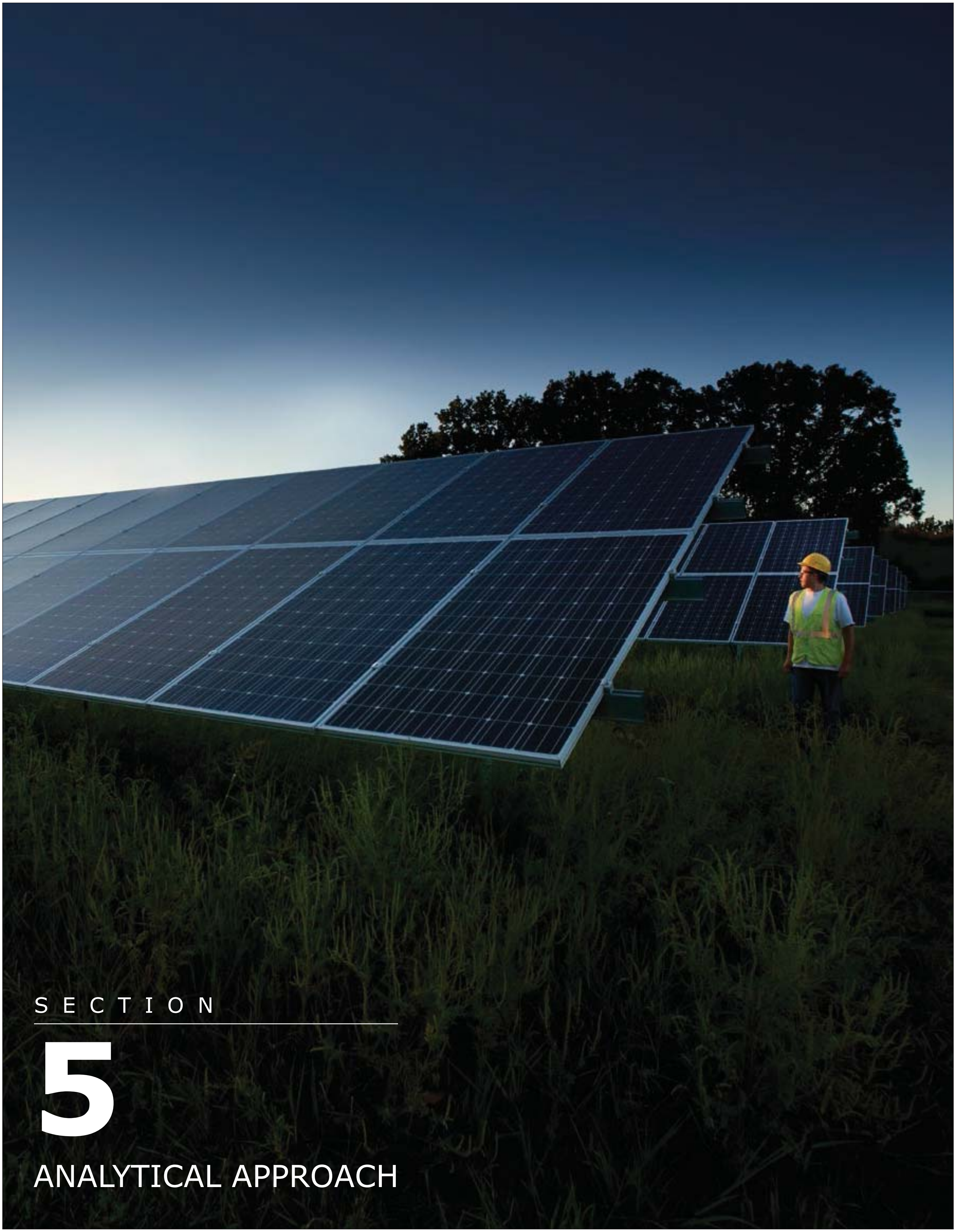
The following components of this report further detail the analysis completed to determine the most reasonable and prudent long-term generation plan for the years 2019 through 2040.

Endnotes

1 The utility's revenue requirement for existing generation that includes the impacts of the financial incentives for energy waste reduction programs is supported by company witness testimony.


Consumers Energy
Count on Us

2018 INTEGRATED RESOURCE PLAN



SECTION

5

ANALYTICAL APPROACH

SECTION 5

Analytical Approach

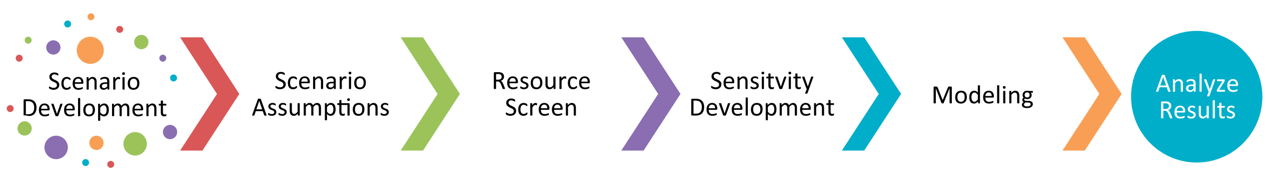
MODELING PROCESS

An IRP modeling process produces portfolio optimization plans based upon industry and cost assumptions of supply-side and demand-side options. The portfolio optimization plans or are generated when a capacity need is identified over a study period. The IRP presented by the company evaluated the need for capacity from 2019 through 2040. Based on design life dates of existing units and contractual agreements, a need was identified to occur in two specific years: 2030 and 2031. Additional analysis was conducted to evaluate early retirement of the Campbell units 1 and 2 and Karn units 1 and 2 in years 2021 and 2023. The company hired a consultant, ABB, who conducted supplemental retirement analysis to determine an optimal year of retirement for these units (Medium Four).

First, capacity shortfalls in the planning period were identified. Next, the company performed a resource screen based upon levelized cost of energy, market value and technical feasibility. The resource screen recognizes feasible technologies for the model to consider in fulfilling the shortfall. Utilization of the MIRPP and CE scenarios and sensitivities, while considering the business objectives of the IRP, a PCA results from the model that performs well under diverse conditions (i.e. natural gas prices, declining capital costs).

To develop a PCA, the company performed a robust modeling assessment to understand the types and combinations of flexible resources that could be used to meet future power needs of our customers. The modeling and assessment process is shown in Figure 5.1 and further explained in this section.

Figure 5.1: IRP modeling and assessment process



Scenario Assumptions

With the business objectives in mind, future worlds are created with underlining assumptions used to test resource alternatives under a different set of uncertain future conditions. These future worlds are called scenarios. In each scenario, the model selects least-cost resource alternatives under the set of assumptions for that scenario to meet customer energy needs. Future worlds or scenarios help the utility and stakeholders understand which mix of resource alternatives can withstand influential changes in variables affecting affordability and reliability of capacity and energy. This IRP contains six scenarios, three of which were developed in collaboration with the MPSC and stakeholders, as described in Section VI Integrated Resource Planning Scenarios and Sensitivities.

Resource Screen

There is a wide range of technologies the utility can consider in the modeling process to meet future needs of our customers. The evaluation of these resources is based upon a technical screening, an economic analysis using a levelized cost of energy (LCOE) evaluation, as well as other criteria. The goal of the resource screen is to offer technologies to the model that are economic and/or provide a market value benefiting customers. Because the model is designed to identify the least-cost resource options, offering a resource that is uneconomic and low in market value when compared with other resource alternatives would only result in the model never selecting the resource. Therefore, the resource screen helps to maximize the modeling effort to identify economic resources under a set of assumptions. The resource screen is further discussed in Section XIV Resource Screen.

Sensitivity Development

Sensitivities are modeling assumptions that change from the foundational assumptions in a scenario. Sensitivities are different from scenarios in that a sensitivity varies one isolated assumption within an established scenario, versus a scenario that includes foundational assumptions used to create a specific future world. The portfolio optimization plans and Net Present Values (NPVs) help in understanding the effect(s) of varying a particular assumption. For example, if the model creates a portfolio optimization plan containing a natural gas-fired resource, varying the foundational assumption for the natural gas price forecast would help to identify how the plan changes when this assumption changes. A series of both required and utility-specific sensitivities were tested on the base plans of each scenario. A description of these sensitivities is further described in Section VI Integrated Resource Planning Scenarios and Sensitivities.

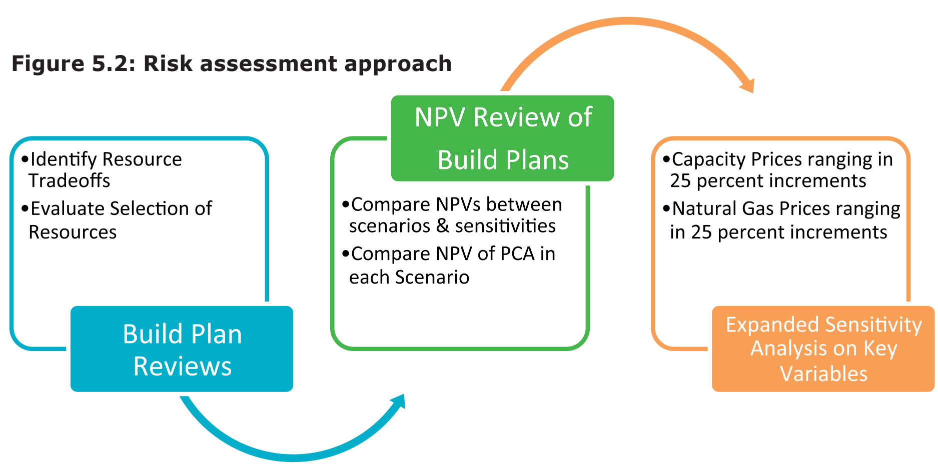
Modeling

Consumers Energy relies upon the Strategist® module PROVIEW to evaluate various combinations of available demand-side and supply-side alternatives to meet future resource requirements. The data associated with the supply-side and demand-side alternatives is inputted into PROVIEW to evaluate each of the alternatives equally. The resource alternatives considered for the demand-side and supply-side integration were the resources remaining after the initial LCOE and market valuation screenings. The alternatives were assumed to be available by the beginning of a particular planning year that follows the capacity and reliability requirements of the MISO. The resulting resource plans were tested for robustness using sensitivity analyses and NPV comparisons. The incremental revenue requirement was also analyzed for the PCA.

Analyze Results

A business objective of the IRP process is minimizing risk to customers in key areas. The company's approach to risk assessment involved a three-step process, see Figure 5.2.

Figure 5.2: Risk assessment approach



Portfolio Optimization Reviews

Portfolio optimization reviews were used to determine when the model selects a particular resource over another, when the set assumptions change from one scenario and sensitivity to another. For example, the model may select a portfolio optimization plan with a demand response resource under a particular scenario or sensitivity, and under another scenario or sensitivity the model may prefer a solar resource. This helps to understand the tradeoffs between one resource and another. The Strategist® model uses mathematical computations to choose the most economic resource to meet a certain level of capacity and energy needs in a given study period. The selected resource needs only to be 1 cent cheaper to be selected over another resource. Understanding the changing variables from one scenario to the next pulls out the factors as to why one resource is chosen over another. This method helped to develop the levels of resources in the PCA.

In looking at Table 5.1 you can see the resource preference each scenario has in the model, and it shows the key drivers in this step of the analysis were i) reductions in capital costs for renewable resources and ii) natural gas prices. Generally, either lower capital costs or higher natural gas prices resulted in more renewable resources. In some cases high natural gas prices caused higher energy prices which incentivized relatively energy intensive wind and dis-incentivized natural gas resources due to increased costs for fuel. This was relevant because the company considers there to be more upside risk than downside risk to natural gas prices and more downside risk than upside risk to renewable resource capital costs. The results of the scenario and sensitivity analysis indicated that there are reasonable futures where gas prices increase or renewable resource capital costs decrease sufficient enough to justify meeting all incremental supply-side needs with renewable resources. This was a key realization in the development of the PCA.

Scenario/Sensitivity	Business as Usual CE Gas	Emerging Technology[1] CE Gas	Environmental Policy[2] CE Gas	Business as Usual AEO Gas[4]	Emerging Technology[1] AEO Gas	Environmental Policy AEO Gas
Capital Cost Asumptions		15% Wind 35% Solar 35% Battery 35% DR	35% Wind 35% Solar 35% Battery	(+60% CE Gas)	15% Wind 35% Solar 35% Battery 35% DR (+60% CE Gas)	15% Wind 35% Solar 35% Battery 35% DR (+60% CE Gas)
Natural Gas Cumbustion Turbine	Red	Red	Red	Red	Red	Red
Natural Gas Combined Cycle	Green	Red	Red	Red	Red	Red
Reciprocating Internal Combustion Engine	Red	Red	Red	Red	Red	Red
Wind	Yellow	Green	Green	Green	Green	Green
Solar	Yellow	Green	Green	Green	Green	Green
Battery	Green	Green	Yellow	Yellow	Yellow	Green
Conservation Voltage Reduction	Green	Green	Green	Green	Green	Green
Demand Response	Green	Green	Green	Green	Yellow	Green
Energy Efficiency	Green	Green	Green	Green	Green	Green

NEVER SELECTED BY MODEL ← → ALWAYS SELECTED BY MODEL

Table 5.1: Resource preference by scenario

Tradeoff Points from Table 5.1

LIMITED PREFERENCE FOR NATURAL GAS

Natural gas-fired generation is only selected in a BAU future at natural gas prices reflective of the Consumers Energy forecast. New natural gas plants are not competitive when compared to renewables and demand-side resources, especially if further cost reductions are realized.

HIGH PREFERENCE FOR RENEWABLES AND DEMAND-SIDE RESOURCES

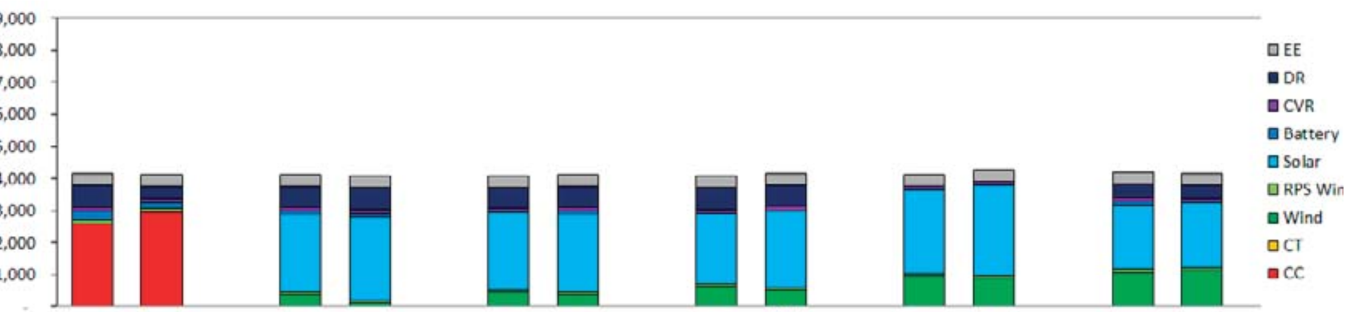
At the assumed capital costs, renewables are sometimes to always selected in all scenarios. The preference for renewables increases as natural gas prices rise. Demand-side resource and renewable options are competitive resources in each scenario. This helped to inform the development of the PCA because investments and growth of both resource types can be assumed to have similar cost impacts to customers.

MODERATE PREFERENCE FOR BATTERIES

Batteries are preferred on a moderate level. Similar to demand-side resources, batteries provide capacity value, but not energy value. The capital costs for batteries decline at a rate that remains higher in some circumstances than renewables and demand-side management resources. Therefore, this resource is not selected as often as other resources.

Figure 5.3 depicts the optimal plan for each scenario as well as the sub-optimal plan. The sub-optimal plans give insights into whether and when one resource is selected versus another.

Figure 5.3: Portfolio optimization plans and sub-portfolio optimization plans by scenario



BAU CE	BAU CE (sub)	ET CE	ET CE (sub)	EP CE	EP CE (sub)	BAU AEO	BAU AEO (sub)	ET AEO	ET AEO (sub)	EP AEO	EP AEO (sub)
361	361	361	361	361	361	361	361	361	361	361	361
673	400	673	673	673	673	673	673	-	-	433	433
115	115	115	115	115	115	115	115	115	115	115	115
300	200	100	100	-	100	-	-	-	-	100	-
-	-	2,411	2,611	2,411	2,411	2,210	2,411	2,611	2,812	2,009	2,009
86	86	86	86	86	86	86	86	86	86	86	86
-	-	380	127	443	380	633	506	949	886	1,075	1,139
-	-	-	-	-	-	-	-	-	-	-	-
2,602	2,967	-	-	-	-	-	-	-	-	-	-

Supply- and demand-side optimizations for all six IRP scenarios with Karn 1 and 2 retiring in 2023, including the first sub-optimal.

NPV REVIEW OF PORTFOLIO OPTIMIZATION PLANS

The NPV review of the portfolio optimization plans for each scenario and sensitivity was assessed at three optimization levels:

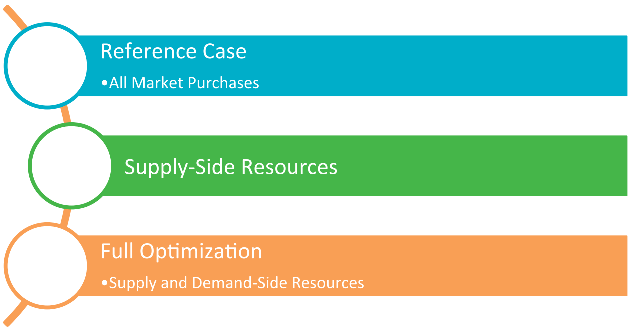


Figure 5.4: NPV review optimization levels

The above mentioned optimization points are studied to gain insights into the risk and results of the model, and should not be confused with the optimization treating demand-side resources differently than supply-side resources. Each level helps to identify whether customers realize increased costs or savings or remain neutral based upon the NPVs. These comparisons are made with the portfolio optimizations under each scenario and sensitivity run. This same approach is used when comparing the PCA and alternate plans in each of the developed scenarios. The lowest NPV plan represents the least-cost plan for customers; Table 5.2 is an example of this. The reference case is assigned a base designation; the arrows are comparing the resulting NPVs of each optimization level back to the reference case.

Table 5.2: Base case scenarios – optimization levels

	BASE CASE SCENARIO NPV (MILLION $)					
	BAU CE	**ET CE**	**EP CE**	**BAU AEO**	**ET AEO**	**EP AEO**
Reference Case	Base	Base	Base	Base	Base	Base
Supply-Side Optimization	↑	↓	↓	↓	↓	↓
Full Optimization	↓	↓	↓	↓	↓	↓

The reference case used provides an understanding of what impact a particular future scenario has on the overall energy market and provides a static comparison for different portfolio optimizations to be compared against. For example, by considering the NPV's between the BAU CE scenario and the BAUAEO scenario, the company was able to gain insight into the impact of increasing gas prices to the level in the AEO forecast. By changing nothing in the underlying resources, it is possible to attribute the cost changes between those scenarios strictly to the change in inputs.

The supply-side optimization allows for easier comparison of the impact of demand-side resources included in the full optimization. This is needed because demand-side resources provide customer savings by avoiding traditional supply-side builds.

Full optimization is the final result of the model. These are the results that were compared in Step 1. First, the NPVs from these results are compared to the supply-side resources to validate that the inclusion of demand-sides resources in the optimization did in fact reduce costs absolutely. Second, these results are compared to each other to understand cost variability across the scenarios and sensitivities. Cost variability across the scenarios is our key quantitative measure of risk. The objective of the PCA is to reduce costs absolutely, but also to reduce cost variability across the many scenarios and sensitivities.

The learning gained by assessing the changes in NPVs resulting in the scenarios and sensitivities at these optimization points were:

- Customers incur fewer costs in scenarios where renewables are selected and capital costs are reduced;
- Demand-side management resources create customer savings;
- Higher natural gas prices cause higher cost to customers, but these higher costs are offset with the implementation of renewables and demand-side management; and

The insights gained to this point indicate renewables and demand-side management resources reduce risk by functioning as a hedge against energy market and commodity costs. Renewable and demand-side resources have little variable expenses while the energy market continues to be driven by marginal generation costs which tend to be set by natural gas fuel generators. Therefore, the reliance on natural gas generation (as was included in the supply-side optimization and selected in the BAU CE scenario) is a less-effective hedge against energy market prices than reliance on renewables because the cost to generate energy from the natural gas generator increases when natural gas prices increase similar to the overall energy market price increases.

A second example related to sensitivity analysis, shown in Figure 5.5, indicates customer costs are reduced with renewables and demand-side resources because the preference for these resources is higher as shown in Table 5.2 above.

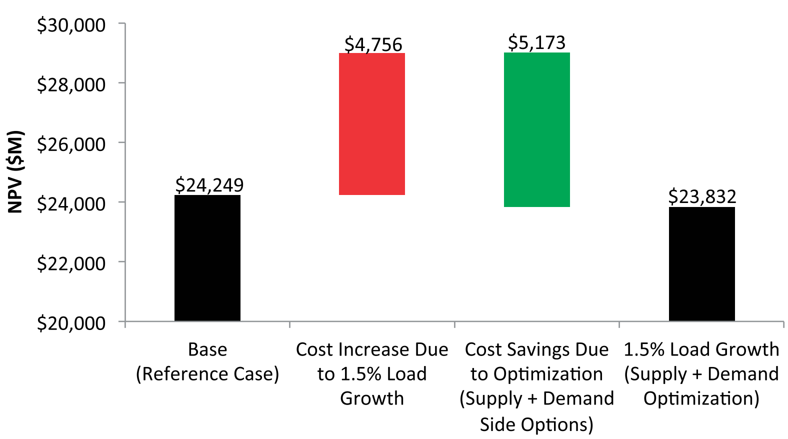


Figure 5.5: 1.5 percent load growth sensitivity – optimization levels

EVALUATION OF THE PCA AND EXPANDED SENSITIVITY ANALYSIS

The above steps are important components of the risk assessment because they are the method by which the final PCA was developed, however, after developing the final PCA, the most important step is to evaluate how it performs in the possible future scenarios. In addition, it is important to understand the impact of variation of certain variables to assess cost variability impacts and to gain additional understanding of how influential the variable is when small changes up and down occur. The two variables evaluated on the PCA were the capacity and natural gas price forecasts. The variability in prices is evaluated on an incremental basis.

The capacity price sensitivities are evaluated at 0, 25, 50, 75 and 100 percent of the Cost of New Entry (CONE) as defined by MISO, and for natural gas prices at -25, 0, 25, and 50 percent of the Consumers Energy natural gas price forecast as shown in Table 5.3. This method allows for a deeper evaluation of the influence these variables can have on the resulting outcome of the analysis. While extreme sensitivities can be run to determine a maximum upper and lower boundary of risk, it does not always result in greater understanding of how sensitive the optimal plans are to small adjustments in assumptions.

Table 5.3: Capacity and gas price sensitivities

CASE RESULTS (Net Present Value in $M)					
		Gas Price			
		-25 percent	**BAU**	**25 percent**	**50 percent**
Capacity Price (percent MISO CONE)	**0 percent**	$19,270	$20,641	$21,851	$23,055
	25 percent	$19,202	$20,572	$21,783	$22,986
	50 percent	$19,133	$20,503	$21,714	$22,917
	75 percent	$19,064	$20,434	$21,645	$22,848
	100 percent	$18,995	$20,365	$21,576	$22,779

The risk assessment using the expanded sensitivity of variables indicates the larger the range of results, the higher the risk associated with natural gas and capacity pricing. The reference point is the BAU gas at 75 percent CONE as indicated by the black box. This gives you a relative understanding of whether customers will realize savings or costs if the future was to remain business as usual.

Based on Figure 5.6, customers have a higher probability of savings if Karn 1 and 2 retire in the year 2023, at a reasonable level of risk to customers.

The methodology used for the Medium Four was also conducted on the PCA. The company evaluated the costs of the PCA under each of the six different scenarios. Those costs were compared to the optimal results for each scenario. The expectation was that the PCA would be higher cost than the optimal solution in each scenario, but would have less cost variation across the scenarios. The NPV results for the PCA and the optimal plans are provided in Table 5.4 below.

Figure 5.6: NPV risk chart with capacity and natural gas price sensitivities

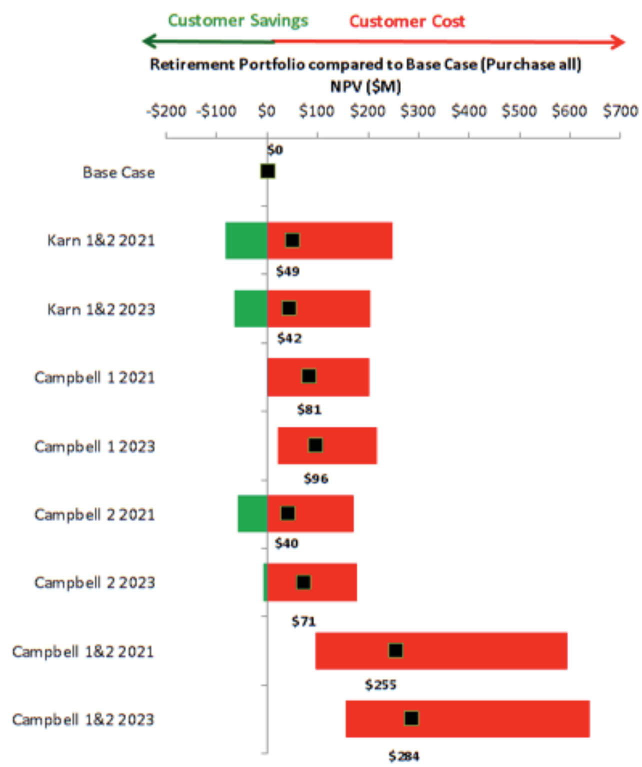


Table 5.4 NPV results for the PCA and Optimal Plans

	BAU CE	BAU AEO	ET CE	ETA EO	EP CE	EP AEO
PCA	$21,224	$22,351	$19,419	$20,429	$20,084	$21,136
Optimal Plans	$20,413	$21,803	$19,382	$19,973	$19,543	$20,079

In addition to the optimal plans from each scenario, an alternate plan was developed to use as a reference point. The alternate plan was a feasible alternative to the PCA, which would still achieve many of the objectives of the IRP, but was believed to be less desirable than the PCA. The alternate plan was designed to give a point of reference to compare the PCA to that included a similar glide path, and helped to assess the level of risk customers incur when natural gas reliance is maximized (one natural gas combined cycle unit) given by constraints of the company's Clean Energy Goal. Comparison between the costs of the PCA and alternate plan across the six scenarios provides insight into the risk mitigation achieved by the PCA through renewables and demand-side resources. Table 5.5 below provides the NPVs of the PCA and the alternate plan for each of the six scenarios.

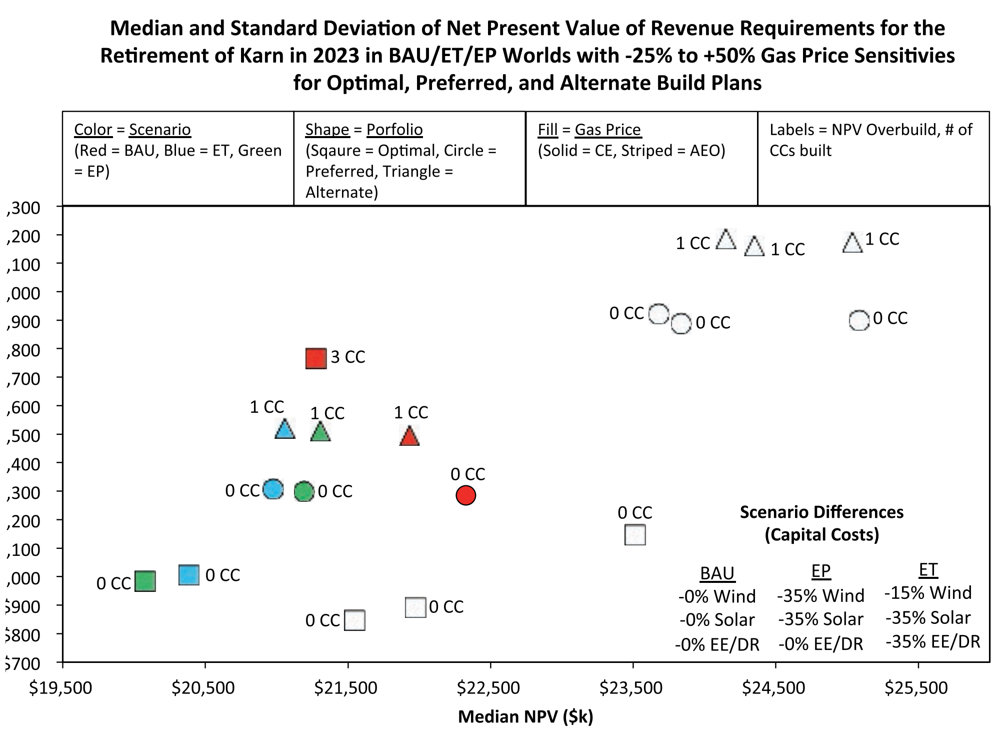
Table 5.5 NPVs of the PCA and alternate plan

	BAU CE	BAU AEO	ET CE	ET AEO	EP CE	EP AEO
PCA	$21,224	$22,351	$19,419	$20,429	$20,084	$21,136
Alternate Plan	$20,902	$22,352	$19,570	$20,913	$20,274	$21,682

As evident in the table, the PCA performs better across the scenarios, with the exception of the BAU case assuming lower natural gas prices, by providing lower costs and less variability than the alternate plan. After considering the PCA cost impacts in the six scenarios and comparing to the alternate plan, the company next needed to understand how influential capacity and natural gas prices were to the results. This allowed for a deeper evaluation of the influence these variables have on the PCA, alternate plan and the various optimal plans. Figure 5.6 visually represents the economic risk to customers with our PCA, the alternate plan, and the optimal plans.

It plots average NPV cost on the horizontal axis and the standard deviation of those costs under the range of natural gas and capacity prices on the vertical axis. The best portfolios are those consistently lower on the vertical axis (representing less variation in the results) and further to the left (representing a lower median cost). The optimal plan is used primarily for reference as these represent the lowest costs and least risk to customers. The optimal plans are plotted to demonstrate the absolute lowest achievable costs. The comparisons that are critical are the: (i) comparison of the PCA to the alternate plan; (ii) comparison of the PCA across the different scenarios. Circles represent the PCA; triangles represent the alternate plan. The color and striping indicate which scenario.

Figure 5.7: Economic risk of PCA



2018 INTEGRATED RESOURCE PLAN

SECTION

6

SCENARIOS AND SENSITIVITIES

SECTION 6

Scenarios and Sensitivities

The IRP contains six scenarios to assess the early retirement of the Medium Four and to comply with the Michigan Integrated Resource Planning Parameters (MIRPP). The scenarios that are utility-specific and MIRPP-required are distinguished by the natural gas price forecast used in that scenario. The natural gas price forecast for the MIRPP scenarios is based on the Energy Information Administration (EIA) – Annual Energy Outlook (AEO) published in 2017, and is considered by the company to be an unduly high projection of natural gas prices. Higher projections of natural gas prices bias the economics of existing coal units toward continued operation. To fully and reasonably evaluate whether to continue operation or accelerate retirement of the Medium Four units, the CE scenarios were developed using the company's natural gas price forecast.

MIRPP SCENARIOS AND SENSITIVITIES

Business As Usual (BAU AEO)

The BAU AEO assumes the existing generation fleet (both utility and non-utility owned) is largely unchanged apart from new units planned with firm certainty or under construction. No carbon regulations are modeled, although some reductions are expected due to age-related coal retirements and renewable additions driven by renewable portfolio standards and goals, as well as economics.

Table 6.1: Business as usual variables and assumptions

VARIABLE	ASSUMPTION
Natural Gas Price Forecast	Natural gas prices utilized are consistent with business as usual projections as projected in the EIA's most recent Annual Energy Outlook reference case. The 2017 EIA-AEO reference case was used in the MIRPP scenarios.
Demand and Energy Forecast	Footprint-wide demand and energy growth rates remain at low levels with no notable drivers of higher growth; however, as a result of low natural gas prices, industrial production and industrial demand increases.
Technological Advancement	Low natural gas prices and low economic growth reduce the economic viability of other generation technologies.
Existing Resources in MISO (non-Michigan)	Maximum age assumption by resource type as specified by applicable regional transmission organization (RTO).
Existing Resources in Michigan	Thermal and nuclear generation retirements in the modeling footprint are driven by a maximum age assumption, public announcements or economics.
Planned New Construction	Specific new units are modeled if under construction or with regulatory approval (i.e. CON) or signed generator GIA.
Generic New Resources (Market & Company-Owned)	Consistent with scenario descriptions and considering anticipated new resources currently in the MISO generation interconnection queue.
Renewable Goals per MCL.460.1001(3)	Not less than 35 percent of the state's electric needs should be met through a combination of EWR and renewable energy by 2025.
Renewable Energy Tax Credits	Existing renewable energy production tax credits and renewable energy investment tax credits continue pursuant to current law.
Energy Waste Reduction	Based upon the maximum allowed under the energy efficiency incentive of 1.5 percent and based upon an average cost of MWh saved. Costs of future program expenditures projected beyond baseline assumptions without a cap.
Technology Costs	• Thermal units and wind track with mid-range industry expectations. • Total resource costs and levels available for EWR and demand response programs are determined by the Statewide Potential EWR and DR studies published by the MPSC. • Solar and other emerging technologies decline with commercial experience.
Existing PURPA Contracts	Assumed to be renewed throughout study period.

Sensitivity 1: Natural gas fuel price projections increase to at least 200 percent above the EIA-AEO natural gas fuel price projections by the end of the study period.

Sensitivity 2: Annual growth rate for energy and demand is 1.5 percent.

Sensitivity 3: 50 percent of the retail choice load returns to the company's full service by 2023.

Sensitivity 4: EWR savings increase to at least 2.5 percent over four years.

Sensitivity 5: The only generating resource allowed to fill any identified energy needs within the study period is natural gas fired simple cycle combustion turbines (CTs).

Sensitivity 6: An assessment of early retirement of the units within the Medium Four, using the EIA-AEO natural gas fuel price projections.

Emerging Technologies (ET AEO)

The ET AEO assumes technological advancement and economies of scale result in a 35 percent reduction in costs for demand response, EWR programs and other emerging technologies. No carbon reductions are modeled, but some reductions occur due to coal unit retirements, and higher levels of renewables, demand response and energy waste reduction.

Table 6.2: Emerging technologies variables and assumptions

VARIABLE	ASSUMPTION
Natural Gas Price Forecast	Fuel price forecasts remain at similar levels to BAU AEO.
Demand and Energy Forecast	Load forecasts remain similar to BAU AEO.
Technological Advancement	Technological advancement and economies of scale result in a greater potential for demand response, energy efficiency, and distributed generation as well as lower capital cost for renewables.
Existing Resources in MISO (non-Michigan)	Thermal generation retirements in the market are driven by unit age-limits and announced retirements (consistent with business as usual).
Existing Resources in Michigan	Retirements of all coal units except the most efficient in the utility's fleet should be considered. Coal units owned by the utility that are not explicitly assumed to retire during the study period shall be retired in the model based upon economics. Retirement of older fuel oil-fired generation should also be considered in this scenario.
Planned New Construction	Specific new units are modeled if under construction or with regulatory approval (i.e. CON) or signed generator GIA
Generic New Resources (Market & Company-Owned)	Consistent with scenario descriptions and considering anticipated new resources currently in the MISO generation interconnection queue.
Renewable Goals per MCL.460.1001(3)	Not less than 35 percent of the state's electric needs should be met through a combination of EWR and renewable energy by 2025.
Renewable Energy Tax Credits	Existing renewable energy production tax credits and renewable energy investment tax credits continue pursuant to current law.
Energy Waste Reduction	Technological advancement and economies of scale results in great potential for programs, as well as a lower capital cost for renewables.
Technology Costs	• Thermal unit costs remain stable and escalate moderately. • Costs for EWR and demand response programs are reduced 35 percent. • Energy storage costs decline over time, particularly batter technologies.
Existing PURPA Contracts	Assumed to be renewed throughout study period.

Sensitivity 1: Natural gas fuel price projections increase to at least 200 percent above the EIA-AEO natural gas fuel price projections by the end of the study period.

Sensitivity 2: Annual growth rate for energy and demand is 1.5 percent.

Sensitivity 3: EWR savings increase to at least 2.5 percent over four years.

Sensitivity 4: Use of renewable energy in the utility's service territory is increased to at least 25 percent by 2030.

Sensitivity 5: An assessment of early retirement of the units within the Medium Four, using the EIA-AEO natural gas fuel price projections.

Environmental Policy (EP AEO)

Regulations targeting a 30 percent reduction in carbon (by mass for existing and new sources) from 2005 to 2030 are enacted across all aggregated unit outputs and modeled as a hard cap on the amount of carbon emissions. These regulations drive some coal retirements and an increase in natural gas reliance. Increased renewable additions are driven by renewable portfolio standards and goals, economics and business practices to meet carbon regulations.

Table 6.3: Environmental policy variables and assumptions

VARIABLE	ASSUMPTION
Natural Gas Price Forecast	Fuel price forecasts remain at similar levels to BAU AEO.
Demand and Energy Forecast	Modeled at a level equivalent to a 50/50 forecast and consistent with BAU AEO.
Technological Advancement	Technological advancement and economies of scale result in a greater potential for demand response, energy efficiency and distributed generation as well as lower capital cost for renewables.
Existing Resources in MISO (non-Michigan)	Non-carbon dioxide emitting resources will be increased, due to the constraint on allowable carbon emissions in the model.
Existing Resources in Michigan	• Non-nuclear, non-coal generators will be retired in the year the age limit is reached. • Coal units will be retired based upon carbon emissions and secondarily upon economics. • Nuclear units are assumed to have license renewals granted and remain online.
Planned New Construction	Specific new units are modeled if under construction or with regulatory approval (i.e. CON) or signed generator GIA.
Generic New Resources (Market & Company-Owned)	Consistent with scenario descriptions and considering anticipated new resources currently in the MISO generation interconnection queue.
Renewable Goals per MCL.460.1001(3)	Not less than 35 percent of the state's electric needs should be met through a combination of EWR and renewable energy by 2025.
Renewable Energy Tax Credits	Tax credits for renewables continue until 2022 to model existing policy.
Energy Waste Reduction	Current programs remain in place and additional growth expected to occur if programs are economically selected to help comply with specified carbon reductions.
Technology Costs	• Technology costs for wind, solar, and other renewables decline with commercial experience and forecasted at levels 35 percent lower than BAU AEO. • Technology costs and limits to resource amounts available, for EWR and demand response programs, will be determined by their respective potential studies.
Existing PURPA Contracts	Assumed to be renewed throughout study period.

Sensitivity 1: Natural gas fuel price projections increase to at least 200 percent above the EIA-AEO natural gas fuel price projections by the end of the study period.

Sensitivity 2: Annual growth rate for energy and demand is 1.5 percent.

Sensitivity 3: Achievement of a 50 percent reduction of carbon in the utility's service territory, modeled as a hard cap on the amount of carbon emissions, by 2030.

Sensitivity 4: EWR savings increase to at least 2.5 percent over four years.

Sensitivity 5: An assessment of early retirement of the units within the Medium Four, using the EIA-AEO natural gas fuel price projections.

CONSUMERS ENERGY SCENARIOS AND SENSITIVITIES

Business As Usual (BAU CE)

The BAU CE scenario is a direct mirror of the MIRPP BAU scenario with the exception of the natural gas price forecast. These scenarios focused on evaluating the accelerated retirement of the Medium Four units, which is achieved by developing sensitivities with these units retiring in the years 2021, 2023 and 2031. The following describes the sensitivities in this scenario.

Sensitivity 1: The Karn 1 and 2 units are assumed to retire by May 31, 2021. All remaining supply side generating resources are kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 2: The Karn 1 and 2 units are assumed to retire by May 31, 2023. All remaining supply side generating resources are kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 3: Campbell Unit 1 is assumed to retire by May 31, 2021. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 4: Campbell Unit 1 is assumed to retire by May 31, 2023. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remained the same.

Sensitivity 5: Campbell Unit 2 is assumed to retire by May 31, 2021. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 6: Campbell Unit 2 is assumed to retire by May 31, 2023. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 7: Capital expenditures for Campbell units 1 and 2 to maintain compliance with Clean Water Action Section 316(b) were included in the cost modeling for both units.

Sensitivity 8: An evaluation was performed regarding what effects the 2018 Federal Tax Reform has upon modeling results. The primary effect of tax reform was on the economics of resources offered to model to fulfill future capacity needs. The Federal Income Tax (FIT) rate prior to tax reform was at 35 percent; post tax reform the FIT decreased to 21 percent. Tax reductions result in lower costs for new resource builds and lower incremental capital costs assumed for the Medium Four evaluated for early retirement. Tax reform is more advantageous for large, long-term assets such as natural gas combined cycle units, and less advantageous for solar and wind because the current production and investment tax credits are minimized when the weighted average cost of capital is reduced.

Sensitivity 9: Campbell Units 1 and 2 are assumed to retire by May 31, 2021. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 10: Campbell Units 1 and 2 are assumed to retire by May 31, 2023. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Emerging Technologies (ET CE)

The ET CE scenario is a direct mirror of the MIRPP ET scenario with the exception the natural gas price forecast and the levels of the demand response offered for selection by the model. These scenarios focused on evaluating the accelerated retirement of the Medium Four units, which is achieved by developing sensitivities with these units retiring in the years 2021, 2023 and 2031. The following describes the sensitivities in this scenario.

Sensitivity 1: The Karn 1 and 2 units are assumed to retire by May 31, 2021. All remaining supply side generating resources are kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 2: The Karn 1 and 2 units are assumed to retire by May 31, 2023. All remaining supply side generating resources are kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 3: Campbell Unit 1 is assumed to retire by May 31, 2021. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 4: Campbell Unit 1 is assumed to retire by May 31, 2023. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remained the same.

Sensitivity 5: Campbell Unit 2 is assumed to retire by May 31, 2021. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 6: Campbell Unit 2 is assumed to retire by May 31, 2023. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 7: An evaluation was performed regarding what effects the 2018 Federal Tax Reform has upon modeling results. The primary effect of tax reform was on the economics of resources offered to model to fulfill future capacity needs. The FIT rate prior to tax reform was at 35 percent; post tax reform the FIT decreased to 21 percent. Tax reductions result in lower costs for new resource builds and lower incremental capital costs assumed for the Medium Four evaluated for early retirement. Tax reform is more advantageous for large, long-term assets such as natural gas combined cycle units, and less advantageous for solar and wind because the current production and investment tax credits are minimized when the weighted average cost of capital is reduced.

Environmental Policy (EP CE)

The EP CE scenario is a direct mirror of the MIRPP EP scenario with the exception the natural gas price forecast and the levels of the demand response offered for selection by the model. These scenarios focused on evaluating the accelerated retirement of the Medium Four units, which is achieved by developing sensitivities with these units retiring in the years 2021, 2023 and 2031. The following describes the sensitivities in this scenario.

Sensitivity 1: The Karn 1 and 2 units are assumed to retire by May 31, 2021. All remaining supply side generating resources are kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 2: The Karn 1 and 2 units are assumed to retire by May 31, 2023. All remaining supply side generating resources are kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 3: Campbell Unit 1 is assumed to retire by May 31, 2021. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 4: Campbell Unit 1 is assumed to retire by May 31, 2023. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remained the same.

Sensitivity 5: Campbell Unit 2 is assumed to retire by May 31, 2021. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 6: Campbell Unit 2 is assumed to retire by May 31, 2023. All remaining supply side generating resources were kept online until their scheduled retirement date as defined in Section VII, Existing Supply Side Generation Resources. All other conditions for the scenario remain the same.

Sensitivity 7: An evaluation was performed regarding what effects the 2018 Federal Tax Reform has upon modeling results. The primary effect of tax reform was on the economics of resources offered to model to fulfill future capacity needs. The FIT rate prior to tax reform was at 35 percent; post tax reform the FIT decreased to 21 percent. Tax reductions result in lower costs for new resource builds and lower incremental capital costs assumed for the Medium Four evaluated for early retirement. Tax reform is more advantageous for large, long-term assets such as natural gas combined cycle units, and less advantageous for solar and wind because the current production and investment tax credits are minimized when the weighted average cost of capital is reduced.

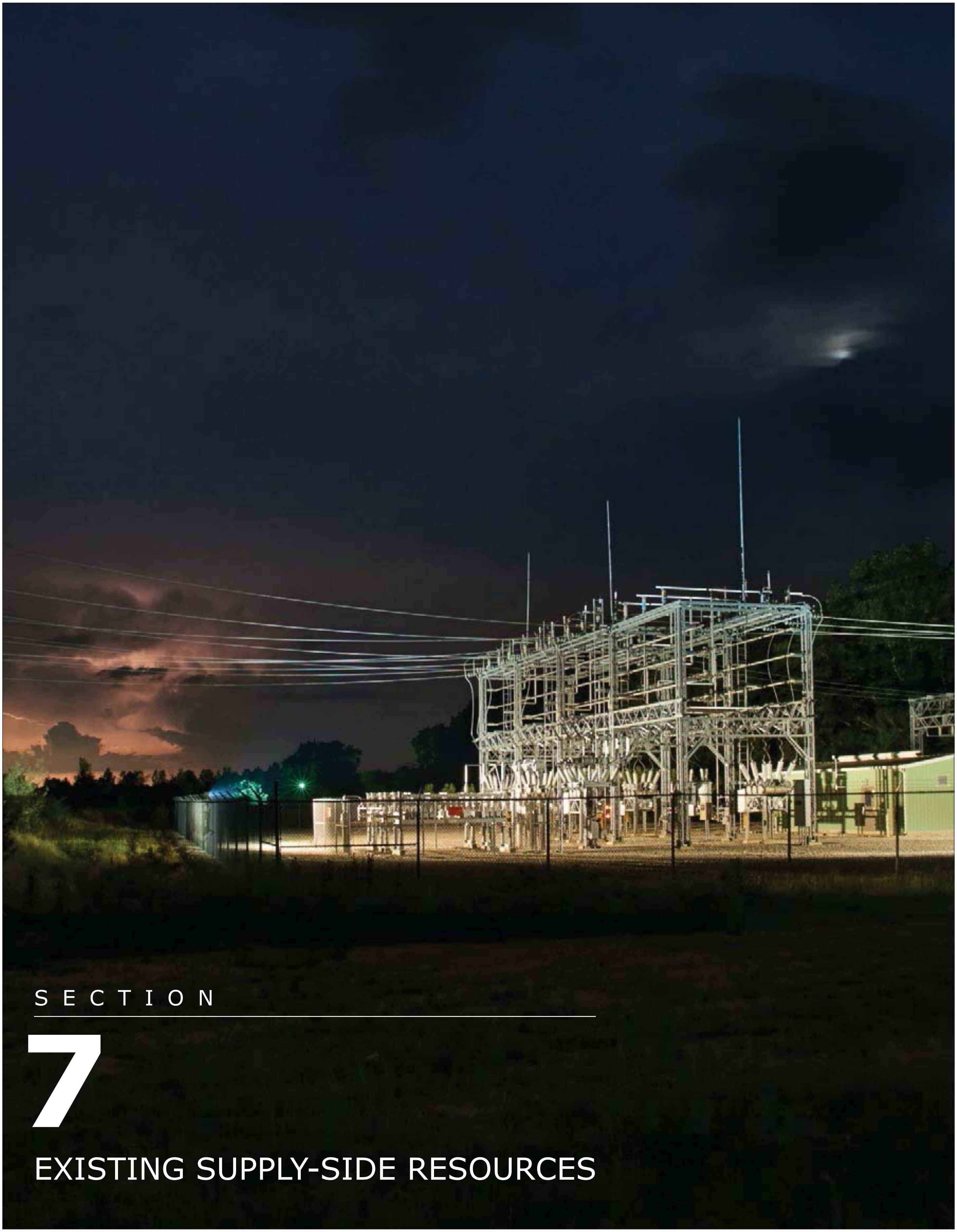
A matrix describing the scenarios and sensitivities in this IRP is included in the appendix to this report (Scenarios and Sensitivities Matrix).

ABB Medium Four Retirement Analysis

The company also employed ABB as a consultant to perform a retirement analysis of the Medium Four units with the Strategist® modeling tool. ABB also validated the Company's modeling related to the potential retirement of the Medium Four units.

The results of the ABB analysis, including model set up, use of Strategist® and identification of retirement years for the Medium Four units was reviewed with subject matter experts at the company.

2018 INTEGRATED RESOURCE PLAN



SECTION

7

EXISTING SUPPLY-SIDE RESOURCES

SECTION 7

Existing Supply-Side Resources

OVERVIEW

Since the early 1900s, Consumers Energy has been producing the energy its customers require in a reliable, flexible and cost-effective manner. The number and type of generating assets for Consumers Energy has fluctuated over the company's history in order to address a variety of changes. Such changes include increases in demand as Michigan's industrial economy grew substantially during the 20th century and a more recent shift in the types of fuel sources utilized in order to reflect the clean and lean energy our customers want.

As of 2018 and the filing of this IRP, Consumers Energy's generating fleet is diverse, flexible and balanced. From hydroelectric plants that have been in operation since the turn of the century to resources that are only a few years old, such as solar gardens, Consumers Energy maintains a portfolio of supply side resources that were used in the planning, modeling and decision making of this IRP. That portfolio and key characteristics of each asset are detailed in the following tables. This chart shows the status quo prior to the PCA:

Fossil-Fueled Generating Units

Table 7.1: Fossil-fueled generating unit key characteristics

Resource	Location	In-Service Date	Age (Years)	Retirement Date	Remaining Est. Time Of Operation (Years)	Licensing Status	Generating Capacity (MW)
COAL FIRED							
JH Campbell 1	West Olive, MI	1962	56	2031	13	Active	259
JH Campbell 2	West Olive, MI	1967	51	2031	13	Active	348
JH Campbell 3	West Olive, MI	1980	38	2040	22	Active	780
DE Karn 1	Essexville, MI	1959	59	2031	13	Active	255
DE Karn 2	Essexville, MI	1961	57	2031	13	Active	260
OIL OR GAS FIRED							
DE Karn 3	Essexville, MI	1975	43	2031	12	Active	600
DE Karn 4	Essexville, MI	1977	41	2031	12	Active	608
Zeeland CC	Zeeland, MI	2002	16	2030	12	Active	527
Zeeland 1A	Zeeland, MI	2002	16	2030	12	Active	159
Zeeland 1B	Zeeland, MI	2002	16	2030	12	Active	157
Jackson	Jackson, MI	2002	16	2030	12	Active	542
Campbell A	West Olive, MI	1968	50	2019	1	Active	12
Gaylord 1	Gaylord, MI	1966	52	2019	1	Active	12
Gaylord 2	Gaylord, MI	1966	52	2019	1	Active	12
Gaylord 3	Gaylord, MI	1966	52	2019	1	Active	11
Straits 1	Mackinaw City, MI	1969	49	2019	1	Active	6

*The company owns 93 percent of the JH Campbell 3 coal fired unit. Other entities own the remaining 7 percent. MW capacity shown reflects the company's share of ownership.

The baseline capacity position of these existing resources makes the following assumptions to the retirement dates of the above units that are accounted for in the PCA:

- J.H. Campbell Unit 3 is retired by end of year 2039 to align with the company's Clean Energy Goal.
- The Jackson and Zeeland units design lives are extended to 2042 because it is assumed these can be maintained at a lower cost than replacement with a new capacity resource.

Nuclear Generating Units

Consumers Energy does not own or operate any nuclear generating units as of the filing of this IRP. Consumers Energy does maintain a contract with Entergy Nuclear Power Marketing, LLC to purchase capacity and energy from the Palisades Power Plant located in Covert, Michigan. The Palisades Power Plant is described in more detail in this report under the discussion of the company's purchase power agreements.

Hydroelectric Generating Units

Table 7.2: Hydroelectric generating unit key characteristics

Resource	Location	In-Service Date	Age (Years)	Retirement Date	Remaining Est. Time Of Operation (Years)	Licensing Status	Generating Capacity (MW)
HYDROELECTRIC							
Alcona	Alcona County, MI	1924	94	n/a	n/a	Active	3
Allegan	Genesee County, MI	1936	82	n/a	n/a	Active	1
Cooke	Iosco County, MI	1911	107	n/a	n/a	Active	7
Croton	Newaygo County, MI	1907	111	n/a	n/a	Active	4
Five Channels	Iosco County, MI	1912	106	n/a	n/a	Active	6
Foote	Iosco County, MI	1918	100	n/a	n/a	Active	3
Hardy	Newaygo County, MI	1931	87	n/a	n/a	Active	32
Hodenpyl	Wexford County, MI	1925	93	n/a	n/a	Active	5
Loud	Iosco County, MI	1913	105	n/a	n/a	Active	5
Mio	Oscoda County, MI	1916	102	n/a	n/a	Active	2
Rogers	Mecosta County, MI	1906	112	n/a	n/a	Active	3
Tippy	Manistee County, MI	1918	100	n/a	n/a	Active	6
Webber	Ionia County, MI	1907	111	n/a	n/a	Active	7

Renewable Generating Units

Table 7.3: Renewable generating unit key characteristics

Resource	Location	In-Service Date	Age (Years)	Retirement Date	Remaining Est. Time Of Operation (Years)	Licensing Status	Generating Capacity (MW)
RENEWABLES							
Lake Winds	Mason County, MI	2012	6	n/a	n/a	n/a	101
Cross Winds	Tuscola County, MI	2014	4	n/a	n/a	n/a	155
Solar Gardens- GVSU	Grand Rapids, MI	2016	2	n/a	n/a	n/a	4
Solar Gardens- WMU	Kalamazoo, MI	2016	2	n/a	n/a	n/a	1

Energy Storage Facilities

Table 7.4: Energy storage facility key characteristics

Resource	Location	In-Service Date	Age (Years)	Retirement Date	Remaining Est. Time Of Operation (Years)	Licensing Status	Generating Capacity (MW)
ENERGY STORAGE							
Ludington Units 1-6	Ludington, MI	1973	45	2049	31	Active	1,097

*The company owns 51 percent of facility, with DTE Energy owning the remaining 49 percent. MW capacity shown reflects the company's share of ownership.

POWER PURCHASE AGREEMENTS

In addition to generating electricity from company-owned resources, Consumers Energy also holds a variety of power purchase agreements (PPAs) with independent power producers throughout Michigan. These non-utility generators (NUGs) enter into a contract with the company, where the company agrees to purchase an agreed upon amount of energy and/or capacity at an agreed upon price. These agreements further ensure a sufficient amount of energy and/or capacity at prudent and reasonable costs and support the company's customers. A summary of the PPAs the company currently holds is listed in the following table.

Table 7.5: Power purchase agreements characteristics

Resource	Location	Current Contract Expiration	Remaining Time Of Contract (Years)	Contract Status	Zonal Resource Credits (ZRCs) Purchased
NATURAL GAS					
Ada Cogeneration LP	Ada, MI	2025	7	Active	29
Michigan Power LP	Ludington, MI	2030	12	Active	123
Midland Cogeneration	Midland, MI	2030	12	Active	1,206
TES Filer City Station LP	Filer City, MI	2034	16	Active	60/225*
NUCLEAR					
Entergy Nuclear Power Marketing, LLC (Palisades Power Plant)	Covert, MI	2021	3	Active	813
HYDROELECTRIC					
Boyce Hydro Power	Sanford, MI	2022	4	Active	11
STS Hydropower Ltd	Ada, MI	2022	4	Active	2
STS Hydropower Ltd	Kalamazoo, MI	2019	1	Active	1
RENEWABLES					
Beebe Renewable Energy	Gratiot County, MI	2033	15	Active	82
Geronimo Huron Wind LLC	Huron County, MI	2033	15	Active	100
Harvest II Wind Farm LLC	Pigeon, MI	2033	15	Active	59
Heritage Garden Wind Farm I, LLC (Wind Portion)	Garden, MI	2033	15	Active	20
Heritage Stoney Corners Wind Farm I, LLC (Phase 2)	McBain, MI	2032	14	Active	12
Heritage Stoney Corners Wind Farm I, LLC (Phase 3)	McBain, MI	2032	14	Active	8
Michigan Wind 1 LLC	Ubly, MI	2028	10	Active	12
Michigan Wind 2 LLC	Bad Axe, MI	2032	14	Active	90
EARP Solar (Original)	Various	2023	5	Active	2
EARP Solar (Expansion)	Various	2030	12	Active	4

*Power Purchase Agreement purchases 60 MW through 2019, then increases to 225 MW.

Table 7.5: Power purchase agreements characteristics (continued from previous page)

Resource	Location	Current Contract Expiration	Remaining Time Of Contract (Years)	Contract Status	Zonal Resource Credits (ZRCs) Purchased
LANDFILL GAS					
Adrian Energy Associations LLC	Adrian, MI	2029	11	Active	3
Gas Recovery 1 and 2 (C&C 1, 2)	Marshall, MI	2029	11	Active	6
Granger Electric	Various	2025–2030	7 to 12	Active	16
North American Natural Resources	Various	2030–2031	12 to 13	Active	8
WM Renewable Energy	Various	2026–2032	8 to 14	Active	16
BIOMASS					
Cadillac Renewable Energy	Cadillac, MI	2028	10	Active	34
Genesee Power Station LP	Flint, MI	2030	12	Active	35
Grayling Generating Station	Grayling, MI	2027	9	Active	37
ANAEROBIC DIGESTOR/SOLID WASTE					
EARP Anaerobic Digester	Various	2035	17	Active	2
Fremont Community Digester	Fremont	2033	15	Active	3
Kent County	Grand Rapids, MI	2021	3	Active	16

ENSURING RELIABILITY: RTO CAPACITY CREDITS AND MODELING OF EXISTING UNITS

A key benefit of the company's generating units and PPAs is the provision of capacity. Midcontinent Independent System Operator, Inc. (MISO), a Regional Transmission Operator (RTO), grants the company's generating units and PPAs with capacity credits, also known as zonal resource credits (ZRCs). A summary of the current capacity credit for the company's generating units is provided in the following table:

Table 7.6: RTO capacity credits

Resource	MLocation	RTO Capacity Credits (ZRCS)
COAL FIRED		
JH Campbell 1	West Olive, MI	256
JH Campbell 2	West Olive, MI	341
JH Campbell 3	West Olive, MI	780
DE Karn 1	Essexville, MI	243
DE Karn 2	Essexville, MI	254
OIL OR GAS FIRED		
DE Karn 3	Essexville, MI	455
DE Karn	Essexville, MI	376
Zeeland CC	Zeeland, MI	519
Zeeland 1A	Zeeland, MI	150
Zeeland 1B	Zeelandv	152
Jackson	Jackson, MI	533
Campbell A	West Olive, MI	11
Gaylord 1	Gaylord, MI	12
Gaylord 2	Gaylord, MI	10
Gaylord 3	Gaylord, MI	10
Straits 1	Mackinaw City, MI	5

Table 7.6: RTO capacity credits (continued from previous page)

Resource	Michigan Location	RTO Capacity Credits (ZRCs)
NUCLEAR		
n/a	n/a	n/a
HYDROELECTRIC		
Alcona	Alcona County, MI	3
Allegan	Genesee County, MI	1
Cooke	Iosco County, MI	7
Croton	Newaygo County, MI	3
Five Channels	Iosco County, MI	6
Foote	Iosco County, MI	3
Hardy	Newaygo County, MI	30
Hodenpyl	Wexford County, MI	5
Loud	Iosco County, MI	5
Mio	Oscoda County, MI	2
Rogers	Mecosta County, MI	2
Tippy	Manistee County, MI	6
Webber	Ionia County, MI	1
RENEWABLES		
Lake Winds	Mason County, MI	17
Cross Winds (Phase 1)	Tuscola County, MI	25
Cross Winds (Phase 2)	Tuscola County, MI	
Solar Gardens- GVSU	Grand Rapids, MI	3
Solar Gardens- WMU	Kalamazoo, MI	1
ENERGY STORAGE		
Ludington Units 1-6	Ludington, MI	990

The company measures operational performance data associated with existing operations. This includes items such as operating costs, heat rates, capacity factors and outage rates. These items are measured as part of the monthly Generation Performance Report that is produced and communicated internally with key company personnel. The Generation Performance Report is a confidential business document and therefore is not included inside this report.

SPOT MARKET PURCHASES AND OFF-SYSTEM SALES

Consumers Energy operates within the MISO energy market. Consumers Energy interacts in the MISO energy market as a load serving entity within Local Resource Zone 7. The company's interaction in the MISO energy market involves selling generated energy and purchasing energy if that energy is available more economically for its customer base. This results in the company making spot market purchases.

2018 INTEGRATED RESOURCE PLAN

SECTION

8

DEMAND-SIDE RESOURCES

SECTION 8

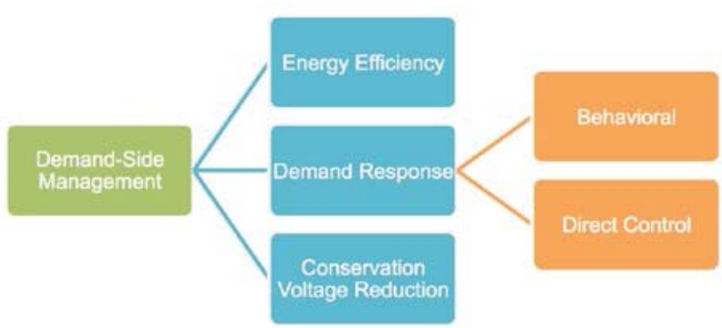
Demand-Side Resources

Consumers Energy offers a suite of demand-side management programs targeting residential, commercial and industrial customer classes to deliver significant peak load reductions. Demand-Side Management (DSM) programs benefit customers and the company by managing loads and stresses on the electrical system when needed most and channeling wholesale generation dollars back to Michigan customers and businesses. These programs do much more than help solve capacity needs, they also:

- Provide rewards to customers who use energy more efficiently;
- Boost Michigan's economy;
- Help manage costs for customers through lower power supply cost; and
- Make use of otherwise idle customer-owned backup generators.

As shown in Figure 8.1, the company's DSM programs can be separated into three types of resources: energy waste reduction, demand response and conservation voltage reduction; demand response programs are further subdivided into direct control and behavioral programs. Future DSM programs have the potential to save customers around $150 to $500 million of NPV in most cases when compared to supply-side resources. From 2009 to 2017, participating customers in our energy waste reduction programs totals $1.4 billion in energy savings. With the PCA, the company projects an additional $17 billion in energy savings through the planning period when energy efficiency savings are held at 1.5 percent and increased to 2.25 percent by 2040.

Figure 8.1: Demand-Side Management structure



Energy waste reduction and demand response programs naturally complement one another, with both opening new channels to communicate and educate customers about the benefits of reducing energy consumption. Although both initiatives could stand alone, the company believes customer savings are enhanced through synergies from shared technology platforms. We believe the total value to customers from a combined DSM effort is greater than the sum of the individual efforts, as represented in Figure 8.2.

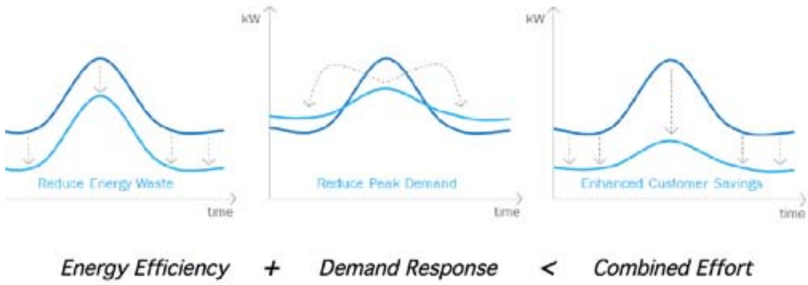


Figure 8.2: Synergies between energy efficiency and demand response

DEMAND RESPONSE PROGRAMS

DR programs provide customers with an opportunity to play a significant role in addressing the operation and sustainability of the electric grid. They can help lower the cost of electricity by reducing or shifting their electric use during a few peak hours a year to better align the supply and demand of resources across the year.

Consumers Energy offers various DR programs to help its customers reduce their electric use during peak hours. These programs benefited all customers in 2017 by allowing the company to cost-effectively manage loads and stresses on the electric grid when it was most needed.

The company has developed DR programs that target both residential and business customer classes, and that reflect the different level of customer preferences to be involved in controlling their electric use (direct control or behavioral). While the company's DR programs are often offered for economic reasons (avoidance of high-priced energy during peak demand hours), direct control resources are also registered with MISO as capacity resources.

The full deployment of the company's DR programs in 2017 marked a milestone in its journey to provide reliable, safe, affordable and clean electric offerings to customers. Some of the many successes in 2017 include:

- The full implementation and expansion of residential and business DR programs;
- 45,897 customers enrolled in the Peak Power Savers® programs (AC Peak Cycling and Dynamic Peak Pricing) in 2017 to deliver 42.9 MW of residential DR;
- 50.1 MW of business DR registered to address MISO emergency events; and
- 11 residential and nine business DR events called during the summer to test and explore customer acceptance and reaction.

Along with these successes, this first year brought with it some valuable learnings, including:

- Motivating residential and business customers to shift or reduce load during peak events requires greater investment in customer education and engagement than originally understood, and

- Changes in rate design have a profound impact on customer willingness to participate in DR programs. For example, a rate design may incent customers with higher energy usage more than those with lower energy usage.

- The value of comprehensive testing of DR systems prior to the start of event season.

These learnings, along with continued feedback from customers and stakeholders, will help ensure the company has a robust set of DR programs available to meet the future electric generation capacity needs of its customers.

The company intends to refine its existing DR program offerings as it gains more experience in deploying these demand-side resources, and to adjust its portfolio of DR program offerings based on residential and business customer feedback. Ultimately, the company believes DR has the potential to function as a reliable, robust "virtual power plant" that can be called upon to satisfy Michigan's electric needs in a clean, sustainable way.

Over the study period, the company is forecasting to reach a demand response level of nearly 1,250 MWs. Consistent with the achievable potential studies conducted by both the company and the MPSC and with continued learnings and development of existing programs, the company is well positioned to achieve higher load reductions through existing programs and development of new programs at an affordable cost designed to optimize the benefits to customers and create a leaner peak demand profile.

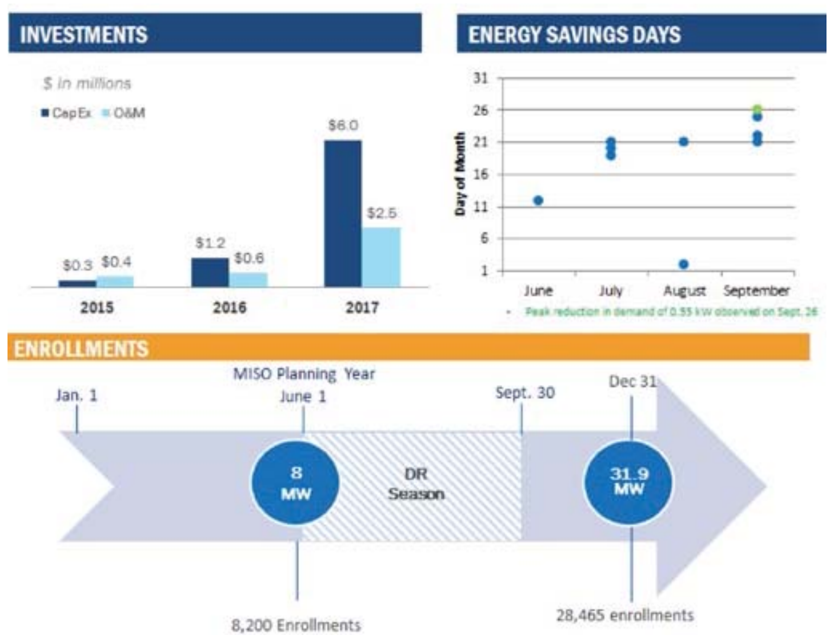
RESIDENTIAL DEMAND RESPONSE PROGRAMS

Peak Power Savers® AC Peak Cycling

The Consumers Energy Peak Power Savers AC Peak Cycling program is a residential direct load management program that includes a two-way communicating load control switch placed on the outside of a customer's central air conditioning unit. Participants in the program receive a $25 Visa® gift card when they initially enroll in the program and a bill credit of $7.84 per month during the peak event season of June through September.

During peak event days, called Energy Savings Days, the company activates the switch to cycle the central air conditioning unit based on a 50 percent cycle strategy to reduce customer electric use during the event. The central AC unit's fan will cycle for short periods keeping the home comfortable. Once the event ends, the central air conditioning unit returns to its normal operation.

Figure 8.3: Peak Power Savers AC Peak Cycling program



The peak events are communicated to the switch by coupling the company's Automated Metering Infrastructure (AMI) and Demand Response Management System (DRMS) with the ZigBee two-way communication technology. A signal is sent from DRMS to the switch during peak events, which may occur between 7 a.m. and 8 p.m. for up to eight hours a day. The typical event is scheduled for four hours and a total of 10 Energy Savings Day events can be called during the season.

KEY LEARNINGS AND ACCOMPLISHMENTS (AC CYCLING)

The company had many learnings in 2017 as it called its first DR events and enrolled over 28,000 customers in the program. Learnings and accomplishments include:

- In a survey administered by Cadmus, 47 percent of customers preferred a bill credit based on the amount of energy saved versus a flat monthly credit. The company will continue to monitor customer expectations and preferences and adjust the program accordingly;

- 40 percent of enrolled customers had central air conditioning units smaller than the 3 ton average originally projected. The 2018 marketing strategy will include components targeted at customers with larger AC units and high electric usage; and

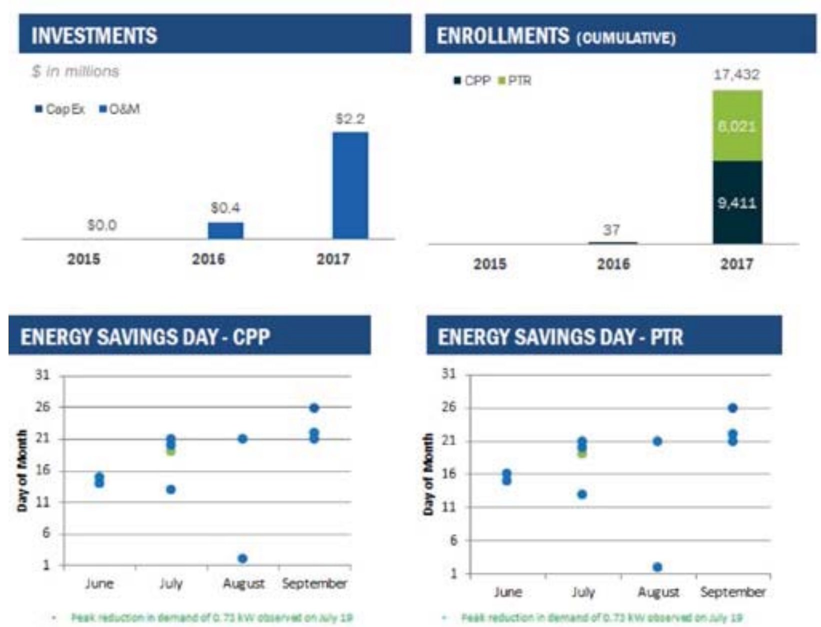
PEAK POWER SAVERS® DYNAMIC PEAK PRICING PROGRAM

The Dynamic Peak Pricing program was designed to reduce electric use during summer peak hours through a combination of price signals and customer outreach. The company offered residential customers the following two rate options under the program:

- Critical Peak Pricing (CPP) – offered customers the lowest time-of-use rate during off-peak hours and the highest rate of 95¢ per kWh during summer peak events (Energy Saving Days); and

- Peak Time Rewards (PTR) – offers customers a low time-of-use rate during off-peak hours and credits them 95¢ per kWh for reducing on-peak energy use during Energy Saving Days.

Figure 8.4: Peak Power Savers® dynamic peak pricing program



Customers participating in the program received alert notifications one day before each event and post-event reports on how well their households did in reducing energy use. The company can call up to 14 Energy Savings Day events from June through September between the hours of 2 p.m. and 6 p.m.

KEY LEARNINGS (DYNAMIC PEAK PRICING)

The company had many learnings in 2017 as it called its first DR events and enrolled over 17,000 customers in the program. Learnings include:

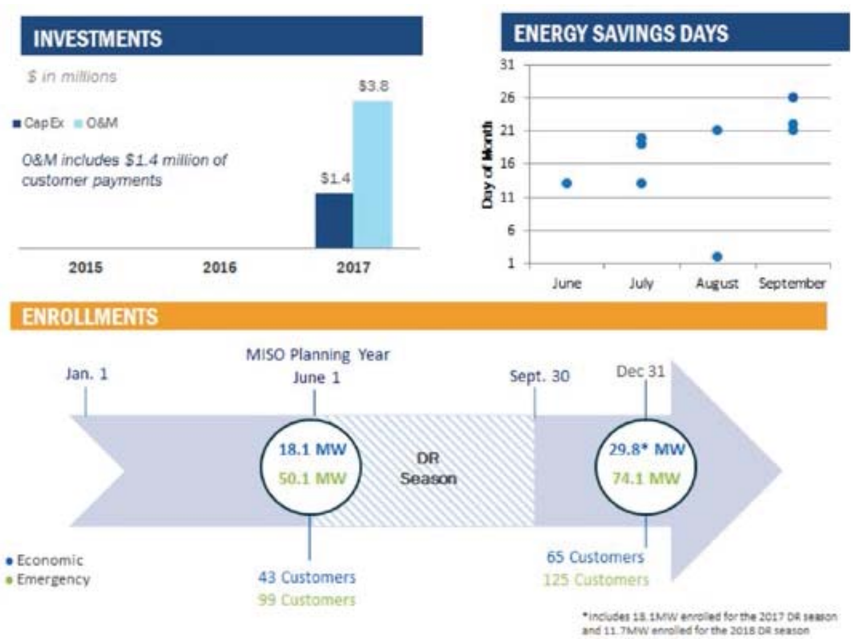
- 62 percent of customers were not very familiar with time-of-use rates. Development of additional educational material will be critical in growing the program to full capacity;
- The largest factor of dissatisfaction (58 percent) was difficulty meeting money savings expectations;
- 96 percent of participants said their household took action to conserve energy during events;
- 76 percent of participants said their household purposefully shifted use to the less expensive times; and
- Under the rate design of case U-17990, customers who used more than 800 kWH monthly benefit the most in bill savings. Customers who used less than 800 kWH monthly saw little to no savings by participation in the program. With the introduction of a mandatory Time of Use (TOU) rate required in Case No. U-18322, the impact on existing residential demand response programs will be further understood as customers react and behave under the new rate.

BUSINESS DEMAND RESPONSE PROGRAMS

Emergency/Economic

In 2017, the company launched its business DR program. As part of this program, business customers were asked to reduce their electric use by a predetermined amount during peak events. Each customer that participated in the program determined the amount of capacity they could curtail and the company would work with them to create a demand reduction plan to implement during peak events.

Figure 8.5: Business demand response programs



The company enrolled 99 business customers (128 accounts) in the emergency DR program resulting in 50.1 MW under contract. While there were no MISO emergency events called during 2017, this capacity resource was available. In 2017, the company paid customers $1.3 million in incentives to business customers enrolled in the emergency DR program.

The company enrolled 43 business customers totaling 18.1 MW in the economic DR program in 2017. Participants were paid a capacity and energy incentive to reduce their electric use during peak events. In 2017, the company paid customers $0.1 million in incentives.

KEY LEARNINGS (BUSINESS)

The business demand response programs had many learnings during its first year of implementation in 2017. The top two reasons customers signed up for the program were to receive an incentive (97.7 percent) and save money on their bill (83.7 percent).

A major learning in 2017 was that 91.7 percent of business customers who did not participate in the economic DR programs indicated economic events are called too frequently and would be disruptive to their business.

Energy Intensive Primary Rate

Additionally, we can encourage load-shifting behavior by virtue of rate design. The EIP rate is offered to encourage off-peak power consumption by charging a high on-peak rate for consumption from the hours of 3 p.m. to 5 p.m. during the summer and 5 p.m. to 7 p.m. during the remainder of the year, when market prices exceed 150 percent of the high peak energy charge for customer voltage level 1. EIP rate customers can avoid those charges by shifting load to an off-peak time. The existing and planned MW reductions are 48 MW and 54 ZRCs for the entire IRP study period.

Interruptible Rate (GI Provision)

Consumers Energy has an active legacy interruptible rate providing 137 MW of load under contract (rate GPD, GI provision). This is available to any full-service customer billed under the company's General Service Primary Demand Rate GPD who is willing to contract for at least 500 kW of on-peak billing demand as interruptible capacity. The aggregate amount of monthly on-peak billing demand that can be subscribed to under this provision is limited to 250 MW. The customers on this rate are obligated to reduce load by the amount specified in their contract when directed. When and if MISO declares a system emergency, we would immediately notify this group of customers of their obligations under the tariff and their contract. MISO's Max Gen Event – Step 2 is when the company issues an "enactment" message to all GI customers notifying them to interrupt their site load by their contractual interruptible amount. GI customers are given 10 minutes to 12 hours' notice to reduce their facility load by their contracted kW amount, depending on MISO's scheduling instructions.

Dispatch Criteria for Demand Resources

The company developed operational criteria to use in judging when to call a DR event. Demand response resources most often are used to shift loads from periods of high prices and/or high system demand, or a combination of high prices and high loads. We determined when our 4-hour load forecast exceeded 25,000 MWh or our 8 hour load forecast was greater than 50,000 MWh, depending on month, and LMPs were greater than or equal to $45/MWh, a DR event will be called to maximize load reductions and energy savings. The AC Peak Cycling program allows 10 events during the summer, with another five events held in the case of a MISO emergency. Once the 10 events occur, no further events are called.

MARKET PURCHASES

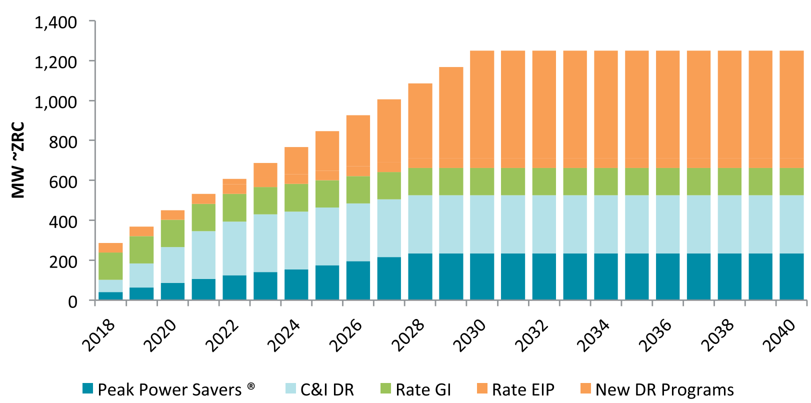
Each day, the company bids all of its generating units into the market and purchases all of its demand from the market. During the summer of 2017, we established load and price triggers to guide our dispatch of demand resources, as mentioned in the 'Dispatch for Demand Resources' section above. Because our Demand Response resources allow for only a limited number of events per season (10 for A/C cycling and 14 for TOU pricing), there are many days a DR event can be called, but are limited by the number of events that can be called.

FORECASTED DEMAND REDUCTIONS

The Residential and Business DR programs are expected to continue to grow over time reaching a level of 430 MW (479 ZRC) by the year 2023 and 525 MW (577 ZRC) by the year 2028, respectively, and maintained at these levels throughout the IRP study period. The Rate GI provision and EIP rate are at 137 MW (154 ZRC) and 48 MW (54 ZRC), respectively, for each year of the IRP study period.

The proposed course of action includes about 540 MW of incremental DR to the existing DR program levels at an average cost of $19.5 million from 2022 through 2040. As the company continues to learn and expand existing programs this incremental level of DR provides flexibility to design a new program or modified program fitting customers' needs. New incremental DR levels begin in the year 2022 and reach the 540 MW level by the year 2030 to meet our greatest time of capacity need and are a blend of behavioral and direct control programs such as capacity bidding and TOU. This scale up of new programs gives our experts time to learn, adjust and optimize the value of DR programs offered to customers, and incorporate potential policy changes such as all customers on TOU rates.

Figure 8.6: Projected demand response reductions



Total projected capital spend from 2019 through 2040 for existing and incremental DR averages $5.8 million per year, totaling around $127 million by 2040. The total projected O&M costs averages to $35 million per year, totaling around $776 million by 2040. The projected O&M assumes all costs associated with the new incremental DR is O&M. Depending upon the actual design of these programs a portion of these costs may shift to capital spend. The cost projections are based upon the expertise of our subject matter experts for existing programs and the statewide potential study conducted by the MPSC in 2017, and are viewed as cost-effective for customers. The level of load reduction is aligned with the achievable potential levels in both the utility and MPSC demand response potential studies.

ENERGY WASTE REDUCTION

Energy waste reduction programs focus on reducing customers' overall energy usage. Reducing energy waste in homes and businesses is clean, smart and relatively inexpensive. Using less electricity helps stabilize volatile energy prices and solidify energy security. It also helps customers save money, providing a boost for Michigan's economy.

Michigan law directs Michigan utilities to offer energy waste reduction programs to customers. Consumers Energy offers a comprehensive portfolio of electric and natural gas energy waste reduction programs to achieve annual energy savings targets.

The company offers incentives to residential customers who reduce energy waste by installing more efficient lighting, appliances, insulation and windows. Commercial and industrial customers can choose from the following programs:

- Comprehensive Business Solutions
- Multi-family
- Small Business

These programs include prescriptive rebates and incentives, custom projects and several initiatives targeting agriculture, building operator certification, new construction and smart buildings retro-commissioning.

While peak demand reductions are not the primary focus of EWR programs, the act of reducing consumption at all times results in significant peak reductions over time.

The cumulative MWh savings projected to be achieved through implementation of the IRP's PCA is slightly more than 9 million MWhs by the end of 2040 at a cost of $2.3 billion and a potential customer savings of $150 to $300 million. Additionally, from 2009 to 2017, participating customers in our energy waste reduction programs totals $1.4 billion in energy savings. With the PCA, the company projects an additional $17 billion in energy savings through the planning period when energy efficiency savings are held at 1.5 percent and increased to 2.25 percent by 2040.

Figure 8.7: Cumulative MWh savings

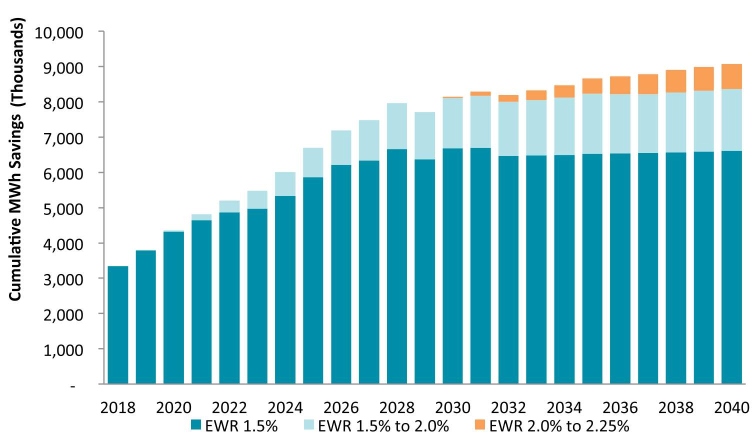
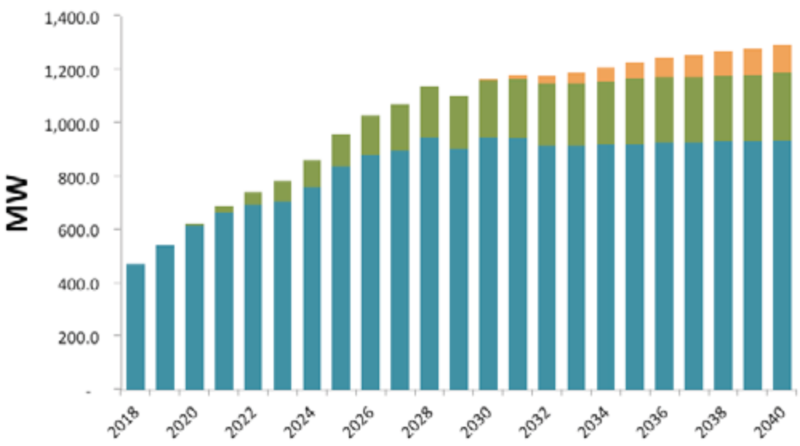


Figure 8.8: EWR projected MW reductions from 2018 levels



CONSERVATION VOLTAGE REDUCTION

The use of advanced technologies, such as the fully-deployed Advanced Metering Infrastructure, enables the company to both empower customers and reduce waste and carbon footprint through reduction in energy usage. The Conservation Voltage Reduction (CVR) program is an example of an advanced grid capability that is designed to reduce energy demand without requiring active participation or behind-the-meter investment by customers.

CVR is a combination of proven technologies used to reduce the amount of load on the system. The technologies work together to optimize control settings on both substation and downstream voltage regulating equipment, and allows for continuous monitoring and automatic adjustments to achieve optimal voltage and load reductions while staying within the regulatory requirements to deliver energy.

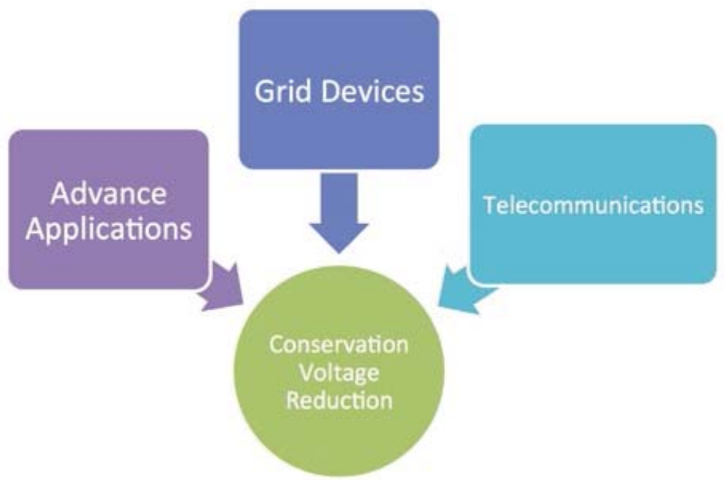


Figure 8.9: System performance technology deployment

The technology will begin operational testing and validation in mid-2018 on 20 circuits to verify software and device functionality, and to develop standard CVR operational procedures to continue the growth of this program.

As presented in Case No. U-20147, on March 1, 2018, the Company shared its five-year Electric Distribution Infrastructure Investment Plan ("EDIIP") for the time period 2018 through 2022. In that plan, the Company presents its future vision for the electric distribution system, which includes modernizing its system and growing advanced grid capabilities that improve system performance and delivers increased value to the customer.

To realize the full customer benefits provided by CVR, a series of sequenced and prioritized grid investments are required across three broad categories on top of traditional physical grid infrastructure upgrades: telecommunications, grid devices and advanced applications.

There are many factors at play to determine the best sequencing of grid modernization investments for customer benefit. Simultaneous, coordinated investments across all three categories are needed to achieve the full potential of benefits for our customers. Any one component that is not deployed creates losses to both the distribution and supply systems.

Figure 8.10: Benefits of Volt/Var Optimization (VVO) and CVR

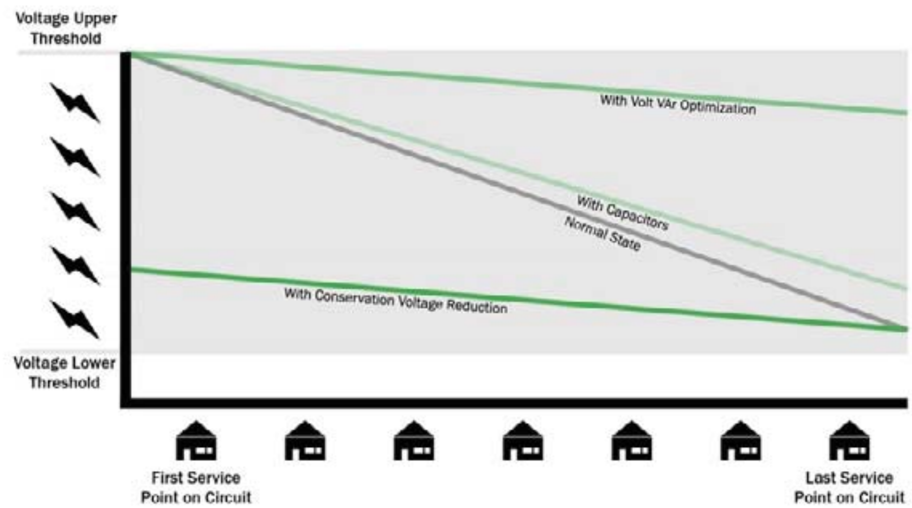


Figure 8.10 illustrates the benefits of Volt/Var Optimization (VVO) and CVR. The "normal state" represents the status of our distribution system prior to the capacitor controller replacement project. In our current state, we must maintain upper threshold voltage at the substation relative to MPSC standards. But due to line losses, our end-of-line customers see a significant voltage drop. With distribution capacitors fully functional, we can slightly raise that end of line voltage as seen in the "with capacitors" line of the chart. However, we will not see significant loss reduction and voltage improvement until we operationalize the VVO project. This project flattens the voltage profile by reducing system losses and improving voltage to our customers. With this step complete, we will then be able to reduce substation output voltage to the lower threshold of the MPSC voltage requirements. This reduction in voltage leads directly to lower energy usage by our customers. By first flattening the voltage with VVO, we are ensuring all customers receive quality voltage with our CVR implementation. These projects concurrently provide large benefits to us and our customers through energy efficiency and energy reduction.

The proposed course of action projects CVR to supply 111 MW by the year 2028 and maintained thereafter at a total capital cost of around $29 million, and a total O&M expense of about $17.6 million.

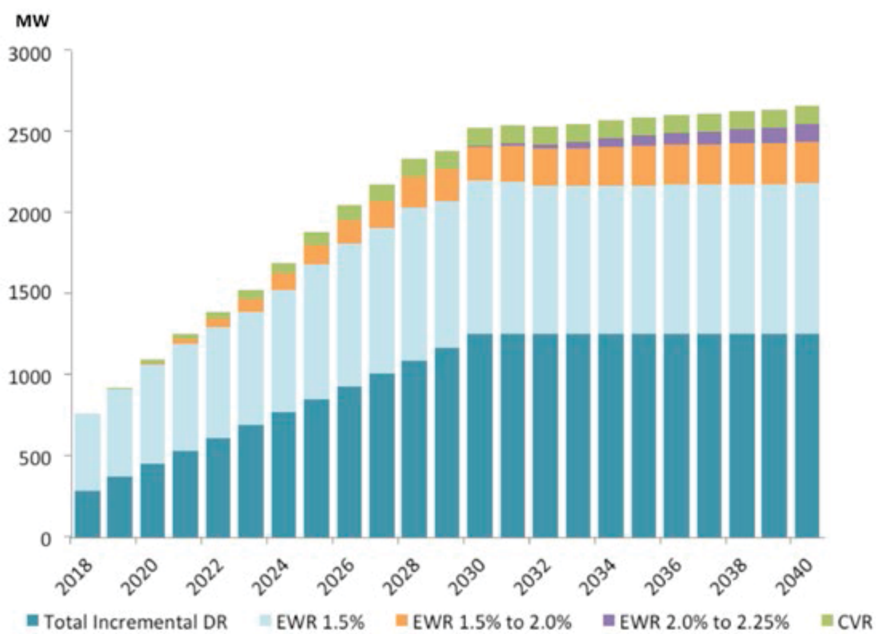
PROPOSED COURSE OF ACTION – DEMAND-SIDE RESOURCES

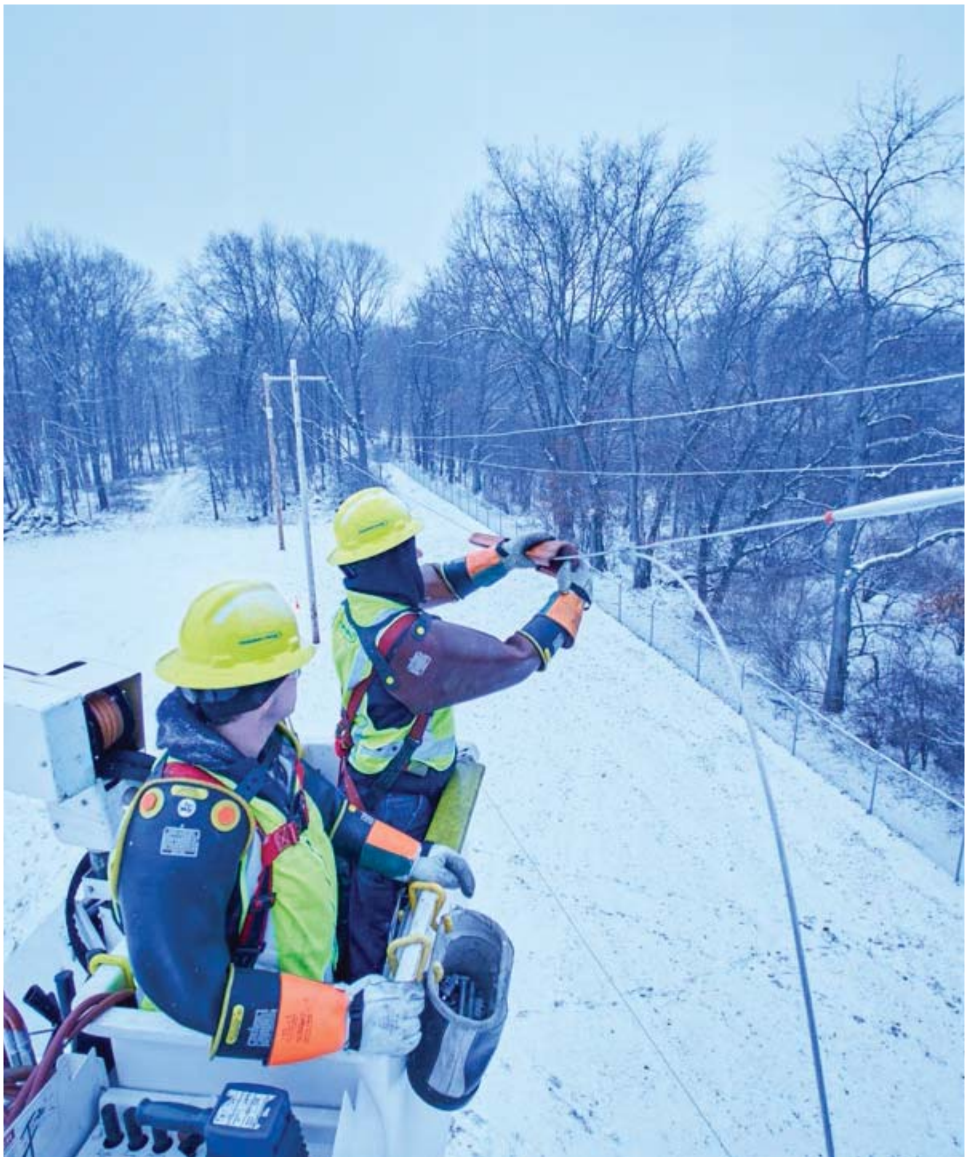
Demand-side resources are an important factor both in the near-term and long-term plan of serving customers' energy needs. These programs are cost effective and reliable resources to keep our operations clean and lean. The proposed course of action projects continued growth and performance of the demand response and energy waste reduction programs, supplemented by CVR. In total, the demand-side management resources are to provide more than 2,700 ZRCs by the year 2040. Table 8.1 depicts the incremental growth of the programs. The projected capital costs are $29 million and the O&M is $17.6 million. New incremental DR programs consist of a blend of behavioral and direct control programs such as TOU and capacity bidding programs identified in the MPSC's state-wide potential study.

Table 8.1: Growth and performance of the demand response and energy waste reduction programs projections

DEMAND-SIDE RESOURCE	MW REDUCTIONS			MISO ZRC		
Planning Year	2019	2030	2040	2019	2030	2040
AC Cycling	44	104	104	49	116	116
Commercial & Industrial	120	290	290	135	325	325
Rate GI provision	137	137	137	154	154	154
Rate EIP	48	48	48	54	54	54
Energy Waste Reduction	0	218	361	0	226	373
Conservation Voltage Reduction	11	111	111	11	115	115
New Incremental DR	0	539	539	0	605	605

Figure 8.11 DSM Projected MW Reductions from 2018 levels





2018 INTEGRATED RESOURCE PLAN

SECTION

9

RENEWABLES AND RENEWABLE PORTFOLIO STANDARDS GOALS

SECTION 9

Renewables and Renewable Portfolio Standards Goals

The company's historical track record is solid in developing and executing an implementation plan to meet the Michigan's Act 295, MCL 460.1001 Renewable Energy Credit Portfolio Standards (RPS). The company achieved and maintained a 10 percent RPS by 2015. Past expansion of renewable assets include Lake Winds® Energy Park, Cross Winds® Energy Park and our renewable energy customer programs.

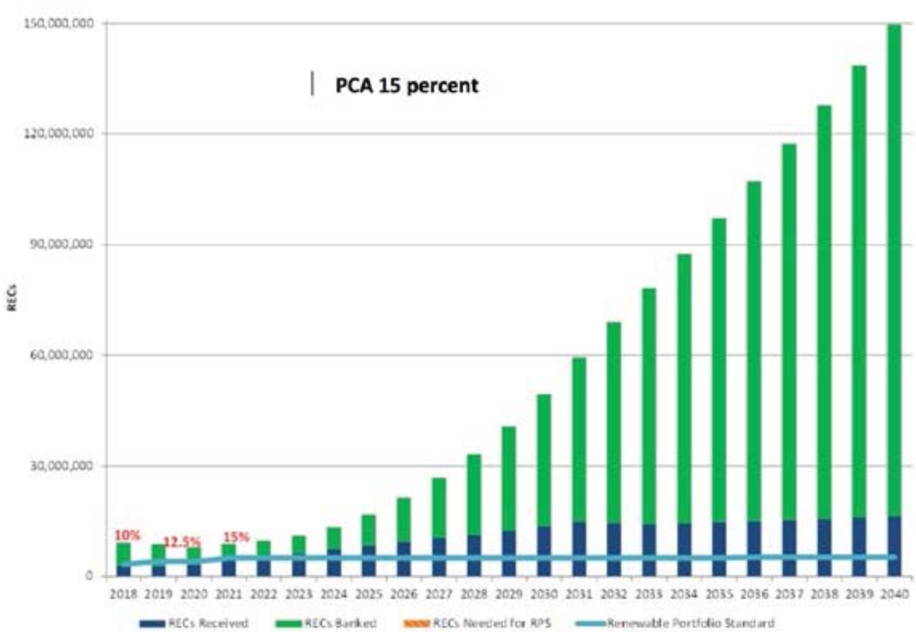
On Dec. 21, 2016, Michigan Gov. Rick Snyder signed Act 342, which amended Act 295, increasing the RPS to 12.5 percent by 2019 and to 15 percent by 2021. The law also asked utilities to discuss what would be required to meet a goal of meeting at least 35 percent of the state's electric needs through a combination of energy waste reduction and renewable energy by 2025.

RENEWABLE ENERGY PLAN

The company's renewable energy plan is designed to achieve the RPS requirement of 12.5 percent by 2019, 15 percent by 2021 and maintain 15 percent through the end of the plan period in 2029. The company also demonstrated that renewable energy credits will be available to support the goal to meet 35 percent of the state's electric needs using a combination of energy waste reduction and renewable energy. To achieve these levels and maintain the 15 percent beyond 2021, the company proposed 525 megawatts (MW) of new wind resources starting commercial operation by 2020 — in order to take advantage of 100 percent of available production tax credits — and up to 100 MW of new solar resources by 2025.

The addition of the proposed wind and solar facilities will allow the company to meet a 12.5 percent RPS by 2019 and a 15 percent RPS by 2021, and continue to meet a 15 percent RPS through the life of the RE plan through 2029 at an expected incremental cost of compliance of $82 million. Beyond the RE plan year of 2029 the company's proposed course of action includes 500 MW to 600 MW increments of solar per year starting in the mid-2020s, which will exceed the 15 percent RPS.

Figure 9.1: 2018 IRP BAU preferred plan for 15 percent compliance



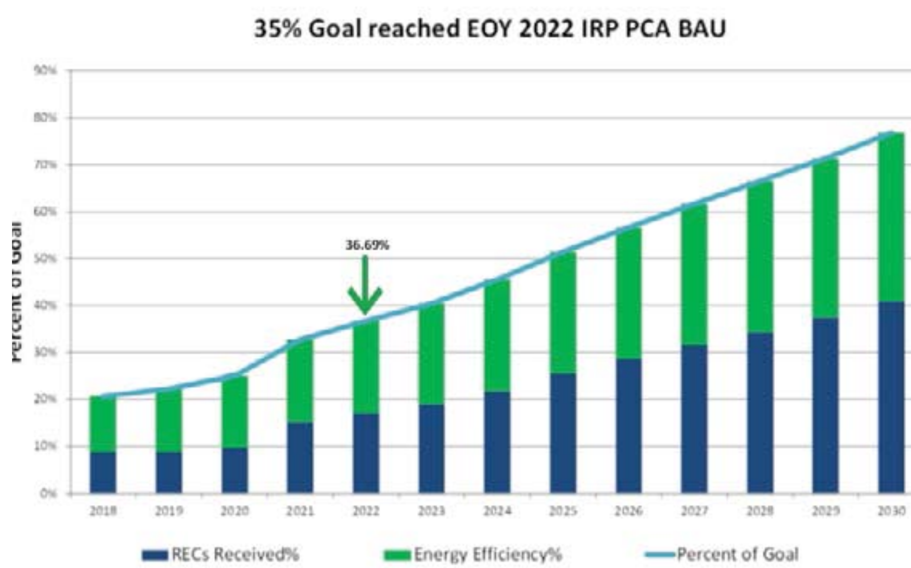
35 Percent Goal of Combined Renewables and EWR by 2025

The 35 percent goal is a different calculation than the renewable energy credit portfolio standard. The 35 percent goal is a combination of cumulative energy efficiency savings and renewable energy credits received in the year 2025. With the incremental levels of renewables, 2 percent year-over-year savings from energy efficiency beginning in 2021 and continued growth in demand response programs, the company is projected to reach a 51 percent combination of renewables and energy efficiency by 2025. That's consistent with the 35 percent goal by the year 2025.

CUSTOMER RENEWABLE PROGRAMS

The company has a variety of customer renewable programs designed to meet the unique needs of our customers. Over the past two years, the company has developed and offered our customers a Large Customer Renewable Energy Pilot Program (LC-REP) tariff offering a specific program tailored to support the sustainability goals of our large commercial and industrial customer class at a reasonable price. Additionally, the Solar Gardens Program is designed for all customers desiring an ability to contribute to a cleaner and greener electric system for Michigan.

Figure 9.2: Combined renewables and EWR



The suite of customer renewable programs available to customers includes:

SOLAR GARDENS PILOT PROGRAM

The Solar Gardens program is designed for all Consumers Energy customers who wish to enroll in the program for a monthly fee. Interested customers subscribe to one-half kilowatt "blocks." The average home subscribes between one and two blocks to cover a portion of their electric use. The plan offers flexible payment plans and customers receive a credit, primarily based on the market value of capacity and energy, for the energy produced by the Solar Gardens Program.

GREEN GENERATION™ PROGRAM

Green Generation ™ produces renewable energy for customers here in Michigan. Energy production comes from 70 percent wind and 30 percent biomass facilities. This independently verified program by Green-e™ can benefit subscribed customers through potential for the customer to qualify for credit toward Leadership in Energy and Environmental Design (LEED) certification if desired. The program is one of the most subscribed programs offered by the company, offering around 25 MW of capacity with approximately 20,000 participating customers.

LARGE CUSTOMER RENEWABLE ENERGY PILOT PROGRAM TARIFF

Customers looking to commit to renewable energy have an option to participate in the Large Customer Renewable Energy Pilot Program Tariff providing a means to match their energy use with renewable energy sources, and an avenue for us to support and work with companies in Michigan. This three-year pilot program was established in 2017 and is 100-percent subscribed to date. The pilot program was conditionally approved in 2017 and is 100-percent subscribed to date.

Figure 9.3: Customer renewable programs

EXPERIMENTAL ADVANCED RENEWABLE PROGRAM (EARP)

The EARP was designed to offer customers the option to sell the energy produced by their distributed energy resources (e.g. solar, anaerobic digestion) to Consumers Energy. The EARP Solar and EARP Anaerobic Digestion are represented by 379 customers contracts participating in the program and have installed 6.4 MW of solar capacity. Those customers with anaerobic digesters sell the output from their systems to the distribution grid at a fixed rate, supplying 1.8 MW of capacity.

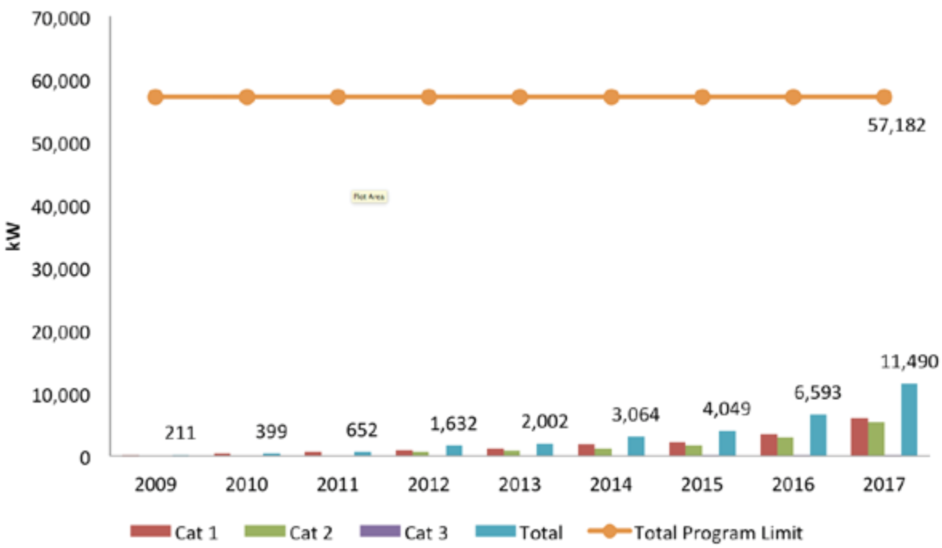
DISTRIBUTED GENERATION NET METERING PROGRAMS

The net metering program allows customers to generate electricity using system sizes 150 kW and below at their home or place of business and selling excess power back to the company for a credit on their next bill. The company files a Net Metering Annual Report in MPSC Case No. U-15787 each year to provide an update on the number of participants, size of installations and program capacity. The net metering program limit for Category 1 customers (20 kW and less) in 2017 was approximately 38 MW, which represents 0.5 percent of the company's average peak demand from 2012 through 2016. However, only about 6 MW of Category 1 customers (or about 16 percent of the available program limit) were enrolled prior to Dec. 31, 2017. Similarly, for Category 2 customers (greater than 20 kW up to 150 kW), the net metering program limit in 2017 was approximately 19 MW, which represents 0.25 percent of the company's average peak demand from 2012 through 2016. However, only about 5.3 MW of Category 2 customers (or about 28 percent of the available program limit) were enrolled prior to Dec. 31, 2017. The company is continuing to see demand for customer generation increase as costs of systems decline over time. We will continue to support our customers who wish to self-generate and provide excess generation back to the grid.

CUSTOMER INTEREST AND POTENTIAL GROWTH OF PROGRAMS

The company offers a number of existing renewable customer programs today. Historical load projections for customer-owned generation such as net metering are included in the forecasting model. Future forecasts do not include growth in customer-initiated or voluntary green pricing programs as these programs are still maturing and are expected to increase gradually over the next few years. However the incremental solar in the PCA could be used to supply future customer demand. For example, the projected 300 MW of incremental solar in 2022 as part of the IRP glide path could

Figure 9.4: 2009 – 2017 net metering participation



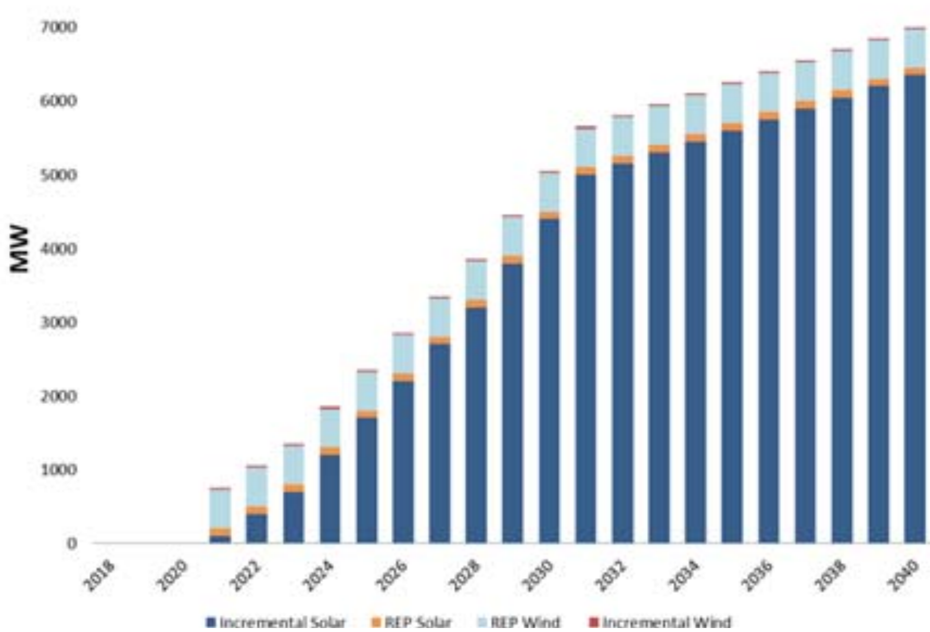
provide the company potential options as demand develops. The company continues to monitor its renewable energy customer programs and will continue to conduct market and customer research to understand renewable customer demand and develop new programs or modify existing pilots as appropriate to meet the demand. For this IRP, PCA short-term horizon through 2021, the company is not expecting to reach the program limits for net metering that are currently in place and, as such, has not incorporated forecasting of distributed energy resources in this filing. The company will continue to monitor the demand for renewable energy and adjust as customer demand dictates. As more knowledge and learnings are gathered from the newly implemented PA 342 Section 61 Voluntary Green Pricing program, we will be able to better identify the impact on peak energy and demand forecasts.

The company has seen increasing levels of demand or interest for renewable energy customer power supply, especially with customer desire to be more sustainable both from a clean and reduced usage perspective. The PCA includes a foundation of incremental levels of renewables and EWR flexible in nature to address future interest in voluntary green pricing or customer-initiated renewable programs.

PROPOSED SOLAR GROWTH

The PCA contains a glide path to achieving a total incremental build of 6.35 GW of solar by the year 2040. The proposed glide path provides time for operating and assessing a system with significant solar generation to have a gradual impact on customer rates and to minimize execution risk associated with the development of 5 GW of solar generation through 2030 as shown in Figure X Renewables in PCA. The renewable build is subject to risk associated with land acquisition (1 MW solar equates to 4 to 6 acres of land), equipment procurement and reconsideration of the Effective Load Carrying Capability (ELCC) by the Midwest Independent System Operator (MISO). Additionally, the plan includes 150 MW of new PURPA Qualifying Facility generation at the avoided cost rate determined in Case No. U-18090 that is yet to be fully resolved.

Figure 9.5: Incremental renewables in PCA from 2018 levels



Development

The PCA proposes to construct solar generation or procure solar capacity through competitively bid build transfer agreements, development asset acquisitions or power purchase agreements. The PCA contemplates adding solar capacity in smaller increments than traditional fossil, baseload generating plants. Under the PCA, solar capacity — whether owned by the company, projects purchased from developers or purchased through power purchase agreements — would be awarded based upon competitive bids. Third-party development participation would be an integral component to the plan, with developers and independent power producers creating more flexibility, diversity of locations, competitive pricing, and capability to develop the amount of solar in proposed in the PCA. The PCA calls for the development of solar over the course of several years, utilizing an incremental approach. This incremental approach is reasonable because it anticipates technological advances in the early years of the plan that reduce costs, and assumes important development, construction, and operating experience is gained in the early years and leveraged to improve overall performance and cost-effectiveness.

Costs

Industry projections used in the analyses assume a declining cost of solar during the early years of the plan; however, there is no guarantee the costs would align. A competitive bidding process is the method the company intends to use to keep costs as low as possible. Strategic alliances formed through competitive bidding may be an effective means to manage critical parts of the solar supply chain, such as solar panel manufacturing. Strategic alliances may provide an opportunity to have known competitive cost rates for solar development over a given segment of the PCA timeframe while allowing for the capture of technology driven cost declines.

Real Estate and Permitting

Real estate is a critical resource for solar development, especially at the projected scale over the PCA period. A solar facility typically requires approximately 4 to 6 acres of space per megawatt of capacity. The 5 GW of solar by 2030 would require approximately 25,000 to 35,000 acres of land. Such real estate will need to be geographically diverse to reduce significant electric system disruptions due to cloud cover, meet electric system standards and be safely integrated into existing electrical infrastructure. Geographic diversity may help to mitigate potential community concerns over the amount of solar installed in one area and provide additional optionality to ensure the lowest cost locations can be utilized. The company is committed to the best land use practices for Michigan in our development processes and will work with entities such as schools and government. The company completed a preliminary analysis of available land in the Lower Peninsula of Michigan, identifying that the required land for the PCA solar development through 2030 is approximately 1.6 percent of the currently available land. As the plan progresses over time, acquisition of large parcels in appropriate locations at reasonable prices could present a secondary challenge. The challenges being considerations such as: pricing, the proximity of the land to existing infrastructure, the zoning requirements of particular communities or environmental sensitivities. The company, with third-party participation and the large amount of candidate locations identified in our initial scan, is supportive of the anticipated development.

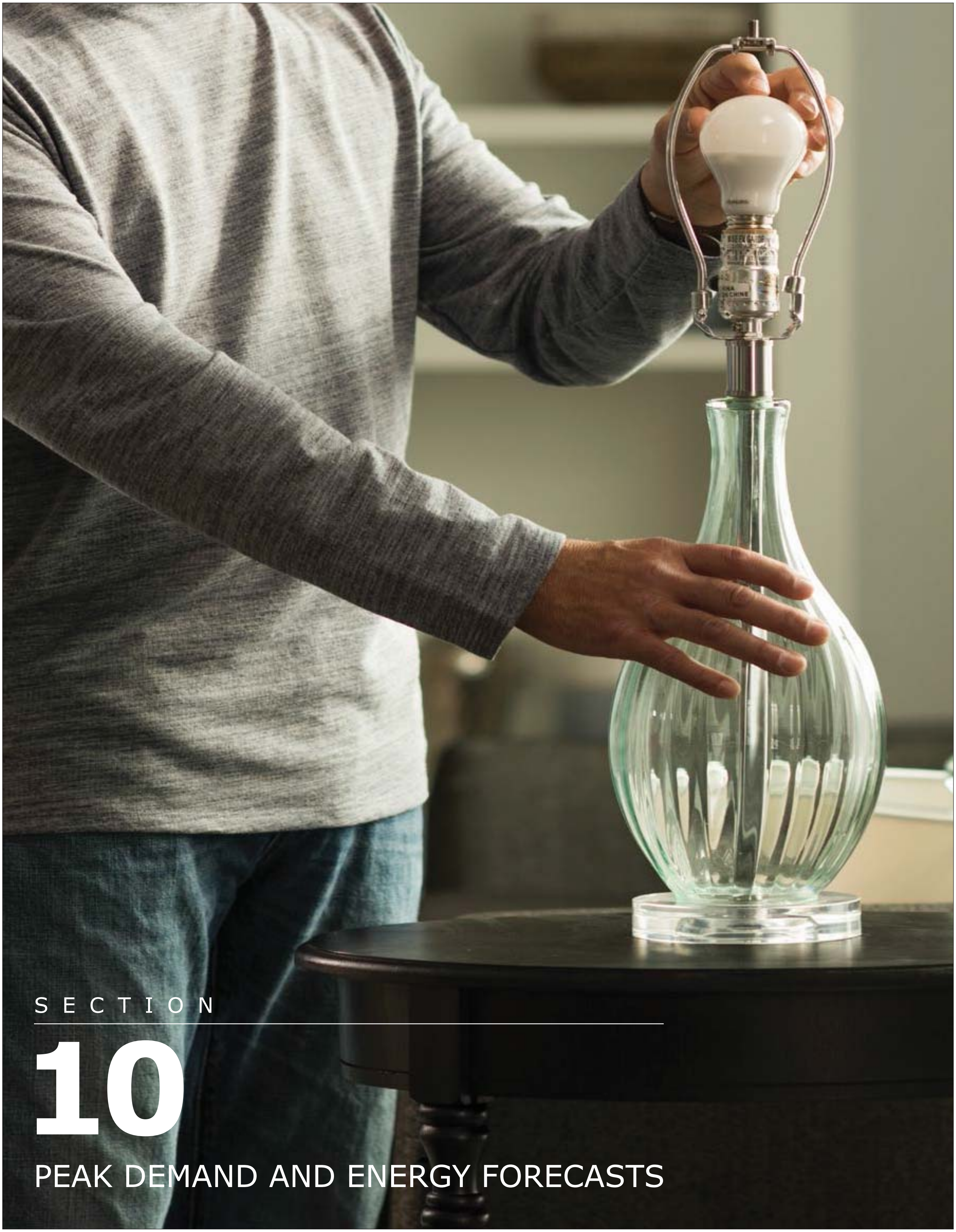
REGULATORY LANDSCAPE

The local regulatory landscape for renewable energy assets continues to evolve as the industry grows. Using wind power development as a proxy for solar development in Michigan, some local communities have changed zoning requirements or introduced wind moratoriums to specifically halt or limit the amount of wind development and siting. Therefore, the company would anticipate similar responses to solar development in the state if overly concentrated in particular geographic locations. Diversification of location for solar as compared to wind is available as the solar resources are comparable across the state, whereas wind development has more advantageous locations compared to other wind sites in terms of electric generation capabilities. It is critical and necessary that the company and third-party developers engage with potentially affected and impacted communities through implementation of this, or any future renewable energy build.

MISO AND SOLAR CAPACITY CREDIT

The current ELCC assumed for the solar build in the proposed course of action is 50 percent. The ELCC factor determines the level of zonal resource credits MISO accepts for a certain level of solar MW build. For example, a 200 MW solar facility provides 100 zonal resource credits the company can count towards meeting customer demand and the planning reserve margin requirements. The ELCC prescribed by MISO is intended to ensure electric reliability on the system. The MISO is planning to re-evaluate the ELCC in September 2018. If adjustments in ELCC are downwards, the resulting affect is the need to develop additional MW of solar or another economic resource to fill future capacity needs, and vice versus for adjustments made upward.

2018 INTEGRATED RESOURCE PLAN



SECTION

10

PEAK DEMAND AND ENERGY FORECASTS

SECTION 10

Peak Demand and Energy Forecasts

An accurate load forecast for the planning period is the starting point of the analysis in an IRP, and a key component in determining whether existing resources satisfy customer demand, or additional resources are required to serve the customer need. Consumers Energy developed its load forecast by analyzing historical data to identify the statistically significant factors in energy sales in each customer class. The resulting models included economic variables and projected increases in energy waste reduction (EWR) to forecast annual system, bundled sales and peak demand. The baseload forecast has total electric deliveries expected to increase at a marginal 0.3 percent in 2018, and remain relatively flat through the next five years (2018 – 2022) at a 0.05 percent CAGR. This projection takes into account the existing EWR and demand response (DR) programs forecasted as part of the base capacity position in this load forecast. Projecting to the end of the IRP forecasting period, total deliveries are expected to grow at a modest 0.2 percent annually. To manage future uncertainties, a high load forecast, ROA Return, and increased energy efficiency savings sensitivities were developed and compared with business as usual (BAU).

KEY VARIABLES

The key variables in developing the baseload forecast used in each scenario are: weather, economy and demographics.

WEATHER

Weather is used in the forecasting model to capture the seasonal variation in deliveries and peak demand across the year. This is accomplished using a 15-year average of heating degree days (HDD) and cooling degree days (CDD) in the econometric models used to create the load forecast.

ECONOMY

The company uses economic indicators to capture the growth expectations related to increased economic activity in its service territory. Primarily, this includes employment and industrial production forecasts provided by IHS Markit, a leading publishing company that provides industry-specific data and analyses.

DEMOGRAPHICS

Population projections are used in the development of the long-term customer forecast. In particular, the forecast of residential customers is derived from the county-level population projections provided by IHS Markit.

FORECASTING METHODOLOGY

The electric deliveries and peak demand forecasts are prepared using a combination of econometric and end-use techniques. Typically, a six-step process is used in developing the electric deliveries forecast.

STEP 1	Gather the class-level historical monthly electric delivery, monthly customer counts, monthly number of billing days, monthly binaries to account for temporal cycles and daily temperatures that have been transformed into monthly HDD and CDD information.
STEP 2	Import of the economic and demographic variables from IHS Markit into the sales modeling framework.
STEP 3	Import electric use forecasts for wholesale, electric vehicles, polycrystalline production, and energy savings from the company's smart energy and EWR programs. These forecasts are exogenous to the modeling framework and were either adopted by the Commission in prior electric rate cases, reflect current industry expectations, or are based on end-use analyses.
STEP 4	Review of the imported observations to identify data issues before running the econometric models.
STEP 5	Executing regression functions and reviewing the corresponding statistical metrics.
STEP 6	Combine the regression forecasts with the external forecasts imported in the third step.

The peak demand forecast process is similar to that of the electric delivery forecast.

STEP 1	Import the company's monthly system peak demands, corresponding minimum and maximum daily temperature, forecasted base electric deliveries, seasonal binaries and number of customers into the demand-modeling framework. Use a weighted sum of the minimum and maximum temperatures to develop the peak CDD and HDD variables prior to importing into the model framework.
STEP 2	Review the imported observations to identify data issues before executing the peak demand econometric model.
STEP 3	Regressing the observed peak demands against the seasonal binary, degree day, and forecasted base electric sales.
STEP 4	Combining the results of the econometric model with the planned peak reductions from the company's direct control DR and peak time-of-use (TOU) programs.

REGRESSION MODELING

Regression modeling is used to develop the electric deliveries and customer count forecast models based on weather and economic variables. Each model is selected based on its ability to properly explain variation in historical data – i.e., how well it fits the data – along with the statistical significance of the model coefficients. Particularly, regression model performance is evaluated based on the adjusted coefficient of multiple determination and mean absolute percent error (MAPE).

Both of these statistical tests are used to evaluate how well the models fit the historical data, and also provide a good indication of how well the models will perform in the forecast period. In most cases, the models used in the company's forecasting process have values between 0.90 and 0.97, indicating a high level of accuracy in the company's forecasts. In addition, to gauge overall model performance, the MAPE values are considered to measure the model errors in which smaller values suggest better model performance. MAPE values between 5 percent and 10 percent are generally considered ideal, although higher values may also be deemed acceptable based on other considerations, such as the R^2a. The regression models used in the company's forecasting process generally have MAPE values between 0.2 percent and 2.1 percent indicating a high level of accuracy in the company's forecasts.

PROJECTIONS

The forecasts provided in this case are the company's best estimate of future electric sales and peak demand. As with any estimate, actual conditions may differ from those assumed in the forecast. The econometric models perform well over the sampling period, accounting for more than 90 percent of the variations in electric sales and peak demand. The models are expected to perform equally well over the forecast period, but may depart from actuals in instances of structural shifts. This would include significant events absent from the historic period used in the models, such as natural disasters. The high load sensitivity modeling in the IRP helps identify the risks associated with increasing load.

Economic Forecasts

As with any forecast, all input assumptions are subject to a level of uncertainty. For instance, the company uses IHS Markit economic forecasts of population, employment and industrial productivity in developing its sales and demand forecasts. As such, the company's forecasts will change as IHS updates its economic forecasts to capture newer data.

Behavioral Changes

The econometric models use historical customer behavior in developing the forecasted electric sales and peak demand. Anticipated changes in behavior, such as EWR or the downturn in the polycrystalline industry, are then added to the forecasts to capture future expectations. However, if customers behave differently than reflected in the historical data as adjusted for expected actions, then the sales and demand forecasts may differ from actual levels.

HISTORICAL GROWTH

In the past five years, weather-normalized electric deliveries decreased at a 0.3 percent compound annual growth rate (CAGR) from 2012 to 2017, with most of the observed loss occurring in the residential class (-0.5 percent for the same period), and the commercial class (-0.2 percent), as shown in Figure 10.1 below.

In large part, the retraction in the residential and commercial sectors is caused by a nearly flat population growth in the electric service territory during this period, coupled with increased energy waste reduction efforts starting in 2008.

Following the 2008 recession, industrial electric deliveries increased 5.2 percent per year from 2009 to 2012. At the same time, industrial sectors exhibited only moderate growth in electric deliveries. From the start of the recession in 2007 until 2017, electric deliveries in a portion of the industrial sector decreased 0.5 percent per year while increasing 7.9 percent per year occurred in other industries for the same period.

Total industrial deliveries are expected to increase in the next two years.

FUTURE GROWTH POTENTIAL

With the level of interest in electric vehicles (EV), plug-in hybrid electric vehicles (PHEV) and battery electric vehicles (BEV), changes to the load forecast are a possibility.

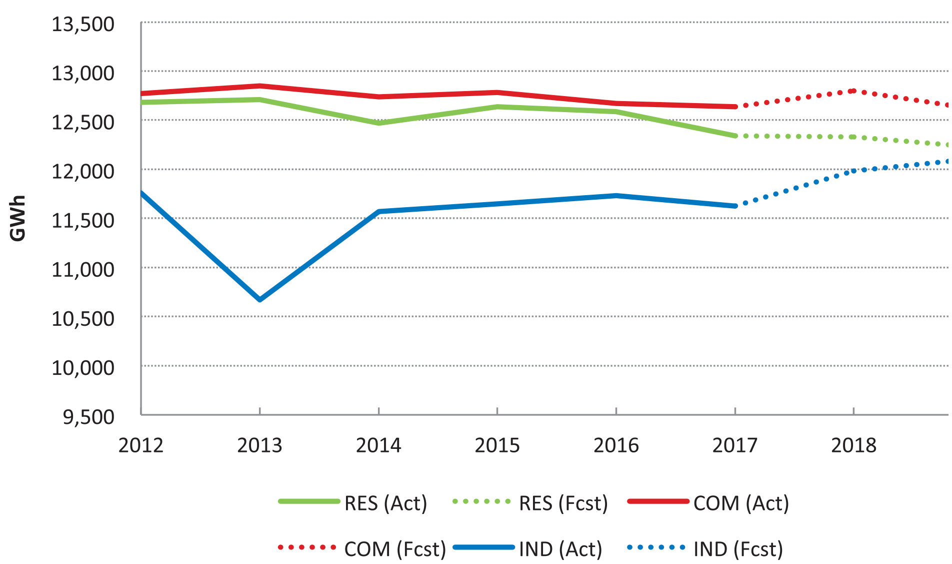
Currently, the baseload forecast does not account for significant growth of EVs. Data acquired from the Alliance of Automobile Manufacturers (2018), shows 2017 Michigan-registered EVs are around 12,500 to 15,000, with approximately 4,000 in the company's electric service territory (2016 Michigan Secretary of State registrations).

With an estimated 8 million total registered vehicles in Michigan, EVs account for a mere 0.2 percent of total registered vehicles in the company's service territory. Realizing the growth potential for EVs in the state of Michigan, the company continues to monitor developments in this industry, as well as projections by third-party data management companies (i.e., IHS Markit, EIA, and Bloomberg New Energy Finance).

Any generation produced due to customer-owned net metering and self-generation facilities will reduce the company's actual deliveries.

This reduction of historic load will, in turn, implicitly impact the regression models' coefficients used for projecting electric deliveries and generation requirements. In other words, although the load forecast does not include an explicit adjustment for customer-owned generation, existing sources of customer-owned generation are implicitly included because of the impact to historical load information.

Figure 10.1: Electric cycle billed, weather-adjusted deliveries by class



The increased EWR sensitivity evaluated in the MIRPP scenarios give some insights into the impacts of load reduction to the utility. The result of these load reductions is fewer investments in supply- and demand-side resources. The incremental and modular approach the PCA offers helps to mitigate our customers' risk if these potential load reductions occur.

BASELOAD FORECAST AND PEAK DEMAND

The baseload forecast is the same through all scenarios (e.g. CE and MIRPP) and is referenced as BAU. This BAU forecast has total electric deliveries expected to increase at a marginal 0.3 percent in 2018, and remain relatively flat through the next five years (2018 – 2022) at a 0.05 percent CAGR. Projecting to the end of the IRP forecasting period, total deliveries are expected to grow at a modest 0.2 percent annually. The trend in total electric deliveries, industrial electric deliveries, and non-industrial electric deliveries are shown in Figure 10.3 below.

The electric deliveries base forecast includes the company's commitment to help customers reduce energy waste by at least 1.5 percent per year beginning in 2017. Figure 10.4 shows the company's projected electric load in MWh with and without adjustments for EWR and DR programs.

Peak Demand Growth

Per the 2015 System Loss Study used at the time the baseload projection was created, the forecasted total electric deliveries are increased by a line loss factor of 7.45 percent to determine the company's total bundled generation requirements. The 2015 System Loss Study was the latest available study at the time the BAU projections were created.

This total bundled generation requirement is analyzed using a regression analysis based on the predicted level of electric deliveries to forecast the peak demand. Weather-normal peak demand grew at a 1.6 percent CAGR from 2003 to 2007, but reversed much of this trend during the 2007 to 2009 recession, when weather-normal peak demand retracted by 4.3 percent. Looking forward, peak demand is expected to increase 0.3 percent per year from 2017 to 2039, the end of the IRP forecast period. The annual system level results of the peak demand forecast are shown in Figure 10.5.

This forecasted peak demand is adjusted to reflect the company's future smart energy programs. The peak demand forecast is reduced by approximately 101 MW in 2018 and increasing to 525 MW by 2028 for the direct control DR and peak TOU programs. Demand reductions are projected to stabilize at this 525 MW level for the rest of the IRP projection period. These programs

Figure 10.2: Historical & BAU Forecasted Electric Deliveries Indexes

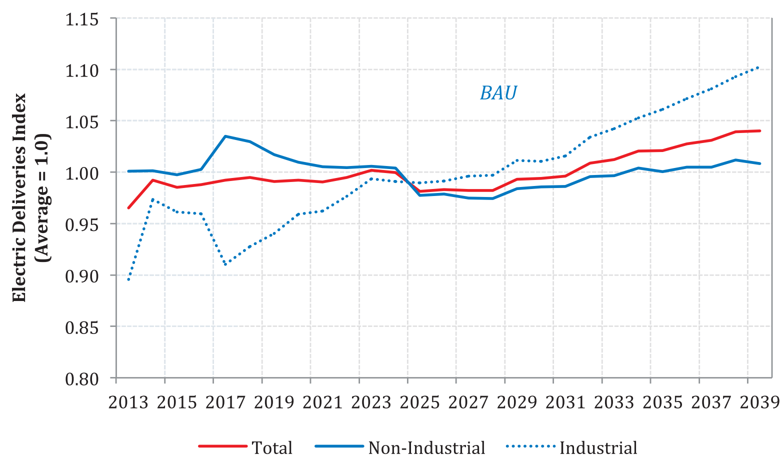
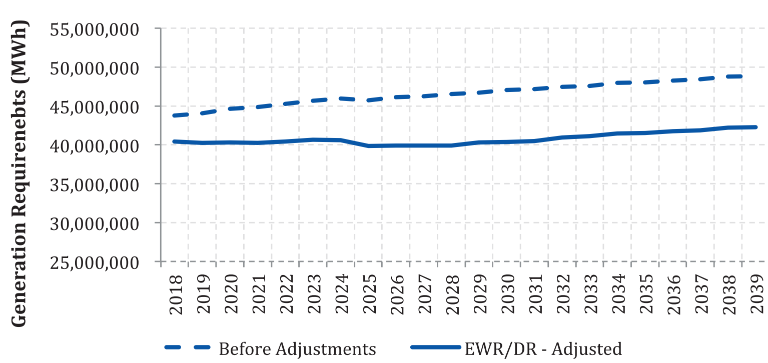


Figure 10.3: Projected BAU Generation Requirements (MWh)



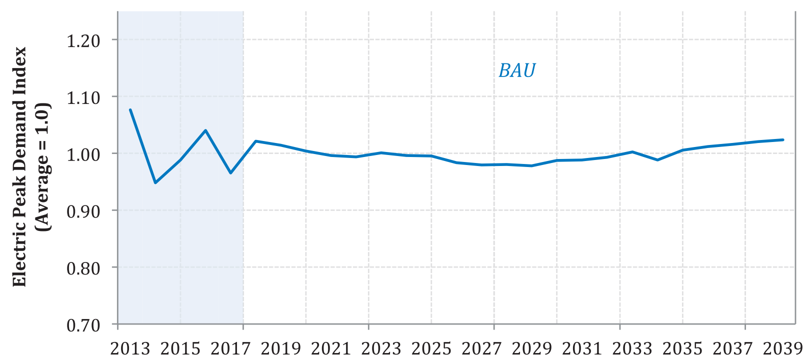
are being implemented as part of the company's smart energy infrastructure investments in which customers are provided technology and information to better manage their impact on the company's system.

The company's direct control DR programs span across both residential and business classes, with 24 MW belonging to the residential class, and 60 MW to the business class, in 2018. By 2028, 104 MW is residential. and 290 MW is the business class. Demand reductions within the AC Peak Cycling program are projected to stabilize at these levels for the rest of the IRP projection period. All of the company's peak TOU programs are within the residential sector. In 2018, the peak TOU program total is 17 MW — growing to 235 MW in 2039.

The company's EWR programs are projected to reduce peak demand by 465 MW in 2018. The cumulative reductions produced by the program are expected to increase to 896 MW by the end of the IRP projection period.

The proposed plans to achieve the peak reductions for the above demand-side management resources are described further in the demand-side resource section of the report.

Figure 10.4: Historical & BAU Forecasted Peak Demand Index



SCENARIOS AND SENSITIVITIES

In addition to the base forecast described above, three different sensitivities were developed for different levels of forecasted demand, and run on the three MIRPP scenarios, as required by Commission Order U-18416. These sensitivities were not run on the CE Gas Price scenarios. The sensitivities run on the MIRPP scenarios are as follows:

SENSITIVITY	MIRPP SCENARIO (S)	CE SCENARIO (S)
2.5% EWR Savings	BAU, ET, EP	Not Applicable
50% ROA Return	BAU	Not Applicable
1.5% above BAU	BAU, ET, EP	Not Applicable

The following sections describe, in further detail, the assumptions of each sensitivity and the affects to the BAU forecast.

High Growth Sensitivity

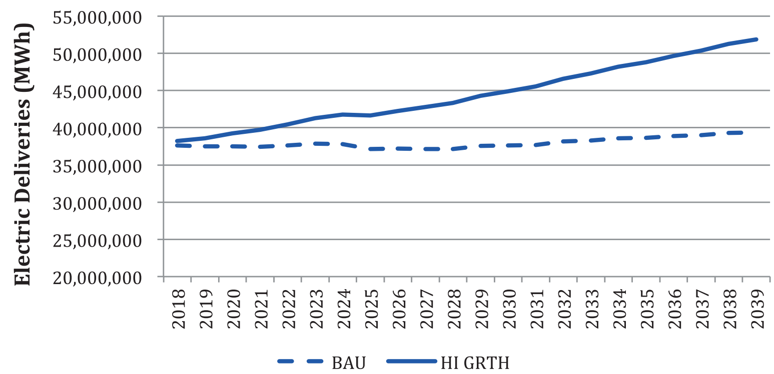
This sensitivity assumes the accelerated economic growth resulting in the total company's electric deliveries increasing by 1.5 percent annually from 2018 to 2039, simulating unusual economic growth in the electric service territory. EWR projections are appropriately adjusted (increase savings) to reflect the electric delivery increase.

Figure 10.6 shows the difference between BAU and the high growth sensitivity.

ROA Shift Sensitivity

This sensitivity assumes 50 percent of the current ROA load is returns to the company's bundled, or full service, load causing an immediate increase in the company's full-service customers. This, in turn, increases the EWR projections that are incorporated in the forecast. The EWR impact, due to this ROA shift, does reduce the overall electric load from 2018 to 2039; however the impact is minor: BAU growth rate (2018-2039 CAGR) is 0.21 percent; 50 percent ROA load shift growth rate is reduced to 0.17 percent.

Figure 10.5: High growth sensitivity

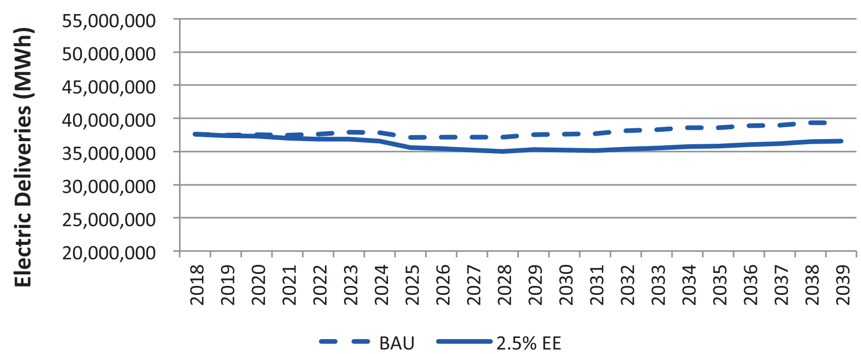


High Energy Waste Reduction Savings Sensitivity

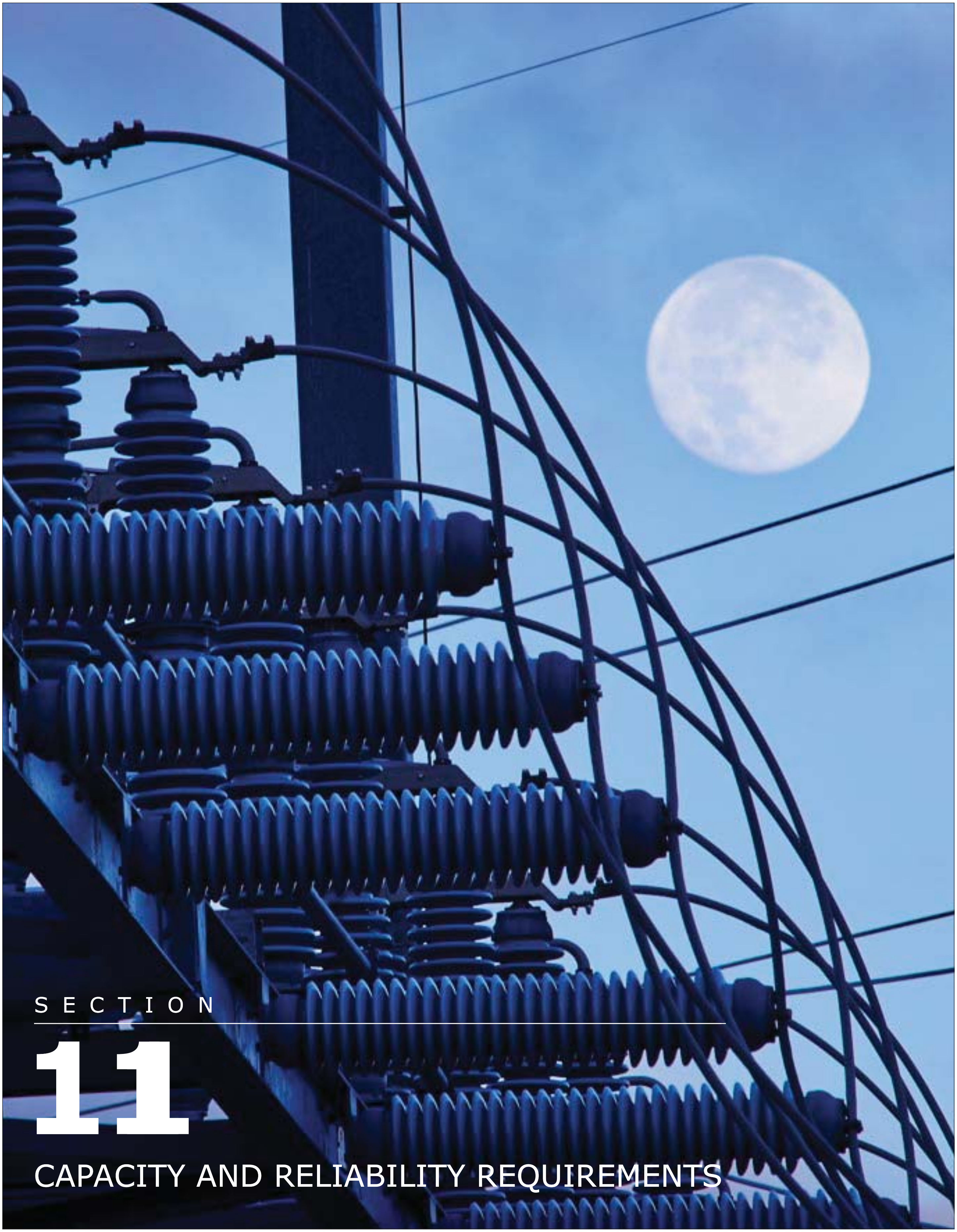
This sensitivity assumes an increase in the annual EWR savings rate from 1.5 percent in the BAU to 2.5 percent in a four-year period, and then maintained year-over-year. Figure 10.7 shows the difference between BAU and this sensitivity.

The CAGR for 2018 through 2039 under this sensitivity is a -0.26 percent reduction compared to the 0.21 percent CAGR for BAU.

Figure 10.6: 2.5 percent EWR sensitivity



2018 INTEGRATED RESOURCE PLAN



SECTION

11

CAPACITY AND RELIABILITY REQUIREMENTS

SECTION 11

Capacity and Reliability Requirements

MIDCONTINENT INDEPENDENT SYSTEM OPERATOR, INC. (MISO)

MISO was established as the nation's first Regional Transmission Organization (RTO) by the Federal Energy Regulatory Commission (FERC) in 2001. MISO monitors the transmission network to strengthen reliability and ensure electric grid stability across 15 states and Manitoba as one integrated system Figure 11.1.

Figure 11.1: Regional transmission organization territories

MISO's Energy Market

MISO provides all market services for energy, operating reserve and transmission service in accordance with the terms of the MISO Open Access Transmission, Energy and Operating Reserve Markets Tariff (MISO Tariff). This includes operation and settlement of the Day-Ahead Energy and Operating Reserve Market (DA Energy Market) and the Real-Time Energy and Operating Reserve Market (RT Energy Market), collectively referred to as the MISO Energy Markets. Consumers Energy participates in the MISO Energy Market. The DA Energy Market takes place on the day preceding the actual operating day and is a forward-looking market where energy and operating reserves for the next day are bought and sold. An operating day spans a 24-hour period, beginning and ending at midnight, Eastern Standard Time. The DA Energy Market is a financially binding market that provides for economic and reliable operation of the electric system for the next operating day. The RT Energy Market takes place on the actual operating day and is designed to continuously balance electric supply and demand at the lowest cost while recognizing transmission system conditions. The DA Energy Market and the RT Energy Market are designed to work together to meet electric needs in the MISO footprint each day in the most economical manner.

MISO's Ancillary Services Market

MISO also operates an Ancillary Services Market (ASM), which is a collection of secondary services offered to ensure the reliability and availability of energy. The ASM provides for generation regulation, spinning and supplemental services and has both a day-ahead and real-time component. Generation regulation serves to continually balance electrical supply and demand. Spinning reserves and supplemental services provide energy to meet demand on the system in the event of a sudden and unexpected loss of generation or transmission service.

MISO's Capacity Market

MISO has a hybrid voluntary annual capacity construct requiring all available generation in the MISO footprint to participate in an annual Planning Resource Auction (PRA), and be available for all 8,760 hours of the MISO planning year. Load-serving entities (LSE) can either choose to participate in the PRA or can pay a capacity deficiency charge. The MISO Planning Year (PY) runs from June 1 to the following May 31. The forward capacity market is designed to ensure sufficient resources are in place to reliably serve load on a forward-looking basis. Load serving entities can meet their planning resource requirements by offering capacity resources and demand into the PRA through one or both of the following methods:

- Offering or self-scheduling capacity resources and bidding demand into the PRA.
- Opting out of the PRA by submitting a Fixed Resource Adequacy Plan (FRAP), offsetting capacity resources and demand against each other.

Planning Reserve Margin Requirement

MISO determines the appropriate amount of capacity required to maintain electric system reliability in accordance with the reliability requirements of the states and the regional reliability organizations that have jurisdiction within the MISO Energy Market Region. ReliabilityFirst, the regional reliability organization for the part of the country in which the company operates, has an established resource planning standard that allows for interruption of firm customer demand as a result of insufficient generation resources — known as loss of load expectation (LOLE) — of no more frequently than one day in 10 years. MISO has adopted this standard as well and requires all market participants to secure resources that are adequate to achieve it. MISO and its Loss of Load Expectation Working Group (LOLEWG) conduct an annual evaluation of customer demand and generators located within the MISO market footprint. This evaluation determines, absent consideration of forced outages, a capacity planning reserve margin target for MISO to satisfy ReliabilityFirst's capacity planning criteria.

Based on that evaluation, MISO establishes a Planning Reserve Margin Requirement (PRMR) applicable to each load serving entity that reflects the one day in 10-year loss of load expectation. To facilitate compliance with the PRMR, MISO has established fungible Zonal Resource Credits (ZRCs), which are a measurement of each resource's available capacity after discounting for the resource's effective forced outage rate.

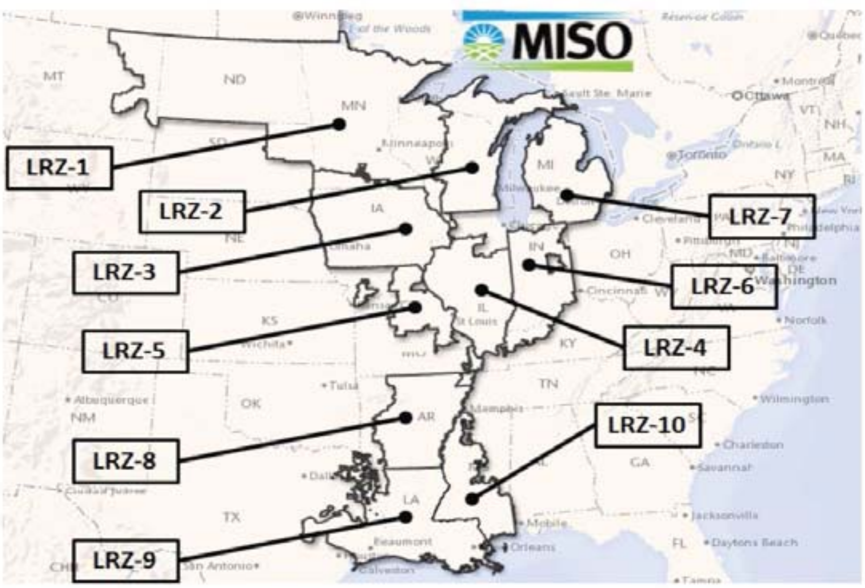
Under the MISO Resource Adequacy construct, the company is required to purchase shortfall capacity needs to meet its PRMR, or its expected peak load plus reserves, for the entirety of each planning year to avoid paying a capacity deficiency charge. The company plans to meet the demand and reserve margin requirements of its full-service, or bundled, customers, and if needed, will secure capacity to meet the needs of ROA customers served by alternative energy suppliers that are unable to demonstrate firm generating capacity for their customers as required by the state reliability mechanism (SRM) in commission Case Nos. U-18441 and U-18444.

Local Resource Zones

As part of its Resource Adequacy construct, MISO has divided its footprint into 10 regions, or Local Resource Zones (LRZs), acknowledging the electric transmission system is constrained. The designation of these LRZs generally follows state boundaries, as shown in Figure 11.2. Michigan's Upper Peninsula is connected with Wisconsin as part of Zone 2. The Lower Peninsula is designated as Zone 7 with the exception of a small part of southwest Michigan that is part of the Pennsylvania-New Jersey-Maryland (PJM) market.

Zone 7 has a peak demand of approximately 20,407 MW resulting in a PRMR of approximately 22,121 MW for planning year 2018/19.

Figure 11.2: MISO local resource zones (LRZs)



Local Reliability Requirement

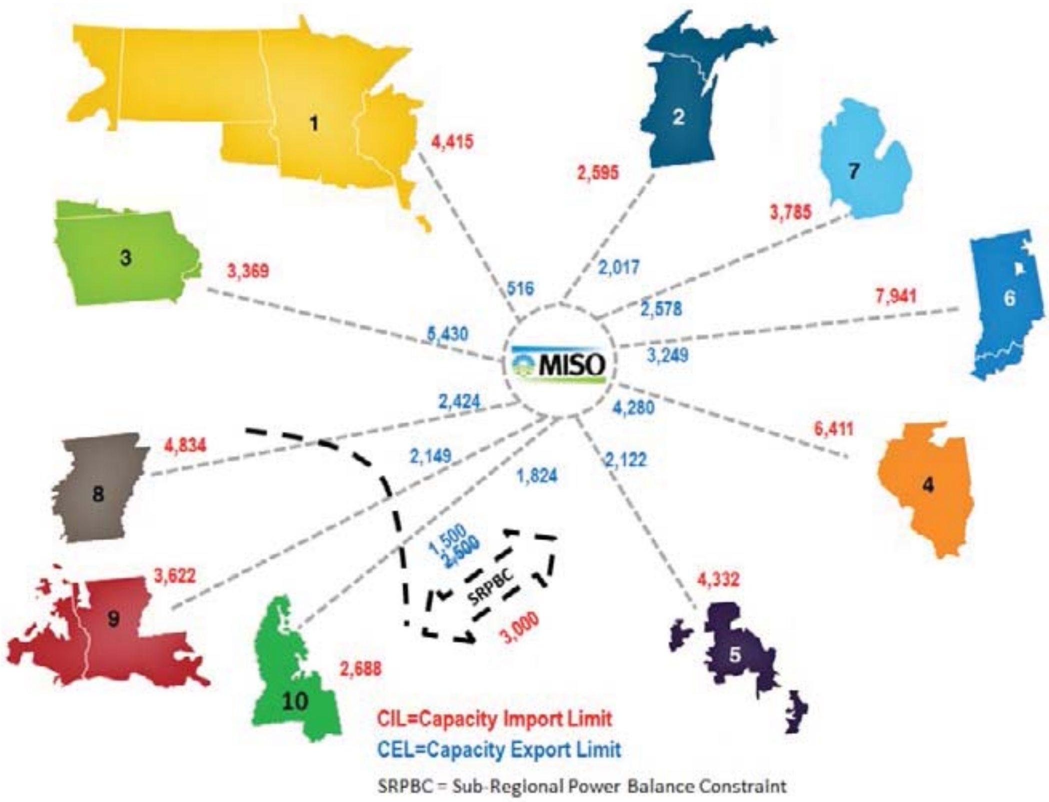
The local reliability requirement (LRR) is the minimum amount of unforced capacity (the amount of installed capacity available at any time, after accounting for unit forced outage rate) that must be physically located in a LRZ to maintain a loss of load expectation of one day in 10 years, without consideration of the benefit of imports from other zones by use of the electric transmission system. The LRR determines the amount of physical generation needed in a zone if it were to be treated as an island, with no ability to obtain power from other zones. The minimum LRR is determined through the MISO LOLE Working Group analysis by either adding or removing planning resources (electric generation) until the LOLE reaches the target of interruption of firm demand no more frequently than one occasion in 10 years.

Capacity Import and Export Limits

The LOLEWG determines the capacity import limit (CIL) and capacity export limit (CEL) to and from each MISO Local Resource Zone. The capacity import and capacity export limits are effectively the electric transmission import and export capability that can be reliably depended upon to transport power between zones. CIL and CEL are updated annually by the LOLE Working Group to capture changes in these capabilities as a result of modifications to the electric system.

Zone 7 has a CIL of 3,785 MW for the 2018/19 planning year, indicating the transmission system itself has the means to move substantial amounts of power into Zone 7. There are no physical transmission line constraints that limit power into Zone 7 until imports exceed the CIL. CILs and CELs for each of the MISO Zones are shown in Figure 11.3.

Figure 11.3: 2018– 2019 capacity import and export limits for MISO local resource zones



Local Clearing Requirement

To ensure adequate supply and reliability, each zone has a local clearing requirement (LCR), or the minimum amount of resources that must be physically located within the zone taking electric transmission import capability into consideration. The LCR is equal to the LRR less the CIL for the zone and less non-pseudo tied exports for the zone. Non-pseudo tied exports are those exports in which MISO maintains dispatch control of the generating resource.

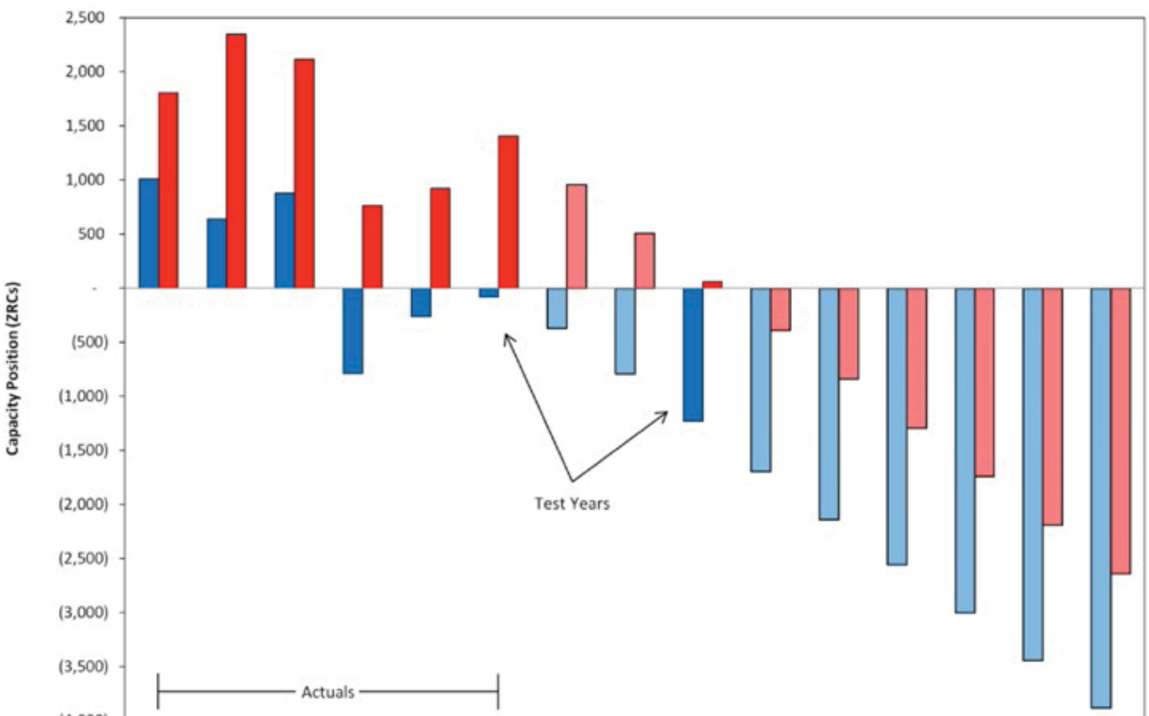
Depending on the outcome of MISO's PRA, using a multi-zone optimization method and zonal deliverability tests, ZRCs included in a FRAP may not be transferable for use in zones other than the zone in which the generator is located. Load-serving entities that submit a FRAP may be subject to a Zonal Deliverability Charge (ZDC) if any ZRCs included in the FRAP are from zones other than the zone in which the load-serving entity's demand is located.

ZONE 7 RESOURCE ADEQUACY

Looking forward, the next major change in the outlook for Zone 7 is the termination of Entergy's Palisades Nuclear Plant beginning in planning year 2021/22. This means the capacity for this resource will not be available in planning year 2021/22; however the plant will continue to operate and deliver energy to the system as it reaches its retirement date. The loss of 780 ZRCs in Zone 7 may result in an increased shortfall from the zone meeting its PRMR for the 2021/22 planning year and the proposed accelerated retirement of Karn 1 and 2 in the 2023 planning year. However, that additional shortfall created will be replaced by the company's plans to expand demand-side management resources, accelerate expansion of the Cross Winds Energy Park, new renewable development for RPS compliance and increased capacity from the modified PPA with TES Filer City.

The historical PRA results for Zone 7 can be seen in Figure 11.4, demonstrating the shift from a capacity surplus to a capacity shortage starting in 2016 planning year.

Figure 11.4: Zone 7 capacity position outlook



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PRMR Position	1,009	640	881	(791)	(264)	(85)	(371)	(792)	(1,233)	(1,696)	(2,137)	(2,557)	(2,999)	(3,440)	(3,882)
LCR Position	1,804	2,346	2,117	764	922	1,408	958	509	59	(391)	(840)	(1,290)	(1,740)	(2,189)	(2,639)

Note: Data is based on LOLE Reports, PRA Actual, and other MISO Sources.

The company's internal analysis suggests Zone 7 will continue to meet its local clearing requirement even after the retirement of the proposed Karn 1 and 2 units in 2023.

If any Local Resource Zone does not meet its LCR in a given planning year, that zone will clear at the Cost Of New Entry (CONE) in the PRA. MISO determines the CONE values for its entire system and for each zone annually and files the calculated values at FERC for approval. Historical CONE values for MISO and Zone 7, as published by MISO, are shown in Table 11.1 below.

Table 11.1: Historical and forecasted CONE values ($/MW-year)

PLANNING YEAR	MISO	LRZ7
2011 — 2012	$95,000	N/A
2012 — 2013	$95,000	N/A
2013 — 2014	$98,000	$99,310
2014 — 2015	$90,750	$90,100
2015 — 2016	$91,290	$90,530
2016 — 2017	$95,110	$94,830
2017 — 2018	$92,750	$94,900
2018 — 2019	$88,480	$90,740

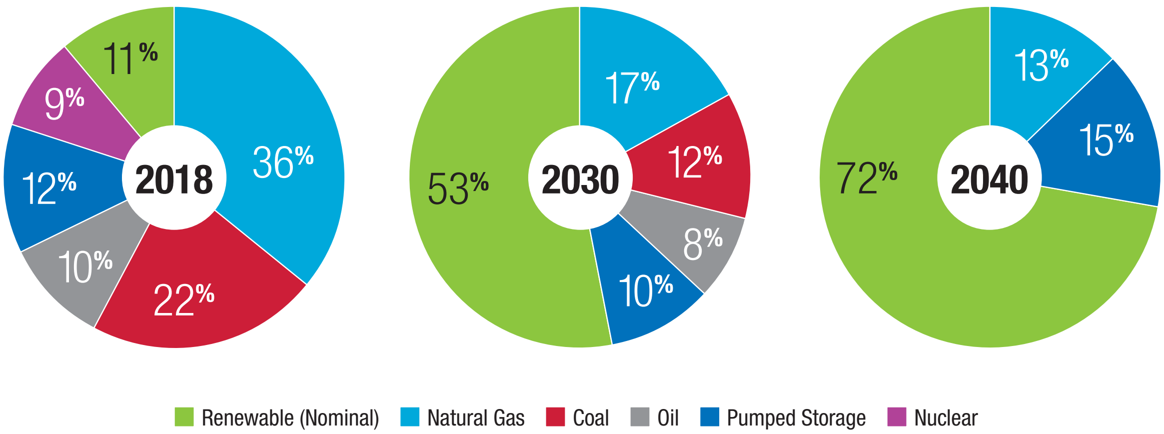
PLANNING RESERVE MARGIN REQUIREMENT

For the 12-month period beginning June 1, 2018, MISO determined an unforced capacity planning reserve margin target for MISO of 8.4 percent (as opposed to an installed capacity, or ICAP, planning reserve margin target of 17.1 percent).

Consumers Energy continues to maintain a diverse and flexible resource portfolio, as shown in Figure 11.5, and as discussed in Section 7 Existing Supply-Side (Generation) Resources. The company's resources include a balanced mix of baseload, intermediate, peaking, intermittent, demand-side and storage resources to reduce energy usage and deliver energy to customers in an affordable, environmentally responsible and reliable manner.

By meeting the required 8.4 percent reserve margin requirement or roughly 606 ZRCs in addition to the company's expected peak load, Consumers Energy will adequately maintain resources to meet full-service customer electricity needs throughout the study period, including during peak load periods. Figure 11.5 shows the capacity breakdown that Consumers Energy will maintain to meet the expected peak load plus reserves in the years 2018, 2030 and 2040. Assumptions on age, capacity factors, licensing and expected retirement or expiring contractual obligations are referenced in Section VIII Existing Supply-Side (Generation) section of this report.

Figure 11.5: Consumers Energy Electric Consumers Energy breakdown of resource supply for 2018, 2030 and 2040



PROJECTED COST AND REVENUES TO COMPLY WITH CAPACITY AND RELIABILITY REQUIREMENTS

The company does not have project costs or revenues to comply with the capacity and reliability requirements. The company does incur transmission expenses and ancillary service revenue by use of the transmission system.

2018 INTEGRATED RESOURCE PLAN

SECTION

12

TRANSMISSION ANALYSIS

SECTION 12

Transmission Analysis

In 2002, the company sold its transmission system to Michigan Electric Transmission Company, LLC (METC). METC is now a wholly-owned subsidiary of ITC Holdings Corporation (ITC). METC subsequently joined Midcontinent Independent System Operator, Inc. (MISO), at which time functional control of the transmission system was turned over to MISO. Subsequently, transmission assets of Wolverine Power Supply Cooperative and Consumers Energy were placed under MISO's functional control. As a result, MISO became the transmission provider responsible for providing transmission service via these transmission systems to the company.

MISO is a multi-state Regional Transmission Organization under the jurisdiction of the Federal Energy Regulatory Commission (FERC). Under a FERC-approved rate schedule, MISO provides regional grid management and open access to the transmission facilities under MISO's functional supervision. This grid management includes the operation and planning of the transmission systems. MISO's Transmission Expansion Plan ("MTEP") proposes transmission solutions to meet transmission needs efficiently, and deliver the lowest-cost energy to customers in the MISO region. MISO engages with stakeholders through a comprehensive planning process to identify essential transmission projects, which are then approved by the MISO Board for inclusion in the MTEP.

Under Module B of the MISO Energy and Operating Reserves Tariff (MISO Tariff) Transmission Service customers may request either point-to-point transmission service (PTP) or Network Integration Transmission service (NITS). PTP service allows load-serving entities to schedule transactions between two points, while NITS is a service that allows load-serving entities to utilize its network resources (as well as other non-designated generation resources) to serve its network load located in the METC pricing zone. MISO evaluates requests for PTP and NITS, and grants service based on available transmission capability. Consumers Energy has contractual service agreements with MISO, and requests transmission service via MISO's Open Access Same-time Information System (OASIS), an internet-based system for information exchange among electric transmission energy market participants. Consumers Energy pays for these transmission services through the appropriate rates and schedules in MISO's Tariff, as approved by the FERC. The company currently has 8,528 MW of yearly (long-term) firm NITS transmission service. The company has no long-term PTP transmission service.

While an IRP may focus on ensuring adequate supply resources are available, it must also address delivering reliable energy to customers. As part of the development of the IRP, proactive engagement with the company's transmission experts, local transmission owners and MISO is an important step in the process to adequately assess the potential for new or upgraded transmission options, and to identify advanced transmission alternatives to supply-side or demand-side resources.

TRANSMISSION OWNER ENGAGEMENT

The company engaged the local transmission owner, METC early on in the planning process. METC is the largest transmission owner in the company's retail service territory. METC is a subsidiary of ITC. Through ITC's joint planning approach, the company was able to gain the perspectives of ITC Transmission (ITCT), which owns the transmission system in the eastern portion of the Lower Peninsula of Michigan. In total, the company and METC had four meetings in the latter part of 2017 and spring 2018.

As a part of the discussions, METC evaluated six scenarios for generation additions and retirements suggested by the company, including potential system improvements or advanced technologies having the ability to increase Michigan's Capacity Import Limit (CIL).

The six scenarios focused on the potential retirement of certain Medium Four units coupled with the addition of a generation replacement option.

Table 12.1: Retirement and generation replacement option of the scenarios

ASSUMED UNIT RETIREMENT(S)	GENERATION REPLACEMENTS EVALUATED
JH Campbell Unit 2	• MISO queue generation • 1,100 MW unit near Thetford • Four 275-MW additions at four sites across lower Michigan
Karn Units 1 and 2	

JH Campbell Unit 1 was not evaluated as a separate retirement option, due to its similarity to JH Campbell 2 for the purposes of this evaluation.

With the retirement and generation replacement option of the scenarios described above, transmission network upgrades are likely required on the Michigan transmission network, to accommodate a changing generation fleet. METC determined the cost of the transmission network upgrades to range between $20 and $40 million, and between $50 and $75 million to accommodate the four 275-MW generation facilities connected to the 138 kV system. These results were compared with the company's assumption in the IRP for transmission network upgrades, and the assumption was found to be in the range of the costs determined by METC.

TRANSMISSION NETWORK UPGRADES

The company assumes a generic transmission network upgrade cost of $54,000 per MW of generation capacity for all generation technologies located in Michigan. The network upgrade cost is based on a survey of 11 recently-executed generator interconnection agreements (GIA) with either METC or ITCT, as reported in the generation interconnection queue on the MISO website[1]. The data was obtained from the executed GIAs posted in the FERC's eDocket[2] system. Network upgrade costs across these eleven GIAs[3] ranged from $1,300 per MW to $179,000 per MW, equating to a weighted average network upgrade cost of $54,000 per MW, consistent with the company's assumption. These costs are inclusive of all transmission owner expenses to accommodate the interconnection of the generation, including rights-of-way, permits and other costs.

1 https://www.misoenergy.org/planning/generator-interconnection/GI_Queue/

2 https://elibrary.ferc.gov/IDMWS/docket_search.asp

3 The eleven GIA's reviewed are contained within FERC dockets: ER14-1709, ER14-2920, ER15-1948, ER15-2387, ER15-2533, ER17-522, ER17-837, ER17-968, ER17-1810, ER17-1833, and ER17-2250.

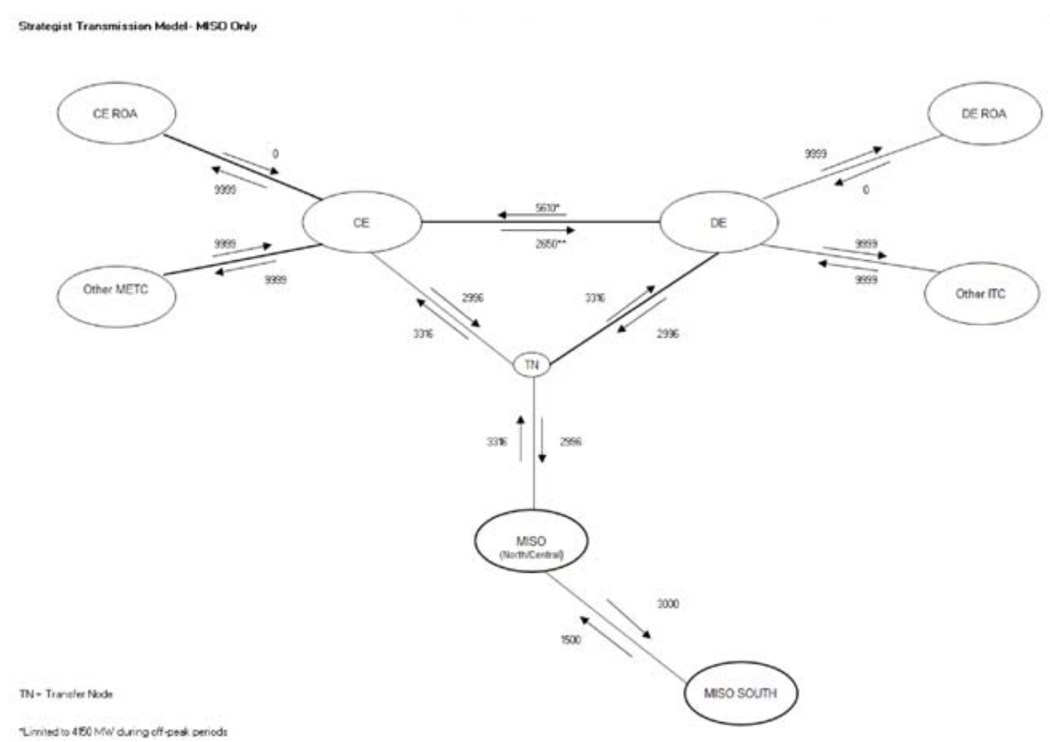
Because network upgrade costs vary by project, the MISO GIA and METC studies provided a range of costs versus a definitive cost. Installed generation capacity (MW), connection voltage and location on the transmission grid are among the variables that influence network upgrade costs. The network upgrade costs for connections to the distribution system would be less costly; thus the incremental and modular approach proposed by the company in the PCA minimizes costs to customers. Definitive network upgrades costs for a specific project are determined through a MISO generator interconnection study for new (or upgraded) generation and/or an Attachment Y study for retiring units.

CAPACITY IMPORT AND EXPORT LIMITS

Import capacity is a measure of the transmission system's ability to transport power from one zone to another. The transmission system provides the path to move remote supply sources into a zone, which is limited by CIL. However, those remote supply sources must exist and be available. Increasing CIL to accommodate remote supply sources could affect reliability. Adding capacity from outside of the zone would potentially leave an unmet local clearing requirement and threaten reliability.

The company used public reports from MISO to include an assumption on CIL and Capacity Export Limit (CEL) for the IRP. MISO analyzed the transmission import and export capabilities for the MISO Local Resource Zone 7 (LRZ7), which is essentially the Lower Peninsula of Michigan. The result of the analysis is contained within the Planning Year 2017-2018 Loss of Load Expectation Study Report (LOLE) on the MISO website. The report provides CIL and CEL data for 2017-2018 planning year and 2021. The company selected the MISO 2021 values, as 2021 was the only year provided within the IRP study years. For 2021, MISO determined the CIL and CEL to be 3,316 MW and 2,996 MW, respectively (See Figure 12.1)

Figure 12.1: Transmission import and export capabilities for the MISO Local Resource Zone 7



CELs represent the maximum amount of power that can be exported to another zone, and becomes an important factor if there is a surplus of local capacity in the zone. The company's proposed course of action does not contemplate constructing a surplus of capacity such that exports in excess of the CEL are needed.

INCREASING CAPACITY IMPORT/EXPORT LIMITS

An increase in the CIL is required if there is a need or desire to import resources in excess of the CIL for LRZ7. When the supply resources are sited within LRZ7, those resources do not use import capacity. The current state of the CIL is based upon the recent MISO Planning Reserve Auction[1] that indicates the LRZ7 imported 320 MW to meet the Planning Reserve Margin Requirement. This is 2,800 MW below the CIL of 3,143 MW. This means there is 2,800 MW of unused import capability. The proposed retirement of Karn 1 and 2, and associated backfill plan that assumes resources are located in the zone, would not negatively impact the CIL.

Because there is an abundance of CIL that is not being utilized — meaning there are no resources planning to fill the available CIL — increasing the CIL would not help to satisfy the company's resource adequacy requirements. Import capacity is not a complete capacity supply option. While the transmission system provides the path to move remote supply sources into a zone, limited by CIL, those remote supply sources do not necessarily exist and do not operate 100 percent reliably.

If the company considers the concept that the grid system does not act as a "copper sheet" in which any resource is deliverable to any load —that energy closer to distribution is subject to fewer constraints and contributes to reliability — increasing CIL to accommodate remote supply sources could affect reliability. Adding capacity from outside of the zone would potentially leave an unmet local clearing requirement (LCR) and threaten reliability.

Through the transmission stakeholder discussions, METC determined an option to increase the CIL for LRZ7 by 1,000 MW through the addition of static var compensators at a cost of approximately $150 million. This capital cost would most likely be included in the rates METC and ITCT charge for transmission service that is then passed on to those utilities customers residing in the zone. If CIL increases are not needed to provide the necessary supply for LRZ7, transmission system investment costs to increase CIL would derive no benefits to ratepayers, but would increase customer rates.

The company's proposed course of action does not require import capacity at or near the CIL. Therefore, the option to increase CIL is not a viable transmission alternative benefiting customers.

TRANSMISSION ALTERNATIVES

Transmission alternatives having the ability to offset supply-side or demand-side resources modeled in the IRP include upgrades that reduce line losses and increase system efficiency. The cost to achieve these performance levels, however, often outweighs the benefits.

1 MISO PRA Results: https://cdn.misoenergy.org/2018-19%20PRA%20Results173180.pdf, p. 10.

For example, a 138 kV transmission line roughly 20 miles in length, utilizing 266 Aluminum Conductor Steel-Reinforced (ACSR), and loaded to 80 percent of its capacity, would incur approximately 6.2 MW of losses. A rebuild of this line to use larger, 954 ACSR conductor, would lower losses to 1.9 MW; however at a cost of approximately $34 million[1], equating to a cost of approximately $8 million per MW of loss savings. This is a less economic alternative than adding economic supply resources and associated network upgrades.

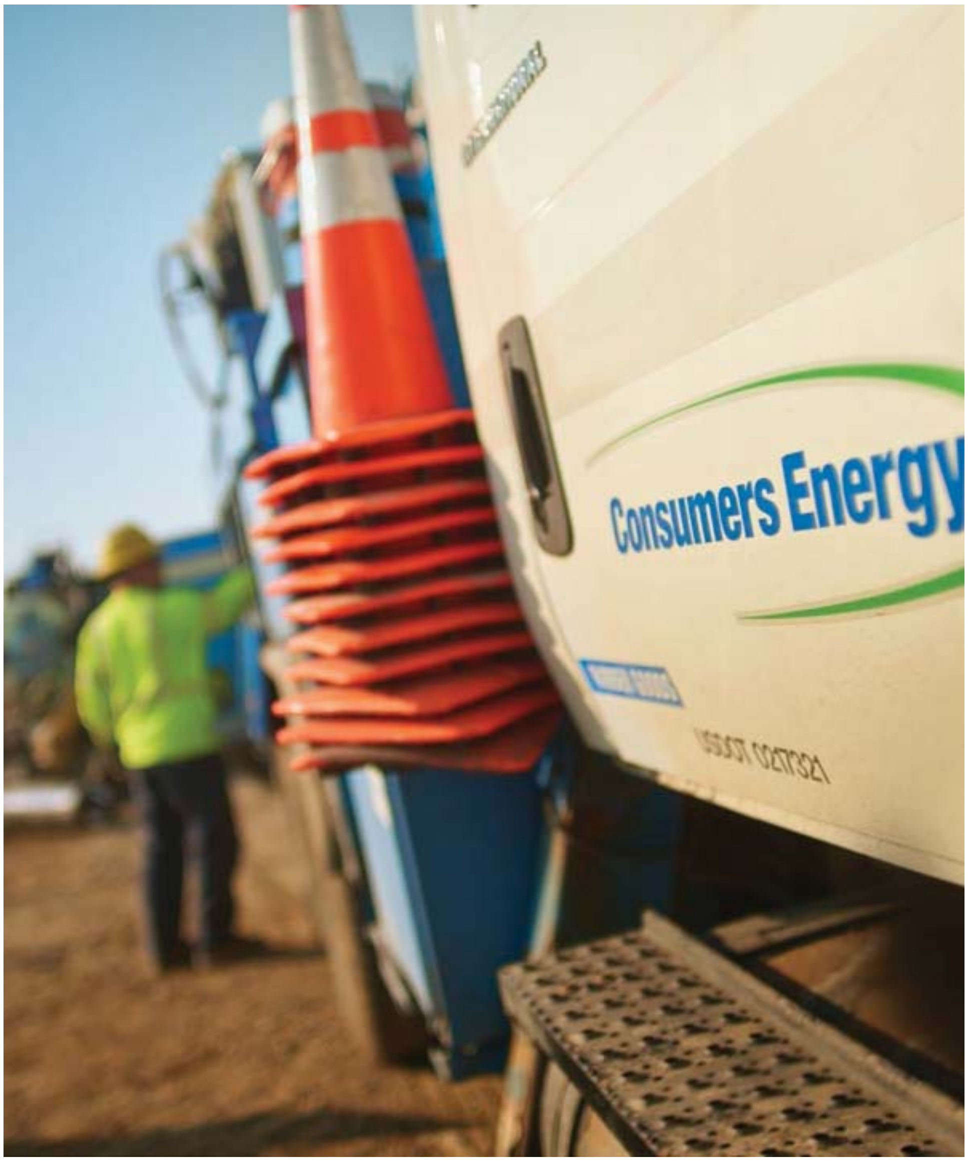
Outside of reducing line losses and increasing system efficiency on the transmission system, both the company and METC indicated limited knowledge of potential transmission advanced technology that could be used as a transmission alternative.

While transmission alternatives may be limited and uneconomic, advanced distribution technologies are cost-effective and reasonable alternatives to supply-side resources. As described in the company's Electric Distribution Infrastructure Investment Plan ("EDIIP") non-wire alternatives such as demand response programs, volt/var optimization and energy efficiency are supply resources having the ability to:

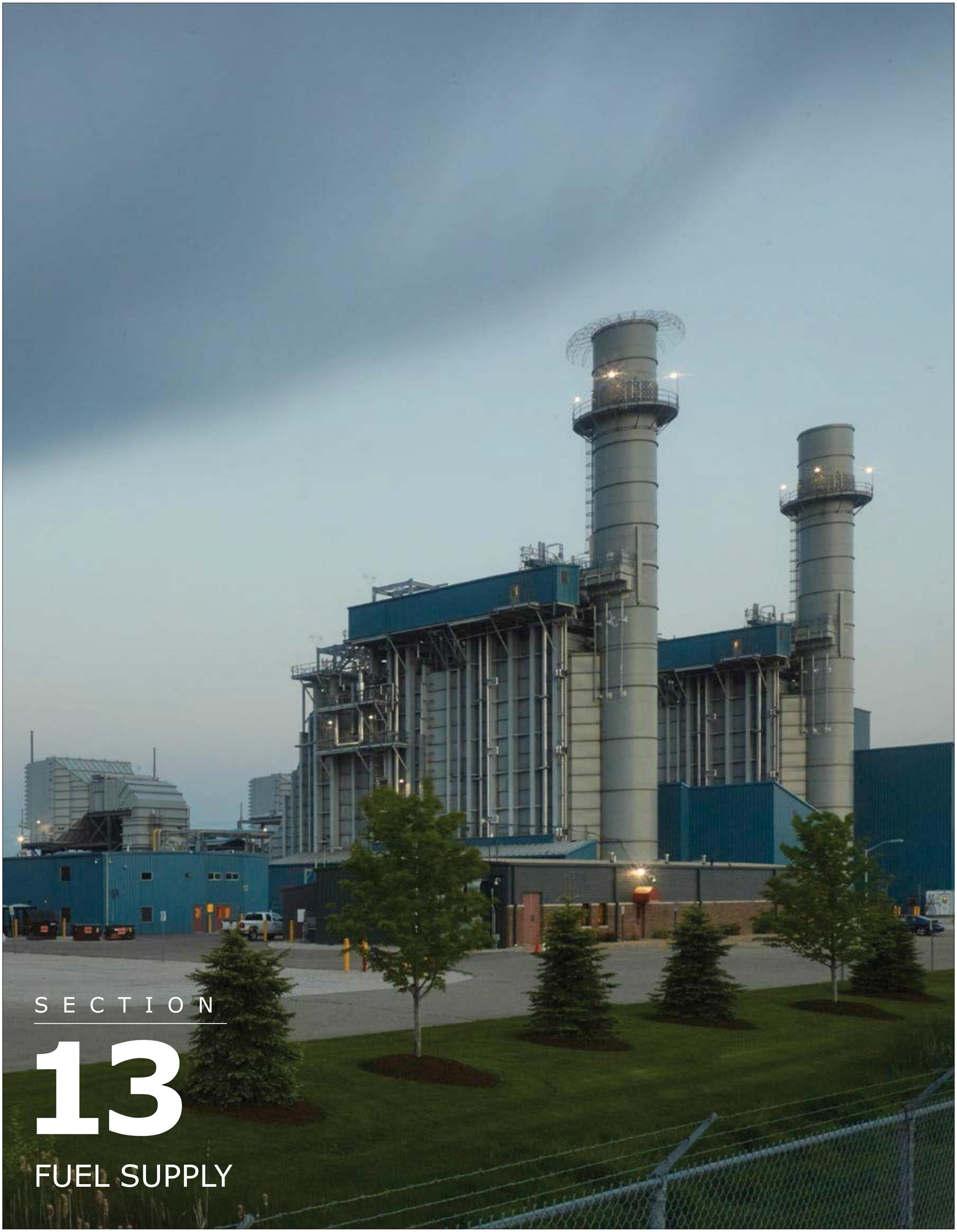
- Promote lower carbon emissions.
- Increase sustainability.
- Create customer savings by way of an advance and modernized grid system.

Further discussion related to the non-wire alternatives are discussed in further detail in Section VIII Demand-Side Resources.

1 Reference costs for METC's Batavia-Barnum Creek Jct rebuild, MTEP#11884: https://cdn.misoenergy.org/20170830%20ESPM%20Item%2005b%20MTEP17%20Projects%20METC124103.pdf, page 24.


Consumers Energy
USDOT 0217321

2018 INTEGRATED RESOURCE PLAN



SECTION

13

FUEL SUPPLY

SECTION 13

Fuel Supply

Consumers Energy's fuel forecast process establishes the basis for its fuel procurement process. Forecasted delivered costs for various fuel types are utilized to determine the company's generation units' most economical fuel blending and dispatch strategies in the MISO energy market. The forecasted delivered costs are determined by using existing contract prices and transportation rates, forecasted forward market prices and forecasted transportation rates.

COAL

Consumers Energy's coal fueled power plants were originally designed to burn Central Appalachia (CAPP) bituminous coal (eastern). In 1988, the company began burning Powder River Basin (PRB) sub-bituminous (western) coal to take advantage of more favorable emissions and pricing compared to CAPP bituminous coal. To date the company burns nearly all western coal for the existing coal-fired generating units.

Forecast Methodology

Near-term (up to two years) forecasted market coal prices are based upon actual market activity, while mid- and long-term coal costs are derived by averaging four long-term forecasts (five to eight years), and linear blending between the short-term and long-term forecasts to develop a mid-term period (three to five years). The four long-term mine mouth price forecasts utilized are IHS, Energy Information Administration – Annual Energy Outlook (EIA or EIA AEO, public source), Energy Venture Analysis, Inc. (EVA), and JD Energy. The forecasted coal transportation rates are computed by applying adjustments to current contract prices using forecasted rail cost adjustment factors based on historical data, along with fuel surcharges based on diesel oil forward pricing.

Procurement Strategy

Consumers Energy manages price and supply risk for its coal fired generation fleet by managing a portfolio of multi-year, annual, quarterly and sometimes monthly coal purchase contracts. This strategy provides for security of supply by purchasing most of the company's coal requirements well in advance of the anticipated burn under multi-year and annual agreements while leaving the remaining coal requirements to be purchased on a spot basis. The shorter term spot purchases provide the company with the ability to adjust to overall requirements as generating unit coal blends and operations change throughout the year, as well as provide the flexibility to take advantage of favorable energy market conditions.

Deliveries

The company's existing coal facilities are situated to receive coal shipments either by rail or vessel or both. The Campbell Generating Complex receives coal shipments by rail only, while the Karn Generating Complex receives shipments by both rail and vessel. The company manages coal transportation contracts with various carriers of bulk commodities to provide the necessary coal supply.

Coal transportation costs (rail and vessel, including railcar costs) were projected specific to each existing Consumers Energy coal fueled generating plant. These transportation costs are added to the mine mouth composite price forecasts to produce delivered coal price forecasts for each existing Consumers Energy coal fueled generating plants. The transportation costs were developed using existing Consumers Energy transportation contract pricing and expected pricing in the near term. The near-term transportation costs were escalated at the quarterly trend of the All Inclusive Index – Less Fuel (AII-LF) and a monthly mileage based fuel surcharge was added to achieve long-term transportation costs through the Planning Period. The AII-LF is a rail industry price index that measures changes in the price level of inputs to railroad operations without the influence of fuel costs. The AII-LF is published quarterly by the American Association of Railroads (AAR) and approved by the Surface Transportation Board (STB).

Trends

In addition to the company's successful rate challenge at the STB, which is reducing the cost of transporting coal to the Campbell Generating Complex and for customers, there is an industrywide trend to reduce coal transportation costs, which have yet to be fully realized. Railroad companies are considering discounts to help stave off decline in coal demand as utilities continue to look to other lesser or non-carbon emitting resources. The company will continue to ensure fair rates for our customers.

Proposed Retirement of Karn 1 and 2 in 2023

The company's procurement strategy of securing coal in various timeframes before the fuel source is needed minimizes price risk, exposure to price volatility of the fuel in the market and supply risk to its customers. The coal purchases are typically made to achieve:

- Approximately 70 percent to 90 percent of the anticipated total volume secured by the fall of each year for the following calendar year.
- Approximately 40 percent to 50 percent secured for the second calendar year.
- Approximately 20 percent to 25 percent secured for the third calendar year.

Based upon the above fuel procurement levels, the company is well positioned to adjust the fuel supply obligations for an accelerated retirement of Karn 1 and 2 in the year 2023.

NATURAL GAS

The company owns and operates natural gas-fired units at Zeeland Generating Station, Jackson Generating Station (Jackson Station), the Karn Generating Complex for the Peaker units 3 and 4, and the Gaylord and Straits Combustion Turbines. These units are supplied natural gas pursuant to gas management services agreements or natural gas utility distribution systems by way of bundled tariffs.

Forecast Methodology

Similar to the approach to the development of the coal and oil price forecasts, Consumers Energy utilizes three long-term and one short-term natural gas price forecast to develop a composite Henry Hub natural gas price forecast for the IRP study period.

Table 13.1: Natural gas forecast methodology

TIME PERIOD OF FORECAST	METHOD AND SOURCES
Short-Term [2017-2022]	Monthly averaging
Long-Term [2023-2040]	An averaging of three third party forecasts IHS Markit (IHS), EIA and EVA

The resulting company natural gas price forecast is a composite of the short-term and long-term forecasts described above.

The company uses this type of forecasting to reflect the most reasonable and accurate fuel forecasts in its studies. Creating a composite fuel price forecast takes into account the expertise and opinions of different well known industry forecast sources as well as the market forwards reflective of actual transactions to minimize inaccuracies in the forecast. An averaging of each industry expert's fuel forecasts is done to give the same weighting in determining the overall composite fuel price forecasts. Using multiple forecasts in this manner reduces the risk of any one forecasting entity being significantly less accurate. In addition, using this approach introduces the analysis of several different, reputable, and independent expert viewpoints into the forecast.

PROCUREMENT STRATEGY AND DELIVERIES

Zeeland Generating Station

Natural gas is supplied to the Zeeland Generating Station from the ANR Pipeline gas transmission system via a 7.5 mile lateral owned by SEMCO Energy Gas Company (SEMCO). The company currently utilizes an agent, pursuant to a gas management services agreement, whose contractual obligation is to procure and deliver gas when needed on a firm basis to the SEMCO interconnection. The company also has a transportation services contract in place with SEMCO that provides for firm transportation from the ANR pipeline interconnection to the Zeeland Plant. The company included the costs of its current contracts with its gas management services agent and SEMCO with appropriate escalations to advance those agreements beyond the time they are set to expire, and to the time they are set to cease operation in the IRP. Firm or secondary firm gas transportation is a requirement of the gas management services agent the company utilizes to provide gas to the SEMCO interconnection point with the ANR pipeline.

Jackson Generating Station

The Jackson Generating Station receives it natural gas supply from the Vector pipeline system through a lateral pipeline owned by the Consumers Energy natural gas utility. Similar to the Zeeland Plant gas management services agreement, the company utilizes a third party agent to manage the gas supply for this facility. The company included the costs of its current contracts with its gas management services agent and the Consumers Energy natural gas utility with appropriate escalations to advance those agreements beyond the time they are set to expire, and to the time they are set to cease operation in the IRP. Firm or secondary firm gas transportation is a requirement of the gas management services agent the company utilizes to provide gas to the Consumers Energy interconnection point with the ANR Vector pipeline.

Karn 3 and 4 Peaker Units

For the Karn 3 and 4 Peaker units, the company has two natural gas sources - one from Consumers Energy's natural gas distribution system and one from DTE Gas northern Michigan gathering system through the DCP Bay Area Pipeline. Natural gas for Karn 3 and 4 is purchased on a spot basis due to the facility operating during times of peak demand in the summer months. The company included the costs of its current contracts with its gas management services agent, the Consumers Energy natural gas utility, DTE Gas, ANR Pipeline and DCP Midstream, with appropriate escalations to advance those agreements beyond the time they are set to expire, and to the point they are set to cease operation in the IRP. A combination of firm and interruptible transport is provided for in these agreements.

Other CE Peaker Units

Consumers Energy operates several peaking generating units fueled by either natural gas or oil. Natural gas consumed by the Gaylord and Straits combustion turbines is supplied by the Consumers Energy natural gas utility or the DTE Gas distribution systems via MPSC approved bundled tariffs (Consumers Energy Rate GS-3 and DTE Gas Rate GS-2).

Assumptions for New Gas Plants

For any new gas plant, the company assumed it would be connected to the company's gas transmission system with the same firm gas transportation structure that would have existed for the proposed Thetford Plant in 2013. It is anticipated a new gas plant, either combustion turbine or gas combined cycle, would be serviced under the Consumers Energy Gas Transportation Service Rate XLT, negotiated for high volume.

PROPOSED RETIREMENT OF KARN 1 AND 2 IN 2023

With the proposed retirement of Karn 1 and 2 in 2023, the forecasts, procurement strategy and deliveries of natural gas to continue operating Karn 3 and 4 does not change. While the Karn 1 and 2 and Karn 3 and 4 units do share some equipment, the natural gas deliveries to the units is not impacted by the proposal to retire Karn 1 and 2 in 2023.

Oil

The company operates a subset of its generating resources with fuel oil, which includes the Campbell combustion turbine fueled by oil, and the two peaking units, Karn 3 and 4, are fueled by natural gas or oil or a blend of the two fuels. The Karn 3 and 4 units were originally designed to burn 100 percent fuel oil; however, with enactment of air quality environmental regulations these units operate together on a blend of oil and natural gas. As a result, the company can better manage air emissions per environmental laws and regulations.

Forecast Methodology

Similar to the approach to the development of the natural gas price forecast, Consumers Energy utilizes three long-term and one short-term crude oil price forecast to develop a composite crude oil price forecast for the IRP study period.

Table 13.2: Oil forecast methodology

TIME PERIOD OF FORECAST	METHOD AND SOURCES
Short-Term [2017-2022]	Monthly averaging for each respective year using NYMEX future prices
Mid-Term [2023-2024]	Linear blending between the short-term and the long-term
Long-Term [2025-2040]	An averaging of three third party forecasts IHS, EIA (public) and EVA

The resulting company annual crude oil price forecast is a composite of the short-term, mid-term, and long-term forecasts described above.

Procurement Strategy and Deliveries

The ability of Karn 3 and 4 to be fueled by natural gas or oil or a blend of the two provides the ability to operationally hedge the price of either fuel against the other. For the fuel oil portion, the company maintains on-site storage tanks to manage the oil inventory. As oil is burned this inventory is replenished from the spot market when market prices are favorable. Deliveries are by tanker truck to the Karn Generating Complex.

Oil burned by the Campbell combustion turbine is purchased on a spot basis to replenish oil consumed from inventory.

SCENARIOS AND SENSITIVITIES

The fuel forecasts developed and assumed for the scenarios and sensitivities analyzed in this IRP are described for the Consumers Energy scenarios and the MIRPP scenarios. The changing forecast between scenarios is related to the natural gas price forecast where the company assumed its utility specific natural gas price forecast versus the EIA-AEO forecast required in the MIRPP scenarios.

Table 13.3: Fuel forecast used in scenarios

FUEL FORECAST	MIRPP Scenarios			Consumers Energy Scenarios		
	BAU	ET	EP	BAU	ET	EP
Consumers Energy Coal Prices Forecast	X	X	X	X	X	X
Consumers Energy Oil Prices Forecast	X	X	X	X	X	X
CE Natural Gas Prices				X	X	X
2017 EIA AEO Natural Gas Prices	X	X	X			
200 Percent of 2017 EIA AEO Natural Gas Prices	X	X	X			

Note: "X" Indicates where the forecast was used.

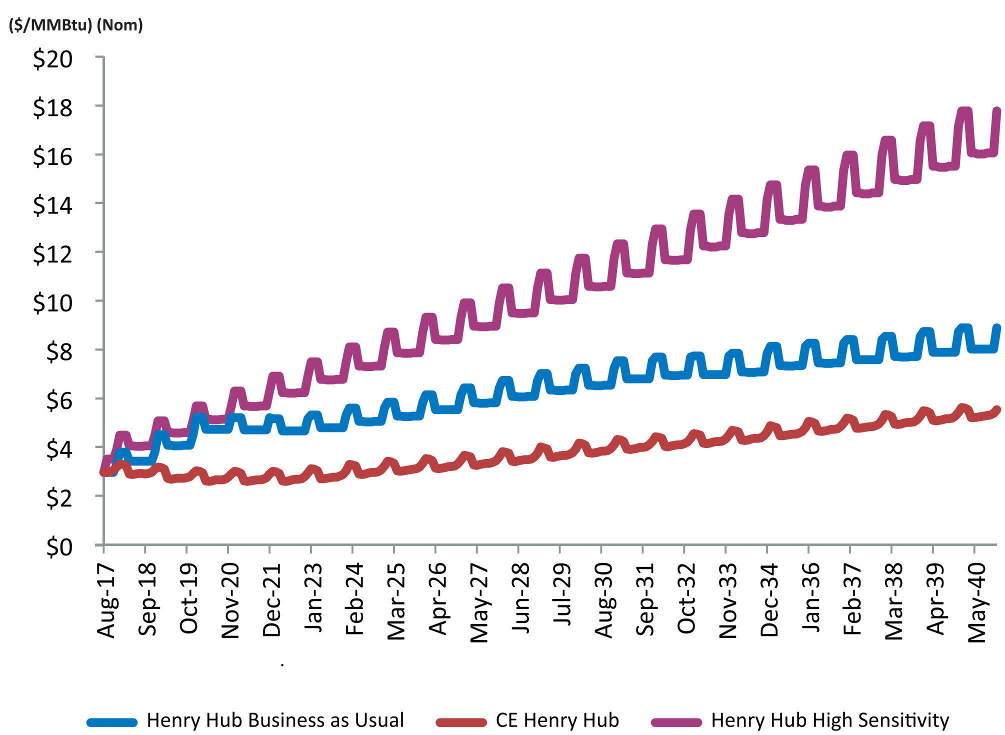
NATURAL GAS PRICE FORECAST FOR CONSUMERS ENERGY SCENARIOS

The BAU outlook for the Consumers Energy scenarios used a 2017 forecast based upon the methodology described above. The sources of forecasts are reflective of that third party's 2017 forecast. The short-term Henry Hub forecast was adjusted to reflect "seasonality" to allow the Strategist® model to better predict the utilization of the generating units using natural gas as a fuel source. This "seasonality" is based on the actual differences in gas prices to be above or below the annual average for the winter period, the spring and fall periods, and the summer period. This BAU outlook was used as the reference assumption in all Consumers Energy scenarios as described in Section VI Integrated Resource Planning Scenarios and Sensitivities section.

Natural Gas Price Forecast for MIRPP Scenarios

The BAU outlook for the MIRPP scenarios used a 2017 EIA AEO natural gas price forecast based upon the methodology described above. The short-term Henry Hub forecast was adjusted to reflect "seasonality" as described for the Consumers Energy scenarios. This BAU outlook was used as the reference assumption in the MIRPP scenarios as described in Section VI Integrated Resource Planning Scenarios and Sensitivities section. Figure 13.1 shows a comparison between the different natural gas price forecasts.

Figure 13.1: Comparison of natural gas price projections



High Natural Gas Prices Sensitivity in MIRPP Scenarios

This sensitivity was analyzed in the three MIRPP scenarios using the EIA AEO natural gas price forecast as required by the MPSC. This sensitivity increases the natural gas price projection to at least 200 percent of the BAU natural gas price projection by the end of the study period.

The development of the forecast uses the BAU and applies a 200 percent sensitivity curve calculated with the delta between a 200 percent end of year 2040 BAU forecast value minus the September 2017 BAU forecast value that is then divided by the years in the IRP study period. The forecast includes a seasonality adjustment for the purposes described in early parts of this section.

Varying Natural Gas Price Sensitivities for Retirement Analysis

A range of natural gas price sensitivities on the BAU of the Consumers Energy scenarios was used to evaluate the level of risk customers were exposed to in terms of the potential cost for continuing to operate or prematurely retire the Medium 4 coal units. The Consumers Energy BAU natural gas price forecast was varied at -25, 0, 25, 50, 75, and 100 percent to understand the level of this risk. The method and results of the risk analysis is further described in Section V Analytical Approach.

2018 INTEGRATED RESOURCE PLAN

SECTION

14

RESOURCE SCREEN

SECTION 14

Resource Screen

The company currently supplies the needs of its customers through a mix of owned resources, power purchase agreements and short-term market purchases. By comparing load and energy demand forecasts to this diverse portfolio of existing options, the company can identify when energy and capacity shortfalls are predicted to occur. Once a capacity shortfall is forecasted, a resource screen is created to evaluate the types of new resources to best serve future customer energy and demand needs.

A resource screen helps to maximize the effectiveness of the modeling effort by evaluating a variety of available generation technologies and identifying the most economic resources able to compete with each other to fill energy and capacity needs. All resource types modeled are assumed to be a utility build. However, this does not preclude the utility from procuring an existing asset or entering into a power purchase agreement.

The appro ach to resource screening undertaken by the company can be defined by three primary steps.

- First, the technology costs and operating assumptions of existing generation resources are entered as baseline resources.
- Next, additional generation resources that are already incorporated into company planning objectives are incorporated, by including their operating assumptions and planned costs into the baseline generation portfolio defined within the study period.
- Finally, an extensive list of potential technology options is evaluated for inclusion in the company's future supply side generation resource portfolio. The evaluation is based on a technical screening, an economic analysis using a levelized cost of energy (LCOE) evaluation, as well as other criteria.

The remainder of this section details the review of existing, planned and potential resource additions during the IRP planning period, as well as a description of the screening process used to determine which resources would be included in the Strategist® model.

EXISTING GENERATION

Existing company generation resources include coal, natural gas, oil, hydroelectric, solar, energy storage, wind and demand-side management programs. In addition, the company purchases energy and capacity through long-term power purchase agreements, and has the ability to rely on the market for short-term energy and capacity purchases. A summary of the existing generation from these sources is described below

Table 14.1: Existing generation resources and capacity

Existing Generation Resources (as of 2018)	**Generating Capacity** (MW)
Coal	1,902
Gas/Oil Fired	2,646
Hydroelectric	84
Wind	256
Solar	4
Energy Storage (Ludington Pumped Storage)	1,097*
Power Purchase Agreements	2,891**
Demand Response	302 (summer)
Energy Waste Reduction	1.5 percent Energy Savings
Market Purchases (2018)	3,316 MW***

* The company owns 51 percent of facility, with DTE Energy owning the remaining 49 percent. MW capacity shown reflects the Company's share of ownership.

** The company has 55 long-term PPAs in place at the beginning of 2018 representing 2,947 MW of contract capacity with independent power producers for the purchase of energy, capacity, and/or RECs.

***Assumed maximum net import limit ("tie-line limit")for modeling purposes

PLANNED GENERATION

The company's renewable energy plan is designed to achieve the RPS requirement of 12.5 percent by 2019, 15 percent by 2021 and to support the goal of meeting 35 percent of the state's electric needs through a combination of energy waste reduction and renewable energy. To be compliant with and maintain the 15 percent by 2021 and beyond, the company modeled 550 MW of new wind resources commencing commercial operation in 2020, in order to take advantage of available production tax credits.

The company plans to increase the levels of its existing DR programs to 687 MW by the year 2023.

The TES Filer City PPA amendment converted their existing facility to a natural gas-fired plant, which will provide an additional 150 MW of capacity. This amendment was approved by the MPSC and is awaiting FERC approval of a waiver to amend the contract because the facility is a CMS affiliate.

POTENTIAL NEW RESOURCE ADDITIONS

As part of its planning process, the company considered a wide range of supply- and demand-side resources. Internal subject matter experts provided information collected from third-party vendors and available market data to summarize cost and performance parameters of these potential technology alternatives.

Potential new resource technologies and their operating assumptions were defined as potential sources of generation to meet future energy needs. The Strategist® model used for identifying and optimizing resource options, however, has an extremely large volume of calculations made as it solves for all solutions to satisfy the model's constraints. Because of this, it was not feasible or practicable to include every possible resource in every scenario and sensitivity optimization. Therefore, some resources were "screened out" before the scenarios and sensitivities were modeled.

Technologies that were screened out are as follows:

THERMAL STORAGE

An initial technical screening indicated thermal storage was a higher cost application than other options associated with energy storage. Therefore, an alternate energy storage system was selected, as described below.

COMPRESSED AIR

An initial technical screening indicated compressed air technology did not demonstrate enough technological advancement to be applied at a utility scale level. Therefore, an alternate energy storage system was selected, as described below.

FLYWHEEL

An initial technical screening indicated flywheel technologies were a higher cost application than other options associated with energy storage. Therefore, an alternate energy storage system was selected, as described below.

COMBINED HEAT AND POWER

The company has an existing program to collaborate with Michigan businesses that may benefit from a combined heat and power (CHP) resource. Based upon company subject matter expert feedback, the current and future economics and growth of CHPs does not reflect a feasible alternative to consider as an alternate resource. The need for a steady steam supply tied to site-specific requirements makes this type of facility less viable then other resources. Therefore, this resource was not included as a potential resource within an LCOE screening or as a resource alternative.

FUEL CELLS

Initial technical screening indicated fuel cells were a higher cost application than other options associated with energy storage. Therefore, an alternate energy storage system was selected, as described below.

GEOTHERMAL

An initial technical screening indicated geothermal storage did not demonstrate enough technological advancement to be applied at a utility scale level. Therefore, an alternate energy storage system was selected, as described below.

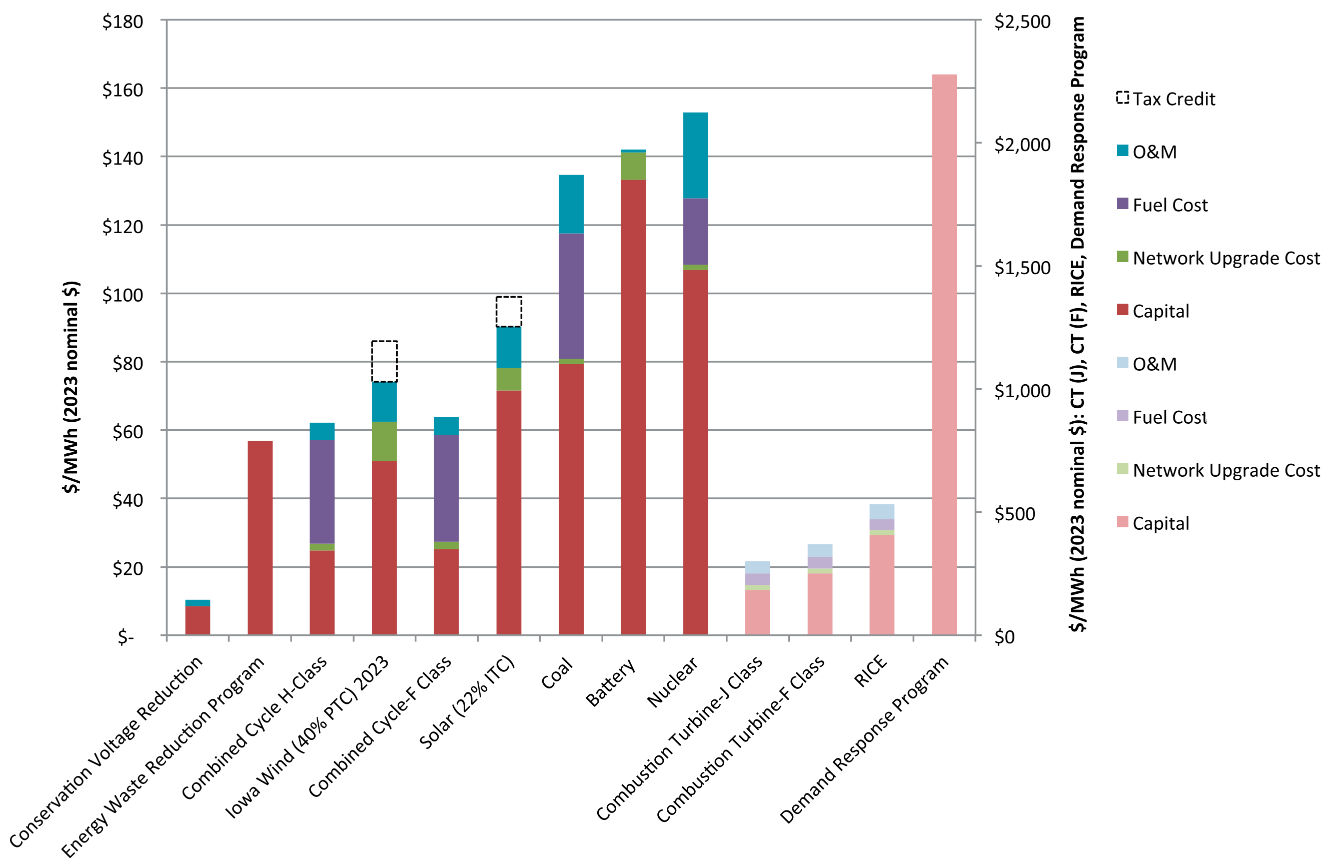
DISTRIBUTED GENERATION

The company continues to benchmark with other utilities and industry groups to learn best practices and trends for distributed generation resources. However, at this point, the company does not anticipate the growth of these resources requires addition of a formal program or option. Therefore, this resource was not included as a potential resource within an LCOE screening or as a resource alternative. The company's existing distributed generation programs are discussed later in this section. We believe solar and battery technology can be deployed in an incremental and modular fashion.

LEVELIZED COST OF ENERGY SCREENING

A preliminary economic analysis of the remaining technologies not screened out in the aforementioned step was performed using a levelized cost of energy comparison between similar technologies. LCOE is calculated by using a technology's input assumptions to forecast the annual costs to operate that technology over its useful life, dividing by the forecasted generation of the unit, and then levelizing the result. The levelizing function

Figure 14.1: Levelized cost of energy of various technologies ($/MWh)



allows the company to take a varying stream of numbers and reduce them to one value, representing the entire period. Usually costs increase over time; levelization takes these increasing values, discounts them, and expresses the result as one number, usually in the current year dollars.

For the company's IRP, the identified $/MWh value was inputted for each technology option for capital, fuel, operation and maintenance, and network upgrade costs. In addition, any associated tax credits available for select technologies were included in the calculation.

The results of this LCOE analysis allow the company to compare the costs of different technology options against each other. The details of the LCOE analysis can be found in the testimony and exhibit of company witness Sara Walz.

Several additional technologies were screened out after completing the LCOE analysis. Specifically, the company eliminated coal, nuclear and F-class combustion turbines from being options in the final base resource plan. This was due to both their LCOE as well as the results of the initial technical screen that had been performed on all potential resource options. Additional components to the LCOE that resulted in coal, nuclear and CT F-class being eliminated, even though they were not the highest cost resources, included:

COAL

- Intensive capital costs and long time periods required for construction do not make this an attractive resource option for future generation builds.
- Construction of a new coal plant did not align with the company's clean and lean objective.

NUCLEAR

- Intensive capital costs and long time periods required for construction do not make this an attractive resource option for future generation builds.

COMBUSTION TURBINE F-CLASS

- This resource had the highest LCOE with the exception of RICE, and does not offer the same flexibility benefits of the RICE CT (smaller footprint, higher efficiency, and fast start times). Therefore RICE was chosen over F-Class CT for the chosen resource plan.

With the completion of the initial screening and the LCOE economic analysis, the company identified the following technologies as options for Strategist® to select from:

NATURAL GAS COMBINED CYCLE (NGCC)

Two classes of gas-fueled combined cycle resources were considered: the F-class and the H-class. The H-class units are considered newer and more advanced technology than the F-class. Both types were evaluated as "2x1" units, meaning new build generation for each class would involve the construction of two combustion turbines and one steam turbine.

The F-class 2x1 has a nominal output of 780 MW, and the H-class 2x1 has a nominal output of 1185 MW, including duct burner firing options. Supplemental duct burner firing options were made available for both the F-class and H-class 2x1 units. Duct firing for an F-class 2x1 has a nominal output of 81 MW, and the H-class duct burner firing has a nominal output of 123 MW.

The details of technology costs and operating parameters for combined cycle units in all scenarios can be found in the testimonies and exhibits of company witnesses Sara Walz and Scott Thomas.

COMBUSTION TURBINE (CT)

Simple cycle combustion turbines are often used for peaking power needs. These units have higher heat rates than combined cycle units; however, operational flexibility of combustion turbines is much greater than combined cycle plants.

Two classes of combustion turbine resources were considered: a 1x0 J-class and a reciprocating internal combustion engine (RICE) class. The 1x0 designation for the J-class turbine unit signifies that it would involve the construction of one combustion turbine and zero steam turbines. The J-class 1x0 has a nominal output of 397 MW. The RICE combustion turbine was evaluated as a three-engine configuration. The benefits of the RICE include a smaller footprint, higher efficiency and fast start times. Because RICE is a modular technology, it is costlier on larger scales than the J-class combustion turbine described above. The nominal output for a RICE combustion turbine is 221 MW.

The details of technology costs and operating parameters for combustion turbines in all scenarios can be found in the testimonies and exhibits of company witnesses Sara Walz and Scott Thomas.

UTILITY SCALE WIND OPTIONS

The company evaluated wind options for future builds. Utility scale wind was modeled as builds beginning in years 2021, 2022, 2023 and 2024+ to reflect the impacts of PTC. For the purposes of the IRP, wind was evaluated as a potential new resource beginning in 2023. The reason wind was not considered as a potential new build resource prior to 2023 was primarily due to the time required to acquire land and contracts, construct the wind farm, and bring the turbines online that would be in addition to the planned wind build requested through the Renewable Energy Plan by end of year 2020 to meet renewable compliance requirements.

In order to offer wind as a cost-effective and feasible option, Michigan-built wind was not included as a resource option. Michigan continues to approach saturation with regards to wind unit construction, with contributing factors being potential construction moratoriums in certain parts of the state, as well as decreased available capacity factors for wind construction in those parts of the state with suitable land remaining for construction. Therefore, wind units offered in the company's IRP represent wind built in the MISO West region, using Iowa as a proxy location. However, if a viable Michigan wind build was available at a similar performance and economic level for customers, the company could pursue this option. Our plan is to continue to move forward with the 550 MW of Michigan wind as proposed in the PCA.

The operating parameters used for wind as a new generation resource can be found in company witness Sara Walz' testimony and exhibit. Technology costs used for wind are based upon IHS Markit.

SOLAR

Pricing of solar continues to fall, and current and continuing Investment Tax Credits (ITC) contributes to this option as an attractive resource for future energy needs. The company evaluated in-state, fixed tilt, solar options as potentials for future new technology builds. This utility scale solar was modeled as builds beginning in years 2021, 2022, 2023 and 2024+ to reflect the impacts of ITC. The capacity factors and Effective Load Carrying Capability (ELCC) for the fixed tilt solar option was forecasted to be 19.9 percent and 50 percent, respectively. Comparing the capacity and ELCC with tracking systems, it was identified that these assumptions are in or near these more advance technologies. Because of this, one can assume that if the model selected a solar unit there is flexibility in determining whether it is fixed tilt or another solar technology with similar operating parameters and costs.

Factors the company considers as it continues to evaluate solar additions to its supply portfolio include new technologies such as tracking systems to maximize sun exposure, opportunities for larger arrays to capitalize on economies of scale, as well as available land within Michigan that is suitable for solar development.

The operating parameters used for solar as a new generation resource can be found in company witness Sara Walz' testimony and exhibit. Technology costs used for solar are based upon IHS Markit data.

ENERGY STORAGE

Energy storage systems (ESS) such as batteries have multiple applications. They have the ability to provide both generation and distribution applications to an electric power grid. The company has identified that with increasing understanding of energy storage technology capabilities, as well as decreasing technology costs, energy storage in the form of batteries is a new technology option that should have its place as a potential resource for future energy needs.

Potential applications of integration of storage technology with other resource options include:

Ancillary Services: Batteries provide assistance in maintaining grid performance by providing frequency regulation.

Capacity: Battery technology can be used as a resource to shave peak load, which allows batteries to be used as a capacity resource.

Price Arbitrage: Batteries/energy storage systems can store energy produced during low pricing periods and sell that energy during periods of higher demand, and therefore higher prices. This is the current operating model of the Ludington Pumped Storage plant in the company's existing generation portfolio. In the same context, ESS can also increase the value of renewable energy systems by storing and shifting renewable energy output to times of greater system need or to avoid curtailment (i.e., firming renewable energy capacity).

Investment Deferral: Energy storage systems can potentially defer investments in additional generation and distribution assets through its use as a resource to shave peak load.

Emergency Backup: Energy storage system such as batteries can supply energy during planned or unplanned outage situations.

For the purposes of resource screening, the company focused on generation application of energy storage technology. Lithium-ion batteries were shown to satisfy the desired attributes the best, with a large block size of 100 MW and dispatch duration of four hours. Therefore, the lithium-ion battery was chosen as the energy storage system to be modeled in the IRP.

The operating parameters and costs used for batteries as a new resource can be found in company witness Sara Walz' testimony and exhibit. Operating parameters and costs for solar are listed by scenario due to the reduced cost assumptions in certain scenarios in the IRP.

DISTRIBUTED GENERATION

Distributed energy resources (DER) underwent an initial technical screening within the IRP process, as the growth of these resources could potentially delay infrastructure upgrades driven by capacity needs, and therefore need to be evaluated for their potential impact within the IRP study period. Factors that were considered during the initial technical screening included appropriate control equipment to isolate or curtail power flow to ensure grid optimization, contractual and rate agreements with customers, and components of customer programs such as net metering and the company's solar distributed generation pilot. The increased energy waste reduction sensitivity evaluated in the MIRPP scenarios gives some insights into the impacts of load reduction to the utility. The result of these load reductions is less investment in supply- and demand-side resources. The incremental and modular approach the PCA offers helps to mitigate our customers risk if these potential load reductions occur.

Table 14.2: Net metering program categories

	CATEGORY 1	CATEGORY 2	CATEGORY 3
System Size	≤ 20 kW	> 20 to ≤150 kW	> 150 to ≤550 kW (Anaerobic digestion only)
Meter Requirement	Single Meter	Two Meters	Two Meters
Billing	Net power supply and net delivery charges in addition to other fixed fees	Net power supply and net delivery charges in addition to other fixed fees	Net power supply and net delivery charges in addition to other fixed fees
Credit	Excess energy credited at power supply and delivery rate	Excess energy credited at power supply rate only	Excess energy credited at power supply rate only

SOLAR DISTRIBUTED GENERATION PILOT

- Customers purchase their own solar system (the company is working with SunPower for purchase and installation). Long-term financing and cash purchase options are available.
- Customers earn bill credits if they generate more electricity than they use.

DEMAND-SIDE RESOURCES

Demand-side resources and energy waste reduction programs have and will continue to be an effective resource option for the company. Accordingly, the IRP process included forecasts of expanded energy waste reduction programs, including conservation voltage reduction, demand response and others. Additional demand-side management measures were evaluated in the IRP modeling in all scenarios and sensitivities as a resource option to be selected by Strategist®.

Planned demand management programs for the company are discussed in Section VIII - Demand-Side Resources of this report.

MARKET CAPACITY PURCHASES

Historically, the company has considered capacity purchases from the MISO planning resource auction when residual, largely unforeseen capacity needs arise. Capacity purchases through bilateral agreements are also considered as a means of meeting sizeable but temporal capacity needs. For example, a portfolio of resources offered into the model optimization could include limited levels (300-500 ZRC) of capacity purchases. However, following the 2016 Energy Law, the company no longer utilizes capacity spot purchases as a long-term planning strategy and therefore has not included such a portfolio in this IRP. Projecting a sustained year-after-year capacity need without specificity of how the need will be met is inconsistent with the company's objectives for compliance with the State Recovery Mechanism, created in Section 6w of PA 341. Additionally, relying too heavily on the market creates price and reliability risk for customers.

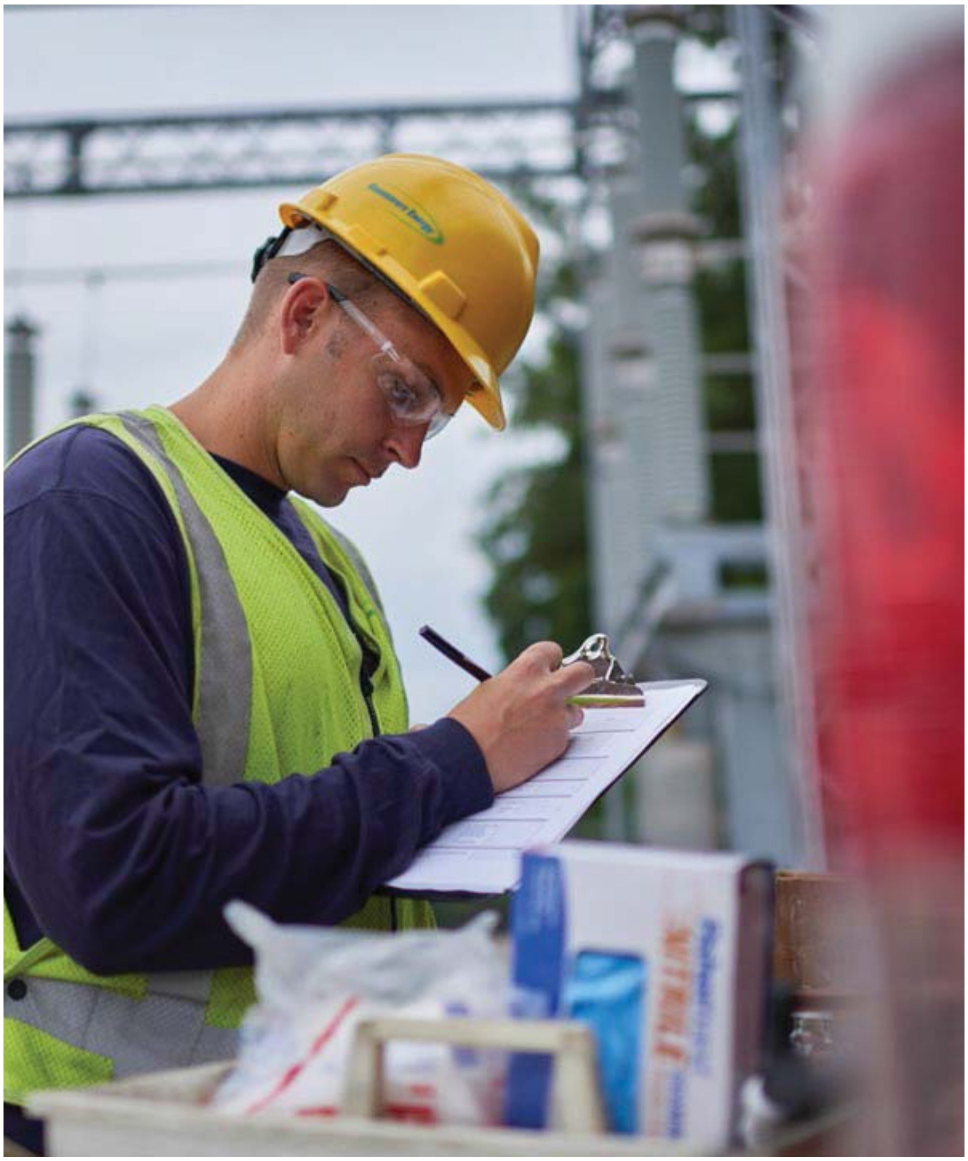
LONG-TERM PURCHASE POWER AGREEMENTS

For the purposes of resource screening within the IRP planning process, existing long-term power purchase agreements entered by the company pursuant to PURPA are assumed to be renewed and were included as existing generation resources within the IRP modeling process. All resource types modeled are assumed to be a utility build. However, this does not preclude the utility from procuring an existing asset or entering into a power purchase agreement.

TRANSMISSION RESOURCES

Various transmission options were evaluated outside of the IRP in a collaborative outreach with Michigan Electric Transmission Company. The IRP process considered potential transmission network upgrade assumptions. While transmission expansion could increase the transfer capability into the Lower Peninsula of Michigan, transmission expansion studies completed by regional planning authorities have not demonstrated economic benefits to customers.

Within the existing import and export capabilities of the transmission system, a fundamental assumption in the company's resource needs assessment and planning process is the transmission topology and the representation of the constraints and limitations on the existing transmission system. This transmission topology is discussed and depicted in Section 12: Transmission Analysis of this report.



2018 INTEGRATED RESOURCE PLAN

SECTION

15

MODELING RESULTS

SECTION 15

Modeling Results

PORTFOLIO DESIGN STRATEGY

Six future scenarios and 13 sensitivities were evaluated in the company's IRP. As described in Section V Analytical Approach, this was performed using the Strategist® portfolio optimization model to evaluate each alternative equally. Several steps were taken to define and execute the proper portfolio design strategy. The resource planning analysis consisted of 44 combinations of scenarios and sensitivities. For each combination, up to eight portfolio optimizations were examined, which are specific combinations of demand- and supply-side options such as reliance on only market purchases, reliance on only gas generation, reliance on gas and renewable generation or reliance on all possible resource options plus demand-side options. In total, there were 225 model runs, some of which took multiple days to complete. This enormous modeling effort represented a robust analysis and suitable foundation for the IRP.

First, a reference portfolio design for each scenario and sensitivity was created to provide a baseline and used to compare all alternative portfolios against using the same scenario or sensitivity. The reference portfolio provides a benchmark for comparing changes in cost, performance, risk and other portfolio metrics. Next, alternative portfolios with different combinations of candidate resources, unit sizes and timing are developed and compared to the reference portfolio.

In order to evaluate all of the different scenarios and sensitivities, the company is presenting five critical portfolio designs evaluated using the Strategist optimization model.

1. Portfolio A — Reference Portfolio (100 percent market purchases):

    a. Company purchases all required incremental capacity from the market at spot prices.

    b. Results in one expansion plan for each scenario and sensitivity.

    c. Amounts of capacity purchases may vary by scenario.

2. Portfolio B — Supply-side Optimization (100 percent supply-side options):

    a. All incremental capacity required to meet demand and reserve margins is accomplished with the supply-side resource technologies.

    b. Designed to evaluate the optimized resource plan if the company does not rely on any capacity market purchases to fulfill its future needs. Constructs supply-side resources but does not execute on demand-side options.

    c. Any single supply-side resource has the opportunity to displace a less economic resource at any point in the optimization of each year.

   d. Results in hundreds of different resource plans generated, ranked by the net present value (NPV) of each portfolio plan.

   e. Lowest cost resource plan varies by scenario and sensitivity.

3. Portfolio C — Strategist Selected Portfolio/Optimization (supply-side plus demand-side management):

   a. Incremental capacity required to meet demand and reserve margins can be met through either new resource technologies or selection of demand-side options such as conservation voltage reduction, energy waste reduction or demand response.

   b. Presents the Strategist optimal resource plan if the company does not rely on any capacity market purchases to fulfill its future needs and considers available demand-side options in addition to the supply-side options. This portfolio provides an indication of the benefits of the demand-side resources compared to supply-side only resources.

   c. Demand-side resources have equal probability of being economically selected as a supply-side resource.

   d. Any resource (supply-side or demand-side) has the opportunity to displace a less economic resource at any point in the optimization of each year.

   e. Results in hundreds of different resource plans generated, ranked by the net present value (NPV) of that portfolio plan.

   f. Lowest-cost resource plan varies by scenario and sensitivity.

4. Portfolio D — Proposed Course of Action (PCA) plan as discussed further in Section 16 Proposed Course of Action:

   a. Consistent capacity replacement portfolio evaluated across all applicable scenarios and sensitivities. Selection of the types of resources and timing of resources for the proposed course of action was determined, and tested under each applicable scenario and sensitivity in the Strategist model to run through the study period.

   b. Results in a corresponding NPV that indicates the performance of the PCA plan in the given scenario or sensitivity.

   c. Once generated, PCA plan was evaluated on all applicable MIRPP and CE scenarios, as well as all MIRPP-required sensitivities.[1]

5. Portfolio E — Alternate Plan:

   a. Feasible capacity replacement option in lieu of the PCA that included one natural gas combined cycle unit

1 In some cases, the PCA was insufficient to fulfill the capacity needs of a given sensitivity. For example, under a 1.5 percent annual load growth assumption, the PCA would be insufficient to meet customer demand; therefore, the PCA was not evaluated on this sensitivity.

b. Consistent capacity replacement portfolio evaluated across each of the six base scenarios. Selection of the types of resources and timing of resources for the alternate plan was determined and tested under each base scenario in the model to run through the study period.

c. Results in a corresponding NPV that indicates the performance of the alternate plan in the six scenarios.

d. Once generated, the alternate plan was evaluated on all MIRPP and CE scenarios. The alternate plan was not evaluated on any sensitivity, as the company is not seeking approval to execute the alternative plan.

A summary of the different portfolio designs, identifying each supply- and demand-side option that was offered to the model in each portfolio, is detailed below in Table 15.1.

Table 15.1: Portfolio design summary

Portfolio Design	Description	Market Purchases	CC H-class	CC F-class	CT	RICE*	Wind	Solar	Battery	EE	DR	CVR
A	Reference Portfolio: 100% market purchases	X	-	-	-	-	-	-	-	-	-	-
B	100% Supply-Side	-	X	X	X	X	X	X	X	-	-	-
C	Strategist Selected/ Optimal	-	X	X	X	X	X	X	X	X	X	X
D	PCA	-	-	-	-	-	X	X	X	X	X	X
E	Alternate Plan	-	X	-	X	-	X	X	X	X	X	X

* RICE stands for Reciprocating Internal Combustion Engine

Next, a reserve margin requirement was input to ensure the company's identified reserve margin requirements would be met for all portfolio options. The forecasted reserve margin requirement was then filled by either existing resources or with the addition of either supply-side or demand-side resources, depending on the portfolio being run.

For each identified planning year — and for each scenario and sensitivity — Strategist utilized financial principles to optimize the resource portfolio selected to best meet the identified energy needs for each year. As it moves through each planning year, resources are added to ensure that required capacity reserve margins are maintained. Strategist optimizes the resources added by creating a large number of portfolios that consider all possible combinations of new resources (either supply-side only, or supply- and demand-side depending on the portfolio being run); the resulting resource portfolios are ranked by the model in economic order.

To do this, the software calculates the costs associated with variable operating and maintenance expense, fuel expense and emission expense for each hour of operation using the least expensive units to generate in each hour. For units added to maintain required capacity reserve margins, the model also calculates the economic carrying costs for each unit added but does not include the remaining carrying costs of units already included in rate base. The IRP modeling also excludes some fixed costs that are common to all scenarios and sensitivities and have no impact on generating unit dispatch and resource plan optimization results.

The economic carrying charge (ECC) is a method for quantifying capital cost streams in financial analysis and resource planning. The ECC method is used in resource optimizations models such as Strategist because it appropriately allocates the portion of capital costs to a project for a given time period in the case that the project lifetime does not exactly align with the study period of the model run. The ECC method also makes comparing resources with different lifespans and commercial operation dates feasible.

The specific calculation method for ECC is as follows:

The ECC is a stream of capital revenue requirements that increase at a given rate. This rate can be either an inflation rate or chosen escalation rate.

In the first year, ECC equals the difference between:

1. The present value of revenue requirements (PVRR) over the lifetime of capital revenue requirements, if the identified resource goes into service in the current year.

2. The PVRR over the lifetime of capital revenue requirements if that same resource is delayed in operation by one year.

For the remaining years that the resource is in operation, ECC is escalated at the given rate.

Therefore, the ECC value in any one year represents the appropriate “capital rent payment” for that resource in that year.

Additionally, since the entire MISO market area is represented in Strategist for each scenario and sensitivity, resource optimizations were performed for the entire regional market area. Based on that optimized regional market area, the model then was able to optimize the Consumers Energy system.

This methodology ensures long-term reliability requirements are met in the study for the company system, the Lower Peninsula of Michigan as well as the entire MISO market footprint. The result of this overall modeling process is the identification of the most cost-effective resource portfolio for each set of input assumptions.

With the nominal economic values developed for each month of the study period, the net present value of the revenue requirement (PVRR or NPV) was calculated and the alternative resource plans within the optimization was ranked in economic order from lowest to highest NPV. Post-optimization, any surplus capacity that remains after planning reserve margin requirements are met is assumed to be sold at the market price of capacity.

The surplus capacity revenue is not calculated within the model so as not to influence the optimization into adding new resources simply to sell off into the market.

SCENARIO AND SENSITIVITY RESULTS

Scenario Modeling

Each of the six base scenarios (BAU AEO, ET AEO, EP AEO, BAU CE, ET CE and EP CE) had a base resource plan that assumed Karn Unit 1 and 2 retirements in 2023. All the selected resource plans from the various scenarios and sensitivities were compared to this base resource plan to test it under the changing assumptions identified in the MIRPP scenarios and sensitivities.

Table 15.2: Legend of Strategist® resource options

Abbreviation	Technology Option
CCF	Combined Cycle F class 2x1
CCH	Combined Cycle H class 2x1
CT	Combustion Turbine J class 1x0
RICE	Reciprocating Internal Combustion Engine
SOL	Solar
WND	Wind
BATT	Lithium Ion Battery
CVR	Conservation Voltage Reduction
DR	Demand Response
EWR	Energy Waste Reduction
Purch	Purchase

For the purposes of portfolio optimization comparison, Portfolios A, B and C were compared against each other for each "base case" scenario as well as all sensitivities run on that scenario. This allowed the company to see the differences between filling a need by purchasing all energy needed (Portfolio A), filling a need by only supply-side resources (Portfolio B) and optimizing with both supply- and demand-side resource options (Portfolio C). Comparisons can be made between the amount and type of resources selected as well as the difference in NPVs this created over the planning period.

For CE scenarios (BAU CE, EP CE, and ET CE), sensitivities were run that allowed the company to perform an analysis of the different retirement years identified as options for the Medium Four units. Within each retirement year option, Portfolios A, B and C were compared.

For MIRPP scenarios (BAU AEO, EP AEO, and ET AEO), the sensitivities that were run included all of the MIRPP sensitivities for that scenario. Within each sensitivity, Portfolios A, B and C were compared.

1) BAU CE

The initial capacity outlook for Business as Usual CE Gas price identifies no major capacity shortfalls until 2030. When different retirement evaluations are conducted on the initial outlook scenario, a capacity shortfall is identified in that retirement year (either 2021 or 2023). In sensitivities evaluating 2021 as the retirement year for the different Medium Four units evaluated, Portfolio B fills the need with a CT. However, in all Medium Four analysis model optimizations, demand-side management programs replace the need for supply-side resources when the portfolio is optimized for both supply- and demand-side resources (Portfolio C). Similarly, in sensitivities evaluating 2023 as the retirement year, demand response replaces wind and/or solar resources to fill the identified capacity shortfall in that retirement year. In all cases, the NPVs for filling capacity needs with supply- and demand-side resources are lower than filling with just supply-side resources.

Finally, the BAU CE scenario fills the identified significant capacity shortfall in 2030 with natural gas combined cycle generation. Optimizing with both supply- and demand-side resources for all base and retirement sensitivities reduces the size of the combined cycle plant but does not eliminate it as a resource. This is an expected outcome based on the lower gas price forecasts in the CE gas scenarios compared to the EIA AEO gas price scenarios. Summaries of the resource selections in each year, under this scenario, for each portfolio, are located in the Appendix of this report.

2) EP CE

As in the Business As Usual CE Gas scenario, the Environmental Policy CE Gas scenario identifies no major energy shortfall until 2030 in the initial capacity outlook scenario. When retirement analysis is conducted for the different Medium Four units under the selected retirement years, in both 2021 and 2023, the resource plans show a preference for renewables as supply-side resources in the Portfolio B optimizations. In 2021 retirement sensitivities, solar is selected as the supply-side resource to replace the capacity need. In 2023 retirement sensitivities, wind is selected as the supply-side resource due to available PTC credits. In both 2021 and 2023 retirement cases, the favorable economics of demand-side management programs result in displacement of some amount of renewables constructed to fill energy shortfalls beginning in the retirement years. In later retirement years, energy storage is selected as an option to fill smaller capacity needs identified after 2031.

There is no economic selection of natural-gas fueled units in 2030 or anywhere within the resource plans under this scenario. Instead, the capacity shortfall is filled with renewable options such as wind and solar and further diversified by the growth of demand-side management programs such as conservation voltage reduction and energy waste reduction. This is to be expected under input parameters from the Environmental Policy scenario, specifically, assumed lower capital costs for renewables and carbon regulation make renewables and demand-side management programs a more attractive option to fill energy and capacity needs. Summaries of the resource selections in each year, under this scenario, for each portfolio, are located in the Appendix of this report.

3) ET CE

As in the Environmental Policy scenario, capital costs for most renewable technologies are at assumed significant capital cost reductions. The decreased capital costs are reflected in the resource plans for this scenario as all identified capacity shortfalls, either in retirement sensitivities or in the initial capacity outlook, are filled with renewable supply-side resources such as wind or solar. In later years, such as 2030, demand-side management programs play a significant role in reducing the amount of renewables that need to be constructed to meet energy and capacity needs. But a significant amount of renewables are still built in this planning year and beyond. Energy storage also is selected as an option in later planning years under this scenario. Summaries of the resource selections in each year, under this scenario, for each portfolio, are located in the Appendix of this report.

4) BAU AEO

In this scenario, gas prices assumed in the model were based on the EIA's 2017 Annual Energy Outlook forecasts as opposed to CE gas price forecasts. Additionally, Karn units 1 and 2 were assumed to retire in year 2023 for all sensitivities, in order to determine the resource plans and resource options constructed under the MPSC sensitivities, absent the energy and capacity those resources would otherwise provide. The capacity outlook reflecting the retirement of Karn units 1 and 2 is hereafter referred to as the "base case". The sensitivities evaluated were those identified within the MPSC requirements. Those sensitivity results and NPVs are discussed later in this section.

In the base case for this scenario, as well as across all sensitivities, even though renewable technology costs are not assumed to decline significantly, the higher base gas price results in no natural-gas fueled resources being selected in any planning year. Resource needs are consistently filled with renewable resources for Portfolio B supply-side optimizations, while demand-side management programs offered in Portfolio C are selected throughout the base case and the different sensitivities. Emerging technology resources such as battery storage are also selected in planning years after 2031. Summaries of the resource selections in each year, under this scenario, for each portfolio, are located in the Appendix of this report.

5) EP AEO

In this scenario as well, Karn Units 1 and 2 were assumed to be retired in year 2023 for all MIRPP required sensitivities. In the initial capacity outlook for the Environmental Policy scenario under EIA AEO gas prices, the large shortfall occurring in 2030 is filled with a mix of renewables, demand-side management programs and/or energy storage. The lower capital prices available for renewable and emerging technologies within this scenario, as well as the lower cost options for demand-side management programs, offer a more beneficial NPV to customers than selecting a gas-fired unit to meet projected energy demand. In the sensitivities associated with this scenario, no natural gas-fired unit is selected to meet a projected energy shortfall in any planning years; within the sensitivities the lower costs of renewables, energy storage and demand-side management programs are valued by the model and are selected more over more capital intensive resources. Summaries of the resource selections in each year, under this scenario, for each portfolio, are located in the Appendix of this report.

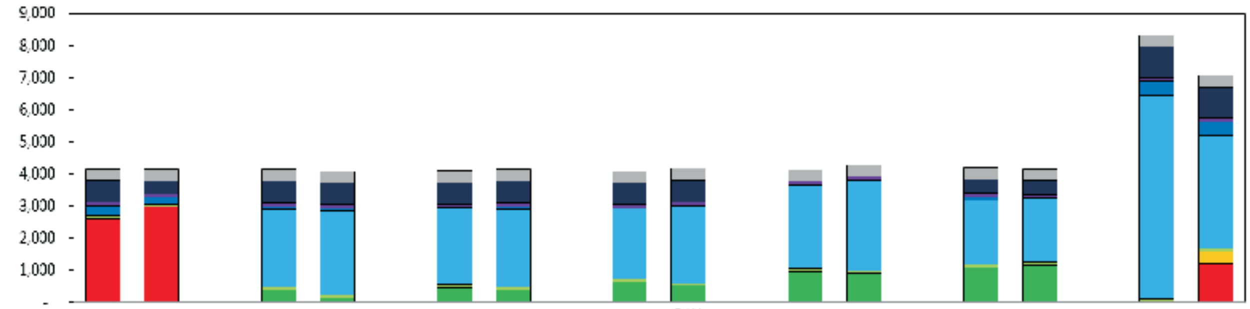
6) ET AEO

The Emerging Technology scenario, under EIA AEO gas prices, behaves very similarly to the Environmental Policy EIA AEO gas price scenario. These resource plans also show that the Strategist supply-side plus demand-side portfolios resulted in renewable and demand-side management options. In the initial capacity outlook scenario, renewables and energy storage resources are constructed to meet the projected 2030 capacity shortfall, due to their lower capital costs. Wind and solar resources also are predominant within all of the MIRPP required sensitivities, balanced by a level of demand-side resources such as energy waste reduction programs and demand-response programs, which are also assumed to be at significantly lower costs. Summaries of the resource selections in each year, under this scenario, for each portfolio, are located in the Appendix of this report.

In addition to identifying the least-cost resource mix for each of the selected scenarios and sensitivities, Strategist also identifies a large number of alternative plans. These alternative plans identify different resource options that would also satisfy the planning reserve margin requirements within the planning period; the purpose of identifying and evaluating a broad range of different resource plans is to identify and compare the relative economics and risks of each combination.

For each scenario, the least-cost resource plan, as well as the first alternative resource plan was compared against each other from a resource perspective. This allowed the company to evaluate the differences in the economics and types of resources selected

Figure 15.1: Supply- and demand-side optimizations for all six IRP scenarios with Karn 1 and 2 retiring in 2023, including first suboptimal



	BAU CE	BAU CE (sub)	ET CE	ET CE (sub)	EP CE	EP CE (sub)	BAU AEO	BAU AEO (sub)	ET AEO	ET AEO (sub)	EP AEO	EP AEO (sub)	PCA	Alt. Plan
EE	361	361	361	361	361	361	361	361	361	361	361	361	361	361
DR	673	400	673	673	673	673	673	673	-	-	433	433	963	963
CVR	115	115	115	115	115	115	115	115	115	115	115	115	115	115
Battery	300	200	100	100	-	100	-	-	-	-	100	-	450	450
Solar	-	-	2,411	2,611	2,411	2,411	2,210	2,411	2,611	2,812	2,009	2,009	6350	3500
RPS Wind	86	86	86	86	86	86	86	86	86	86	86	86	86	86
Wind	-	-	380	127	443	380	633	506	949	886	1,075	1,139	0	0
CT	-	-	-	-	-	-	-	-	-	-	-	-	0	397
CC	2,602	2,967											0	1186

within the planning period, as well as review the total amount of capacity selected within the different scenarios. The PCA and Alternative Plans (Portfolios C and D) were also evaluated against the least-cost and first alternative plan for each scenario. Those results are visualized in Figure 15.1.

Next, costs for the five critical portfolios in each scenario were compared below. Specifically, NPV results are provided in lines 1-5 for each portfolio that summarize the costs associated with each portfolio option that were evaluated under the six defined scenarios.

Table 15.3: Portfolio evaluations

			(A)	(B)	(C)	(D)	(E)	(G)
IRP PORTFOLIO ECONOMICS BY SCENARIO Net Present Value (million $)								
Line No	**Portfolio Design**	**DESCRIPTION**	**Strategist Modeling Results - Base Case Scenario**					
			BAU CE	**EP CE**	**ET CE**	**BAU AEO**	**EP AEO**	**ET AEO**
1	A	Reference Case (Do nothing, short-term market purchases all years)	20,450	20,576	20,625	24,220	24,249	24,353
2	B	Supply-Side Optimization, no demand-side options	20,913	19,499	20,223	23,220	20,971	21,650
3	C	Supply + Demand-Side Optimization	20,417	19,549	19,841	22,918	21,063	21,483
4	D	Proposed Course of Action	21,228	20,091	19,880	23,713	22,482	22,319
5	E	Alternate Plan	20,906	20,279	20,043	23,721	23,045	22,848

As discussed above, the reference case (portfolio design A) is designed to be the reference portfolio, which means delta calculations can be taken for the remaining portfolios against this reference number in order to compare the economics associated with the various options chosen to fill capacity needs in the planning years. Those delta calculations are shown below for the five critical portfolios under all six scenarios.

Table 15.4: Delta calculations of portfolios

				(A)	(B)	(C)	(D)	(E)	(G)
Net Present Value Difference to Reference Case (million $)									
Line No	**Portfolio Design**	**DESCRIPTION**	**CALCULATION**	**Strategist Modeling Results - Base Case Scenario**					
				BAU CE	**EP CE**	**ET CE**	**BAU AEO**	**EP AEO**	**ET AEO**
6	A	Reference Case (Do nothing, short-term market purchases all years)	(Line 1 - Line 1)	0	0	0	0	0	0
7	B	Supply-Side Optimization, no demand-side options	(Line 2 - Line 1)	463	-1,077	-402	-1,000	-3,278	-2,703
8	C	Supply + Demand-Side Optimization	(Line 3 - Line 1)	-33	-1,027	-784	-1,302	-3,186	-2,871
9	D	Proposed Course of Action	(Line 4 - Line 1)	778	-485	-745	-506	-1,767	-2,034
10	E	Alternate Plan	(Line 5 - Line 1)	457	-297	-582	-499	-1,204	-1,506

When these results are reviewed, it is important to note several items. First, new supply-side resources as opposed to purchasing all capacity and energy needs from the market results in significant customer savings for almost every scenario. Second, including demand-side resources in addition to supply-side resources in the optimization, shown as Portfolio C, projects the potential to further reduce customer costs. The PCA in five of the six scenarios indicates significant customer savings compared with Portfolio A. While Portfolio C is a lower-cost option, the PCA provides increased flexibility to manage the remaining existing assets and also allows the company to leverage advancements in technologies and to gain experience. The alternate plan, in many cases, projects the least amount of customer savings but represents a course of action the company could consider — absent approval of the PCA.

As an example of how to review Table 15.4 above and the associated portfolios costs and customer savings, consider the column of information associated with the ET CE scenario. Compared to purchasing all capacity (and remaining energy) needs from the market, selecting new supply-side resources in this scenario is projected to save customers $402 million NPV. Once demand-side resources are included as Strategist options, customer costs are further reduced by $382 million NPV, resulting in a total of $784 million savings compared to the reference case (Portfolio A). The PCA for the ET CE scenario indicates customers would save $745 million NPV compared to the reference case. Finally, the alternate plan also indicates that it would provide a savings to customers compared with Portfolio A; however, the economic benefit to customers is not as great as the Strategist optimal or PCA portfolios in this scenario.

Under all six scenarios, a majority of the values listed in Table 15.4 are negative. This means that for all but minimal cases in the BAU CE gas scenario, meeting projected capacity needs with a combination of supply- and demand-side options is a lower cost to customers than relying on the market to meet future needs. This is primarily driven by the fact that in most of these scenarios, large amounts of low-cost renewables as well as demand-side resources are chosen as optimal resources within the modeling process, and this results in lower-cost outcomes than purchasing energy and capacity from the market. This is particularly true when low-cost renewables and demand-side options are added in the scenarios using the EIA AEO gas price forecasts, in which power prices are elevated, or in scenarios such as Emerging Technology where significant cost reductions are assumed for renewable and demand-side resources.

One item of note is that the PCA indicates customer savings of between $485 million NPV and $2.03 billion NPV compared to 100 percent market reliance across all scenarios except BAU CE. The BAU CE modeling results indicate the PCA would be an increase of NPV costs under BAU CE gas price assumptions and BAU assumptions on the costs of renewables and demand-side programs. While the BAU CE results indicate some level of risk associated with the identified PCA, it is important to remember that this projected cost result is one of only six potential outcomes. If gas prices increase above assumed levels included in the CE gas price forecasts, or if the cost of renewable energy technology decreases, significant savings for customers could be realized through the PCA.

SENSITIVITY MODELING

As described in Section VI) Scenarios and Sensitivities, multiple sensitivities were run on the different scenarios described above The effects of the required MIRPP sensitivities, including changes to NPVs as well as differences in resource plans, are discussed below:

1) 1.5 percent Annual Load Growth

When analyzing this sensitivity against the base, the reference portfolios within each scenario are approximately $5 billion more expensive. This means that if load grew at 1.5 percent per year, customer costs on an NPV basis would increase by approximately $5 billion, if all capacity needs were met with market purchases. If supply and demand resources were utilized instead of purchasing to meet all energy needs, then costs would go down by between $2.46 billion NPV and $5.17 billion NPV.

The net effect of the various replacement options indicates that if load were to grow at 1.5 percent per year and capacity needs were met with the most optimal plan, customer costs would actually be lower than base case reference portfolio costs in the EP and ET scenarios. However, the base reference portfolio for this sensitivity is just that, a reference. In reality the company would not purchases all of its energy needs off the market, but instead would apply Portfolio D, the PCA. However, the PCA was developed to supply currently projected customer demand requirements, not the level of annual

Figure 15.2: BAU 1.5% load growth

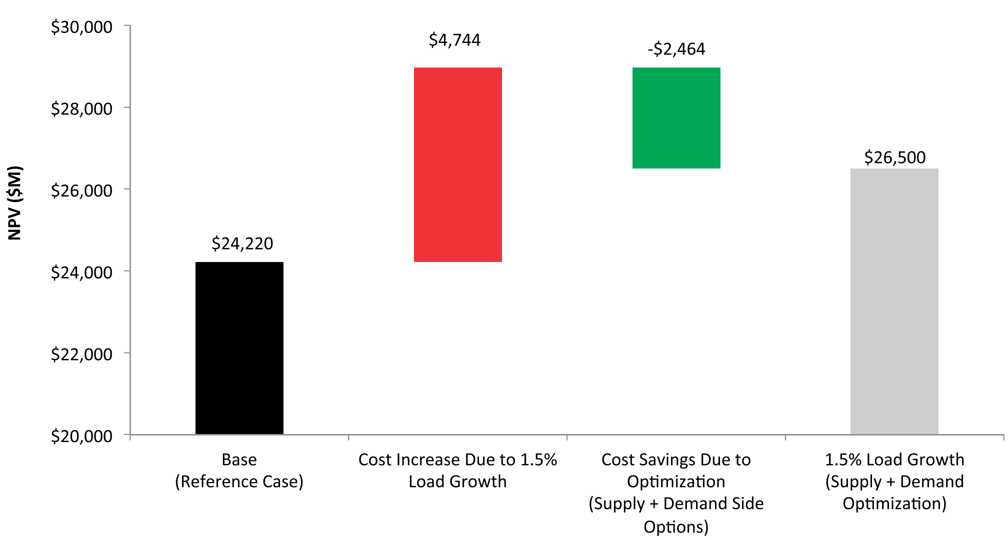


Figure 15.3: Environmental policy 1.5% load growth

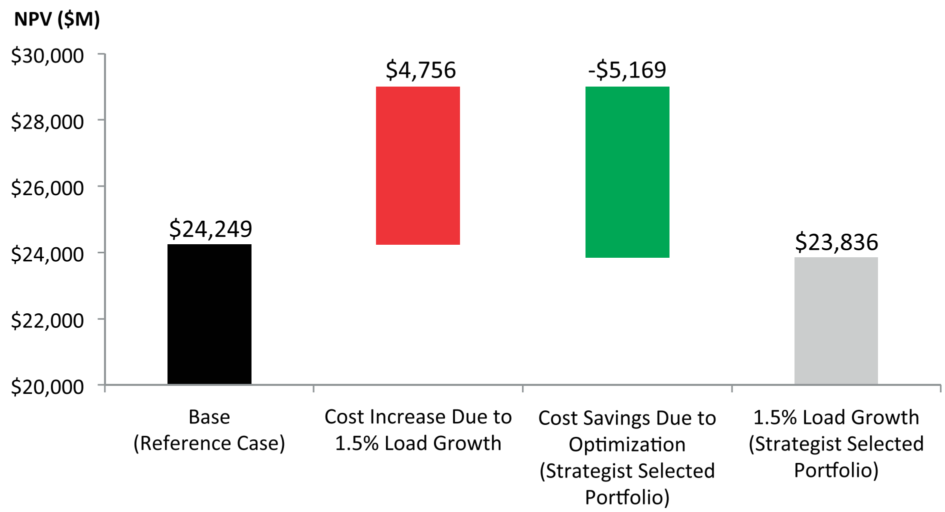
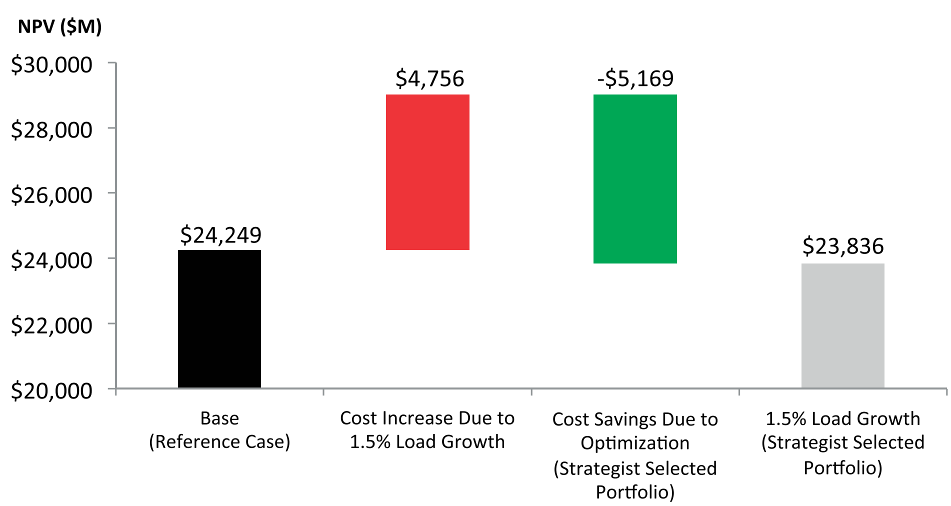


Figure 15.4: Emerging Technologies: 1.5% Load Growth



growth described in this sensitivity. If load did increase at or near levels of the 1.5% load growth sensitivity, additional analysis would be performed on the PCA to identify what is needed to meet demand.

Summaries of the resource selections in each year, under this sensitivity and for each portfolio, are included in the Appendix of this report.

2) 2.5 percent Energy Waste Reduction Savings

The results generally indicate that compared with base, if EWR levels were achieved and maintained at 2.5 percent starting in 2021, the reference portfolios are approximately $1.2 billion NPV lower compared with base reference portfolios. If, instead of market purchases to meet capacity needs, supply and demand-side resources were utilized, then NPV costs would go down further by between $959 million NPV and $2.6 billion NPV. Overall, less supply-side and demand response programs would be needed to satisfy the projected customer demand. The analysis aligns well with the company's PCA, which is reliant on the expansion of energy waste reduction programs in order to reduce demand and save customers money.

Figure 15.5: BAU 2.5% energy efficiency growth

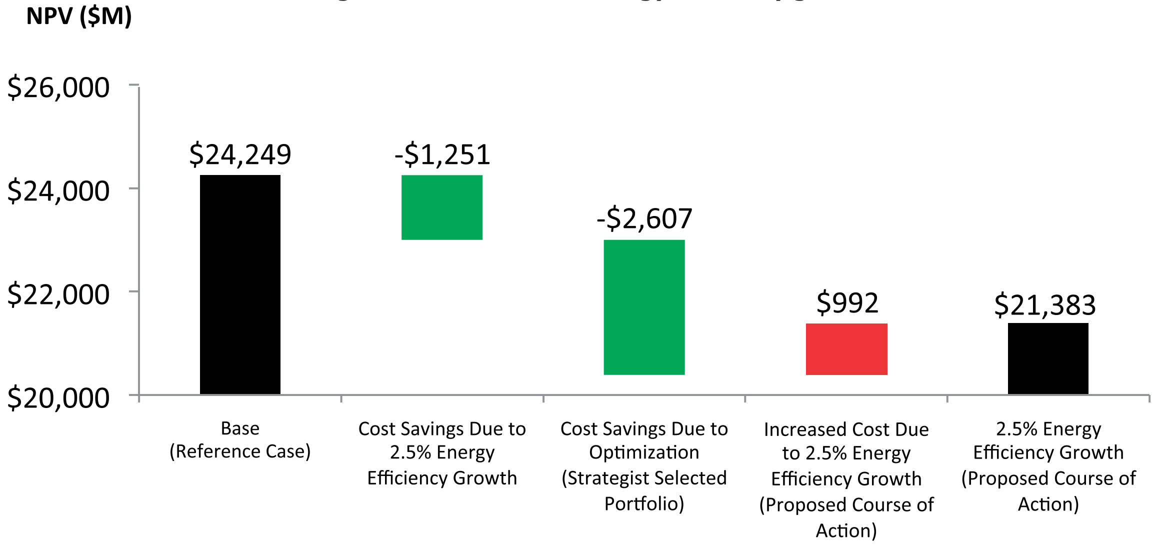


Figure 15.6 Environmental policy 2.5% energy efficiency growth

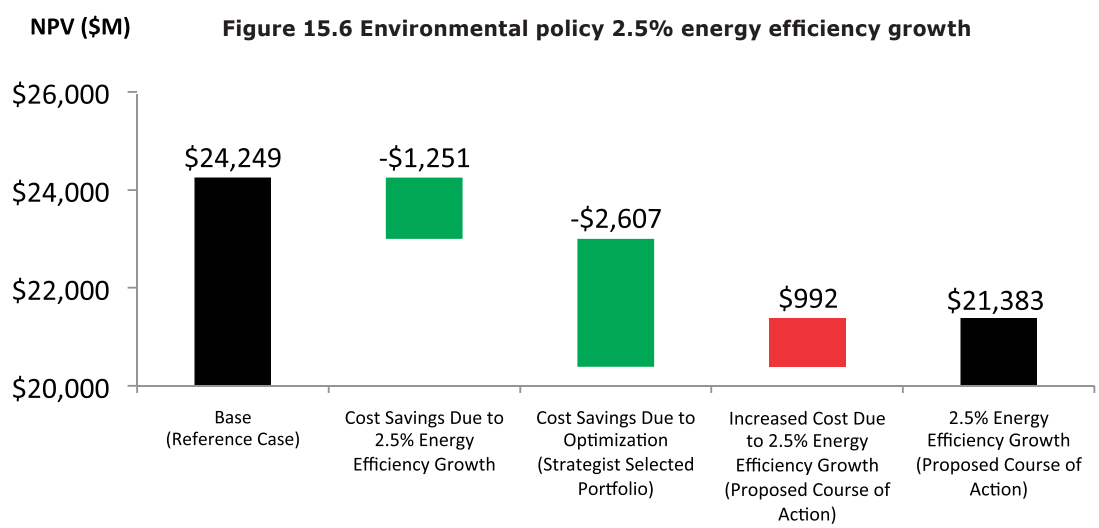
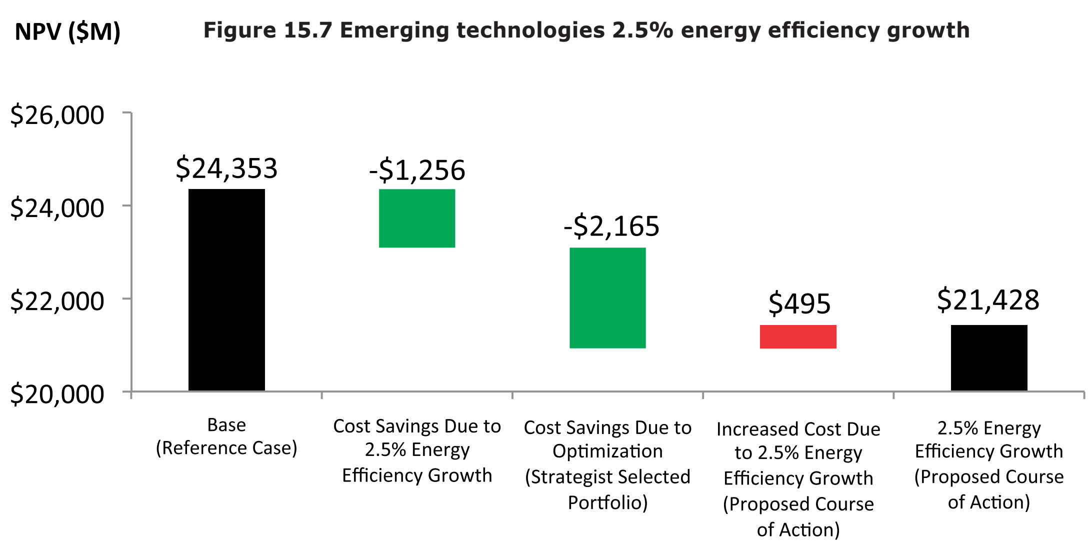


Figure 15.7 Emerging technologies 2.5% energy efficiency growth



Summaries of the resource selections in each year, under this sensitivity and for each portfolio, are included in the Appendix of this report.

3) 200 percent Gas Price

The results for this sensitivity generally indicate that compared with base, if gas prices increased to 200 percent of AEO base gas prices by 2040, the reference portfolios would increase by between $6 billion and $6.7 billion NPV compared with base reference portfolios. If, instead of market purchases to meet capacity needs, supply- and demand-side resources were utilized, then NPV costs would go down by between $5.5 billion NPV and $9.2 billion NPV compared to the sensitivity reference portfolio. In the Emerging Technology and Environmental Policy worlds, the availability of low-cost renewables helps drive this significant difference in NPV costs; low-cost renewables help mitigate the

Figure 15.8: BAU 200% increase in gas price

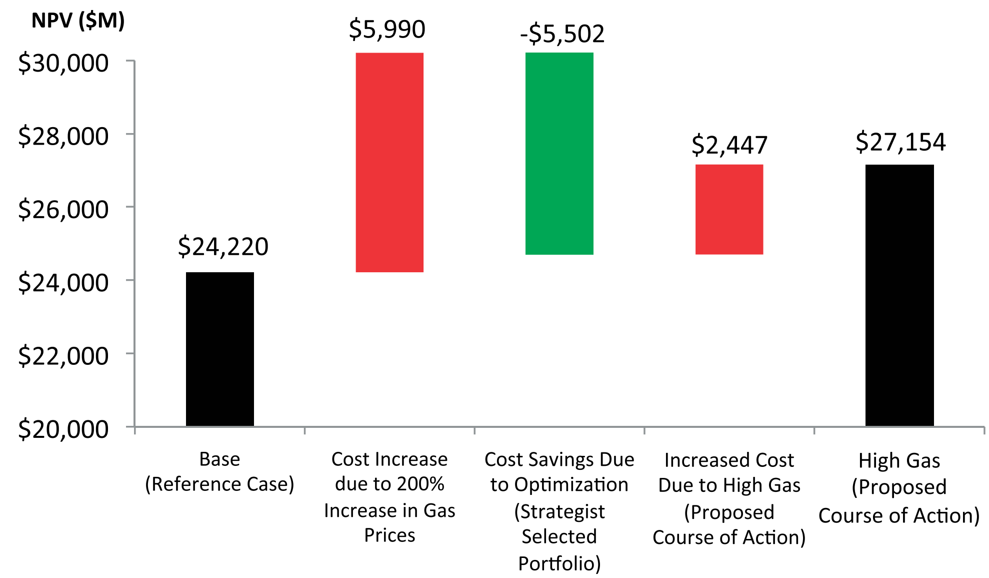


Figure 15.9: Environmental policy 200% increase in gas price

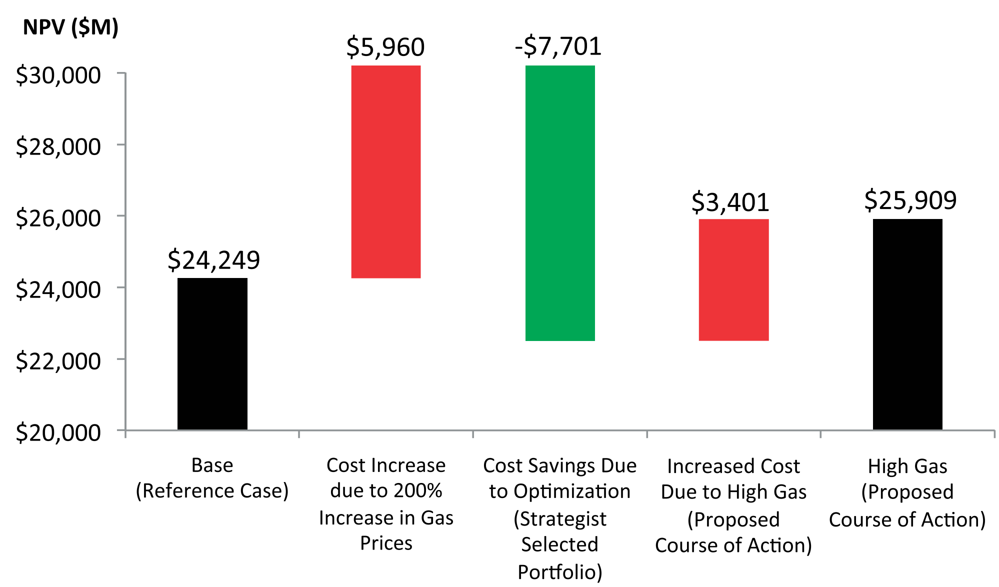
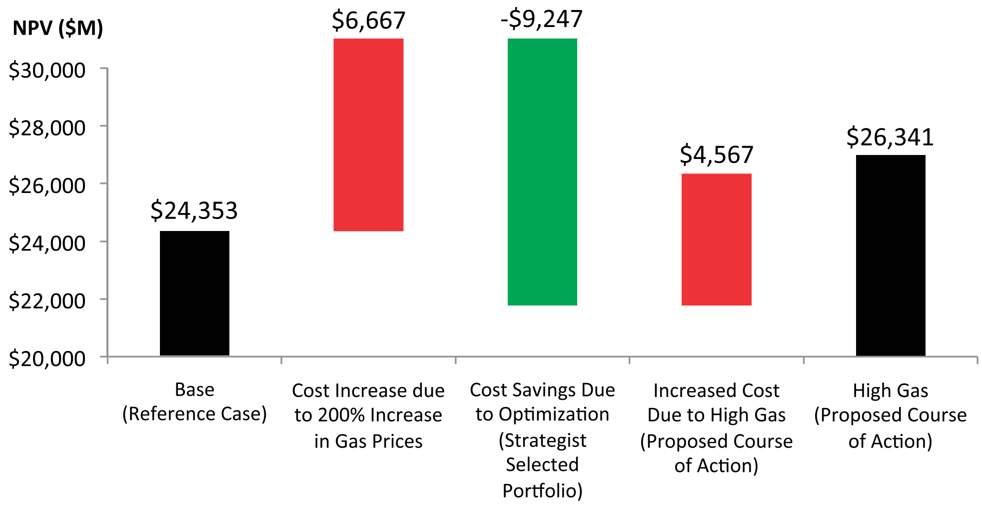


Figure 15.10: Emerging technologies 200% increase in gas price



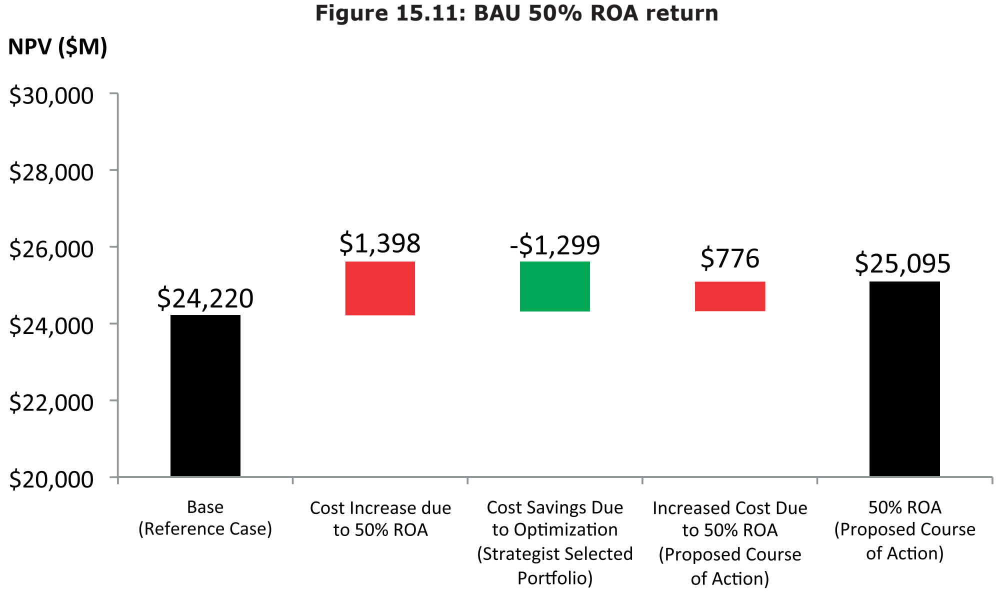
risk of high gas prices as discussed later in the risk assessment portion of this section. The use of demand-side and renewables in the PCA reflect the ability to mitigate the risk to higher natural gas prices.

Summaries of the resource selections in each year, under this sensitivity and for each portfolio, are included in the Appendix of this report.

4) 50 percent ROA Return

Under this sensitivity, which was only run on the Business As Usual scenario, additional capacity and energy needs would be required, which compared to base, would increase costs by $1.4 billion in the reference portfolios. If, instead of market purchases to meet capacity needs, supply- and demand-side resources were utilized, then NPV costs would

Figure 15.11: BAU 50% ROA return



go down by $1.3 billion NPV compared to the sensitivity reference portfolio. With a slightly higher level of need resulting from the return of ROA customers, additional solar would be needed to serve the ROA customers.

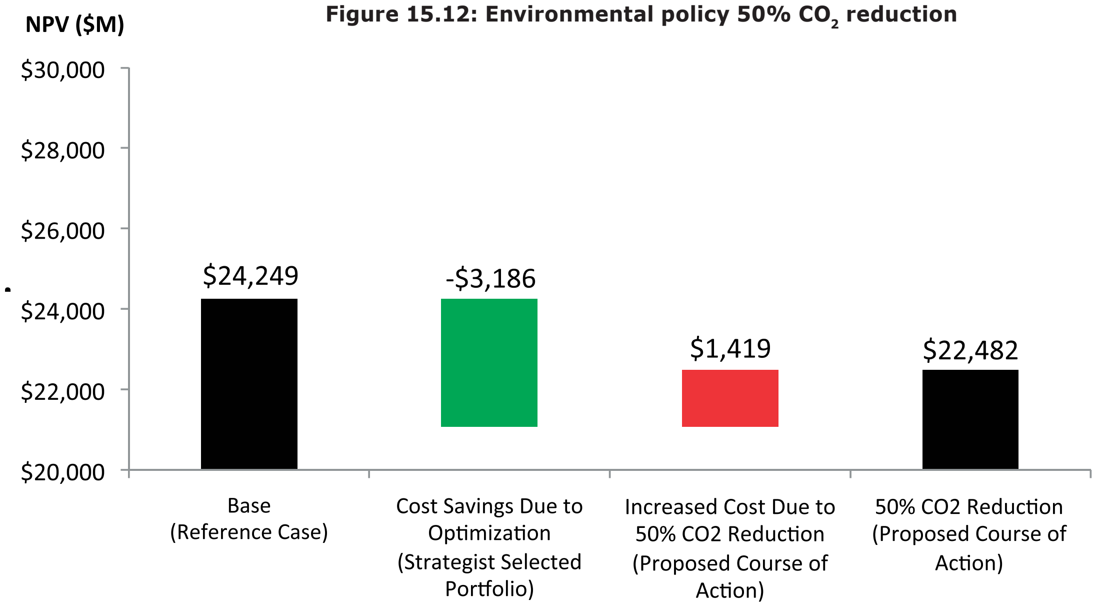
Summaries of the resource selections in each year, under this sensitivity and for each portfolio, are included in the Appendix of this report.

5) 50 percent carbon reduction

This sensitivity was only required to be run on the Environmental Policy scenario. The company found, upon completion of modeling for the base Environmental Policy scenario, that the optimal resource mix selected already achieved the 50 percent CO2 reduction goal. Therefore, there was no need to run an additional sensitivity to achieve this target, as the target had been achieved in the base reference case for the Environmental Policy scenario.

Summaries of the resource selections in each year, under this sensitivity and for each portfolio, are included in the Appendix of this report.

Figure 15.12: Environmental policy 50% CO_2 reduction



6) 25 percent Renewables by 2025

This sensitivity was only required to be run on the Emerging Technologies scenario. The company found, upon completion of modeling for the base Emerging Technologies scenario, that the optimal resource mix selected already achieved the 25 percent renewables target. Therefore, there was no need to run an additional sensitivity to achieve this target, as the target had been achieved in the base reference case for the Emerging Technologies scenario.

Summaries of the resource selections in each year, under this sensitivity and for each portfolio, are included in the Appendix of this report.

Figure 15.13: Emerging technologies 25% RPS by 2030

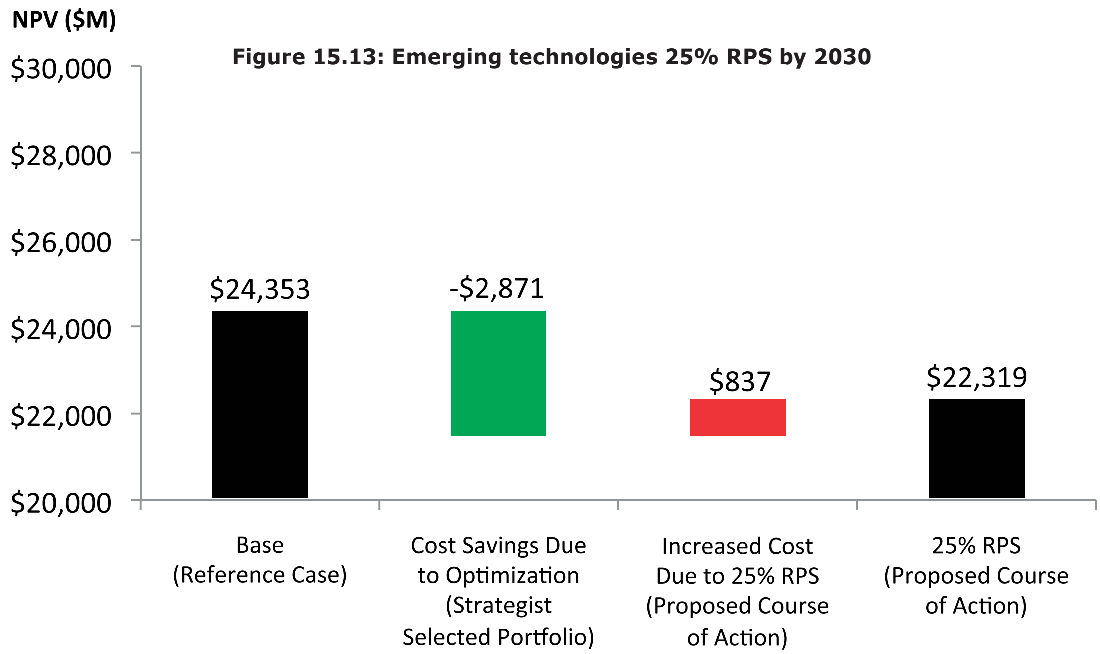
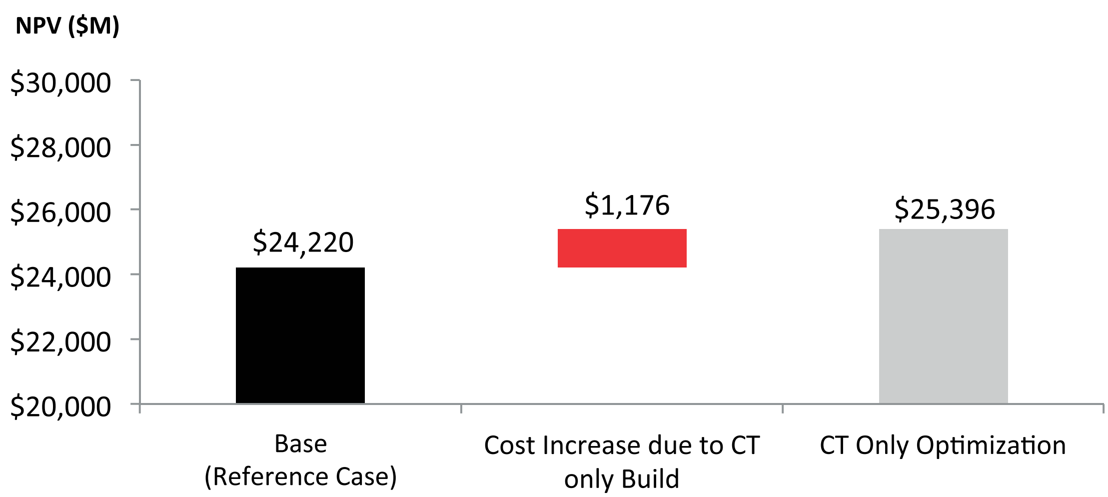


Figure 15.14: BAU 50% ROA return



7) CT Only

This sensitivity was only required to be run on the Business As Usual scenario. There is no reference portfolio for this sensitivity, only a single optimization compared to base case reference portfolio. If the resource mix expansion were limited only to CT resources, NPV costs would increase by $1.2 billion. This is due to higher energy prices resulting from higher natural gas prices in the market.

Summaries of the resource selections in each year, under this sensitivity and for each portfolio, are included in the Appendix of this report.

RISK ASSESSMENT

One of the purposes of running selected sensitivities on the identified scenarios was to evaluate the risks of the different scenarios by subjecting them to additional diverse conditions.

High Load Growth

The sensitivity around high load growth (1.5 percent load growth per year) was designed to evaluate the risks of different load growth patterns on the Business As Usual, Emerging Technology and Environmental Policy scenarios. High load growth may introduce risk around whether or not sufficient energy and capacity can be available to customers within the varied "worlds" created by the different scenarios.

From an analysis of the NPV results provided by the different resource plans in the high load sensitivity, the company found that when low-cost renewables are available, this mitigates the risks presented by high load. When low cost renewables are available, as they are in the Emerging Technology and Environmental Policy scenarios, the cost savings resulting from optimization of supply and demand-side resources (as opposed to market purchases) are significantly more ($4.6 billion and $5.2 billion, respectively) than in the Business As Usual scenario ($2.5 billion where low-cost renewables are not available).

Energy Waste Reduction Savings at 2.5 percent

The sensitivity around energy waste reduction program growth (2.5 percent energy efficiency savings over four years) was designed to evaluate the impact of a significant growth in energy waste reduction savings over a relatively short period of time. When performing a similar analysis of NPV results as performed for the high-load sensitivity, a similar customer benefit from low-cost renewables is seen. When low-cost renewables are present in the Emerging Technology and Environmental Policy scenarios, the cost savings from an increase in energy waste reduction programs is over $2 billion as opposed to under $1 billion in the Business As Usual scenario.

High Natural Gas Prices

High natural gas prices was another sensitivity that was run on all three identified scenarios. This sensitivity was designed to test the risk of significant increases in natural gas prices, and the effect on the different scenarios described and modeled. When the high gas reference case is compared to the base reference case for all three scenarios, an increase in costs results. This is not unexpected and the degree of cost increase is relatively similar between the three scenarios. Preference for demand-side resources as well as renewables increase as natural gas prices rise; therefore these low cost resources result in significantly more savings in the Emerging Technology and Environmental Policy world as compared to Business As Usual.

50 percent Retail Open Access Return to Utility

There were several sensitivities that were run on only one scenario, which allowed the company to evaluate, analyze and perform a risk assessment of specific conditions on an individual scenario. The 50 percent ROA return sensitivity evaluated the risk to customers if 50 percent of the retail choice load returns to the company's capacity service by 2023. We can see through an evaluation of the NPV results that in this sensitivity, run only on the Business As Usual scenario, there is a risk of increased costs to serve the additional demand. However, optimization with supply- and demand-side resources has some impact of mitigating this risk, although not completely. While overall costs would increase as a result of the return of ROA customers, the allocation of fixed cost to more customers would improve the impact to all customers.

CT Only

An additional sensitivity run only on the Business As Usual scenario was placing a constraint on modeling so that the only capacity resource offered to fill any identified energy needs within the study period is natural gas fired simple cycle combustion turbines (CTs). The risk identified within this sensitivity is that when restricting choice to only one type of generating resource, and not including demand-side options as an equal resource to meet future needs, costs will increase. A portfolio mix containing only CTs as future projects would also increase customers' exposure to risk related to fluctuations in natural gas prices.

25 Percent Renewables by 2030

In the Emerging Technology scenario, a sensitivity centered on renewable energy served the purpose of evaluating risks on a scenario that was designed with significantly lower renewable and technology costs throughout the IRP study period. In this sensitivity, use of renewable energy in the utility's service territory was increased to at least 25 percent by 2030. Within the company's modeling, it was found that 25 percent renewables were achieved by 2030 in the initial outlook case, Portfolio C, for this scenario; therefore there was little to no risk for this parameter.

Carbon Emission Reductions

In the Environmental Policy scenario, a sensitivity centered on carbon emission reductions served the purpose of evaluating the risk associated with establishing carbon reduction targets. The baseline for the Environmental Policy was a 30 percent reduction in carbon by mass from 2005 to 2030. The 50 percent carbon reduction sensitivity defined within the IRP requirements further tested the risk of these policies by determining NPV effects from further raising carbon reduction targets. Within the company's modeling, it was found that a 50 percent reduction in carbon was achieved in the initial outlook case, Portfolio C, for this scenario; therefore there was little to no risk for this parameter.

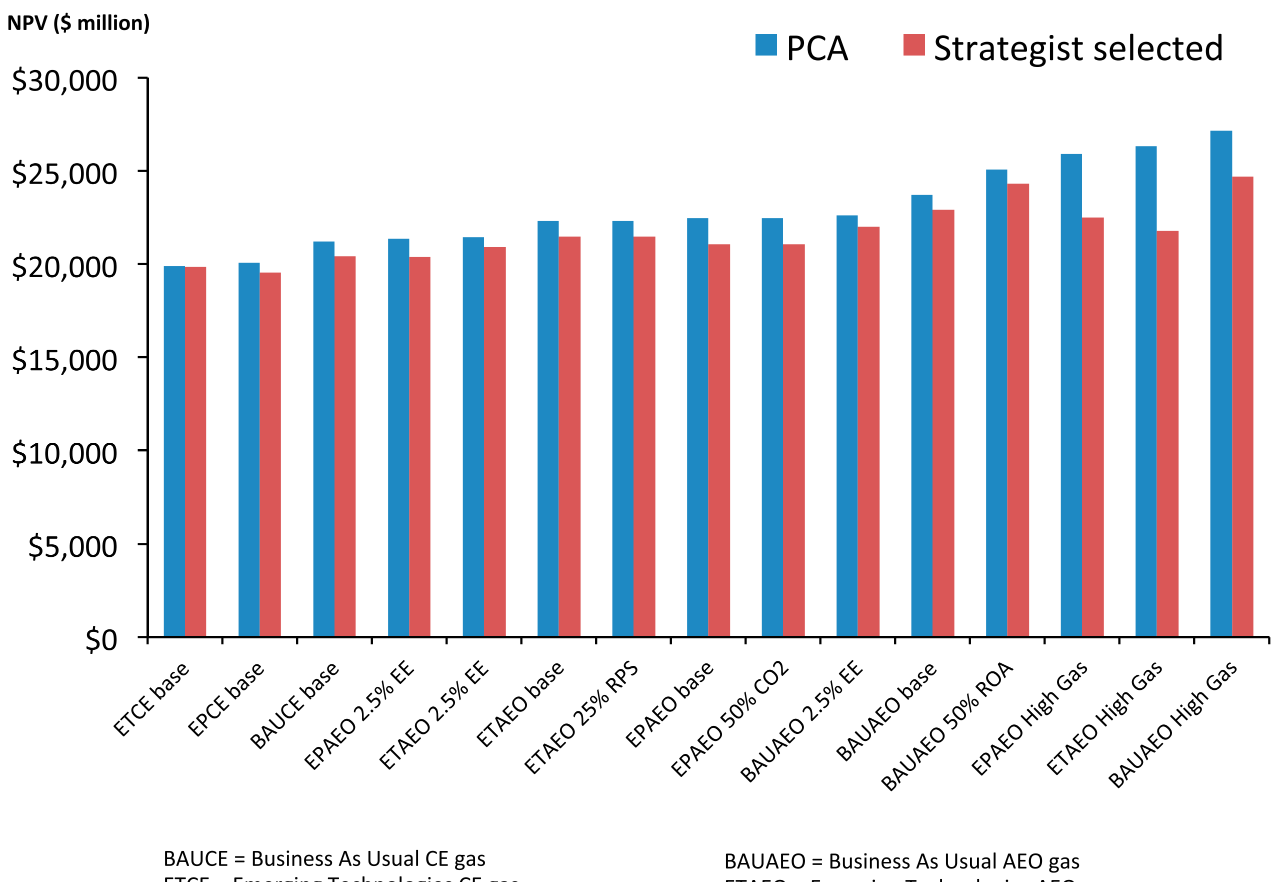
Tax Reform – Fixed Charge Rate

A final sensitivity the company chose to create and model in the six base scenarios was centered on tax reform. This sensitivity was modeled to identify and evaluate any risks that recent tax law changes may have had on modeling assumptions, inputs, resource plans and associated NPVs within the different IRP scenarios identified. A 21 percent federal income tax rate was input into the Strategist model via a fixed-charge rate, in place of the original 35 percent rate and the six base scenarios were modeled. The primary effect of tax reform was on the economics of resources offered to model to fulfill future capacity needs. Tax reductions resulted in lower costs for new resources and lower incremental capital costs assumed for the Medium Four units evaluated for early retirement. Tax reform has some risk impact on resource mix, as lower incremental capital costs are more advantageous for large, long-term assets such as natural gas combined cycle units, and less advantageous for solar and wind because the current production and investment tax credits are minimized when the weighted average cost of capital is reduced.

Proposed Course of Action (PCA)

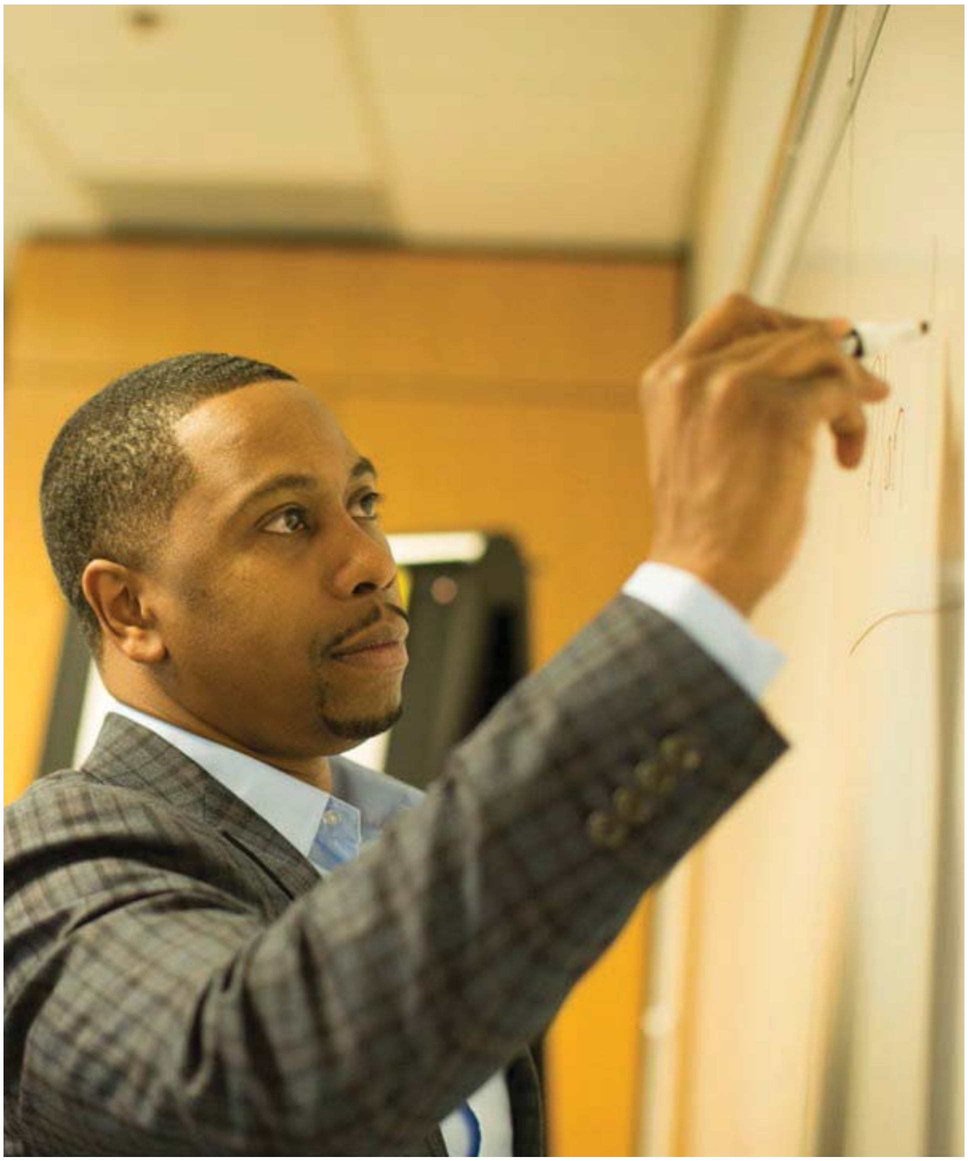
In addition to the above defined sensitivities, the company also performed a risk assessment on the different scenarios by evaluating its PCA through each of the six base scenarios, as well as many of the defined sensitivities. This allowed the company to evaluate the economic performance of its PCA by seeing the range of NPVs generated. The smaller the range of NPVs indicates the PCA performed similarly in all worlds and therefore exposes customers to less risk. A graph of the performance of the PCA in the defined scenarios and sensitivities is included below.

Figure 15.15: Net present value of 2018 IRP sensitivity results – Proposed course of action ($ MILLION)

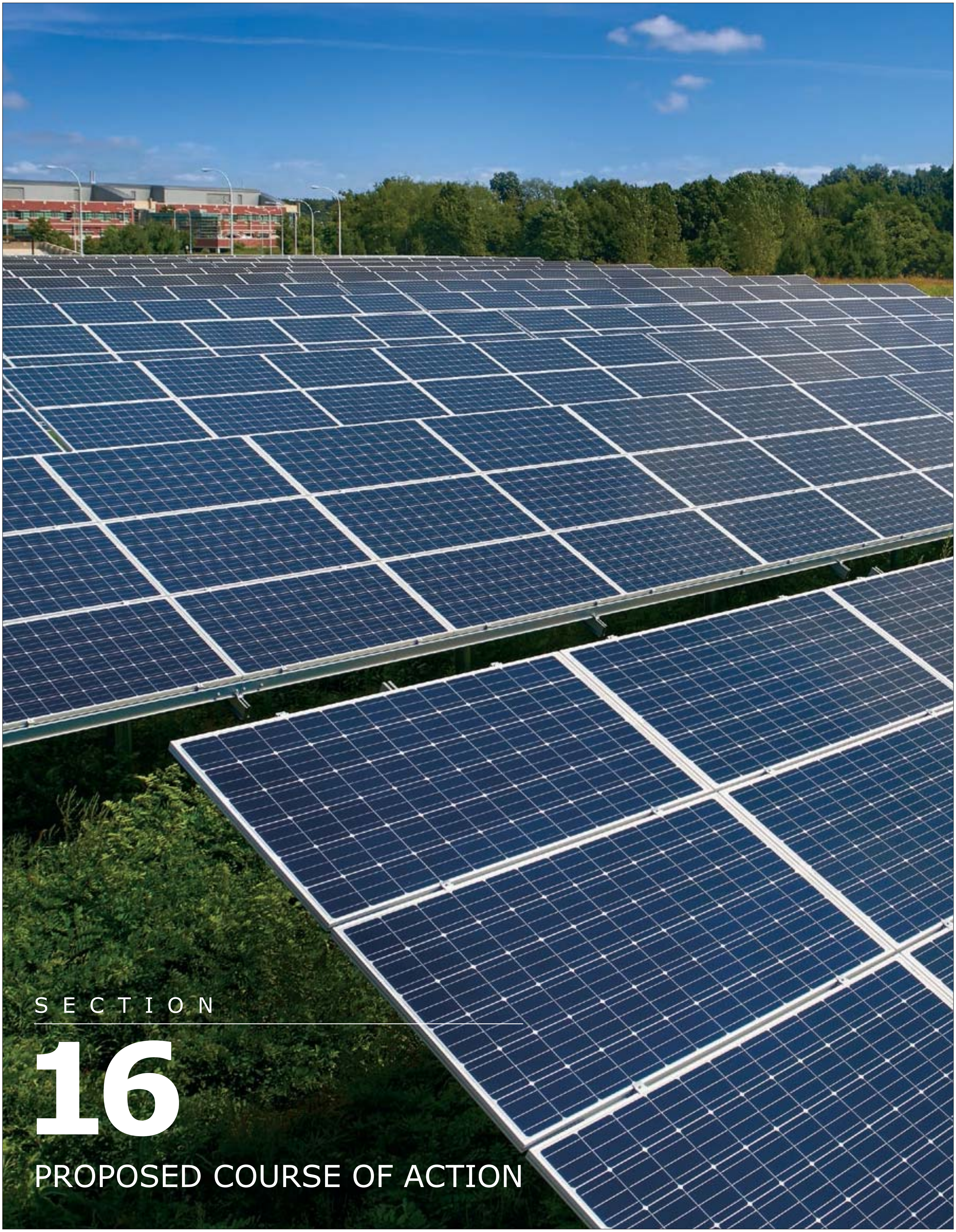


BAUCE = Business As Usual CE gas
ETCE = Emerging Technologies CE gas
EPCE = Environmental Policy CE gas

BAUAEO = Business As Usual AEO gas
ETAEO = Emerging Technologies AEO gas
EPAEO = Environmental Policy AEO gas



2018 INTEGRATED RESOURCE PLAN



SECTION

16

PROPOSED COURSE OF ACTION

SECTION 16

Proposed Course of Action

The proposed course of action (PCA) is the result of the entire IRP and represents the most reasonable plan that achieves all planning objectives set forth by the commission as well as the company and described in Section IV Introduction of this report. The company's "clean and lean" strategy combined with the clean energy breakthrough goals is a step forward to delivering an energy supply supported by a diverse mix of resources that minimize cost and environmental risks to customers, while maintaining affordability.

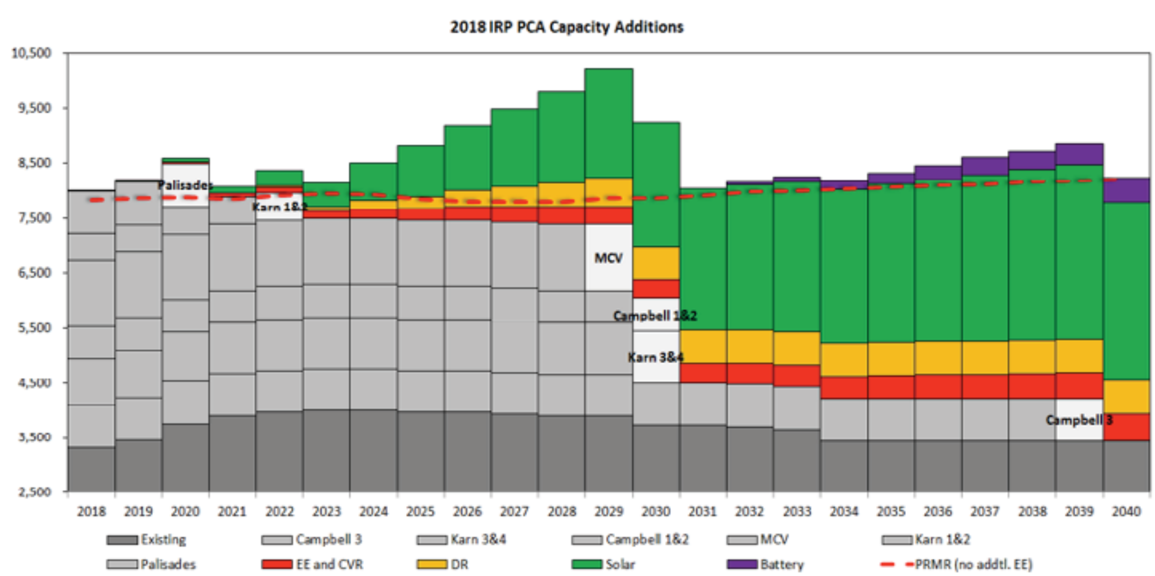
TECHNOLOGY RESOURCE MIX AND PLAN TO MEET FUTURE CAPACITY REQUIREMENTS

The PCA includes replacement plans for the Karn 1 and 2 generating units, several other company-owned generating units set to retire in the 2030s and a large power purchase agreement expiring in 2030. The PCA contains the new resource options shown in Table 16.1 and includes the existing generation fleet to meet forecasted customer capacity needs:

Table 16.1: New resource options to meet forecasted customer capacity needs

Generation Technology	MW Levels by 2040	ZRC Level by 2040	Fuel $
Solar Generation	6,300	3,200	0
Wind Generation	550	86	0
Batteries	450	450	0
Demand Response	1,250	1,400	0
Energy Waste Reduction	1,263	1,307	0
Conservation Voltage Reduction	111	115	0

Figure 16.1: Proposed course of action and existing resources



- Using a modular, incremental approach, these resources options are phased in from 2019 through 2040 and leverage the historical performance and supply of our existing generation resources. Figure 16.1 is an incremental resource plan to the base capacity outlook that includes the proposed retirement of Karn 1 and 2 in the year 2023. In the development of supply-side resources, such as solar and wind, the company will continue to work with communities and interested parties in Michigan to comply with local, state and federal regulations.

SELECTION PROCESS OF THE PROPOSED COURSE OF ACTION

The process used to develop the PCA is detailed in Section V Analytical Approach and Section 15 Modeling Results. At a high level, the company defined a set of business objectives (Figure16.2) to guide the development of the IRP. These business objectives in combination with our clean and lean strategy provided further targets to consider through the IRP process. The development of scenarios and sensitivities, defined assumptions and a robust risk analysis as described in earlier sections of this report support the development of the PCA.

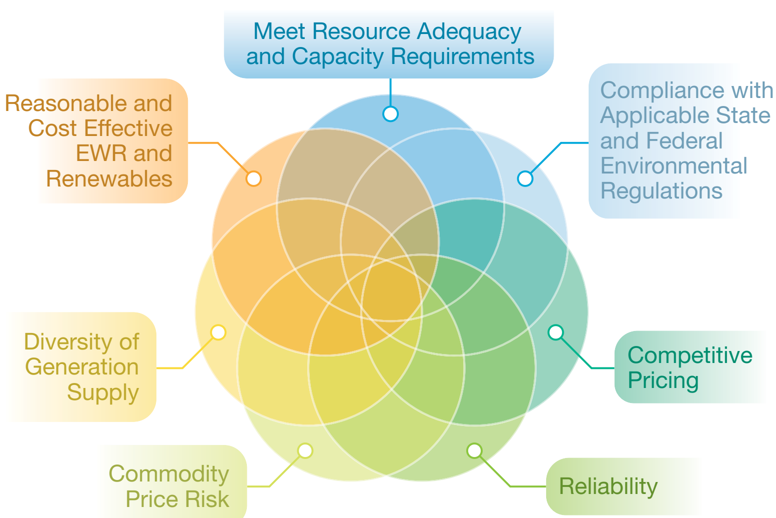


Figure 16.2: Business Objectives aligned with MCL 460.6t Section 8

HOW THE PLAN SATISFIES BUSINESS OBJECTIVES

The proposed course of action (PCA) satisfies the following:

RESOURCE ADEQUACY AND CAPACITY REQUIREMENTS

The PCA provides incremental capacity the company and its customers can count on to meet resource adequacy and capacity requirements by securing enough zonal resource credits to meet or exceed projected peak demand.

COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

The PCA phases out fossil fuel emissions, while maintaining affordable rates and bills by calling for clean non-carbon emitting resources throughout the planning period. The company must ensure the PCA meets the RPS specified in Michigan law and complies with applicable state and federal environmental regulations. Transitioning to a clean and lean resource portfolio positions the company to achieve compliance with potential environmental regulation that may be imposed in the future, such as carbon dioxide emissions regulations, which reduces future financial risk to customers. The PCA also must align with the company's clean energy goal, which extends beyond the compliance level required by current law and illustrates the company's deep commitment to protecting the environment.

COMPETITIVE PRICING

The PCA provides an opportunity to ensure competitive pricing on resources that are similar if not better than those projected in this IRP. The use of demand-side management programs with the ability to be scaled incrementally in combination with competitive bidding ensures the most economic resources to serve our customers. The PCA must provide for affordable customer bills and competitive pricing, which are critical to support the lives of the company's residential customers and the businesses of its commercial and industrial customers. The PCA must provide for both a financially healthy utility that attracts capital investment for needed electric infrastructure and affordable bills for customers. In a traditional utility regulatory environment, utility investors earn returns on capital investment in new infrastructure. This traditional regulatory model gives little incentive for utilities to utilize PPAs to meet energy and capacity needs. Act 341 appropriately authorized the commission to approve financial compensation for utilities that utilize PPAs. The commission's adoption of such compensation is critical to creating a stable, sustainable regulatory and financial model that drives utilization of PPAs that benefit Michigan and the company's customers.

RELIABILITY

The PCA incorporates a glide path to ensure there is adequate time to understand the effects on reliability of the system and to modify development or implementation as necessary to maintain reliability. The PCA provides sufficient capacity to serve anticipated peak electric load plus applicable PRMR and LCR results in a reliable energy supply that is lean and modular. A lean and modular portfolio ensures reliability by avoiding exposure to failures in transmission and distribution systems or to a loss of a single, large central generating station.

COMMODITY PRICE RISK

Commodity price risk is minimized with the proposed renewable and demand-side management resources called for in the PCA. These resources provide energy with no incremental commodity cost and reasonable energy market exposure. This supply portfolio minimizes potential for surplus capacity, diversifies supply resources, insulates the company and its customers from commodity price risks and protects against high customer rates.

DIVERSITY OF GENERATION PORTFOLIO

The generation portfolio produced by the PCA is diverse. The plan incorporates a blend of demand-side management, contractual agreements, wind, natural gas, coal and battery storage. No resource is overly relied upon in the proposed plan. The modular nature of the plan allows flexibility to change course in the future if demand-side or solar resources become difficult to execute at levels in the plan or if other resources like batteries become more cost-effective for customers.

REASONABLE AND COST-EFFECTIVE ENERGY WASTE REDUCTION AND RENEWABLES

Cleaner energy resources utilizing wind, sun and technology advancements provide energy and capacity to customers that is reasonable and cost-effective to the benefit of our customers and to Michigan.

CLEAN AND LEAN STRATEGY

Using the business objectives was to identify a PCA that is aligned with the company's clean and lean strategy. The company strives to eliminate coal and reduce carbon emissions by 80 percent by 2040. Cleaner resources such as wind, solar, batteries and natural gas are important components to achieving this goal over the planning horizon of the IRP. Consideration was given to programs that allow customers to reduce energy usage throughout the day and during peak times. The PCA includes various demand related programs intended to both reduce and supply energy during the peak times. The PCA is a lean and modular portfolio because of demand-side management (peak reductions), and renewables developed incrementally ensure the right amount of resources to serve customers in a reliable and affordable manner.

CUSTOMER VISION

Based upon the feedback received during the stakeholder engagement efforts supporting this IRP, the company is well aligned with our customers' vision of increased levels of renewables and advanced technologies like demand response and energy efficiency programs, all of which support a sustainable future for Michigan.

CUSTOMER RATE IMPACTS

The customer cost impacts of the PCA are reasonable because it has a compound annual growth rate of only 0.68 percent over the entire planning period. Total incremental revenue requirements are projected to increase only $658 million over the entire planning period and only $108 million during the near-term period.

The NPV comparisons can be seen in Appendix X. As described in detail in Section V Analytical Approach, renewables and demand-side resources reduce costs to customers. Customer rate impacts as provided in Appendix X are based upon an assumption that the discount rate is 7.32 percent. If the discount rate were adjusted downward, the resulting affect would be a reduction in costs. If it were adjusted upward, the resulting affect would be an increase in costs.

IMPLEMENTATION PLAN

The company plans to continue to follow the regulatory process pursuant to applicable MPSC orders and PA 341 Section 6t. Implementation of the PCA in the first three years focuses on the continued expansion of demand response, developing renewable energy to meet the RPS, implementation of the Conservation Voltage Reduction program and preparing to achieve 2 percent energy efficiency savings by 2021.

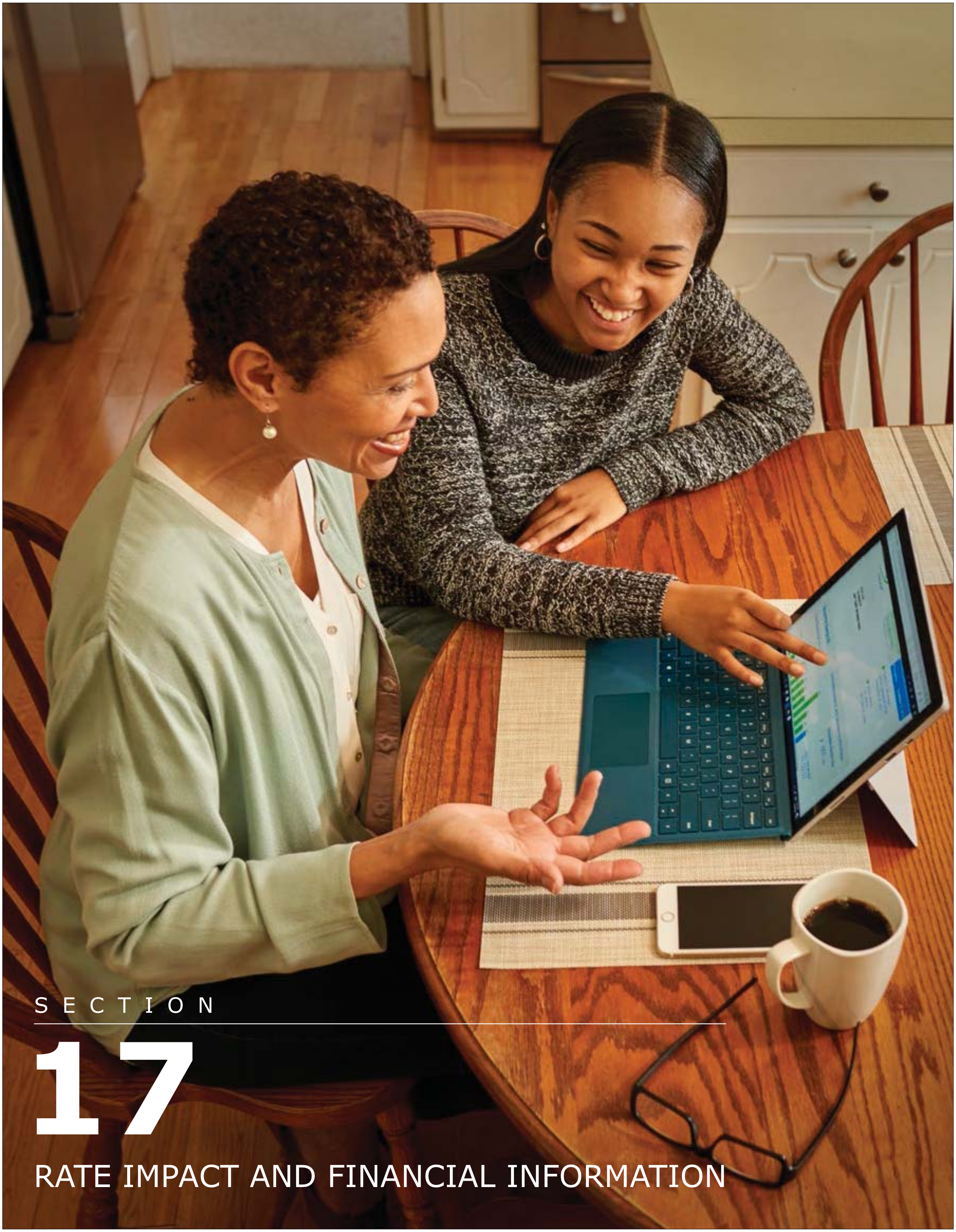
The company will file annual reports with the commission on May 31 of each year subsequent to the approval of the proposed plan. The first of such reports would be filed on May 31, 2020. These reports will give updates on the status of all projects and investments that will be commenced by the company subsequent to the commission's approval.

Table 16.2: Short-term actions by resource

ACTION PLAN	
Demand Response	Customer acquisition and improvements of the DR program offerings are planned to achieve the level of reductions proposed.
Energy Waste Reduction	Continue to grow on past successes for providing energy efficiency savings to the benefit of residential and business customers.
Renewable Energy	Work towards acquiring the wind and solar build identified in the Renewable Energy Plan Case No. U-18231.


Consumers Energy

2018 INTEGRATED RESOURCE PLAN



SECTION

17

RATE IMPACT AND FINANCIAL INFORMATION

SECTION 17

Rate Impact and Financial Information

CUSTOMER RATE IMPACTS

The company aims to deliver energy at affordable rates and bills for customers. Historical energy waste reduction programs have saved around $1.4 billion in energy savings for participating customers, and project $17 billion in savings with these programs. Utilization of energy-saving and reduction programs such as EWR and DR programs help to offset future supply-side resources and reduce effects of new supply-side builds. The annual increases in revenue requirement for the PCA vary over the time period, but in 20 of the 21 years they are less than 2 percent and have a compound annual growth rate (CAGR) of less than 0.7 percent. This rate impact is developed using the incremental expenditures.

An alternative plan was evaluated to understand the risks associated with the PCA. The alternative plan includes similar resources as the PCA with the exception of the addition of a single natural gas-fired combined cycle plant in the year 2031, which reduces the magnitude of solar build throughout the study period. The alternative plan is capable of meeting the company's goal to reduce carbon emissions by 80 percent compared to 2005 levels, and to eliminate coal by the year 2040. Customer rate impacts of including a natural gas-fired facility results in a CAGR of 0.83 percent, and would result in a one-time increase of 8 percent in the year 2031. This indicates the PCA is more reasonable and prudent than an alternate plan exposed to commodity price fluctuations. The costs considered the revenue requirement and rate base, fixed and variable operations and maintenance costs, environmental costs.

FINANCIAL ASSUMPTIONS

A series of financial assumptions were utilized to determine the NPV of revenue requirements, the average system rates per kWh by year and the nominal revenue requirements by year, and these can be found in Appendices X and X. Appendix X contains the projected year-over-year impact of the PCA and the alternative plan on the company's revenue requirement, rate base, plant-in-service capital accounts, non-fuel fixed operations and maintenance accounts, and non-fuel variable operations and maintenance accounts. There are no projected impacts on fuel cost, emissions cost and effluent additive costs associated with the incremental resources in the PCA because they are clean resources that do not have these types of costs.

Table 17.1: Financial assumptions in Strategist®

FINANCIAL ASSUMPTION	VALUE
General Rate of Inflation (average 2015-2040)	2.31 percent
Allowance for Funds Used During Construction (AFUDC) Rates	7.345 percent
Cost of Capital Rates & Assumed Capital Structure (Debt, Equity, and Weighted)	Debt at 2.5 percent Equity at 5.05 percent
Discount Rate	7.55 percent (scenarios and sensitivities) 7.32 percent for PCA
Tax Rates	35 percent (scenarios and sensitivities) and 21 percent for PCA & FCR sensitivity,

2018 INTEGRATED RESOURCE PLAN

SECTION

18

ENVIRONMENTAL

SECTION 18

Environmental

Consumers Energy has been committed to protecting the environment for decades using various approaches including fuel switching and installing pollution control equipment. The company has prudently ensured compliance with all applicable state and federal environmental regulations. Investments the company has made to achieve such compliance have been done in a manner that has minimized, to the extent reasonably possible, the associated costs for customers. In addition to maintaining compliance, these investments also ensure continued supply reliability while having a positive impact on the environment by achieving significant reductions of pollutants.

The applicable regulations for the company's existing generation resources fall into three main categories: air quality, water quality, and waste management.

The following will detail the list of applicable regulations and compliance dates associated with the company's existing generation fleet and the proposed course of action (PCA).

LIST OF APPLICABLE REGULATIONS AND DESCRIPTIONS

Table 18.1: Applicable regulations and descriptions

AIR QUALITY REGULATIONS				
Regulation	**Acronym**	**Controlled Pollutant**	**Applicable Resource(s)**	**Compliance Date**
Cross-State Air Pollution Rule	CSAPR	NOx, SO	Coal	2018
Mercury Air Toxics Standards	MATS	Hg, PM, Acid Gases, Metals	Coal	2015*
Michigan Mercury Rule	MMR	Hg	Coal	2015*
New Source Performance Standard	NSPS	GHG	Coal	2015

* Compliance is 2016 with a one-year extension

TABLE 18.1: APPLICABLE REGULATIONS AND DESCRIPTIONS
(CONTINUED FROM PREVIOUS PAGE)

Water Quality Regulations				
Regulation	**Acronym**	**Controlled Pollutant**	**Applicable Resource(s)**	**Compliance Date**
Clean Water Act §316(b)	316(b)	Fish Protection	Coal	2018-2022
Steam Electric Effluent Guidelines	SEEG	Effluent	Coal	2020-2023

Coal Combustion Residuals (Waste) Regulations				
Regulation	**Acronym**	**Controlled Pollutant**	**Applicable Resource(s)**	**Compliance Date**
Resource Conservation Recovery Act	RCRA	Coal Combustion By-Product	Coal	2018

DESCRIPTION OF APPLICABLE ENVIRONMENTAL REGULATIONS

Cross-State Air Pollution Rule (CSAPR): CSAPR governs the emission of sulfur dioxide (SO2) and nitrogen oxides (NOx) from fossil-fueled Electric Generating Units (EGUs) through the use of an allowance-based “cap-and-trade” program. CSAPR restricts interstate trading for addressing relatively small changes in year-to-year emissions variability. Phase I took effect on Jan. 1, 2015, and Phase II on Jan. 1, 2017. CSAPR will apply to all of Consumers Energy’s baseload generation facilities and combustion turbines.

MERCURY AIR TOXICS STANDARDS (MATS)

MATS is a federal rule finalized by the EPA in December 2011, and regulates emissions of mercury (Hg), acid gases, certain metals and organic constituents via emission rate limits or the use of work practices for coal and oil-fired EGUs. Unlike earlier regulations allowing allowance purchases or emission averaging over multiple units, MATS requires unit-by-unit control equipment. Compliance with MATS was required by April 16, 2015, unless an extension was granted. Consumers Energy applied for, and was granted, an extension until April 16, 2016, by the MDEQ. MATS will apply to all of Consumers Energy’s coal- and oil-fired generation facilities.

MICHIGAN MERCURY RULE (MMR)

The purpose of the Michigan Mercury Rule (MMR) is to regulate the emissions of mercury in Michigan. Existing coal-fired EGUs must choose one of three methods to comply with the emission limits, and any new EGU will be required to utilize Best Available Control Technology (BACT). Initial compliance with MMR was Jan. 1, 2015; however, the MDEQ revised the MMR in October 2013 to align the compliance deadline to the MATS compliance date. In addition, the MDEQ issued variances for compliance requirements under MMR and also indicated that construction extensions granted via MATS would also cover MMR-related requirements. Therefore, the effective date of compliance with MMR was April 16, 2016.

GREEN HOUSE GAS (GHG)

On Oct. 23, 2015, the EPA published into the Federal Register the finalized Clean Power Plan (CPP) addressing carbon emissions from EGUs. This was a parallel rulemaking under §111 of the Clean Air Act (CAA), and included §111(d) Existing Source Performance Standards (ESPS) and CAA §111(b) New Source Performance

Standards (NSPS) (the "§111(b) rule"). Legal motions were immediately filed challenging the §111(d) rule for existing EGUs. In addition, motions to stay the rule were filed by numerous utilities, unions, states (led by West Virginia and Texas), coal interests (led by the National Mining Association) and by business interests (led by the Chamber of Commerce of the United States). On Feb. 9, 2016, the U.S. Supreme Court of the United States (SCOTUS) acted on the filed motions and issued five orders granting a stay of the CPP pending judicial review. The orders indicate that the stay will be in effect through a determination by the Court to deny any petitions for writs of certiorari that are filed, or after a judgment is issued by the Court if the Court takes the case on certiorari.

After completing a thorough review, as directed by the Energy Independence Executive Order, on Oct. 16, 2017, the EPA published into the Federal Register a proposal to repeal the CPP. The EPA proposes a change in the legal interpretation as applied to section 111(d) of the CAA, on which the CPP was based, to an interpretation that is consistent with the Act's text, context, structure, purpose, and legislative history, as well as with the EPA's historical understanding and exercise of its statutory authority. The EPA accepted comments on the proposal through April 26, 2018.

The CAA §111(b) rule was not subject to the §111(d) stay issued by the SCOTUS and thereby remains in effect. Litigation surrounding the §111(b) rule has been placed in abeyance pending the outcome of the SCOTUS stay. The EPA has not yet acted on the §111(b) rule. Instead it appears to be focusing its efforts on the CPP.

The outcome of these EPA rules in court, or the impact of the new Trump administration on the EPA rules, is uncertain, and the regulatory activity will continue to be monitored regarding greenhouse gas emissions standards that may affect EGUs.

CLEAN WATER ACT §316(B) (316(B))

On Aug. 15, 2014, the finalized the Clean Water Act, Section 316(b) rule ("316(b)"), establishing new standards for Cooling Water Intake Structures (CWIS). 316(b) became effective on Oct. 14, 2014, and requires existing power generation facilities, with a design intake flow greater than 2 million gallons per day (mgd) from waters of the United States for cooling, to reduce impingement and entrainment of fish and other aquatic organisms at CWIS. Additionally, any facility subject to 316(b) with actual flows in excess of 125 mgd must provide an entrainment study with its National Pollutant Discharge System (NPDES) permit application. As such, 316(b) applies to all units on Consumers Energy's Karn and Campbell sites.

STEAM ELECTRIC EFFLUENT GUIDELINES (SEEG)

On Nov. 3, 2015, the EPA published the final effluent limitation guidelines (ELG) rule for the steam electric power generating point source category (referred to as SEEG) into the Federal Register ("SEEG rule"). The final SEEG rule establishes effluent limitations based on Best Technology Available (BTA) for existing sources, including dry or closed-loop bottom ash systems. The final SEEG rule excludes oil-fired generation units and units with a nameplate capacity of 50 megawatts (MW) or less. The final SEEG rule also establishes New Source Performance Standards (NSPS) and pretreatment standards for existing and new sources that discharge to publically owned treatment works.

On Sept. 18, 2017, the EPA published into the Federal Register its intent to conduct a rulemaking to potentially revise certain Best Technology Available (BTA) effluent limitations and pretreatment standards for existing sources (PSES) for the steam electric power generating point source category. As a result, the EPA is postponing the earliest compliance dates for the new, more stringent BTA effluent limitations and PSES for flue gas desulfurization (FGD) wastewater, and bottom ash transport water, for a period of two years. The EPA stated it does not intend to conduct a rulemaking that would potentially revise the new, more stringent BTA effluent limitations and pretreatment standards for fly ash transport water, flue gas mercury control wastewater and gasification wastewater (Consumers Energy does not produce any of these three wastewater streams), or any of the other requirements in the SEEG rule. As such, the EPA is not changing the compliance dates for the BTA limitations and PSES established by the SEEG rule for these waste streams. The EPA's action to postpone certain compliance dates is intended to preserve the status quo for FGD wastewater and bottom ash transport water until the EPA completes its next rulemaking concerning those waste streams, and it, thus, does not otherwise amend the effluent limitations guidelines and standards for the steam electric power generating point source category.

Compliance with new BTA effluent limitations does not apply until a date determined by the permitting authority that is "as soon as possible" beginning Nov. 1, 2020, but no later than Dec. 31, 2023.

RESOURCE CONSERVATION RECOVERY ACT (RCRA)

On April 17, 2015, the EPA published 40 CFR Parts 257 and 261, Disposal of Coal Combustion Residuals (CCRs) from Electric Utilities, in the Federal Register under Subtitle D of the RCRA. The new rules establish minimum national criteria for purposes of determining which CCR solid waste disposal facilities and solid waste management practices pose a reasonable probability of adverse effect on health or the environment under RCRA. The rule is considered self-implementing, meaning that affected facilities must certify compliance with the published standards and schedules despite existing state rules, or adaptation of state rules, to encompass new standards. By codifying standards under Subtitle D, owners and operators are not required to obtain permits, and states are not required to adopt and implement the new rules. Instead, the rules' only enforcement mechanism is for a state or citizen group to bring a RCRA citizen suit in federal district court against any facility that is alleged to be in noncompliance with the newly promulgated minimum standards.

In December 2016, the Water Infrastructure Improvements for the Nation Act ("WIIN") was passed. This law provides authority for state-implementation of coal ash management through a state permit program, in lieu of the current enforcement of the CCR Rule through the RCRA Citizen Suit Authority. States may elect to submit a CCR permit program to the EPA for approval and the EPA must either approve the permit program or enforce their own. Michigan is currently in discussions with stakeholders on how best to implement a state program. In the interim, the EPA has direct enforcement authority of the RCRA CCR rule in addition to states and citizens.

REGULATORY IMPACT ON THE PROPOSED COURSE OF ACTION

The PCA contains a diversified blend of existing resources with additional expansion in renewables and demand-side resources. While much of the existing fossil-fueled generation is subject to the above list of environmental regulations, nearly all of the applicable regulatory compliance dates stated in the above charts have been reached with the exception of the SEEG and 316(b) requirements that apply to the Campbell and Karn generating complexes. The proposed retirement year of 2023 for Karn 1 and 2 aligns well with the compliance dates associated with the water regulations assumed to require a level of investment by this date. Retiring these assets in the year 2023 enables the company to avoid more than $77 million in estimated compliance costs associated with SEEG and 316(b) compliance.

The regulatory impact on the additional resources identified in the PCA should be minimal. With no additional proposed fossil-fuel generating plants, and an increase in renewables and demand-side management, this plan significantly minimizes the environmental compliance regulation associated with traditional fossil-fuel generation sources.

The use of demand-side management eliminates environmental compliance regulations as they are “virtual power plants” leveraging advanced technologies, such as smart meters, to create a leaner customer peak demand, which reduces waste and costs for customers.

Increasing renewable energy eliminates the exposure to existing regulations focused on air quality, water quality and waste management required for coal- and natural gas-fired generating resources. However, renewables are not completely risk-free with regard to environmental regulations.

Wind and solar resources are subject to avian and threatened and endangered species regulations, which could impact siting locations as well as production. Wind resources are also subject to local ordinance restrictions pertaining to sound and shadow flicker, as well as local moratoriums on wind development in some cases.

Consumers Energy has and maintains strong relationships with local and state stakeholders to partner with them in the development of these resources. While there is some regulatory risk, the continued collaboration between the utility, its customers, communities and regulators can mitigate this risk.

CAPITAL COSTS TO COMPLY AT EXISTING GENERATING SITES

Capital costs for compliance of the existing fleet are forecasted to be incurred on the Medium Four units for the RCRA, SEEG and 316(b) environmental regulations. The figures below reflect the $77 million savings in estimated compliance costs associated with SEEG and 316(b) compliance. What remains are the expenditures that are aligned with the PCA. RCRA-related expenditures are not included as they are unavoidable regardless of whether or not the units continue to operate. Consumers Energy has nearly completed the capital investments necessary for compliance with RCRA. There are additional closure activities; however those expenses are Cost of Removal (COR).

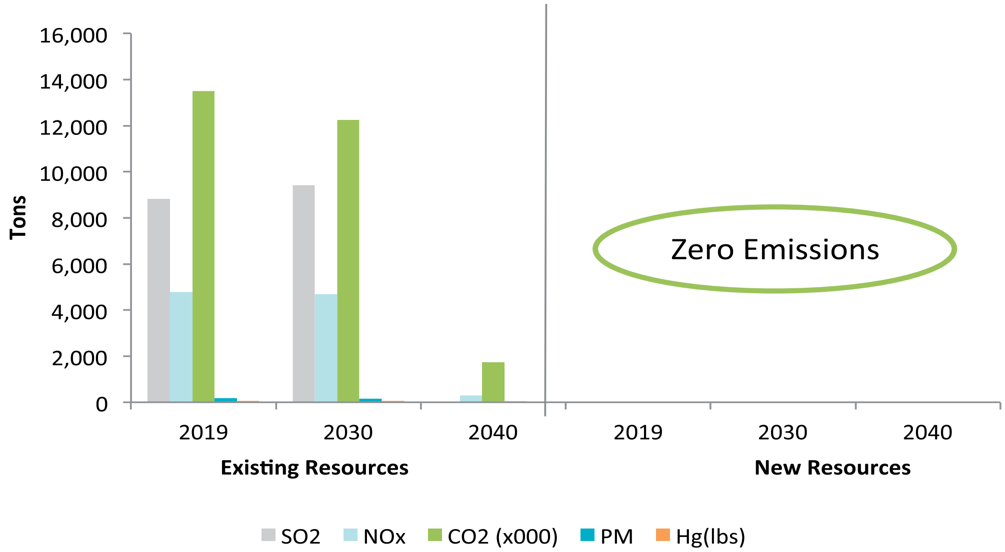
Table 18.2: Capital costs to comply at existing generating sites

	Karn 1&2 Retires 2023 ($K)	Campbell 1&2 Retires 2031 ($K)
SEEG	$1,048	$24,909
316(b)	$118	$265

Comparison of Annual Emission Projections

With the PCA, sulfur dioxide (SO_2), oxides of nitrogen (NOx), carbon dioxide (CO_2), particulate matter (PM) and mercury (Hg) are projected to decline as fossil fuel generation retires. The new resources proposed by the company produce no additional emissions.

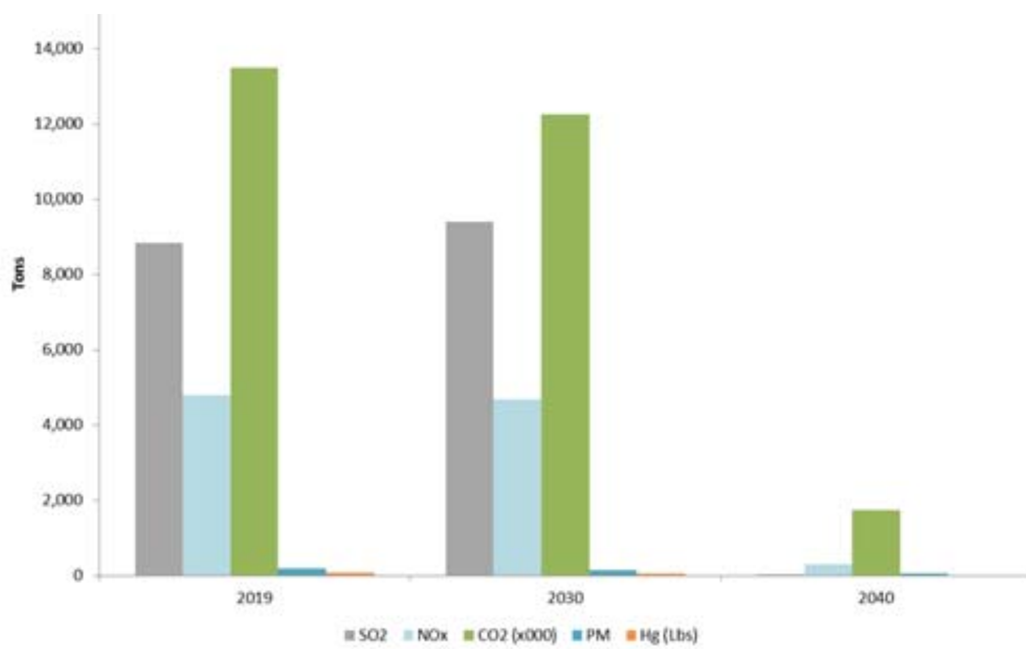
Figure 18.1: Emissions of existing and new resources in PCA



Total Projected Emissions

To evaluate the variance in total projected emissions of the PCA in different scenarios, the PCA was modeled in the BAU CE case and the three MIRPP scenarios. The emission projections for the PCA have minimal change between the MIRPP scenarios and the CE BAU scenario. This is because the dispatch of the existing fossil fleet with the levels of renewables and demand-side resources are not significantly impacted.

Figure 18.2: Total projected emissions of PCA (Year 2040)



COMPANY'S PLANET BREAKTHROUGH GOALS

In the past five years, Consumers Energy has created a cleaner, more sustainable energy future for Michigan by being a leader in reducing air emissions, reducing water usage, saving landfill space and boosting the amount of renewable energy supplied to customers. Consumers Energy plans to meet Michigan's energy needs by reducing carbon emissions by 80 percent from 2005 levels and eliminating coal by the year 2040. The continued transformation to cleaner fuel sources is part of a long-term, strategic commitment to protect the planet.

Through 2017, our actions have reduced our carbon emissions by 38 percent, reduced our water usage by 35 percent and avoided more than 1 million cubic yards of landfill disposal. The company is committed to build upon this success and has also developed new, five-year environmental goals for Michigan's water, waste, and land:

- **Water:** Save 1 billion gallons of water.
- **Waste:** Reduce waste to landfills by 35 percent.
- **Land:** Enhance, restore, or protect 5,000 acres of land in Michigan.

These goals represent our deep commitment to leave Michigan better than we found it.

PROJECTED CARBON EMISSIONS

Under the assumption the company continues operating the existing generating units to their design lives, we would be coal-free and reduce carbon emissions 65 percent by the year 2040 (Figure 18.3). However, the PCA has the potential to achieve a 92-percent reduction in carbon emissions and be coal-free by the year 2040 (Figure 18.6, fulfilling our planet breakthrough goals in a reliable and affordable manner.

Figure 18.3 Consumers Energy's business as usual base case

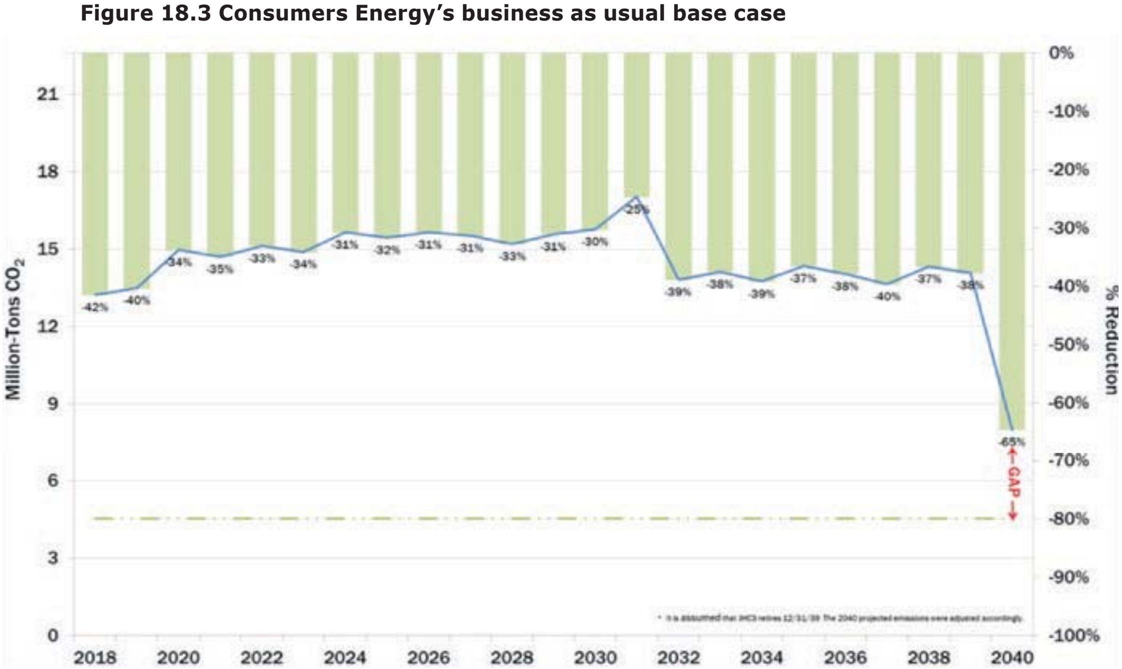
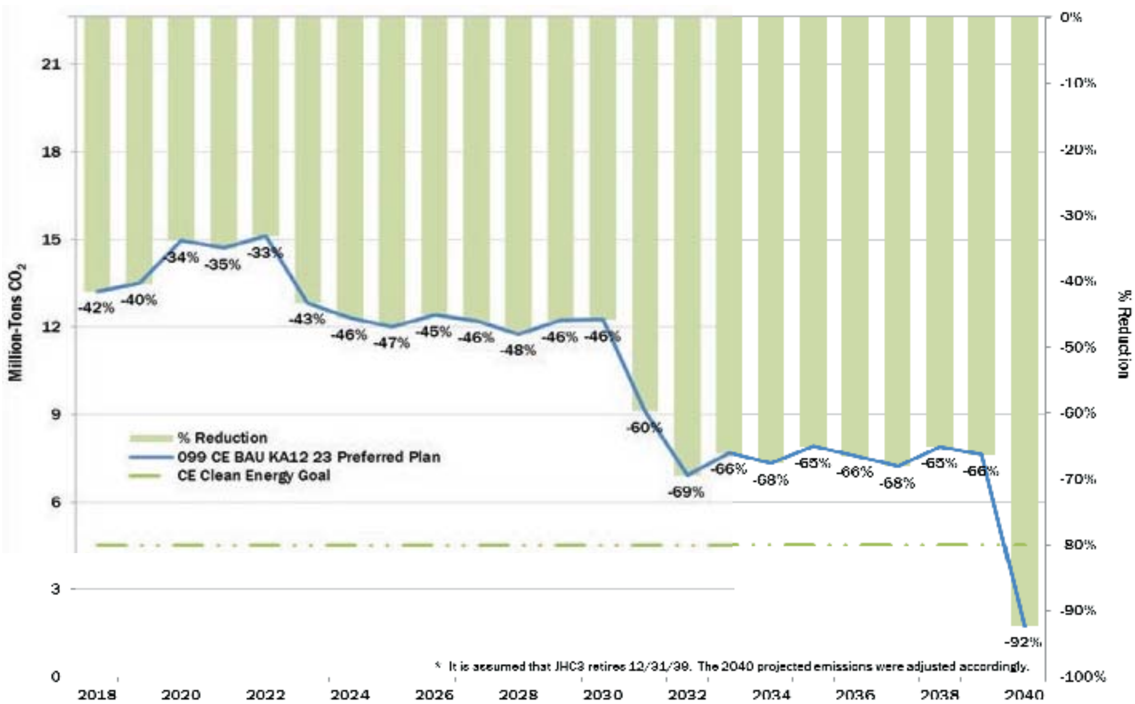


Figure 18.4 Consumers Energy's business as usual PCA



SECTION

19

APPENDIX

2018
INTEGRATED RESOURCE
PLAN

Index of Abbreviations

AC – Air conditioning

ACSR – Aluminum conductor steel-reinforced

AFUDC – Allowance for funds used during construction

AII-LF – All Inclusive Index – Less Fuel

AMI – Automated Metering Infrastructure

AQCS – Air quality control system

ASM – Ancillary services market

BACT – Best available control technology

BATT – Battery

BAU – Business as usual

BEV – Battery electric vehicle

BTA – Best technology available

CA – Campbell

CAA – Clean Air Act

CAAP – Central Appalachia

CAGR – Compound annual growth rate

CAPEX – Capital expenditure

CC – Combined cycle

CCF – Combined cycle F-class 2x1

CCH – Combined cycle F-class 2x1

CCR – coal combustion residuals

CDD – cooling degree days

CE – Consumers Energy

CEL – Capacity export limit

CF – Capacity factor

CFR – Code of Federal Regulations

CHP – Combined heat and power

C&I DR – Commercial and industrial demand response

CIL – Capacity import limit

CPP – Critical peak pricing

CPP – Clean Power Plan

CVR – Conservation voltage reduction

CWIS – Cooling water intake structures

CO_2 – Carbon dioxide

CON – Certificate of Necessity

CONE – Cost of new entry

CSAPR – Cross-State Air Pollution Rule

CT – Combustion turbine

CWA – Clean Water Act

DER – Distributed energy resources

DG – Distributed generation

DR – Demand response

DRMS – Demand response management system

DSM – Demand-side management

EARP – Experimental Advanced Renewable Program

ECC – Economic carrying charge

EDIIP – Electric Distribution Infrastructure Investment Plan

EE – Energy efficiency

ELCC – Effective load carrying capability

EGU – Electric generating unit

EIA-AEO – Energy Information Administration – Annual Energy Outlook

EIP – Energy intensive primary

ELG – Effluent limitation guidelines

EO – Energy optimization

EP – Environmental policy

EPA – Environmental Protection Agency

EPRI – Electric Power Research Institute

ESS – Energy storage systems

ESPS – Existing source performance standards

ET – Emerging technologies

EV – Electric vehicle

EWR – Energy waste reduction

FCR – Fixed charge rate

FERC – Federal Energy Regulatory Commission

FGD – Flue gas desulfurization

FIT – Federal income tax

FOM – Fixed operating and maintenance

FRAP – Fixed resource adequacy plan

GHG – Greenhouse gas

GIA – Generator interconnection agreement

GPD – General Service Primary Demand Rate

GW – Gigawatt, one billion watts

GWH – Gigawatt hours

HDD – Heating degree days

HG – Mercury

HVAC – Heating, ventilation and air conditioning

ICAP – Installed capacity

IPP – Independent power producer

IRP – Integrated Resource Plan

ITC – Investment tax credit

ITCT – ITC Transmission

KA – Karn

KW – Kilowatt, one thousand watts

KWH – Kilowatt hours

LCOE – Levelized cost of energy

LCR – Local clearing requirement

LCREPP – Large Customer Renewable Energy Pilot Program

LEED – Leadership in Energy and Environmental Design

LF – Load factor

LMP – Local marginal price

LOLE – Loss of load expectation

LOLEWG – Loss of load expectation working group

LRR – Local reliability requirement

LRZ – Local resource zone

LSE – Load-serving entities

MAPE – mean absolute percent error

MATS – Mercury and Air Toxics Standards

MCV – Midland Cogeneration Venture

MDEQ – Michigan Department of Environmental Quality

METC – Michigan Electric Transmission Company

MIRPP – Michigan Integrated Resource Planning Parameters

MISO – Mid-Continent Independent Transmission System Operator, Inc.

MMBTU – Million British Thermal Units

MMR – Michigan Mercury Rule

MPSC – Michigan Public Service Commission

MTEP – MISO Transmission Expansion Plan

MW – Megawatt, one million watts

MWH – Megawatt hours

NERC – North American Electric Reliability Corporation

NGCC – Natural gas combined cycle plant

NITS – Network Integration Transmission Service

NOX – Nitrogen oxide

NPDES – National Pollutant Discharge Elimination System

NPV – Net present value

NSPS – New Source Performance Standards

NYMEX – New York Mercantile Exchange

NUG – Non-utility generator

O&M – Operating and maintenance

OASIS – Open Access Same-Time Information System

PA – Public act

PJM – Pennsylvania-New Jersey-Maryland market

PCA – Proposed course of action

PM – Particulate matter

PPA – Power purchase agreement

PRA – Planning resource auction

PRB – Powder River Basin

PRMR – Planning Reserve Margin Requirement

PSCR – Power supply cost recovery

PSES – Pretreatment standards for existing sources

PTC – Production tax credit

PTP – Point-to-point

PTR – Peak time rewards

PURCH – Purchase

PURPA – Public Utility Regulatory Policies Act

PVRR – Present value of revenue requirement

QF – Qualifying facility

RCRA – Resource Conservation and Recovery Act

RE – Renewable energy

REC – Renewable energy credit

REP – Renewable energy plan

RFP – Request for proposal

RICE – Reciprocating internal combustion engine

ROA – Retail open access

ROR – Random outage rate

RPS – Renewable Portfolio Standard

RTO – Regional Transmission Organization

SEEG – Steam Electric Effluent Guidelines

SCOTUS – Supreme Court of the United States

SO_2 – Sulfur dioxide

SOL – Solar

SRM – State reliability mechanism

STB – Surface Transportation Board

TOU – Time of use

UCAP – Unforced capacity

UCT – Utility cost test

VOM – Variable operating and maintenance

WIIN – Water Infrastructure Improvements for the Nation Act

WND – Wind

ZRC – Zonal resource credit

ZDC – Zonal deliverability charge

APPENDIX 02

Stakeholder Engagement Report

APPENDIX 02

Stakeholder Engagement Report

EXECUTIVE SUMMARY

The Integrated Resource Plan (IRP) is a valuable tool for our major strategic decisions, laying the foundation for how we serve customers for decades to come. The resource plan considered a wide variety of perspectives on Michigan's energy future, including the utility, regulatory and political environment, technological advancement and customers.

The Company established a stakeholder engagement process to gather these viewpoints comprised of three methods of communication:

- Public outreaches
- Technical workshops
- Periodic updates

Each component of the process was designed to provide transparency, education and a feedback mechanism for the targeted audience. All three methods of communication influences development of the IRP through engaged questions, multiple comments and suggestions.

- Major themes emerged in the learnings and input we received from stakeholders, such as:
- Embracing the opportunity to lead the way on reinventing the production and delivery of energy resources at an affordable price to customers by way of customer centric program offerings to assist them in meeting voluntary sustainability goals.
- Limiting reliance on natural gas fired power plants.
- Expanding localized non-carbon emitting resources to advance a distributed generation system.

The feedback was reflected when the company modeled scenarios to determine the least cost resource plan able to withstand high levels of uncertainty (e.g. environmental regulations, declining cost of renewables, uncertain fuel prices) over a 20-year period. The efforts by the Michigan Public Service Commission to engage stakeholders was foundational to incorporating the customer vision obtained through the company's stakeholder engagement process.

The vision of the company and our customers is aligned. The company's incremental, modular approach to reducing carbon emissions 80 percent by 2040 and eliminating coal by 2040 will lead the way in the creation of a sustainable energy future for Michigan.

INTRODUCTION

The purpose of stakeholder engagement was to create an information exchange between customers and those representing our customers. The stakeholder engagement strategy was to educate participants about the purpose of an IRP, inform them of the process, and invite them to share their ideas, suggestions and opinions about how we should plan to meet Michigan's future energy needs.

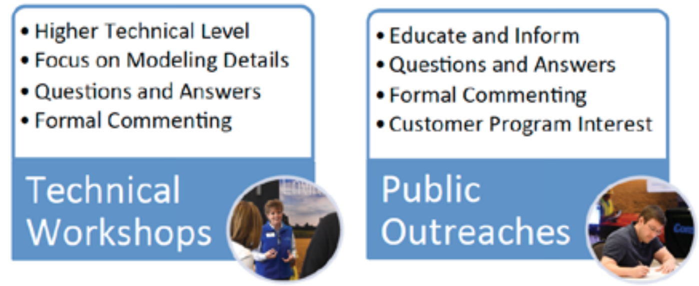


Figure 2.1: Stakeholder engagement strategy

Two different customer groups were identified:

- Stakeholders who represent our customers through regulatory proceedings (termed "key stakeholders").
- General public.

These two groups were expected to have different interests and needs from the stakeholder events based upon different levels of understanding regarding the general and technical aspects of developing an IRP.

As a result, we developed two distinct event formats to serve these unique audiences as shown in Figure 2.1. For the general public, we held two public open house events to provide a broad overview of the IRP process and offer the chance to ask questions of our subject matter experts.

For stakeholders in more technical aspects of the IRP, we held a series of technical workshops to address questions, and obtain detailed insights and requests to influence the analytical part of the IRP.

PUBLIC OUTREACH

A public open house format was offered to the general public focused on informing and answering questions about the IRP 1. We also provided a mechanism for formal comments and offered one-on-one experiences with company experts involved in the development of the IRP. The public forums were designed to engage in meaningful discussions about long-term generation resources, how they can influence the future of meeting Michigan's energy needs and areas of focus considered in an IRP.

The open houses were organized according to four main areas of interest:

- IRP Overview
- Environment
- Emerging Technologies
- Renewables.

Participants were asked to start at the overview table for a foundation on the purpose of an IRP. The participants were then free to choose specific topics aligned with their interests. Participants wishing to make a formal input for the utility could complete hand-written comment cards or give verbal comments to a stenographer. Those giving formal comment were asked to identify themselves and provide comments on site.

Consumers Energy serves 1.8 million electric customers covering the majority of Michigan's Lower Peninsula (see Figure 2.2). Based on the electric service territory, we located open houses in East Lansing and Grand Rapids. The East Lansing location was based upon its central location to the majority of our electric customers and Grand Rapids because it is located within one of our largest service territories offering easy highway access from any part of the state and major areas of employment during the work day.

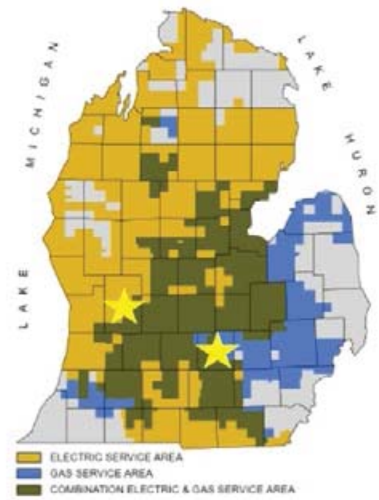


Figure 2.2: Consumers Energy's electric and gas service territory and event locations

Additional benefits of the open house format included:

Table 2.1: Open house format

Flexibility	Attendees could arrive at any time and were not tied to a specific presentation time.
Expertise	Ability to have one-on-one conversations with Consumers Energy's experts and leaders on each specific topic.
Efficiency	Attendees did not have to wait for discussion on area of interest that would have been required in a presentation forum.
Customized	This format allowed each guest to discuss their topic of interest for the length of time that they wanted to spend. Content of the responses was adjusted based on each guest's understanding of the topic. If the answer was not clear, guests could ask for clarification immediately.

GETTING THE WORD OUT AND LOGISTICS

The public open house events were held on Jan. 29 at the Kellogg Center in East Lansing (219 S. Harrison Rd., East Lansing, MI 48824) and on Feb. 12 at Consumers Energy's John Russell Leadership Center in Grand Rapids (120 Front Ave. SW, Grand Rapids, MI 49504). The events were scheduled strategically to ensure we could consider and incorporate input into decisions about the modeling and planning process.

The public open houses were widely promoted through a multi-faceted communications strategy including:

- **News media:** Press releases were issued statewide Jan. 15 and Feb. 8. Media advisories were issued statewide Jan. 26, Jan. 29 and Feb. 12. These efforts resulted in print and broadcast news coverage.

- **Customer outreach:** Consumers Energy included information about the public open house events on customer bills beginning on Jan. 2, 2018. Customer bills go out in waves and this starting date provided the message on all customer bills in advance of the Jan. 29 event and some received it twice as it continued through to waves that were received by Feb. 12. Due to limited space, basic information was provided on the bills themselves and a link to a community blog was provided with more information (Figure 2.3). The call center was alerted to the message and the event details.

- **Website:** Consumers Energy promoted the public open house events on its website at ConsumersEnergy.com.

- **Social media:** A community blog post was available beginning Jan. 2 to support the customer bill notices and other social media outreach. The events were promoted statewide through sponsored Facebook posts on Jan. 22 and Feb. 2. The events were also shared on Twitter and LinkedIn. Social media tools allow us to report on the reach of the public notice related to each event. The following graphics capture the reach of Facebook and Twitter related to the Jan. 29 open house. The Facebook post reached 63,672 people and generated a total of 2,077 unsolicited reactions, comments and shares. Twitter helped us reach another 3,689 people. Prior to the Jan. 29 event, 464 people had clicked through to the blog post to get more event details.

- **Employee outreach:** Consumers Energy employs approximately 7,400 employees and around 3,000 contractors. Internal communications newsletters were used to reach the employee base. Connect, a monthly magazine for employees was used to provide a more in-depth story about the IRP and our intranet offered an internal electronic bulletin board for employees, as a way to provide the latest information about the public forums.

- **State and Federal Governmental Affairs official outreach:** Our State and Federal Governmental Affairs staffs shared information about the events with elected officials and asked them to share the information with their constituents.

- **Technical workshop participants:** Information about the public open house event in East Lansing was shared with all attendees at the first technical workshop and the event was included on the PowerPoint presentation that was shared with all key stakeholders following the meeting.

The public open house event format was structured so people could arrive any time between 4 and 7 p.m., and circulate among station areas at their own pace based on their specific areas of interest.

Figure 2.3: Notice on bills

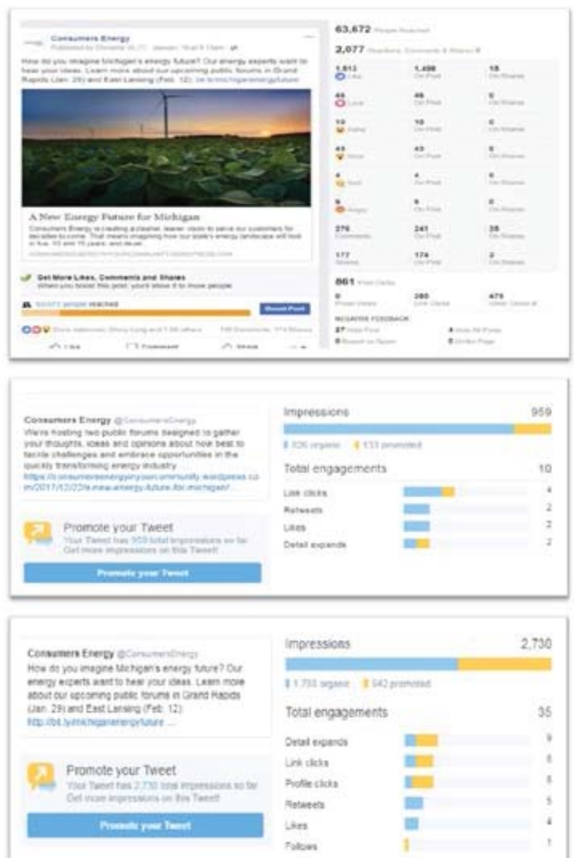


Figure 2.4: Social media outreach

This time frame was set to allow people to attend either during the work day or after traditional working hours. Each station area was staffed by one or more of Consumers Energy's subject matter experts. The stations were:

- IRP Overview
- Environment
- Emerging Technologies
- Renewables.

Also included:

Table 2.2: Other open house stations

STATION	PURPOSE
Registration Table	Guests signed in and received information about the room layout and event format.
Comment Tables	Several tables were available for guests to write comments on a paper form to leave for the Consumers Energy team.
Stenographer	A stenographer was also available in case people preferred to speak their comments rather than write them down. This option removes barriers in case a guest cannot write in English, or is physically unable to provide written comments.
Refreshments	Light refreshments were available to create a welcoming environment.

Attendance

EAST LANSING EVENT

There were 16 people who signed in at the East Lansing event. Four written comments were collected and two people left comments with the stenographer.

GRAND RAPIDS EVENT

There were 37 people who attended the Grand Rapids event. In Grand Rapids, there were 24 written comments collected and three people left comments with the stenographer. All comments from both events are provided in Appendix 2A.

The majority of those who left written comments at the public open house stated a favorable opinion of the format. A similar pattern was observed by company representatives that received verbal comments.

TECHNICAL WORKSHOPS

The company offered two technical workshop sessions to better identify and collaborate with stakeholders representing our customers through regulatory proceedings. This provided an opportunity to inform key stakeholders of our approach and plans, take questions and solicit feedback.

The technical workshops were designed to dig deeper into the modeling approach that helps determine the short- and long-term actions a utility choses to follow, and obtain feedback from stakeholders. The workshops were in-person meetings led by company subject matter experts.

The two technical workshops followed the same basic format based on three, 1-hour segments:

1. Presentation of information by the company on the project schedule and status, modeling approaches and explanations, information sources, and responses to comments formally provided by the stakeholders to the company.

2. Stakeholder questions specifically to clarify information presented or to ask for information on a topic that was not presented. Using the attendance list, each guest was given the opportunity to ask questions. The company provided a verbal response to each question.

3. Each attendee was given the opportunity to provide one or more comments. To ensure accurate portrayal of stakeholder comments, participants were asked to agree upon the accuracy of each comment as written.

Benefits of the technical workshop format for attendees include:

Table 2.3: Technical workshop format

Equal Opportunity	The controlled structure of the meeting provided all participants equal opportunity to ask questions and provide comments. Uncontrolled environments can miss an attendee comment or question and lack sufficient time to engage all attendees.
Expertise	Ability to have a dialogue between Consumers Energy's leaders and experts and attendees. The opportunity to find common understanding on what each stakeholder would like to see in the IRP.

Getting the Word Out and Logistics

The technical workshop sessions were held on Dec. 12, 2017, and Feb. 27, 2018, in Jackson, lasting approximately three hours each. The events were intentionally scheduled so the input could be considered and incorporated into decisions about the modeling strategy and the planning process.

Key stakeholders were identified based on the parties authorized intervention in the company's most recent electric rate case. Using identification, a mailing list was developed for meeting invitations. Additional invitations were sent upon request to parties not given intervention rights. The invitation list also included commission staff.

For the Dec. 12 event, a meeting invitation was sent via email with a letter attachment on Nov. 17, 2017, and a paper copy of the letter was mailed on Nov. 20, 2017. A copy of the letter and the mailing list is provided in Appendix 2B. The company individually met with the Sierra Club, which was unable to attend the first technical workshop to take their questions and comments. This meeting took place on Jan. 8, 2018, at the Consumers Energy Parnall Office.

For the Feb. 27 event, a "Save the Date" email was sent on Jan. 19, 2018, and three emails were sent the week before the meeting to request RSVPs and deliver meeting materials in advance of the meeting. Copies of these communications are provided in Appendix 2B. Additional conversations with key stakeholders were scheduled following this meeting to continue building trust and relationships that would help develop the best IRP for Michigan.

Both technical workshop sessions required in-person attendance to ensure participants had the opportunity to adequately hear and engage in the workshop.

FEEDBACK AND OUTCOMES

The stakeholder dialogue and feedback was productive and gave Consumers Energy the ability to attain:

- The customer vision on the future generating supply mix and the delivery of that supply.
- Diversity in thought on future outlooks.
- Clear and transparent communications fostering trusting relationships focused on what is best for Michigan.

CUSTOMER VISION

Customer comments and discussions through the public outreach process focused on developing more renewable energy and clean energy resources in three different ways:

- Utility scale.
- Customer programs.
- Distributed generation resources.

With the future development and evolution of these resources, reliance on traditional supply side resources consisting of coal and natural gas fired power plants would decrease. The need to transition to cleaner energy sources sooner rather than later was a consistent message within the comments.

This customer vision carried through comments and suggestions offered for consideration. For example, suggested sensitivities focused on increasing levels of energy efficiency and demand response programs, and increasing levels of renewables to satisfy growing interest by customers.

TECHNICAL STAKEHOLDERS

The feedback received from the technical workshops carried similar themes of the public comments, but also included a greater focus on the content of the regulatory filing, minimizing time constraints in the regulatory process and providing an opportunity to resolve disagreements prior to the contested case proceeding. The company took action in some form on all comments. Examples of requests from stakeholders and the resulting actions taken by Consumers Energy included:

- Run a lower natural gas price forecast sensitivity than the commission required forecast by developing three utility specific scenarios using the utility specific natural gas price forecast.
- The company solicited feedback from each technical stakeholder to suggest up to two sensitivities.
- Sharing of detailed information ahead of the filing date, worked with third parties on a process to share their confidential information, development of a process where temporary modeling licenses would be provided for stakeholders during the IRP proceeding, and development of a cross-reference matrix to guide a stakeholder through the filing.

A list of the comments as captured in each technical meeting, as well as the individual written responses from Consumers Energy is provided in Appendix 2B.

CONCLUSION

The stakeholder engagement process was a valuable experience in building deeper connections with customers to help guide thinking and decision making in the development of an IRP. The process provided transparency, education and an avenue for stakeholders to provide feedback on the IRP. There were no major issues received by the company through feedback during the outreach process that were not considered in the development of the PCA in the IRP. We will continue to standardize and improve upon this process. The company appreciates those who participated in the public outreaches and the technical stakeholder discussions.

Stakeholder Engagement Report Appendices Index

APPENDIX 2A - PUBLIC OUTREACHES

APPENDIX 2B - TECHNICAL WORKSHOP

Stakeholder Engagement Report

APPENDIX 2A - Public Outreaches

Appendix 2A - Public Outreaches — East Lansing

Registration list

Intergrated Resource Plan
REGISTRATION
JAN. 29 • EAST LANSING

Consumers Energy
Count on Us

NAME	CITY	ZIP
Larry WARD, Michigan Conserv. Energy Forum	Lansing, MI	48933
Doug Tamboer CE	E. Lansing MI	48823
Breanne Bartkowski, DEQ	East Lansing, MI	48823
Shelby Kurland	east lansing, mi	48823
Brandon Brooks	Okemos, MI	48864
JAN BEECHLER	HASLETT, MI	48840
Mike Berkowitz	East Lansing, MI	48823
Pat Poll	East Lansing, Mi	48823
Melanie Conran	Lansing, MI	48906
Rex Litwiller	Lansing MI	48906
Cathy Cole	Lansing MI	48820
Karen Gould	Lansing MI	48917

Intergrated Resource Plan
REGISTRATION
JAN. 29 • EAST LANSING

Consumers Energy
Count on Us

NAME	CITY	ZIP
Mark Smith	Grand Ledge	48837
Charlotte Jameson	East Lansing	
Douglas Jester	East Lansing	48823
ANGEL BOSHEA	JACKSON, MI	49201

Appendix 2A - Public Outreaches — East Lansing

Written comments

Integrated Resource Plan
COMMENTS
Consumers Energy Count on Us®
JAN. 29 • EAST LANSING

- Really appreciated the opportunity to interact with the groups representing consumers. I'm interested in the planning for the conversion to electric cars and the increased demand they will create.
- I use the variable rate meter now as I use a plug in electric car. But note there is no cross program to use the air conditioning cycle rate at the same time. It is one or the other.
- My California friends have purchased solar installed on their property through the electricity supplier and would hope someday Consumers has that available. I understood I can buy solar through Consumers, but like the idea of having my own panels and it seems such installations could contribute to the IRP goal.
- I am concerned that the tariff my hurt solars price efficiency. Thanks

REQUIRED:
Mark Smith | Grand Ledge MI | 48837
NAME | CITY | ZIP

Integrated Resource Plan
COMMENTS
Consumers Energy Count on Us®
JAN. 29 • EAST LANSING

The integrated resource plan sounds really wonderful! I enjoyed learning more about consumer's energy's mission to create a more diverse portfolio. Thank you for having this open house!

REQUIRED:
Shelby Kurland | East Lansing | 48823
NAME | CITY | ZIP

Integrated Resource Plan
COMMENTS
Consumers Energy Count on Us®
JAN. 29 • EAST LANSING

Thanks for hosting this info. session and giving people an opportunity to weigh in. I hope going forward that Consumers focuses heavily on energy efficiency, demand response, and renewables in the IRP. That will help keep our utility bills low and protect our environment. Let's not overbuild natural gas!

REQUIRED:
NAME | CITY | ZIP

Integrated Resource Plan
COMMENTS
Consumers Energy Count on Us®
JAN. 29 • EAST LANSING

I support the expedited closure of coal power plants prior to their regular closure dates. CE needs to pursue a greener future, faster than the legislative agenda currently mandates. CE should be the precedent rather than follow it.

REQUIRED:
Brandon Brooks | Okemos | 48864
NAME | CITY | ZIP

Appendix 2A - Public Outreaches — East Lansing

Stenographer comments

INTEGRATED RESOURCE PLAN COMMENTS

Kellogg Center
219 S. Harrison Rd.
East Lansing, MI 48824

Monday, January 29, 2018
Beginning at 4:00 p.m.

Speakers: Mike Berkowitz and Melanie Conran

1

DICKINSON REPORTING
(517)487-1072

East Lansing, MI
Monday, January 29, 2018
At 4:36 p.m.

MIKE BERKOWITZ, East Lansing, 48823

MR. BERKOWITZ: All right. So my comments aren't super long or deep or anything. The main concern I have is simply getting Consumers Energy to move as fast as possible towards as much renewable energy as possible.

I'm very concerned with environmental pollution and the external pollution costs of fossil fuels in general. Coal and natural gas in particular.

And I think it's great that Consumers Energy is kind of moving towards -- or moving away from coal; but I'm very nervous about the heavy move towards natural gas. And I think that's out-competing space in the market that renewables or energy efficiency could take hold of.

So that's my main concern, and I hope Consumers will consider pushing as fast as possible towards clean, sustainable, renewable sources.

(At 4:37 p.m. - Mr. Berkowitz's comments are concluded.)

MELANIE CONRAN, LANSING, 48906

(At 4:56 p.m. - Ms. Conran begins.)

2

DICKINSON REPORTING
(517)487-1072

MS. CONRAN: So they were talking about the Opt-in Program for changing your rates based on your time of day usage, and my comment was why do we get a choice? It reflects a more accurate cost for people using energy, so I would be in favor of that being mandatory. You know, with certain exemptions for people that had extenuating circumstances.

(At 4:57 p.m. - Ms. Conran concludes.)

(At 6:08 p.m. - Ms. Conran continues.)

MS. CONRAN: We are happy to see a development of more sustainable options and ideas and education. We are very concerned about both the pace of the changes as well as what appears to be intentional blindness to the future that we are all staring at.

Why is it -- if we know that landfills are bad, recycling is good, sustainable energy sources are good, coal and nuclear and fracking are all intensely problematic on an ever-increasing scale, why is it that we continue to do the wrong things? We know better. We should be better.

Without collecting the data, asking the hard questions like what is the real cost of our use of unsustainable resources to our planet and our future, how can we ever set both a realistic and survivable

3

DICKINSON REPORTING
(517)487-1072

goal for 100% sustainability that doesn't just push this off onto the next generation?

Without that goal, we're just making pretty pictures and going through the motions that will never -- that will not ever be enough or in time.

Why is there a cap on the percentage of sustainable energy that can go back into the grid? This should be incentivized. Why are you not identifying and paying an appropriate carbon tax? Why do we need to wait for legislation? We know it's the right thing. We should do the right thing now.

Profit should not be driving your future goals. The people, the planet, the future are the only things that matter.

And we need to stop pointing to underprivileged people or people with medical conditions or whatever as an excuse not to do the right thing. If we need to give them credits or give them other opportunities to get help from the community, then that's what we need to do. We need to have the people that can afford it pay proportionally more because we all benefit from these upgrades.

(At 6:11 p.m. - Ms. Conran's comments are concluded.)

* * *

4

DICKINSON REPORTING
(517)487-1072

Appendix 2A - Public Outreaches

Stenographer comments

Appendix 2A - Public Outreaches — Grand Rapids

Registration list

Intergrated Resource Plan
REGISTRATION
FEB. 12 · GRAND RAPIDS

Consumers Energy
Count on Us

NAME	CITY	ZIP
Alain GODEAU	BELMONT	49306
Sr. Mary Brigid Clingman OP	Gr. Rapids	49503
David Froker	Gr. Rapids	49525
Ronald Bush	Comstock Park	49321
Robert Mortray	Gr Rapids	49503
Judith Jonker Bredeweg	GR	49506
Jordan Chrispell	GR	49503
Steve Handlovits	Wyoming	49519
Chris & Parry Eckman	GR	49546
Evelyn Ritter	GR	49503
Craig Ressler	Caledonia	49316
Johanna Sizlch	Grand Rapids	49507
Patrice Vrona	GR Township	49546

NAME	CITY	ZIP
Mike Bylsma	Grand Rapids	49546
Ashley Kimble	Holland	49424
Ann & Kyle Tuck	Comstock PK	49321
Sean Brady	Wheaton IL	60189
Mike Dunlap	Grosse Ile	48138
Luisa Dunlap	Grosse Ile	48138
Gillian Green	Grand Rapids	49546
Liam Considine	Grand Rapids	49546
Cliff Alles. Gr.ie	Rockford	49341
Daniel Sikorski	GR	49503

NAME	CITY	ZIP
Ellington Ellis	Byron Ctr.	49315
Erik Nordman	Spring Lake	49456
Andy Balaskovitz	Grand Rapids	49506
Jan OConnell	Grand Rapids, MI	49546
Uko Zylstra	Grand Rapids	49507
John Man	Grand Rapids, MI	49525
NATHAN STRAIT	GRAND RAPIDS	49525
John Considine	G. R.	49546
Mindy & Jon Miner	Rockford	49341
Bentley Johnson	Ann Arbor	48104
Robert Synk	Grand Rapids	49507
Kevin Dispense	Grand Rapids	

Appendix 2A - Public Outreaches — Grand Rapids

Written comments

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS
Consumers Energy Count on Us®

1. CONSIDER CUSTOMER DEMAND for RENEWABLE ENERGY! WHEN PLANING for FUTURE GENERATION CONSUMERS SHOULD PLAN FOR MORE RENEWABLES

2. GET OFF OF YOUR HIGH HORSE AND ALLOW NET METERING FOR EVERYONE.
ALLOW A FAIR NET METERING POLICY and STOP THE LEGISLATURE FROM THE CURRENT TENDENCY TO ALLOW GOV + DTE to "GRANDFATHER" NET METERING FOR ONLY 10 YEARS, AND GIVE ONLY 10¢ PER EACH KWATT PRODUCED BY NEW NET METERING CUSTOMERS AFTER 2018. NO. NO. NO.

3. PLAN FOR THE GRID OF THE FUTURE.
DISTRIBUTED ENERGY WILL COST YOU LESS in the LONG RUN BECAUSE YOU WILL NOT BE REQUIRED TO BUILD AS MANY POWER PLANTS and UPGRADE THE POWER LINES.

4 PLAN TO RETIRE + REPLACE THE CAMPBELL POWER PLANT with RENEWABLE ENERGY.

REQUIRED:
NAME: RONALD BUSH CITY: COMSTOCK PARK ZIP: 49321

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS
Consumers Energy Count on Us®

Alain GODEAU alain.Godeau@comcast.net

I am advocating for much more clean energy. Many residential customers are willing to commit themselves installing Solar Panels on their houses (DG). Some of them are even much more progressive and want to instal SMART INVERTER and energy storage in their house. IN doing this they will be able to actively practice "load shifting" and contribute to lowering peak load.

Consumers Energy should propose experimental projects in the Distributed Energy Ressources possibilities

REQUIRED:
NAME: CITY: ZIP:

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS
Consumers Energy Count on Us®

Renewables!!! Sustainability

CCL Citizens Climate Lobby

CCE " " Education

Put fees on Carbon Emissions/Fossil Fuels at point of extraction
$ goes as dividends to all citizens distributed through existing avenues (eg Soc Sec)

Public Health Justice Biodiversity

REQUIRED:
NAME: Dr Judith Jonker Bredeweg CITY: GR ZIP: 49506

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS
Consumers Energy Count on Us®

I am most concerned about our energy source, that the use of coal be discontinued asap as soon as possible, leading toward completely renewable source.

REQUIRED:
NAME: Ann Tuck CITY: Comstock Pk ZIP: 49321

Appendix 2A - Public Outreaches — Grand Rapids

Written comments

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

As a sustainable balance is critical to restoring balance... homeostasis... to survival of earth, so then is this new meeting crucial to have a voice & vision. Nothing less than human survival as a species at stake & ending the current mass extinction is the [illegible] in the core mind.

I look forward to a 100% renewable future, maximum energy efficiency & restoration of biomes with an endless amount of future generations guiding our families.

Thank you.

REQUIRED:
NAME: Cliff Alles-Carre CITY: Rockford ZIP: 49341

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

I think that distributed generation and storage is one of the most exciting and essential aspects of a transformational vision for a clean energy future.

I am concerned about the removal of true net metering with the addition of tariffs.

Consumers need to be incentivized by time of use costing, full payment for energy generation and storage. If done correctly this can all contribute to a more efficient stable grid.

The [illegible] of equipment is heavily influenced by these policy decisions...

I believe a revenue neutral carbon fee and dividend that solves the market failure on the cost of GHG emissions is something America should pursue. This would also create a great thirst and demand for GHG free energy production. I hope Consumers Energy plans for this possible reality.

Everything we can do for a GHG FREE future!

REQUIRED:
NAME: Liam Considine CITY: Grand Rapids MI ZIP: 49546

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

- Nicely set-up. Good people manning the tables
- Is it possible to do more of these events?
- Renewables, Renewables, Renewables !! Less Coal as soon as possible
- How are you doing for the Paris accord?

REQUIRED:
NAME: CITY: ZIP:

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

Micro-Grid-info
Did Get Good info Thanks

REQUIRED:
NAME: CITY: ZIP:

Appendix 2A - Public Outreaches — Grand Rapids

Written comments

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

I'm very interested in seeing more pilot projects like Circuit West and CHP. Would like to see more projects with grid resilience, DER, and building efficiency/stricter building codes (to reduce heating load.)

I would also like to see a proposed timeline for retirement of each unit in the coal fleet.

REQUIRED:
NAME: Robert Montroy CITY: Grand Rapids ZIP: 49503

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

I'd like consumers to consider itself in a race with Germany to convert to Renewables. Germany is way ahead of us, we need to catch up!

I'd like to see Consumers commit to distributed generation. Every customer should be able to produce electricity for the grid.

Closing coal plants faster is important. And replacing the power with renewables NOT other fossil fuels.

Consider the urgency of climate change. take seriously the goal of keeping the earth from warming more than 2°C. Have agressive goals like being 80% renewable by 2030 and 100% by 2050.

I'm paying an extra 7% or so on my bill for Green Generation. People who don't sign up for green generation should pay an extra "Pollution fee".

The world is converting from Fossil Fuels to Renewables and Consumers is also. But it shouldn't be converting reluctantly. It should be pushing the legislature for laws that facilitate faster conversion.

Consumers should view homeowners who put up solar panels as partners not competitors. Consumers should make the economics of home renewables attractive so more people will take the plunge.

Consumers' goals for renewables should be much more agressive than the legislature's 15% renewables in a pathetic goal. We can do so much better than that!

REQUIRED:
NAME: Robert Synk CITY: Grand Rapids ZIP: 45507

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

- Consumers Energy should try and shut down their coal-fired plants earlier than 2030. Ratepayers would like to see these old dirty units retired as soon as possible and also with renewable energy and storage costs declining, it will be most cost effective to do this earlier.

- Consumers Energy should also be using the most up-to-date cost numbers to make sure they are not biased against the new technologies that are emerging every day. We are actually seeing solar and storage making pretty big decreases every year.

- Consumers should be developing a path Now to retiring the West Olive Campbell coal-burning plant and this should be part of this 15-year plan, if not earlier. We need to make this plan Now so that ratepayers do not suffer the rate increases to prop up these old dinosaur plants.

- Besides just the cost of keeping these plants running there are also big concerns of all the toxic pollution released by the Campbell plant, which is nearly 800,000 pounds of pollution back in 2016... making it the large polluter in west michigan.

- In these New energy future for michigan and this Integrated Resource plan - Consumers Energy should plan to replace the Campbell fossil fuel plant w/ 100% clean renewable energy.

REQUIRED:
NAME: Jan OConnell CITY: Grand Rapids ZIP: 49546

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

- More notification needs to be done about this meeting here today. Received initial info from a few groups but not Consumers Energy.

- Also more notification regarding Consumers Energy Programs they have to offer -- especially time of use energy, I just found out tonight.

REQUIRED:
NAME: Jan OConnell CITY: Gd Rpds ZIP: 49546

Appendix 2A - Public Outreaches — Grand Rapids

Written comments

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

Consumers Energy
Count on Us®

I've been paying attention to what's been going on in Hawaii regarding renewables. As you know, they are isolated with no grid to rely on, and they have lots of sunshine. They are exploring ways to encourage private generation while meeting demand.

They have proposed a plan where generation is valued depending on when it occurs. More is paid during periods of high demand, less is paid during periods of low demand. This makes a great deal of sense to me.

Also, there is no cap on generation. This cap seems artificial to me and makes no sense. If I generate more energy than I use in a year, so what? The "cap" should be limited by infrastructure and by the financial incentive. If more is generated than can be used at that moment, then it should be stored. (I realize we are nowhere near this point at this time.)

REQUIRED:
NAME: Craig Ressler CITY: Caledonia ZIP: 49316

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

Consumers Energy
Count on Us®

I would like to see the company endorse a carbon pricing scheme, such as the carbon fee and dividend proposal espoused by Citizens' Climate Lobby.

REQUIRED:
NAME: Robert Mordhorst CITY: Grand Rapids ZIP: 49503

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

Consumers Energy
Count on Us®

Renewables, Renewables, Renewables
Follow (please) the Paris Climate Accord
Much less Coal, Costs are important, but having a clean healthy planet is more important!!
Do the Right thing for the future, not the next Quarter.
Thanks for the open house, do more of these please.

I Forgot to Sign Before

REQUIRED:
NAME: Perry Eckman CITY: Grand Rapids ZIP: 49546

Consumers Energy Open House
Feb 12, 2018

- I am an environmentalist and a proponent of clean energy.
- We installed solar panels on our home last year, so we are now called Distributed Generation customers.
- We got into the program then, so we could get the federal tax rebate on our installation before it expires, and also get grandfathered into the Net Metering program for 10 years.
- Net Metering pays us almost full retail value for the excess electricity we put back into the grid.

- I have attended several meetings of the DG Working Group at the MPSC about the upcoming changes to the rate structure for small-scale solar customers.
- It appears likely that the utilities and MPSC will replace Net Metering with a program that will significantly reduce the value that DG customers are paid for their energy outflows to the grid.
- I won't get into the reasons that I feel this is not justified, but these have been presented at the MPSC.

- Electric cars are coming. Utilities will have to produce more electricity, and this electricity generation should be clean and distributed. The benefits of distributed solar for the grid are many: high production during peak hours, distributed generation to reduce transmission losses and costs, load leveling, and many more.
- Instead of viewing DG customers as Competitors to be squeezed, Consumers should see rooftop solar installations as a business opportunity. It is a modern, flexible, creative way to produce energy and, oh yeah, it helps the environment.
- Why not consider rooftop solar as a viable option and promote, rather than stifle, this technology?

- One scenario suppresses the clean energy business and makes more money for Consumers.
- The other scenario enhances and expands the clean energy business and makes more money for Consumers.
- Get into solar! Sell the panels and control the inverters and networks! Lead the way!
- Make it a profitable business for Consumers! (your profits are guaranteed)
- Promote it!

JONATHAN MINER
MINER.JONATHAN@GMAIL.COM
ROCKFORD, MI 49341

Appendix 2A - Public Outreaches — Grand Rapids

Written comments

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

Customers, myself included, want more renewable energy to be purchased from Consumers Energy. As a renter, I can't install my own solar panels on my apartment to provide energy for my home. However, I still want to be environmentally concious with my energy consumption. This includes minimizing my energy consumption, being efficient, and using green resources. Thats where you come in. I don't want my energy to come from coal or natural gas. I want solar, wind, or hydroelectric power. Natural gas is detrimental to our environment just as much as coal power is. Fracking is endangering our water supplies, and causing dangerous seismic activity. It's time to stop investing in your outdated, costly, unhealthy, and environmentally irresponsible coal plants. Retire the Campbell plant! Each year, renewable energy resources are becoming more affordable. Factor in the environmental costs and health costs of coal and natural gas... there's no competition. Don't switch to renewable resources in 30 years, your company should have already switched yesterday!

You supply energy to nearly 2/3 of Michigan residents. Your employees are included in that group. It's time Consumer's Energy realizes its impact and responsibility to take care of the environment. We're "counting on you".

REQUIRED:
Jordan Chrispell (NAME) Grand Rapids (CITY) 49503 (ZIP)

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

More renewable options + usage

would love to see only 10% coal and eventually (before 2030) no coal usage. Educating the consumers on the necessity of protecting and caring for this planet. The open house was great. I'm sorry I would have missed it had a friend not made me know. Please consider increasing your communication to your consumers.

But most importantly lets provide a more integrated system and next generation grid. Lets Increase renewable energy options. Wind turbines on a aircraft carrier off the shores of Lake MI, Superior, Huron, Erie, Ontario. Retire the coal plants sooner.

Thank you

REQUIRED:
Chris Eckman (NAME) Grand Rapids (CITY) 49546 (ZIP)

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

To what degree is natural gas obtained by fracking? What is the social cost/environmentable cost H/A/V water waste, land-air deterioration, roads - etc

How are renters able to access housing repair, rebates, upgrades?

How are shareholders informed of accountability standards? Are there ongoing shareholder dialogs on acc'tability & transparency?

How have COP 21 standards been incorporated?

What is CE's stance on appointments of industrial personell to MPSC to regulate their industries?

mbclingman@grdominicans.org

REQUIRED:
Sister M Brigid Clingman OP (NAME) 2025 E Fulton GR (CITY) 49503 (ZIP)

Integrated Resource Plan
COMMENTS
FEB.12 • GRAND RAPIDS

I want to encourage Consumers to embrace distributed energy and not see it as an enemy. It is inevitable that we will move in that direction and you have the power to make the transition smooth or hold us back unnecessarily. I believe there is plenty of opportunity for profit - get into the solar business - get into the battery storage business, etc. Let's get to our clean energy future as fast as possible!

REQUIRED:
Mindy Miner (NAME) Rockford, (CITY) 49341 (ZIP)

Appendix 2A - Public Outreaches — Grand Rapids

Written comments

Integrated Resource Plan
COMMENTS
Consumers Energy
Count on Us®
FEB.12 • GRAND RAPIDS

~~I loved it~~

I found this event to be very beneficial for not just educating but for connecting directly to Consumers Energy employees where they address their concerns.

REQUIRED:

NAME	CITY	ZIP
Kevin Dispense	Walker, MI	49534

Integrated Resource Plan
COMMENTS
Consumers Energy
Count on Us®
FEB.12 • GRAND RAPIDS

(1) I AM DISAPPOINTED THAT WE/YOU did not provide some time for A Common Presentation — so we all could HEAR / LET QQ SURFACE AND THEN HAVE A MUCH MORE (for me) PRODUCTIVE interaction w/ Consumers' PLANS GOING FORWARD.

(2) My comments: CE, You ARE BIG, YOU WIELD Power IN/FOR the community. WE LIVE IN AN UN-ORDINARY WORLD/TIME when there is clear evidence THAT THE PLANET IS AT RISK for UNIMAGINABLE LOSS, DESTRUCTION... AND AS OUR PRIMARY CHANNEL FOR PROVIDING ENERGY, I WANT YOU TO TAKE THE Resources that ARE BEST AVAILABLE (+) LEAST HARMFUL TO NATURE - GOING FORWARD. NOT "OR"

And TAKE YOUR PLACE AT THE "HEAD of the PARADE" TO ZERO OUT CO_2 + continuing disastrous EVENTS/COSTS. BE THE LEADER for this AGE - going forward.

TAKE US TO 100% CLEAN, SUSTAINABLE... SEE THAT GOAL/VISION and DRAW the MAP. INNOVATIVE MINDS ARE AVAILABLE to You. Future Generations will bless or Curse our Generation for WHAT WE PUT INTO THIS next 5-YR PLAN.

Do the Right thing for Earth even tho... And the burden is on your shoulders.

REQUIRED:

NAME	CITY	ZIP
Johanna Szick	GR Rapids	49507-3534

Integrated Resource Plan
COMMENTS
Consumers Energy
Count on Us®
FEB.12 • GRAND RAPIDS

Is offshore wind part of Consumers' long term energy plan?

How are microgrids being integrated into the plan?

What is Consumer's position on the planned closure of the nuclear plant in South Haven? That is 800 MW of carbon-free electricity - what will replace it? Can Consumers ensure that the ~~los~~ replacement power will be carbon-free?

REQUIRED:

NAME	CITY	ZIP
Erik Nordman	Spring Lake	49456

Integrated Resource Plan
COMMENTS
Consumers Energy
Count on Us®
FEB.12 • GRAND RAPIDS

I would like to see more solar, renewables and resiliency efforts. The price of solar is coming way down, and when you include the risk costs of old coal plants & natural gas pipelines, it is even more competitive. ~~But~~ I would love to see a goal of 20% renewables by 2020. ~~More efforts like Circuit West would be great and~~

Additionally, due to how much land you manage, you have a responsibility to increase habitat restoration of those areas. I would love to see more local and native seed mixes purchased. Joining the Right-of-Way Stewardship Council and becoming accredited would be a huge step in the right direction. This is important for many ~~the~~ reasons. The decline in bee populations is a huge risk for our food systems. More areas of diverse habitats also support endangered species by creating ~~places~~ places ~~they don't yet~~ ~~to~~ where they could live.

Circuit West is an amazing effort and the IRP should include resources for more projects like that. It strengthens the community because it makes businesses more likely to move here. It also increases the ability for the community to recover from storms. Finally, it makes it a more attractive place to live and will increase real estate prices. Generally all solar and renewable efforts will increase the perception of Grand Rapids as "innovative" and be great for ~~the~~ attracting new residents and businesses.

REQUIRED:

NAME	CITY	ZIP
Evelyn Ritter	Grand Rapids	49503

Appendix 2A - Public Outreaches — Grand Rapids

Stenographer comments

INTEGRATED RESOURCE PLAN COMMENTS

Russell Leadership Center
120 Front Ave., SW
Grand Rapids, MI

Monday, February 12, 2018
Beginning at 4:00 p.m.

Speakers: John Considine, Jonathan Miner, and Gillian Giem

1

DICKINSON REPORTING
(517)487-1072

Grand Rapids, Michigan
Monday, February 12, 2018
Beginning at 4:00 p.m.
JOHN CONSIDINE, GRAND RAPIDS, 49546

MR. CONSIDINE: I'd encourage Consumers Energy and the Commission to look at ways to support independent generation of power, distributed energy generation. Consumers Energy has a new business model which could sell people batteries, solar panels, windmills on an individual basis or a business basis, large and small. They can make their profits as the purveyor of choice.

Rather like computers in the 1950s, Consumers Power has one enormous processing plant with a few generators. If you have lots of distributed energy produced, it takes the load off the transmission system. Battery power can give ways to flatten peak demand, and it's more productive for everybody.

This is a first step towards allaying concerns for CO2, carbon dioxide. They don't need to be stuck with stranded power plants if incentives are set correctly for electric vehicles.

(At 4:51 p.m. - Statement concluded.)

(At 4:59 p.m. - Mr. Considine returns and continues.)

2

DICKINSON REPORTING
(517)487-1072

MR. CONSIDINE: I would encourage more time-of-use monitoring for residential customers. Smaller units of time, perhaps one-hour blocks. And, to truly reflect that, sometimes energy is very expensive, and sometimes it's much cheaper.

For example, electrical use on a hot August afternoon is very expensive but much cheaper in the morning. If you want people to modify their behaviors, both in production and consumption, it needs to be reflected in pricing models.

(At 5:00 p.m. - Statement concluded.)

(At 5:22 p.m. - Mr. Miner begins.)

JONATHAN MINER, ROCKFORD, 49341

MR. MINER: I am currently enrolled in a net metering program. I have solar panels on my house. I would also like to be enrolled in the time-of-use program that's meant to send me price signals where I'll conserve energy at the peak times.

Right now, I'm not allowed to be in both programs; and I don't know why. They told me to come over here and ask for that. Perhaps, if enough people ask for it, it will be possible.

It seems to be just an issue of someone writing a program or doing the calculations because I have a Smart Meter. Someone's already keeping track of

3

DICKINSON REPORTING
(517)487-1072

the energy that comes into my house and then my house puts out into the grid and when that happens, so it seems like a simple thing. So I'd like to be allowed to be in both programs.

Thank you.

(At 5:23 p.m. - Statement concluded.)

GILLIAN GIEM, GRAND RAPIDS, 49546

(At 6:16 p.m. - Ms. Giem's statement begins.)

MS. GIEM: I'm just going to keep it short and sweet. It looks like Consumers Energy is doing really great things and that there's a lot on the horizons. I hope that Consumers Energy continues to pursue a sustainable and environmentally-aware focus towards mitigating climate change and providing quality service for their customers.

Thank you for being so involved in the community.

(At 6:20 p.m. - Statement concluded.)

* * *

4

DICKINSON REPORTING
(517)487-1072

Appendix 2A - Public Outreaches — Grand Rapids

Stenographer comments

Appendix 2A - Public Outreaches

Handouts

A new energy future for Michigan

Integrated Resource Plan will help lay the foundation for key decisions

CONSUMERS ENERGY is creating a cleaner, leaner vision to serve our customers for decades to come.

We're imagining how our state's energy landscape will look in five, 10 and 15 years, and developing a smart, flexible strategy to provide the power Michigan needs — no matter what the future brings.

Cross Winds Energy Park, Caro

Consumers Energy Count on Us®

Solar Gardens at Grand Valley State University

Renewable energy and natural gas are key components of our strategic vision to serve customers.

Lake Winds Energy Park, Ludington

Zeeland Generating Station, Zeeland

A new energy future for Michigan

What's happening?

As part of Michigan's new energy law, we are developing an Integrated Resource Plan (IRP), that will serve as a long-term tool for supplying affordable, reliable energy to customers throughout the state.

This requires forecasting Michigan's energy future using a variety of assumptions about factors such as market prices, energy demand and levels of clean energy resources, including wind, solar, demand response and energy efficiency.

Why is it important?

The IRP will provide a valuable tool for our major strategic decisions and help lay the foundation for how we serve customers for years to come.

How will we plan for the future?

The IRP process includes brainstorming with customers and key stakeholders to develop the IRP and build deeper understanding of our shared goals. Then, we'll weigh options to meet the state's long-term electricity needs and use modeling tools to evaluate resources under different scenarios and assumptions.

What happens when the IRP is complete?

We plan to provide the IRP to the Michigan Public Service Commission (MPSC) in mid-2018. Once we've filed, the MPSC has about one year to review the plan and determine whether we've developed the most reasonable and prudent strategy to serve our customers.

Costs of specifically identified investments in an approved IRP are considered reasonable and prudent for cost recovery purposes if started within three years of the MPSC's approval.

How will we measure the IRP's success?

The plan will align with our 'triple bottom line' of people, the planet and profit. Ultimately, our goal is a strategic vision that makes sense for our company, our customers and our state.

Consumers Energy Count on Us®

Stakeholder Engagement Report

APPENDIX 2B - Technical Workshop

Appendix 2B - Technical Workshop

Invite Letter to Technical Workshop 1

WORKING TO DELIVER THE ENERGY YOU NEED, WHENEVER YOU NEED IT.
THAT'S OUR PROMISE TO MICHIGAN.

Consumers Energy
Count on Us®
A CMS Energy Company

November 20, 2017

Cathy Cole
Michigan Public Service Commission Staff

Dear Ms. Cole,

Consumers Energy is beginning efforts to file an Integrated Resource Plan (IRP) no later than June of 2018. We would like to invite you to a Technical Workshop intended specifically for key stakeholders to provide input and stay informed regarding our IRP design.

The Technical Workshop will be held on December 12, 2017 from 1 – 4 p.m. in Auditorium D at the Commonwealth Commerce Center located at 209 E. Washington Street, Jackson, MI 49201. Please RSVP to Jessica Woycehoski by phone at 517-788-0722 or via email to jessica.woycehoski@cmsenergy.com with the names of participants. Due to the potential level of attendance, we respectfully ask that you send not more than four representatives from your organization.

Following this Technical Workshop, Consumers Energy desires to continue engaging stakeholders throughout the IRP development process to educate and build support for our IRP. Accordingly, we are planning to have a subsequent workshop in early 2018.

We value your participation as an informed stakeholder and encourage you to take the time to participate in the stakeholder event on December 12th.

Best Regards,

Jessica Woycehoski
Electric Supply Resource Planning
Consumers Energy

One Energy Plaza • Jackson, MI 49201 • 800-477-5050 • ConsumersEnergy.com

Appendix 2B - Technical Workshop

One Example of Invite Email to Technical Workshop 1

Jessica M. Woycehoski

Subject: Consumers Energy's Invite for IRP Technical Workshop

From: Jessica M. Woycehoski [mailto:JESSICA.WOYCEHOSKI@cmsenergy.com]
Sent: Monday, November 20, 2017 10:45 AM
To: Chris Bzdok <Chris@envlaw.com>
Cc: TJ Andrews <tjandrews@envlaw.com>; Kimberly Flynn <kimberly@envlaw.com>; Karla Gerds <karla@envlaw.com>; Marcia Randazzo <marcia@envlaw.com>
Subject: Consumers Energy's Invite for IRP Technical Workshop

Dear Christopher Bzdok,

Please find attached a formal invite to Consumers Energy's first Technical Workshop on our Integrated Resource Plan efforts. RSVP to this event is requested.

If you have questions or comments please feel free to contact me.

Best Regards,

Jessica Woycehoski
Resource Planning Lead
Electric Supply Planning
O: 517-788-0722| **C:** 517-315-7365
WORKING TO DELIVER THE ENERGY YOU NEED, WHENEVER YOU NEED IT.
THAT'S OUR PROMISE TO MICHIGAN!

Appendix 2B - Technical Workshop

Invite List and Attendee List for both Technical Workshops

Interested Party	Attendee Name	Technical Workshop 1	Technical Workshop 2
Clark Hill - ABATE	Rod E. Williamson	YES	NO
Clark Hill - ABATE	Bryan Brandenburg	YES	YES
ELPC	Margrethe Kearney	YES	YES
Fraser Law - HSC	Jennifer Heston	YES	YES
Fraser Law - HSC	Brooke Beebe	YES	NO
NRDC	Ariana Gonzales	YES	YES
UCS	Sam Gomberg	YES	YES
MEC	James Clift	YES	YES
Counsel to Attorney General Bill Schuette	Sebastian Coppola	YES	NO
Counsel to Attorney General Bill Schuette	Celeste Gill	YES	YES
MPSC	Cathy Cole	YES	YES
MPSC	Lynn Beck	YES	NO
MPSC	Jesse Harlow	YES	NO
MPSC	Lumi Makinde	YES	YES
MPSC	Naomi Simpson	YES	YES
MPSC	Karen Gould	NO	YES
MAE	Zach Heidemann	YES	NO
Varnum Law	Laura Chapelle	NO	YES
MCV	Kevin Olling	YES	YES
MCV	Laurie Valasek	YES	YES
MCV	Renee Schroll	YES	YES
MCV-Dykema	Richard Aaron	YES	NO
Sierra Club	Michael Soules	NO	YES
Sierra Club	Regina Strong	YES	YES
Environmental Law	Chris Bzdok	NO	NO
Midland Cogeneration Venture Limited Partnership	Charles Dunn	NO	YES
Midwest Cogeneration Association	John Liskey	NO	YES
Michigan Department of Environmental Quality	Breanna Bukowski	NO	YES
MPSC	Katie Smith	NO	YES
MPSC	Sarah Mullkoff	NO	YES
MPSC	Nyrehe Royal	NO	YES
InvenergyLLC	Robert Greskowiak	NO	YES
MEC	Charlotte Jameson	NO	YES

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 1

1

2018 Integrated Resource Plan
Technical Workshop

December 12, 2017

Consumers Energy
Count on Us®

Agenda

- 2018 IRP Purpose and Objectives
- Timeline
- Base Capacity Position
- Scenarios & Sensitivities Discussion

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 1

2018 IRP Purpose

3

- Develop proposed action plan regarding disposition of four coal units.
- Meet the requirements of an Integrated Resource Plan per PA 341/342
- Meet the requirements of MPSC Orders for IRP.
  - U-18418 IRP Modeling Requirements (Iss. 11/21/17)
  - U-18461 IRP Filing Requirements

2018 IRP Objectives for Medium 4 Coal Units

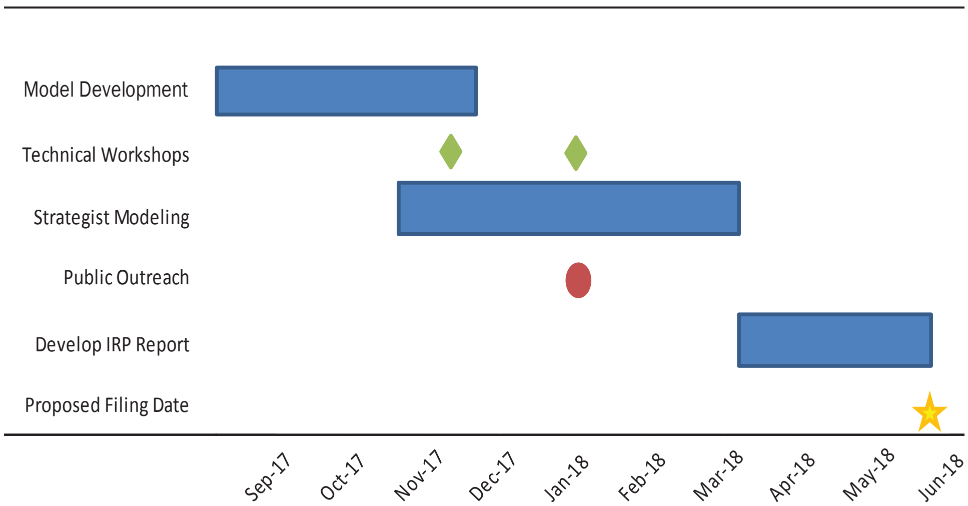
4

- Capacity Replacement Costs
- Impact to Recovery of Undepreciated Book Value
- Customer Rate Impacts
- Consider Non-Economic Variables
  - Portfolio Balance
  - Employment
  - Community Impact
- Effect on Contractual Fuel Obligations
- Internal Rate of Return
- Near-term Revenue Requirements
- Conditions of Existing Equipment
- Execution Risk

Appendix 2B - Technical Workshop

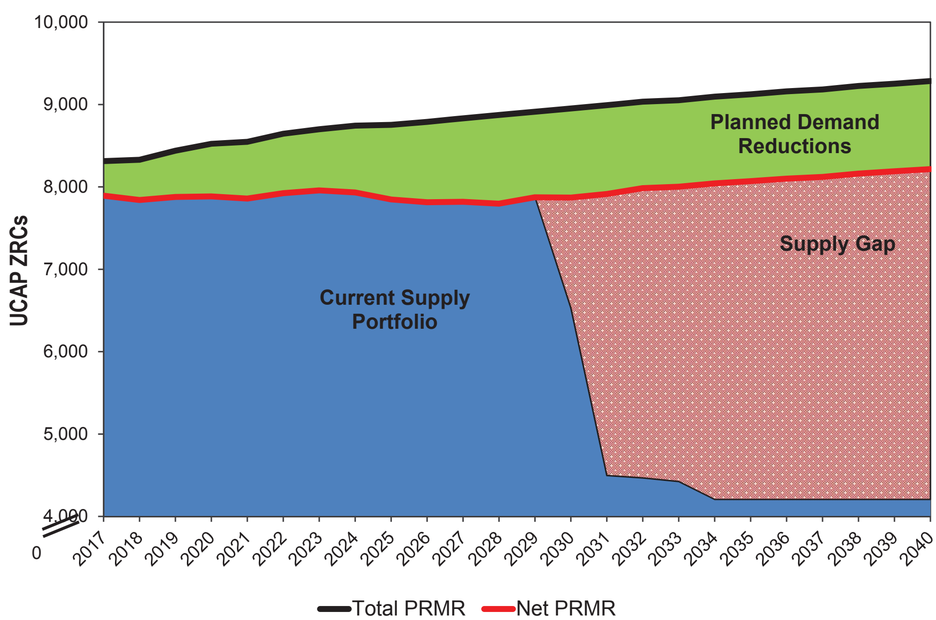
Presentation at Technical Workshop 1

Preliminary Schedule - June 2018 Filing 5



Aggressive Timeline to Complete level of Modeling Required

2018 IRP Base Capacity Position 6



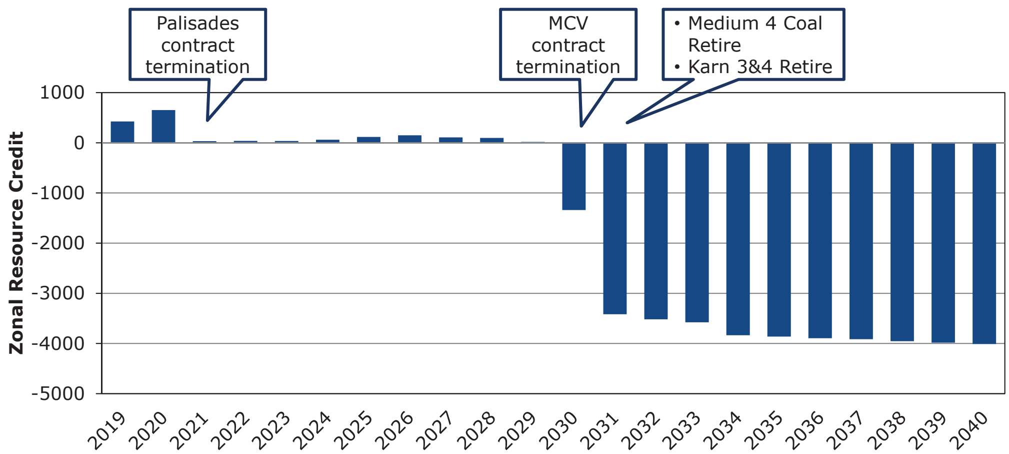
Base Capacity Position in Study Period 2019-2040

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 1

Base Capacity Position

7



ADDITIONAL NOTES ON CAPACTY RESOURCES:

- 1.5% EE 2017-2040
- Filer City PPA Amendment
- Demand Response at 400 MW (2019), 720 MW (2025)
- Renewable Energy Plan, Wind
- Cross Winds Phases II and III
- Existing PURPA contracts <20MW assumed to renew

Base Capacity Position in Study Period 2019-2040

Consumers Energy Count on Us

Business As Usual

8

	High	Base	Low
Electric Demand & Energy	+1.5% of BAU	BAU	50% ROA Return
Natural Gas Prices	200% of BAU	EIA-AEO 2017	Utility Forecast
Energy Waste Reduction	2.5% Ramp over 4yrs	1.5% 2017-2040	NA
Demand Response	NA	Current Outlook	NA
Renewables	NA	15% by 2021 35% by 2025 (EWR & RE)	NA
Thermal Retirements	NA	(at a minimum) KA1&2 2021 &2023 CA1 2021 & 2023 CA2 2021 & 2023	NA
Technology Replacement	Combustion Turbine Only	↓ Solar & ET Costs Existing PURPA	NA

Business As Usual Consistent with Existing Policy and Law

Consumers Energy Count on Us

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 1

Emerging Technologies

9

	High	Base	Low
Electric Demand & Energy	+1.5% of BAU	BAU	NA
Natural Gas Prices	200% of BAU	EIA-AEO 2017	NA
Energy Waste Reduction	2.5% Ramp over 4yrs	**Costs 35% below BAU**	NA
Demand Response	NA	**Costs 35% below BAU**	NA
Renewables	**25% by 2030**	15% by 2021 35% by 2025 (EWR & RE)	NA
Thermal Retirements	High retirement	(at a minimum) KA1&2 2021 &2023 CA1 2021 & 2023 CA2 2021 & 2023	NA
Technology Replacement	NA	↓ **RE &Storage Costs** **Existing PURPA**	NA

Growth of Emerging Technology and Renewable Resources

Consumers Energy Count on Us®

Environmental Policy

10

	High	Base	Low
Electric Demand & Energy	+1.5% of BAU	BAU	NA
Natural Gas Prices	200% of BAU	EIA-AEO 2017	NA
Energy Waste Reduction	2.5% Ramp over 4yrs	1.5% + Growth	NA
Demand Response	NA	BAU + Growth	NA
Renewables	NA	15% by 2021 35% by 2025 (EWR & RE)	NA
Thermal Retirements	**CO2 Regulation**	(at a minimum) KA1&2 2021 &2023 CA1 2021 & 2023 CA2 2021 & 2023	NA
Technology Replacement	NA	**35% Lower RE Costs** Existing PURPA	NA

Carbon Regulations Drive Lower Cost and Growth of Clean Energy Resources

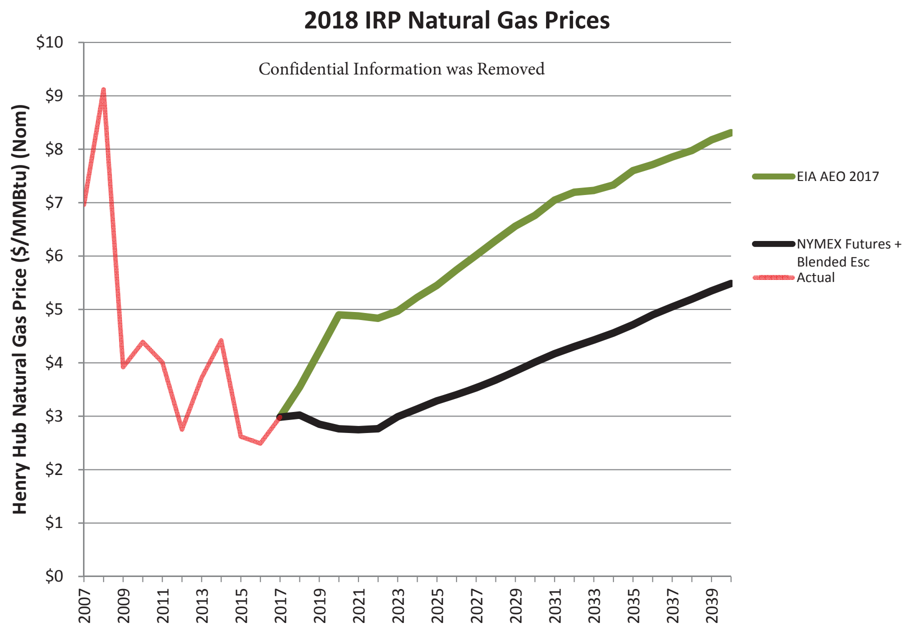
Consumers Energy Count on Us®

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 1

Natural Gas Price Outlook

11



Retirement Analysis

12

Final Order – U-18418	ET Scenario – U-18418
"In modeling each scenario and sensitivity evaluated as part of the IRP process, *the utility shall clearly identify all unit retirement assumptions and unless otherwise specified in the required scenarios, the utility has flexibility to allow the model to select retirement of the utility's existing generation resources*, rather than limiting retirements to input assumptions."	"…*Company-owned resource retirements may be defined by the utility, however, a meaningful analysis of whether coal units should retire ahead of business as usual dates should be performed.* Retirements of all coal units except the most efficient in the utility's fleet should be considered, *and those coal units owned by the utility that are not explicitly assumed to retire during the study period shall be allowed to retire in the model based upon economics.*

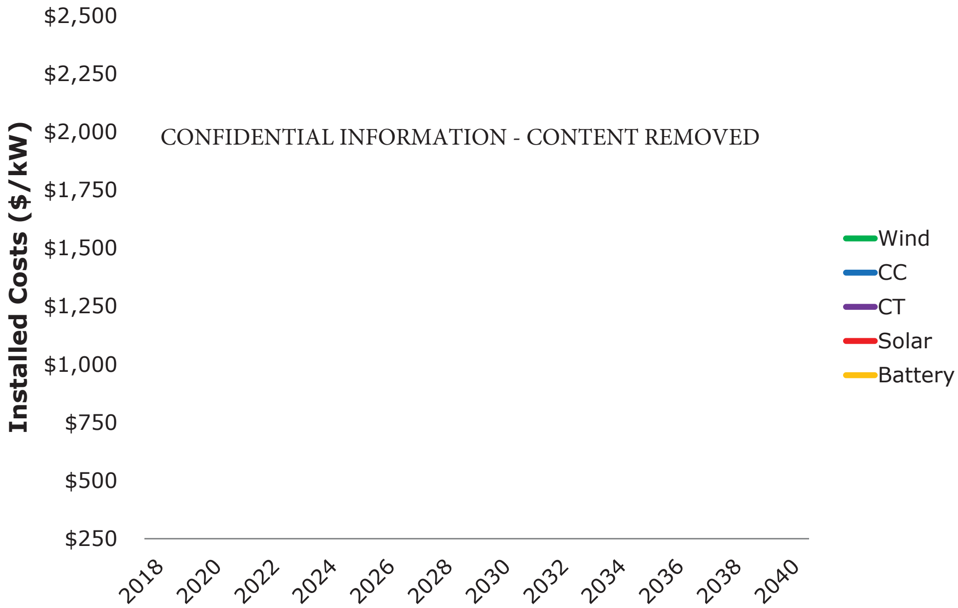
Retirement Analysis performed in all three scenarios

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 1

2018 IRP New Technology 2018-2040 (BAU)

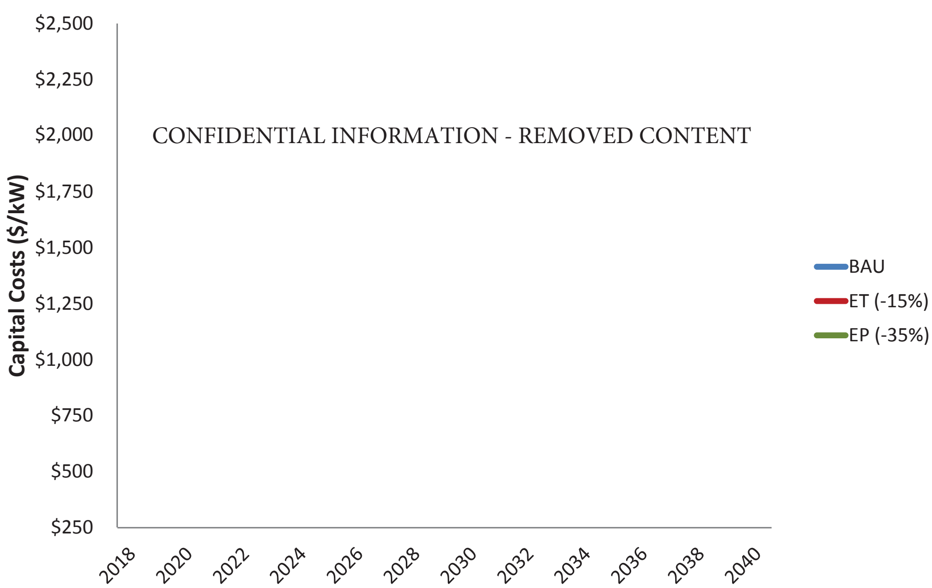
13



Consumers Energy Count on Us®

Capital Cost Curve - Wind

14



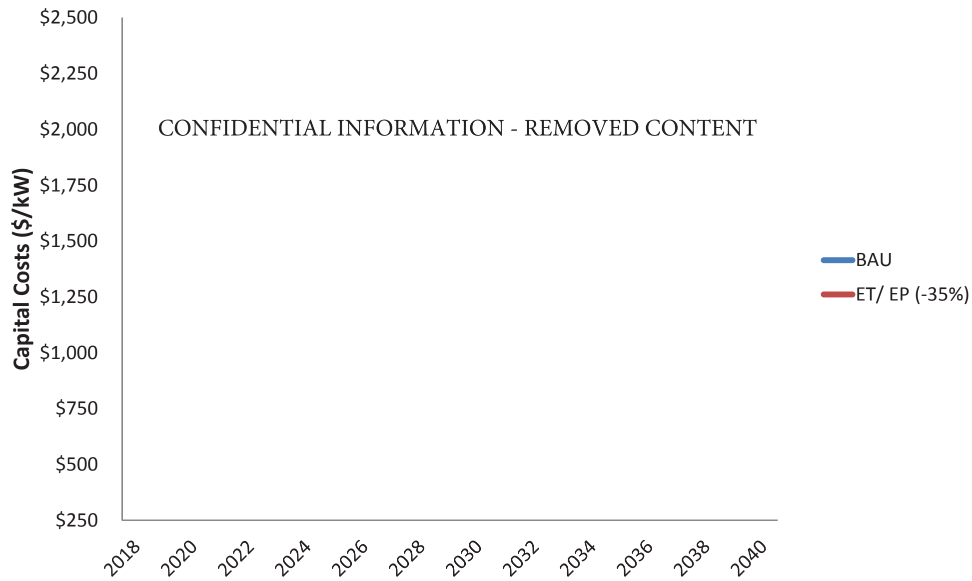
Consumers Energy Count on Us®

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 1

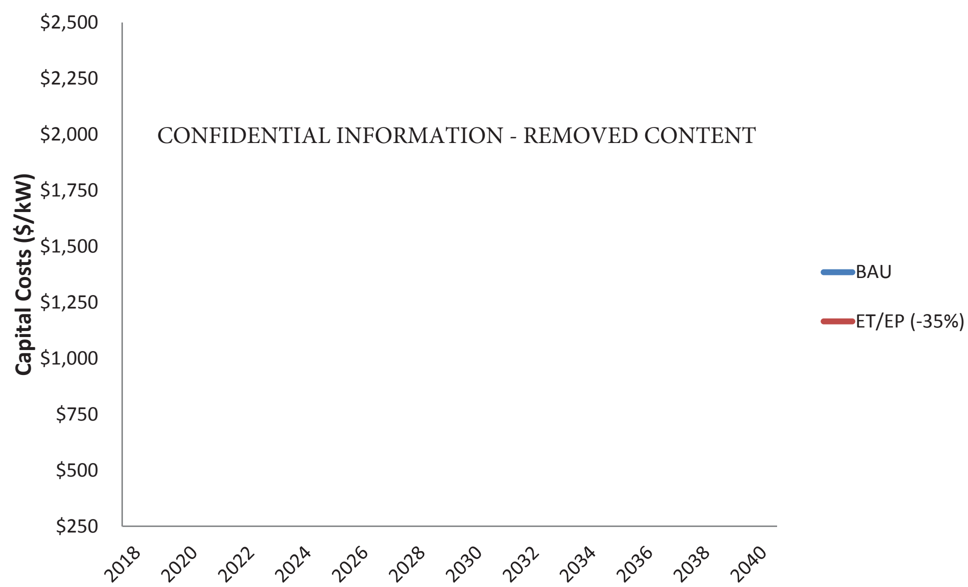
Capital Cost Curve - Solar

15



Capital Cost Curve - Storage

16

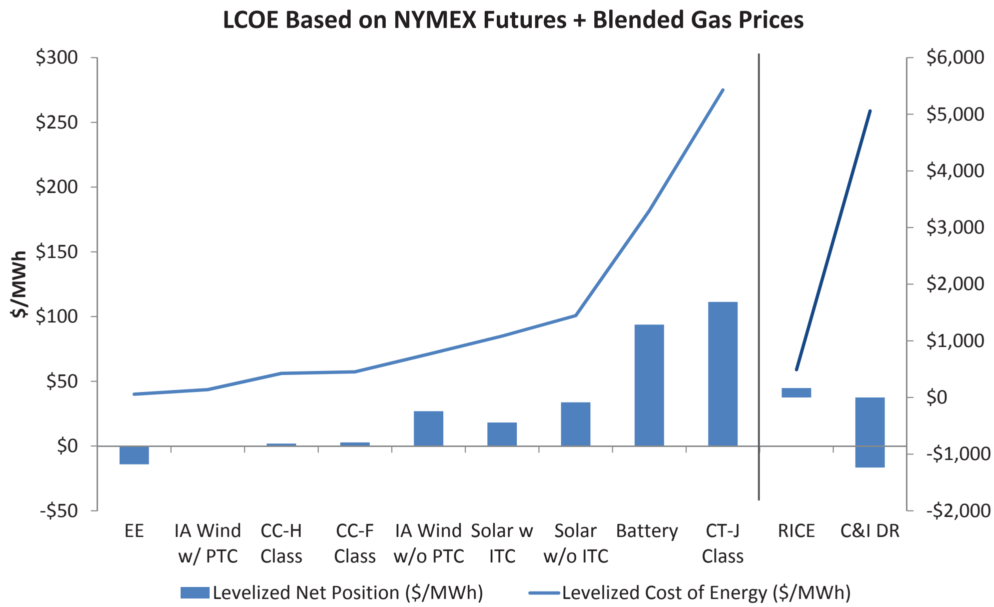


Appendix 2B - Technical Workshop

Presentation at Technical Workshop 1

Prescreen – Levelized Cost of Energy

17



Questions

18

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 1

2018 Integrated Resource Plan Technical Workshop
Stakeholder Comments

Company Responses

Consumers Energy Count on Us®
A CMS Energy Company

The following are comments provided by stakeholders at Consumers Energy's Technical Workshop on the Company's 2018 Integrated Resource Plan, and the Company's response to each comment.

1. Consider the process that will be utilized to provide access to the modeling information and data.

   Response:
   The Company is still considering this process. The Company is also considering an appropriate method for providing input and output data early in the process pursuant to a protective order or non-disclosure agreement.

2. Make sure we are considering the type of energy and energy efficiency that customers are demanding.

   Response:
   Consideration is being given to increased levels of energy efficiency, demand response and clean energy resources in the IRP evaluations. The Company is offering these resources on equal footing as supply-side options and is using the information given in the Energy Waste Reduction and Demand Response statewide potential studies to provide guidance on program levels. Consideration has been given through benchmarking and customer interest surveys for renewables programs.

3. Consider frequent updates to emerging technology costs.

   Response:
   The source being used is IHS Markit for renewable costs (includes batteries, wind, and solar). The IHS Markit for solar and wind is August 2017 and the vintage for batteries is October 2017.

4. Consider the impact on total customer costs if lowest cost doesn't meet customer aspiration. For example, model selection of Natural Gas technology, but significant future demand for voluntary green pricing program drives additional construction of renewables at a higher total cost.

   a. But ensure no cross-subsidization.

   Response:
   Consideration has been given through benchmarking and customer interest surveys. Renewable Energy Plan supports future development that meets energy law requirements and takes into consideration customer interest. The current scenarios satisfy this request and can be defined as Voluntary Green Pricing. No cross-subsidization for Voluntary Green Pricing programs is required by law, thus a program designed by the Company will be in compliance with this requirement.

5. Consider declining Levelized Cost of Energy for renewable resources.

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 1

Response:
The Company believes declining LCOE's have been driven by reductions in upfront capital cost and improved capacity factors associated with renewable technologies. Those considerations have been incorporated into the study design. The Company has assumed installed capital cost curves (in nominal dollars) for solar to decline in the initial years, then gradually increase, remaining flat through the study design, batteries decline over the study design period, and wind starts low gradually increasing. The assumptions include improved capacity factors to a point, and then remain stable.

6. Currently, Consumers largest customer has an interconnection request submitted to MISO. What is Consumers doing to plan for the loss of 7% of its customer demand?

   Response:
   The company is not modeling an expected 7% reduction in customer demand. The Company recognizes a level of uncertainty with forecasts, of which includes demand forecasts. There is also a level of uncertainty on whether a customer reduces demand by 7%. As greater certainty is obtained on significant changes in a customer's demand, the company develops plans to address this change. This is not done in the context of an IRP.

7. Public engagement: Engage public in the vicinity of Medium 4. Explain uncertainty and IRP process.

   Response:
   Public outreaches were centrally located in the Company's largest service territories to obtain a greater diversity and population of the Company's customers. One public outreach was located in Grand Rapids near the vicinity of the JH Campbell 1&2 site the other in East Lansing that is central to all customers.

8. Consider allowing the model the freedom to decommit Medium 4 units. Capacity factors may provide valuable information regarding economics of the units.

   Response:
   Coal units are designed and intended to run as baseload units. This topic has been discussed widely in Power Supply Cost Recovery filings and the Commission has found the Company's operation of its coal-fired units prudent. Consistent with expected operation, the Medium 4 coal units are modeled as must-run resources. Furthermore, in this IRP filing, Strategist ® is used as a capacity expansion tool with a corresponding production cost modeling simulation. However, like several other capacity expansion tools, Strategist's® production cost simulation is simplified; specifically, Strategist's® is a dispatch model (moving an online unit from low output levels to higher output levels, based on pricing signals) and not a commitment model (determining whether to bring offline units online).

9. Be very clear about how Load Forecast is developed. Specifically identifying how EWR is incorporated and at what cost.

   Response:
   The Company is working to clearly identify assumptions, inputs, and outputs in the load forecast(s) used in the IRP.

10. Regarding PURPA assumptions – consider sensitivity with significant increases in PURPA generators. Specifically, regarding increased PURPA solar generators.

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 1

a. Consider locations where less than 20 MW solar might be best located on the distribution system.

Response:
Given the continued uncertainty and pending MPSC proceeding related to PURPA, additional sensitivities of major PURPA increases are not assumed within this IRP. At this time the IRP does not consider best locations of resources interconnected into the distributions system. However, through the interconnection process specific assessments are made on distribution system impacts, cost of upgrades, and maintaining radial flow of power.

11. Consider having Consumers provide assistance and/or performing modeling based on interveners and other interested parties input or recommendations, during or before the start of the proceeding.

    a. Consider a process that would allow this with minimal burden.

Response:
Consumers Energy requested each stakeholder to provide up to two sensitivities for the Company to consider that are different than those required by the MPSC or planned by the Company. This offer excluded natural gas price sensitivities because this sensitivity requires optimization of both Consumers Energy and the outside world (other companies within MISO) that requires a significant amount of run time.

12. Consider reflecting shortfalls of capacity resulting from AES deficiencies in the four year SRM planning period.

Response:
This is reflected through the 50% ROA return sensitivity in the BAU.

13. Consider multiple gas price sensitivities. EIA tends to be high and small changes in gas price can have significant impacts on outcomes. Additional third party price strips might be valuable. Also, consider a very low gas price.

    a. Be sure to provide comparison information (including growth rate, etc.) to the various prices used in the modeling.

Response:
Comparisons and insights into high versus low natural gas price forecasts can be achieved through the interpolation between the EIA-AEO and Consumers Energy natural gas price forecasts. The Company has pursued three additional scenarios to evaluate the effects of a lower natural gas price forecast through the use of the Company's utility specific natural gas price forecast.

14. Make sure Consumers is capturing additional costs. For example, gas infrastructure if the model selects significant gas units or additional quick start units if significant intermittent resources are selected.

Response:
The Company is working with ITC to identify applicable transmission costs. The Company is considering gas infrastructure and network upgrades as part of the modeling evaluation.

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 1

15. Robust table of contents for exhibits and work papers. Specifically, identify which documents support which scenarios and sensitivities.

    Response:
    The Company is working to structure and identify necessary documents in the regulatory filing.

16. Consider providing modeling data and inputs prior to initiating the IRP proceeding.

    Response:
    The Company is considering an appropriate method for providing input and output data early in the process pursuant to a protective order or non-disclosure agreement.

17. Consider allowing Strategist to select PPA or Asset acquisition.

    Response:
    Determinations of ownership or build arrangements are considered outside of the software once selection of supply options is identified. It would be appropriate to consider PPA versus Company ownership if there is a material difference in cost to customers. The Company does not believe such a material difference exists for the technologies being evaluated.

18. Consider creating similar sized new asset blocks. Specifically, be aware of impacts on optimal solution as a result of asset block size.

    Response:
    The Company is considering similar sized new asset blocks for each resource being considered (e.g. wind, solar, demand response); however constraints within the model may be necessary because the IRP software is unable to accept a large number of resource blocks into the expansion plan. For example, if an asset block is set at 25MW and the IRP software has to fill a 1,000MW capacity need, limitations on number of new units selected may results in only 30 blocks of this resource being selected, leaving the expansion plan short. To avoid this issue, a larger sized asset block is created for the resource to allow the IRP software tool to select more of it and fill the capacity need.

19. Consider providing Stakeholder documents in advance of the Stakeholder Technical workshop.

    Response:
    Materials were provided shortly after the first technical workshop to all attendees. Based on this feedback, materials were provided prior to the second technical workshop.

20. Consider evaluating Medium 4 early retirements under both EIA and Consumers gas price forecasts.

    Response:
    The Company is evaluating the Medium 4 early retirement using both natural gas price forecasts.

21. Allocate sufficient time for a robust risk assessment. Understanding the impact to an optimized plan of very different future worlds. (The risk associated with being wrong).

    Response:
    The Company is pursuing a risk assessment that utilizes scenarios and sensitivities to determine risks associated with future changes in assumptions. The evaluation may include a probabilistic ranking of potential outcomes to determine the level of risk associated with

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 1

optimal plans and feasible sub-optimal plans. The Company is also researching agent-based stochastics that is in addition to the scenarios and sensitivities probabilistic assessment to evaluate one resource versus another resource.

22. The cost impact portion of this effort is as important as the modeling. It should consider all costs that impact the customer. The resulting action plan should reflect and consider fully delivered cost to customers.

    Response:
    The Company is evaluating the cost impacts to customers as average system rates per kWh by year for the proposed course of action and other feasible options. A list of costs included in the modeling are; existing fixed charges (e.g. Rights of Way, poles and fixtures, taxes), network upgrades, capital, and operation and maintenance.

23. Robust build versus buy impact analysis, as appropriate.

    Response:
    A build versus buy analysis is considered after the IRP is complete and prior to moving forward with a definitive project that is in a proposed course of action or a Commission approved course of action.

24. Comparison of resource options should consider a uniform set of metrics. Information should be presented in a uniform manner.

    Response:
    The Company is attempting to present information in a uniform manner. For example, the Company can identify use of discount rates, inflation rates, and nominal dollars, and applies them uniformly to generation resources evaluated in the modeling software.

25. Consider higher levels of demand response beyond 720MW by 2025 planned in the base case.

    Response:
    Customer program experts identify the achievable level of demand response. Demand response beyond the Company's base outlook is to be offered to the model for consideration, consistent with the Statewide potential studies.

26. Model considers preparation for ramping up to levels of demand response, energy efficiency, and renewables that can be obtained when a need arises.

    Response:
    Demand response, and energy efficiency programs required to fill a need are modeled to include the ramp up time so that the size of the program is at the highest level possible and/or feasible when significant capacity needs arise.

27. Encourage a 600MW market purchase and less than 50% Cost of New Entry (CONE).

    Response:
    The Company is limiting capacity purchases to no more than 300MW, reflecting our point of view that capacity surplus is minimal. The Company is conducting capacity price sensitivities at 0%, 25%, 50%, 75%, and 100% CONE.

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 1

28. Consider hosting additional public outreaches located near areas the IRP provides decisions impacting communities. Provide a website with information allowing comments to be submitted. Consider open mic portion of the meeting to hear other participant comments.

    Response:
    The Company's Public Outreaches are intended to provide an educational opportunity, obtain customer feedback on the Company's IRP plan, and enhance the level of engagement with the customer on a personal level that is difficult to achieve through a website or other social media. Additional public outreach (stakeholder engagement) efforts will be carried out in host communities with impacts from host communities to the extent those are identified in the IRP as part of a communications roll out plan. Area managers are in regular contact with community leaders around the state and are keeping communities informed about Consumers Energy projects.

29. Replacement evaluates full series/portfolios of options – not only gas.

    Response:
    The Company is offering a variety of resources for the model to select. These resources consist of energy efficiency, demand response, continuous voltage reduction, wind, solar, battery storage, combustion turbines, reciprocating internal combustion engines and combined cycle units.

30. Find options that reduce impact to customer rates related to undepreciated book value of retiring assets.

    Response:
    The Company is evaluating undepreciated book value and customer rate impacts when considering potential retirement.

31. Consider tax reform impacts.

    Response:
    The Company is addressing tax reform by conducting sensitivity on the Proposed Course of Action and optimal plans to determine the effects of tax reform on net present values of generation portfolios selected by the IRP software.

Appendix 2B - Technical Workshop

Save the date, invite letters, and emails to Technical Workshop 2

Jessica M. Woycehoski

From: Jessica M. Woycehoski
Sent: Monday, December 18, 2017 8:59 AM
To: rwilliamson@clarkhill.com; bbrandenburg@clarkhill.com; colec1@michigan.gov; mkearney@elpc.org; jheston@fraserlawfirm.com; agonzalez@nrdc.org; james@environmentalcouncil.org; GillC1@michigan.gov; BeckL12@michigan.gov; DohertyR1@michigan.gov; HarlowJ@michigan.gov; MakindeL@michigan.gov; SimpsonN3@michigan.gov; HeidemannZ@michigan.gov; KRolling@midcogen.com; LMVALASEK@midcogen.com; rjschroll@midcogen.com; raaron@dykema.com
Subject: Consumers Energy's IRP Technical Workshop Dec. 12, 2017 - Materials
Attachments: ConsumersEnergy_IRPTechnicalWorkshopAttendeeList_121217.pdf; Consumers Energy_2018IRP_TechnicalWorkshop_Comments121217.pdf; ConsumersEnergy_IRPTechnicalWorkshopPresentation_121217.pdf

Thank you to for attending last week's technical workshop related to Consumers Energy's IRP. Please find attached the final documents as an outcome of the Company's Technical Workshop on December 12, 2017. Please note, the assumptions contained in the slides are preliminary and are subject to change based on the modeling and analysis that will be performed by the Company in preparation for its Integrated Resource Plan filing.

We look forward to continued discussions regarding the IRP efforts.

Best Regards,

Jessica Woycehoski
Resource Planning Lead
Electric Supply Planning
O: 517-788-0722| **C:** 517-315-7365
WORKING TO DELIVER THE ENERGY YOU NEED, WHENEVER YOU NEED IT.
THAT'S OUR PROMISE TO MICHIGAN!

Appendix 2B - Technical Workshop

Save the date, invite letters, and emails to Technical Workshop 2

Jessica M. Woycehoski

From: Jessica M. Woycehoski
Sent: Tuesday, January 30, 2018 1:34 PM
Subject: Save the Date! Tehnical Workshop #2 for Consumers Energy's Intergrated Resource Plan

Please save the date for Consumers Energy's 2nd Technical Workshop for the Integrated Resource Plan.

Date: February 27, 2018
Time: 9:00 a.m. to 12:00 p.m.
Location: One Energy Plaza, Jackson, MI 49201

- More information to follow. We hope you will plan to attend.
- Feel free to share this invitation with others in your organization.
- *Note*: There will not be phone or video remote participation options available.

Thank you.

Jessica Woycehoski
Resource Planning Lead
Electric Supply Planning
O: 517-788-0722| **C:** 517-315-7365
WORKING TO DELIVER THE ENERGY YOU NEED, WHENEVER YOU NEED IT.
THAT'S OUR PROMISE TO MICHIGAN!

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 2

IRP Technical Workshop 2
Agenda

February 27, 2018

Consumers Energy Count on Us®
A CMS Energy Company

Time	Topic
10 minutes	Welcome, Safety Tailboard, Intros, Housekeeping, and Structure of today's meeting.
45 minutes	• Summary and Objectives of Technical Workshops
	• Discuss Additional Scenarios o Required by MPSC (3) o Consumers Energy's Additional (3)
	• Clarifying Questions
10 minutes	**Break**
45 minutes	• Company Responses to Stakeholder Comments
	• Clarifying Questions
	• Share Suggested Sensitivities from Stakeholders
10 minutes	**Break**
55 minutes	Stakeholder Comments
5 minutes	Closing Remarks

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 2

1

Integrated Resource Planning Technical Workshop #2

February 27, 2018

Consumers Energy
Count on Us®

IRP Status Update

2

- Public Outreaches
- Technical Workshops
- Modeling Efforts
- Addition of three scenarios to address EIA-AEO Natural Gas Price Forecast

Consumers Energy Count on Us®

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 2

Additional Scenarios

3

MPSC Required Scenarios

Business As Usual
- EIA AEO Gas Price Forecast

Emerging Technology
- EIA AEO Gas Price Forecast

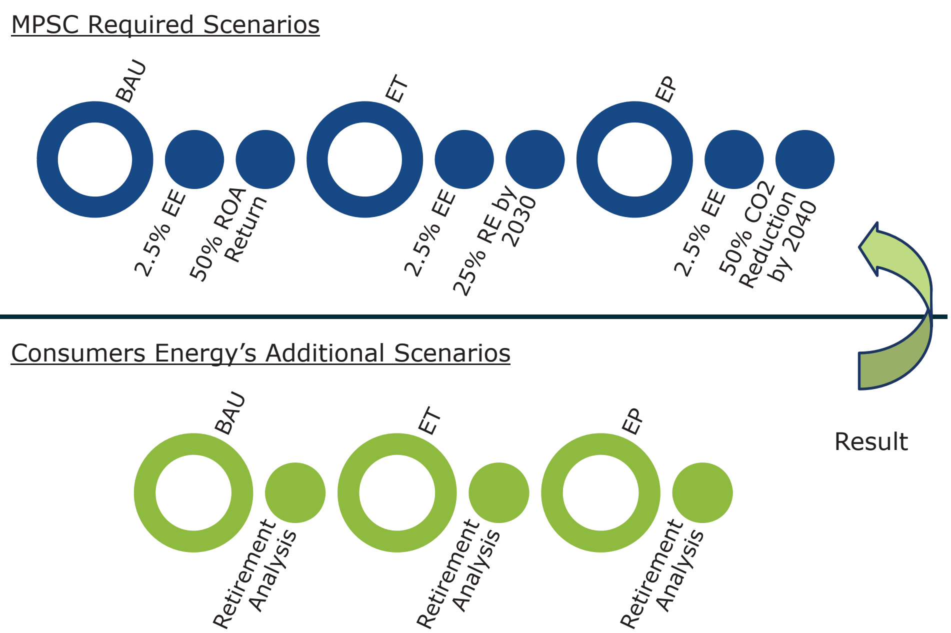
Environmental Policy
- EIA AEO Gas Price Forecast

Consumers Energy's Additional Scenarios

Business As Usual
- CE Gas Price Forecast

Emerging Technology
- CE Gas Price Forecast

Environmental Policy
- CE Gas Price Forecast



Appendix 2B - Technical Workshop

Presentation at Technical Workshop 2

5

QUESTIONS

6

BREAK

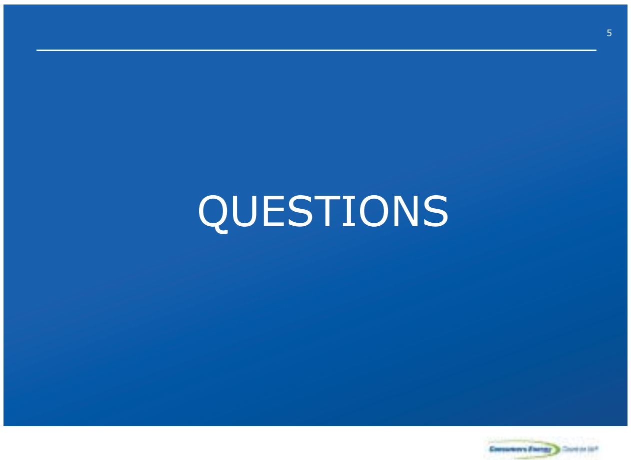
Overview of Responses to Comments

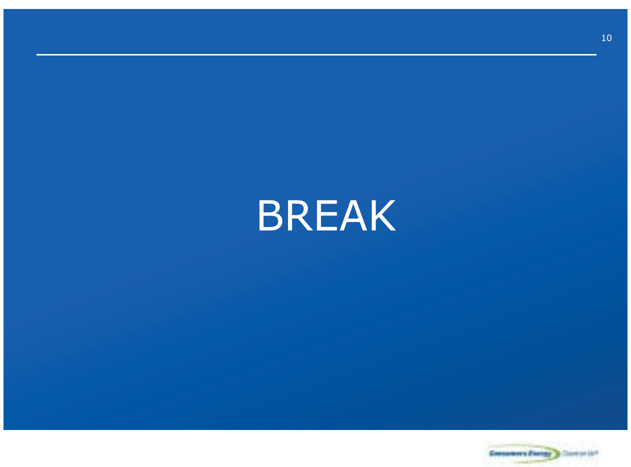
7

- Organization, level of details, and information sharing of documents to be filed in the case
- Frequent updates of emerging technology costs
- Modeling of build vs. buy
- New asset blocks to be similarly sized
- Capacity price sensitivities and market purchases
- Let model select optimal retirement years
- Consider wind, solar, and batteries versus natural gas
- Perform modeling for stakeholders prior to contested case proceeding

Appendix 2B - Technical Workshop

Presentation at Technical Workshop 2





Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 2

Consumers Energy's Integrated Resource Plan
Technical Workshop 2

Stakeholder Comments and Responses

Consumers Energy Count on Us®
A CMS Energy Company

The following are comments provided by stakeholders at Consumers Energy's Technical Workshop on the Company's 2018 Integrated Resource Plan held February 27, 2017.

1. Consider allowing each stakeholder to submit some amount of data requests in advance of the filing with the intent of the Company providing those responses in the initial filing.

   Response:
   The Company will accept data requests in advance of the filing and will determine the extent to which it is able to fulfill the request prior to filing. However, the fulfillment of the request before the filing date may be dependent upon the request.

2. Clarify sensitivity B. suggested by ABATE: Run sensitivity consistent with U-18494 three step proposal. The relevant sensitivity would be related to calculation C. Relates to accumulated deferred tax balances.

   Response:
   Excess deferred taxes have occurred because of assets that exist today. These excess deferred taxes will be recognized in base rates, and are not contingent upon new future asset resources that are modeled in the IRP; therefore this sensitivity was not run.

3. Energy Efficiency and Renewable Energy are important. Consider the Grand Rapids programs:
   - Goal for City Ops to be 100% renewable energy by 2025;
   - Future programs to incent private business/landowners to pursue additional energy efficiency and renewable energy.

   Response:
   The Company offered higher levels of energy efficiency and demand response programs into the model to evaluate these resources against other supply-side resources, such as solar and wind. Additionally, cost reductions in renewables required to be modeled by the Commission provides the information necessary to determine the economic viability of replacing capacity needs with renewables. The Company will consider how renewable and energy efficiency resources incorporated into the proposed course of action might support customer sustainability commitments and goals.

4. Consider evaluating public commitments/goals that customers have made and the impact this would have on renewable energy and energy efficiency demand.
   a. Also provide clarity on how this evaluation influenced load forecast used in the evaluation.

   Response:
   The Company will explain how the planned resources and offerings of renewable energy and energy efficiency demand reflected customer sustainability goals and commitments. The Company will explain the influence of energy efficiency resources/programs on the load forecast. Also please see the response to question (3), above.

5. Easier access to streamlined customer usage and cost data.

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 2

Response:
The IRP uses customer usage and cost data at an aggregated level. To the extent customer level data is available at an aggregated level, it will be provided. However, the intent of this comment is more appropriate in a rate case proceeding where Cost of Service by rate class is handled.

6. Provide clarity on creation and interactions of Load Forecast and energy efficiency forecast. Specifically, this was a challenge in DTE Certificate of Necessity case.

   Response:
   The load forecast incorporates historical energy efficiency savings and planned expansion to 1.5% energy efficiency. The base load forecast does not embed or project energy efficiency savings above 1.5%. A separate load forecast was created in the IRP for a sensitivity that evaluates the impacts of energy efficiency up to 2.5%. Levels of energy efficiency beyond the base of 1.5% were offered into the IRP models as a demand-side option to fill capacity needs in all other sensitivities. The Company will make efforts to clearly explain development of the load forecast and how energy efficiency is accounted for.

7. Information on how potential study was used. Specifically, how did we create costs and reflect potential in our evaluation (i.e. Reliance on max achievable potential vs simply achievable, is achievable considered a cap?)

   Response:
   The Company relied on both the high potential and low potential results in the Demand Response state-wide potential study and the 100% Incremental and Business as Usual cases in the Energy Waste Reduction state-wide potential study. The costs created for demand response programs were based on the high and low pricing corresponding with the high and low programs determined to be applicable to Consumers Energy's service territory. Achievable was not considered a cap.

8. Provide information on how the 2017 State-wide potential study was used. If this study was not relied upon exclusively, how was it used?

   Response:
   Both the Energy Waste Reduction and Demand Response statewide potential studies were used in the development of the modeling blocks offered to the model as a supply-side resource.

9. Consider Strategist limitations, particularly in its treatment of non-traditional resources, and explore ways to bolster analysis to compensate for these limitations.

   Response:
   The Company has considered other factors besides the least-cost solutions provided in the Strategist® model. The other factors include, but are not limited to, environmental emissions, unrecovered book balance, supply balance and ramp up rates to determine the proposed course of action in an IRP.

10. Modification of sensitivity: Consider if Karn 1&2 are not retired by 2023, evaluating retirement in 2025.

    Response:
    Retirement beyond 2023 requires significant investment for water regulations that, if implemented, would likely only be prudent for operation through 2031. Based on this

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 2

reasoning, we are not considering 2025 as a potential retirement year.

11. It is critical to evaluate the retirement of the Medium 4 on dates other than 2021 and 2023. If ABB is unable to determine a method to allow the model to select/evaluate optimal retirement, additional priority should be given to requested sensitivity, A1 (as submitted by CARE).

    Response:
    ABB was able to evaluate the discrete years 2021, 2023, and 2031. With this analysis ABB made a set of assumptions to evaluate years between 2023 and 2031. The Company conducted the requested sensitivity listed as A1 submitted by CARE that is in addition to ABB's analysis.

12. Determine a method to accommodate comments from public outside of the Public Outreach events.

    Response:
    The Company desired a level of engagement not possible outside of face-to-face interaction. We designed our public outreach events to educate the public and provide a forum to interact directly with customers. We are considering other methods of accommodation for our next IRP.

13. Consider an additional stakeholder meeting once modeling is concluded but in advance of filing.

    Response:
    The Company is continuing stakeholder discussions during and after modeling in advance of the filing.

14. Find a way to allow for selection of resources with total costs lower than existing resource variable costs when a capacity need does not exist.

    Response:
    Allowing selection of a new resource over an existing resource as suggested would not account for the long-term value the existing asset is providing to customers. Specifically, the recommended evaluation neglects impacts to customer rates, emissions, unrecovered book value, higher or lower reliance on energy markets and capacity markets and other factors. The economic evaluations performed in this IRP will consider the total costs of new resources that would be required to sufficiently meet customer demand. Specific existing resources have been evaluated in this IRP for early retirement. The retirement analysis considers a number of economic factors, including total projected and sunk costs (variable and fixed), as well as customer rate impacts, community and employee impacts, environmental impacts and more.

15. Consider sensitivities around discount rates at Treasury bill rates.

    Response:
    The Company is considering discount rates at Treasury bill rates. The analysis will cover 50 basis points up and down from the base discount rate of 7.55% in the model.

16. 300 MW cap on market: If Consumers has a significant shortfall, reevaluate 300 MW purchase cap specifically giving consideration to recent Mid-continent Independent System Operator Resource Adequacy potential changes.

    Response:

Appendix 2B - Technical Workshop

Comments and Responses in Technical Workshop 2

Reliance on capacity purchases from the market may, in some circumstances, benefit customers in the short-term (between one to five years). The Company has utilized purchased capacity in prior years to meet short-term needs. However, for long-term planning purposes, a reliance on the availability of capacity and competitive pricing from the market exposes customers to risk. Securing firm capacity resources provides Michigan with a long-term security of supply.

Appendix 2B - Technical Workshop

Request for sensitivities and list of suggestions by stakeholders

Jessica M. Woycehoski

From:	Jessica M. Woycehoski
Sent:	Monday, February 5, 2018 8:31 AM
To:	'rwilliamson@clarkhill.com'; 'bbrandenburg@clarkhill.com'; 'colec1@michigan.gov'; 'mkearney@elpc.org'; 'jheston@fraserlawfirm.com'; 'agonzalez@nrdc.org'; 'SGomberg@ucsusa.org'; 'james@environmentalcouncil.org'; 'sfisk@earthjustice.org'; 'tjandrews@envlaw.com'; 'GillC1@michigan.gov'; 'tjlundgren@varnumlaw.com'; 'lachappelle@varnumlaw.com'; KRolling@midcogen.com; 'LMVALASEK@midcogen.com'; rjschroll@midcogen.com; 'raaron@dykema.com'; colec1 @michigan.gov
Cc:	Robert W. Beach; Gary A. Gensch Jr
Subject:	Consumers Energy's Request for Stakeholder Sensitivities for IRP

Dear Stakeholders,

The Company is offering an opportunity for each stakeholder group to suggest up to two sensitivities for the Company to consider modeling as part of its 2018 Integrated Resource Plan filing. Please send suggested sensitivities to me by no later than February 23rd. Please include sufficient detail on your suggested sensitivities to allow us to accurately assess modeling requirements. Please note that we are not able to model gas price sensitivities due to significant modeling and computational efforts.

Sincerely,

Jessica Woycehoski
Resource Planning Lead
Electric Supply Planning
O: 517-788-0722| **C:** 517-315-7365
WORKING TO DELIVER THE ENERGY YOU NEED, WHENEVER YOU NEED IT.
THAT'S OUR PROMISE TO MICHIGAN!

Appendix 2B - Technical Workshop

Request for sensitivities and list of suggestions by stakeholders

Stakeholders Suggested Sensitivities for Consumers Energy's Integrated Resource Plan

February 27, 2018

Consumers Energy Count on Us®
A CMS Energy Company

The following items are suggested sensitivities by stakeholders received on February 27, 2018 in response to the Company's ask for up to two sensitivities each stakeholder group for the Company to consider as part of its 2018 Integrated Resource Plan filing. Organizations responding to the request included:

- ABATE
- Hemlock Semi-Conductor (HSC)
- CARE
- Environmental Law and Policy Center (ELPC)
- Michigan Environmental Council (MEC)
- Natural Resources Defense Council (NRDC)
- Sierra Club
- Union of Concerned Scientists (UCS)

Suggested Sensitivities:

ABATE

A. Expansion of Choice. Last year, the Legislature spent considerable time debating Michigan's energy policy and the merits of a deregulated electricity market. While the Legislature maintained the 10% cap on choice, the issue is far from settled. Given the intensity of debate surrounding this issue, it would be unreasonable for utilities to ignore the possibility of an expansion to Michigan's retail open access market. Therefore, the Commission should require that utilities include a sensitivity gauge in each of their scenarios that reflects the impact related to such an expansion. Rather than speculate on the potential size of the expansion, ABATE suggests that utilities utilize the number of customers in their respective choice queues as a reference point.

B. Decrease in the federal corporate income tax rate, which will affect the revenue value of various tax credits. Gain a proper understanding of CECo's reliance on green energy-based tax incentives.

HSC

A. Assume the MCV contract will expire in 2025, rather than have it extend to 2030.

CARE, ELPC, MEC, NRDC, Sierra Club, UCS

A. In addition to the coal unit retirement scenarios Consumers is already planning (incl. scenarios involving 2021 and 2023 retirement dates for the Medium Four), run two coal retirement sensitivities:
   1. Run a sensitivity in which Strategist selects the retirement dates for each of the Medium Four units. Under this sensitivity, the modeling run would be performed first to identify retirement dates. Then, the results would be adjusted outside the model to account for (i) the avoidable capital costs and (ii) the NUG rate impacts stemming from the Strategist-selected retirement dates.
   2. To the extent Consumers is not already planning to do so, run a sensitivity in which both Karn 1 and 2 are selected for retirement in 2021-23, and the Campbell units are assumed to retire according to Consumers Energy's plan.

Appendix 2B - Technical Workshop

Request for sensitivities and list of suggestions by stakeholders

B. Run two sensitivities with respect to energy efficiency. In these sensitivities, the load forecast should not embed utility EWR program savings but should reflect codes and standards including EISA lighting efficiency standards circa 2020. If in either sensitivity the cumulative efficiency exceeds Consumers Energy's share of the economic potential from the Commission's EWR potential study, then estimate incremental potential that will be available due to technological change and add that to the available potential. A proxy for technology improvement would be to look at the portion of current EWR program savings that accrue from measures that were not included when efficiency potential was estimated for the 21st Century Energy Plan.
   1. Target 2% annual incremental first-year savings throughout the planning period.

   2. An all-cost-effective energy efficiency sensitivity (if greater than 2% annual incremental first-year savings). An all cost-effective scenario would include financial incentive (e.g. rebate) offerings of as much as 100% of incremental cost for any measures for which that is the incentive level at which participation and cost-effective savings would be maximized. For measures which fail cost-effectiveness at incentive levels less than 100%, the incentive would be set at a level at which the measure is cost-effective. Cost-effectiveness should include transmission, distribution, and ancillary services benefits.

C. Run two sensitivities with respect to demand response:
   1. Consumers Energy's share of the Low Achievable demand response from the Commission's demand response potential study, and

   2. Consumers Energy's share of the High Achievable demand response from the Commission's demand response potential study.

D. Run sensitivity for utility-scale PV costs, based on NREL 2017 Annual Technology Baseline, using the "Low" cost path. Note that NREL ATB shows results for 14%, 20%, and 28% net capacity factor but these do not affect costs. Consumers should provide at least four utility-scale resource options to the IRP model, performance of which should be modeled using the NREL System Advisor Model: south-facing, fixed tilt (14.1% capacity factor, 50% ELCC); southwest-facing fixed-tilt (13.4% capacity factor, 62% ELCC); single-axis tracking (15.8% capacity factor, 62% ELCC); and dual-axis tracking (18.4% capacity factor, 65% ELCC).

E. Run sensitivity with respect to PURPA contracts, assuming that contract prices are based on PURPA avoided costs as decided in U-18090. Assume that current PURPA contracts are renewed for 20 years and that incremental utility-scale solar systems are added as follows:
   1. 2019 – 30 MW of projects come online with 20 year contracts
   2. 2020 – 40 MW of projects come online with 20 year contracts
   3. 2021 – 50 MW of projects come online with 20 year contracts
   4. 2022 – 60 MW of projects come online with 20 year contracts
   5. 2023 – 60 MW of projects come online with 20 year contracts

F. Run two sensitivities with respect to storage:
   1. Unsubsidized storage, assuming that storage costs are now and follow the trends forecast in Lazard's levelized cost of storage analysis released in November 2017 (https://www.lazard.com/media/450338/lazard-levelized-cost-of-storage-version-30.pdf).

   2. Using the Lazard storage costs and projections from November 2017, but assuming that storage is integrated to a shared inverter with solar and therefore benefits from the solar investment tax credits in current law.

G. Run a sensitivity in which all renewable energy projects in Consumers Energy's plan that can be initiated before 2022 are accelerated to the earliest feasible start of construction date to maximize benefits from current-law production tax credits and investment tax credits.

Appendix 2B - Technical Workshop

Request for sensitivities and list of suggestions by stakeholders

H. Run a sensitivity with respect to voluntary renewable energy purchases, assuming that all renewables included in this program are incremental to Consumers planned portfolio, based on the following table:

Year	Customer-Requested Renewables as % of Consumers Energy Sales
2018	0.10%
2019	0.50%
2020	1%
2021	2%
2022	3%
2023	4%
2024	5%

MICHIGAN PUBLIC SERVICE COMMISSION

Consumers Energy Company

Total Fuel Cost Of Existing Owned Units: Environmental Policy, CE Gas, Karn 1&2 Ret May 31, 2023 - Alternate Plan

			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)
Line No.	UNIT NAME	TYPE	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	CAMPBELL 1	COAL	$ 30,810	$ 35,420	$ 36,451	$ 36,203	$ 39,173	$ 45,225	$ 41,825	$ 47,719	$ 45,651	$ 42,888	$ 48,112	$ 45,485	$ 47,383	$ 19,776	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2	CAMPBELL 2	COAL	$ 42,537	$ 41,407	$ 44,493	$ 46,413	$ 47,424	$ 50,426	$ 55,590	$ 54,857	$ 50,965	$ 57,205	$ 54,618	$ 54,154	$ 56,346	$ 23,532	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3	CAMPBELL 3	COAL	$ 127,232	$ 122,024	$ 145,928	$ 142,341	$ 150,685	$ 130,547	$ 149,554	$ 138,327	$ 154,362	$ 147,690	$ 137,403	$ 152,711	$ 145,321	$ 135,516	$ 151,964	$ 144,689	$ 135,516	$ 151,555	$ 145,096	$ 135,516	$ 151,555	$ 144,689	$ -
4	KARN 1	COAL	$ 29,397	$ 30,350	$ 29,202	$ 32,036	$ 33,078	$ 14,517	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	KARN 2	COAL	$ 30,759	$ 31,462	$ 32,180	$ 33,324	$ 32,442	$ 12,295	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	JACKSON CC	NATURAL GAS	$ 7,291	$ 10,042	$ 14,533	$ 19,569	$ 22,378	$ 24,205	$ 24,438	$ 25,193	$ 26,617	$ 27,544	$ 27,636	$ 27,822	$ 30,416	$ 29,571	$ 26,056	$ 33,741	$ 37,804	$ 39,402	$ 41,138	$ 43,385	$ 46,013	$ 47,527	$ 70,057
7	STRAITS 1	NATURAL GAS	$ 2	$ 0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8	ZEELAND 1A (CT)	NATURAL GAS	$ 1,204	$ 1,407	$ 1,722	$ 1,785	$ 2,147	$ 2,255	$ 2,481	$ 2,465	$ 2,587	$ 2,725	$ 2,794	$ 2,865	$ 3,439	$ 2,622	$ 2,325	$ 2,883	$ 3,240	$ 3,391	$ 3,594	$ 3,699	$ 4,058	$ 4,181	$ 5,098
9	ZEELAND 1B (CT)	NATURAL GAS	$ 782	$ 806	$ 1,140	$ 1,286	$ 1,604	$ 1,842	$ 1,955	$ 1,978	$ 2,162	$ 2,406	$ 2,483	$ 2,556	$ 3,016	$ 2,505	$ 1,881	$ 2,815	$ 3,224	$ 3,474	$ 3,514	$ 3,832	$ 4,260	$ 4,285	$ 5,567
10	ZEELAND CC	NATURAL GAS	$ 30,161	$ 39,810	$ 47,161	$ 55,452	$ 60,077	$ 55,070	$ 52,754	$ 55,885	$ 55,199	$ 56,071	$ 56,664	$ 52,861	$ 68,599	$ 76,539	$ 57,117	$ 82,877	$ 85,697	$ 83,597	$ 86,614	$ 90,628	$ 91,997	$ 98,892	$ 118,203
11	THETFORD	NATURAL GAS	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
12	KARN 3	NATURAL GAS	$ 523	$ 357	$ 740	$ 832	$ 937	$ 950	$ 1,017	$ 1,007	$ 1,052	$ 1,194	$ 1,265	$ 1,303	$ 1,718	$ 19	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	KARN 3	OIL	$ 148	$ 121	$ 338	$ 361	$ 464	$ 455	$ 456	$ 526	$ 551	$ 609	$ 644	$ 652	$ 867	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
14	KARN 4	OIL	$ 55	$ 86	$ 297	$ 323	$ 456	$ 449	$ 446	$ 544	$ 557	$ 627	$ 648	$ 655	$ 806	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
15	CAMPBELL A	OIL	$ 4	$ 0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Note:
1. Costs are in Million Dollars.
2. The costs presented exclude auxiliary and fixed transportation expenses.