

2016 Integrated Resource Plan
Non-Technical Summary



I. Introduction

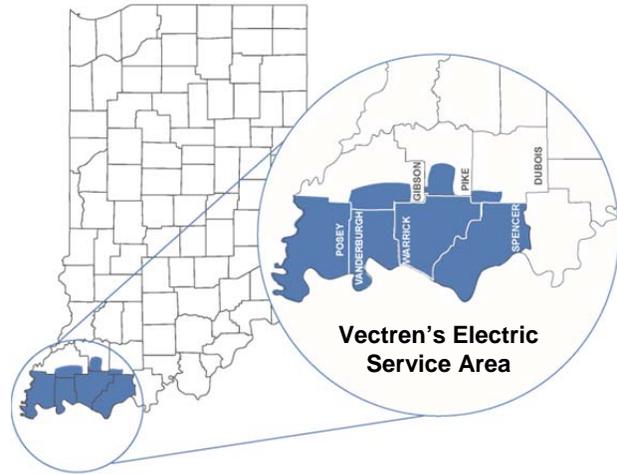
Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. (“Vectren”) engaged in a planning exercise during 2016 to evaluate its electric supply needs over a 20-year planning horizon. That exercise culminated in this 2016 Integrated Resource Plan (“IRP”). This planning exercise evaluated anticipated customer demand for electric supply in Vectren’s electric service territory and identified resources to satisfy that demand. It included public meetings designed to solicit input from stakeholders about modeling assumptions. The evaluation then sought to use the inputs to estimate the total 20-year net present value cost, in 2016 dollars, of the various resource plan options to satisfy that demand. The analysis factored in the risk with heavy emphasis on evaluating the plan in the face of multiple possible future states. The future could bring various government regulations, varying fuel prices, varying resource costs, etc. This analysis was used to identify the portfolio of electric supply and demand side resources that best balances reliability, cost, risk, and sustainability.

Based on this planning process, Vectren has selected a preferred portfolio plan that balances the energy mix for its generation portfolio with the addition of a new combined cycle gas turbine facility and solar power plants and significantly reduces its reliance on coal-fired electric generation. Vectren’s preferred portfolio reduces its cost of providing service to customers over the next 20 years by approximately \$60 million as compared to continuing with its existing generation fleet. Additionally, the preferred portfolio reduces carbon dioxide output by approximately 46% by 2024 from 2012 levels, exceeding the Clean Power Plan (CPP) regulation, which requires a 32% reduction by 2030. When considering 2005 levels, this would be a reduction of almost 60%. Importantly, from a risk perspective, Vectren will continue to evaluate its preferred portfolio plan in future IRPs to ensure it remains the best option to meet customer needs.

What follows is a summary of the process Vectren engaged in to identify this portfolio, focusing on Vectren’s operations, an explanation of the planning process, and a summary of the preferred portfolio.

II. Vectren Overview

Vectren provides energy delivery services to over 144,000 electric customers and approximately 110,000 gas customers located near Evansville in southwestern Indiana. In 2015, approximately 50% of electric sales were made to large (primarily industrial) customers, 26% were made to residential customers and 24% were made to small commercial customers.



The table below shows Vectren Generating units. Note that Vectren also offers customers energy efficiency programs to help lower customer energy usage and bills.

Unit	Installed Capacity ICAP (MW)	Primary Fuel	Unit Age	Coal Unit Environmental Controls ¹
AB Brown 1	245	Coal	1979	Yes
AB Brown 2	245	Coal	1986	Yes
FB Culley 2	90	Coal	1966	Yes
FB Culley 3	270	Coal	1973	Yes
Warrick 4	150	Coal	1970	Yes
AB Brown 3	80	Gas	1991	
AB Brown 4	80	Gas	2002	
BAGS 2	65	Gas	1981	
Northeast 1&2	20	Gas	1963 / 1964	
Blackfoot ²	3	Landfill Gas	2009	
Fowler Ridge	50	Wind PPA	2010	
Benton County	30	Wind PPA	2007	

¹ All coal units are controlled for Sulfur Dioxide (SO₂), Nitrogen Oxide (NO_x), Particulate Matter (dust), and Mercury. All coal units are controlled for Sulfur Trioxide (SO₃) except FB Culley 2.

² The Blackfoot landfill gas generator is connected at the distribution level.

III. Integrated Resource Plan

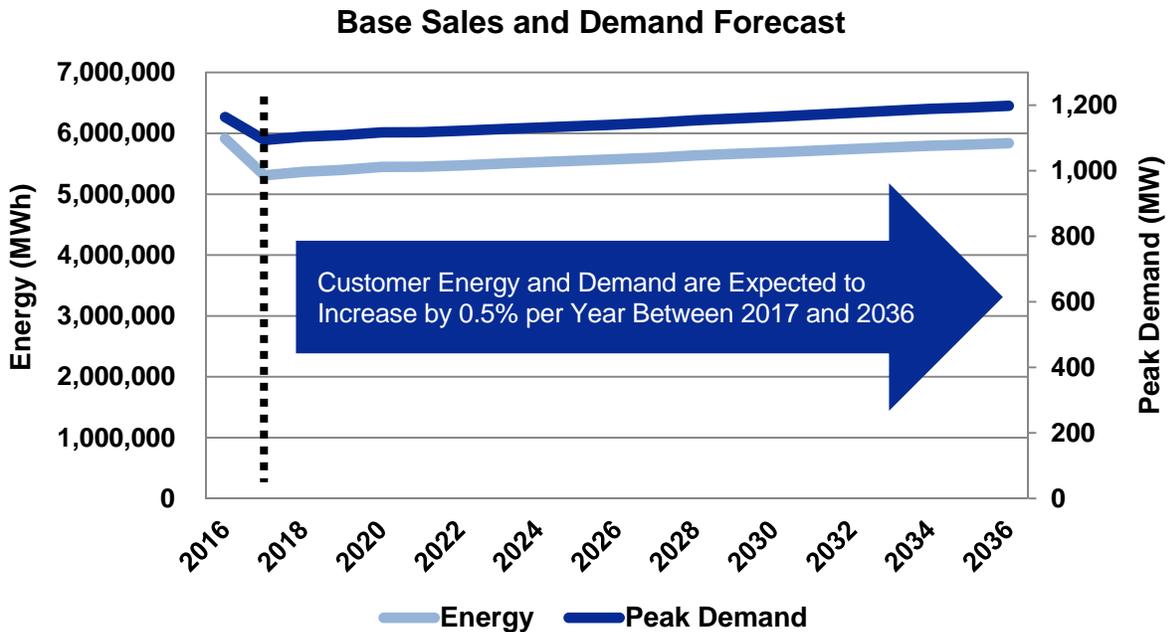
Vectren periodically submits IRPs to the Indiana Utility Regulatory Commission (IURC or Commission) as required by IURC rules. The IRP describes the analysis process used to determine the best mix of generation and energy efficiency resources (resource portfolio) to meet customers' needs for reliable, low cost, environmentally acceptable power over the next 20 years. The IRP can be thought of as a compass setting the direction for future generation and energy efficiency options. Future analysis, filings and subsequent approvals from the IURC are needed to finalize the detailed course.

Vectren considered input/perspectives from stakeholders, including but not limited to Vectren residential, commercial and industrial customers, regulators, elected officials, customer advocacy groups, environmental advocacy groups, and Vectren shareholders. Throughout the IRP analysis, Vectren placed an emphasis on reliability, customer cost, risk, and sustainability.

A. Customer Energy Needs

An IRP begins by evaluating customers' need for electricity over the 20-year planning horizon. Vectren worked with Itron, Inc., a leader in the energy forecasting industry, to develop a forecast of customer energy and demand requirements. Demand is the amount of power being consumed by customers at a given point in time, while energy is the amount of power being consumed over time. Energy is typically measured in Megawatt hours (MWh), and demand is typically measured in Megawatts. Both are important considerations in the IRP. While Vectren purchases some power from the market, Vectren is required to have enough generation and energy efficiency resources available to meet expected customers' annual peak demand plus additional reserve resources to help maintain reliability. Reserve resources are necessary to minimize the chance of rolling black outs; moreover, as a MISO (Midcontinent Independent System Operator) member, Vectren must comply with MISO established reserve requirements.

Vectren utilizes sophisticated models to help determine energy needs for residential, commercial, and large customers. These models include projections for the major drivers of energy consumption, including but not limited to, the economy, appliance efficiency trends, population growth, price of electricity, and weather. In 2017, a large customer is expected to commence generating a large portion of its energy needs with its own generation, which will decrease Vectren’s overall energy and demand forecast between 2016 and 2017. Beyond 2017, these forecasts, which do not include future energy company sponsored energy efficiency, indicate that overall customer energy and demand are expected to grow by 0.5% per year.



B. Resource Options

The next step in an IRP is identifying resource options to satisfy customers' anticipated need. Many resources were evaluated to meet customer energy needs over the next 20 years. Vectren considered both new and existing resource options. Burns and McDonnell, a well-respected engineering firm, provided Vectren with detailed information on each of the generating



Energy Efficiency/Demand Response



Natural Gas, including CHP



Coal



Renewables, Wind & Solar



Battery Storage

resources, including but not limited to, capital costs, operating costs, operating characteristics, how much generation to expect under various conditions, plant emissions, etc. These costs provide a complete picture of the cost of various resource options over the entire 20-year period. Numerous costs impact supply resources, but the following that had a particularly significant impact on the IRP were EPA regulations, low natural gas prices, and renewable costs.



Through investments in emissions control equipment over the past 15 years, Vectren's power system became one of the best controlled for emissions in the Midwest.

i. Environmental Protection Agency (EPA) Regulations

While Vectren's coal plants are controlled to meet or exceed current regulations for Sulfur Dioxide (SO₂), Nitrogen Oxide (NO_x), mercury, and particulate matter (dust), new EPA regulations require Vectren, and other utilities around the country, to make incremental investments in coal-fired generation plants if they are to continue operating them. The EPA regulation adoption process begins with a notice of proposed rulemaking, accepts comments from the public,

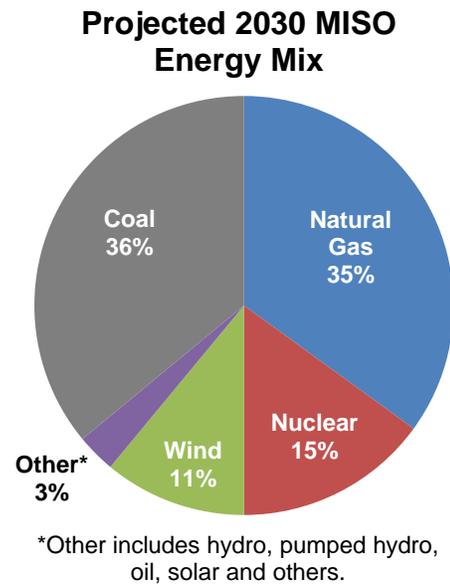
and then finalizes rules for announcement. The EPA issued final rules for Effluent Limitations Guidelines (ELG) in 2015 (regulates water discharge) and Coal Combustion Residuals (CCR) in 2015 (regulates coal ash ponds) that were more stringent than first proposed. The Clean Power Plan (CPP), which regulates carbon dioxide emissions, would also impact the ability to cost-effectively operate coal-fired generation if it moves forward and is also more stringent than first proposed.

Each new regulation increases the cost of operating existing coal-fired plants over the 20-year horizon. Investment in Vectren's existing coal-fired generation to achieve compliance with ELG regulations would be significant. As currently written, ELG compliance would require investments by 2023.

ii. Low Gas Prices

The cost of fuel used by generation facilities to produce electricity is also accounted for in evaluating the cost of various electric supply alternatives. Gas prices are low and projected to be stable over the long term. Shale gas has revolutionized the industry, driving these low gas prices, and is fueling a surge in low-cost gas generation around the country. Vectren's IRP reflects the benefit low gas prices provide to gas-fired generation.

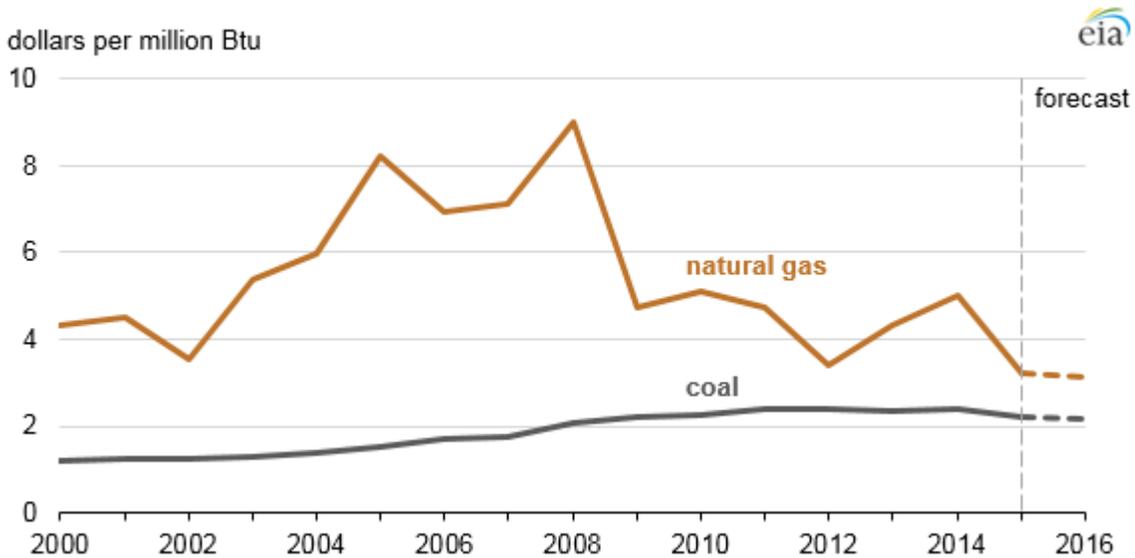
Vectren is a member of MISO, an independent transmission operator, which functions as the regional transmission operator for 15 Midwestern and Southern states, including Indiana (also parts of Canada). Within the MISO footprint, energy from gas generation has increased from 17% of total electric generation in 2014 to



28% in 2016. Energy from gas generation is projected to grow to 35% by 2030³.

While the cost advantage of natural gas makes switching to natural gas-fired generation appear to be preferable from a cost perspective, Vectren also factored in the risk of particular supply side resources to its IRP. Reliance on an all natural gas generation portfolio would eliminate any resources that could mitigate the impacts of high gas prices or environmental regulations impacting natural gas facilities that might occur in the future. Vectren’s risk modeling identified the risks with an unbalanced portfolio.

The table below shows average gas and coal fuel receipt costs at electric generating units between 2000 and 2016⁴. Note that shale gas has driven low gas costs since 2009.

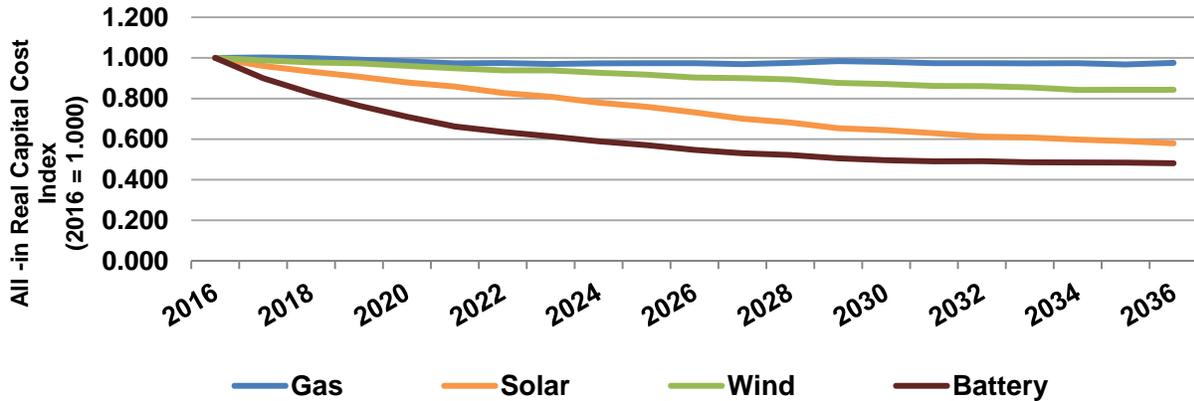


iii. Cost of Renewables

³ MISO, 2016 Winter Readiness Workshop, presented on October 31st 2016, <https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/Workshops%20and%20Special%20Meetings/2016/20161031%20Winter%20Readiness%20Workshop/20161031%20Winter%20Readiness%20Workshop%20Presentation.pdf>, Slide 64

⁴ U.S. Energy Information Administration, *Electric Power Monthly*, and *Short-Term Energy Outlook* (March 2016); <http://www.eia.gov/todayinenergy/detail.cfm?id=25392>

Another factor in Vectren’s resource evaluation is the timing of the reduction in renewable energy costs. Vectren must either invest in its coal-fired generation to comply with ELG requirements, as currently written, or construct replacement generation by 2023. Renewable costs continue to decline, but they are still expected to be more expensive in the Midwest region than other alternatives in the next several years. Vectren needs to learn more about integrating solar resources in its territory, but the price decline and cost effectiveness of large renewable investments does not support a larger investment by Vectren based upon the timing for resource decisions. Advancements in technology should drive renewable and battery storage costs down over the next several years, making them more competitive with other generation resources. Pace Global, an industry expert consultant, helped develop cost curves based on industry projections as well as their expert judgment. The cost curves below were included in Vectren’s IRP analysis.



C. Uncertainty/Risk

The future is far from certain. Uncertainty creates a risk that a generation portfolio that was reasonable under an anticipated future fails to perform as expected if the future turns out differently. Vectren’s integrated resource plan analysis was developed to identify the best resource mix of generation and energy efficiency to serve customer energy needs over a wide range of possible future states. To help better understand the wide range of possibilities for regulations, technology breakthroughs and shifts in

the economy, complex models were utilized with varying assumptions for major inputs (commodity price forecasts, energy/demand forecasts, market power prices, etc.) to develop and test portfolios with varying resource mixes.

IV. Analysis

Having identified its need for electricity and the potential resources to satisfy that need, Vectren conducted an analysis to identify a 20-year preferred resource plan. Vectren's 2016 IRP analysis was more robust than ever before. A methodical, step-by-step analysis was used to determine the preferred portfolio. Analysis steps are listed below.

- 1) Determined objectives in developing a preferred resource plan, including:
 - a) Maintain reliability
 - b) Minimize cost to customers
 - c) Mitigate risk to customers and Vectren
 - d) Provide environmentally acceptable power leading to a lower carbon future
 - e) Include a balanced mix of energy resources
- 2) Worked with consultants and IRP stakeholders to anticipate future uncertainties and incorporate them into several possible future states of the world. The future could bring economic development, economic stagnation, increased pace of technological development, more regulations, or fewer regulations. Multiple possibilities were explored.
- 3) Utilized computer modeling to consider various resource combinations to meet customer energy needs in each of these possible futures. The model is a deterministic, optimization model. It considered thousands of possible resource combinations to satisfy customer demand and energy needs for each pre-determined future. The model optimizes on cost to the customer. Seven portfolios were created; one for each pre-determined future. While creating these computer-generated resource portfolios are an important step in resource planning, it is also important to use judgment to consider other possibilities in creating portfolios with a balanced mix of resources to meet customer energy needs.

- 4) Worked with external stakeholders that participated in Vectren's IRP public stakeholder meetings to develop two balanced portfolios. Vectren also worked with expert consultants to develop five additional balanced portfolios. Additionally, Vectren included a portfolio very similar to the current mix of resources, which is heavily reliant on the five existing coal units. In all, 15 portfolios were created for analysis.
- 5) Utilized probabilistic modeling to simulate operating each of the 15 portfolios under 200 possible computer-generated futures. The model captured portfolio performance to determine likely portfolio operating costs, emissions of carbon dioxide and regulated pollutants, exposure to the energy markets, risk, etc. In essence, this resulted in 3,000 model runs.
- 6) Used a balanced scorecard approach to evaluate the potential impact of multiple risk factors on each portfolio, including but not limited to, customer cost, environmental impact, flexibility, balance of resources, and economic impact to the communities that Vectren serves. No single portfolio performed best in all categories; however, the preferred portfolio performed well in all measured risk contingencies.

V. Stakeholder Process

Vectren believes in the importance of stakeholder engagement. Vectren's objectives for stakeholder engagement are as follows:

- **Listen:** Understand concerns and objectives
- **Inform:** Increase stakeholder understanding of the Integrated Resource Plan process, key assumptions, and the challenges facing Vectren and the electric utility industry
- **Consider:** Provide a forum for relevant, timely stakeholder feedback at key points in the Integrated Resource Plan process to inform Vectren's decision making

Vectren worked hard to have an open forum for stakeholders to voice questions/concerns and make suggestions on the IRP analysis. Each Vectren stakeholder meeting was opened by Carl Chapman, Chairman, President, and Chief Executive Officer of Vectren. He and other senior management, Vectren subject matter experts, and expert consultants actively participated in each meeting to help address stakeholder questions/concerns. Additionally, Vectren addressed stakeholder questions outside of public meetings via irp@vectren.com in a timely manner.

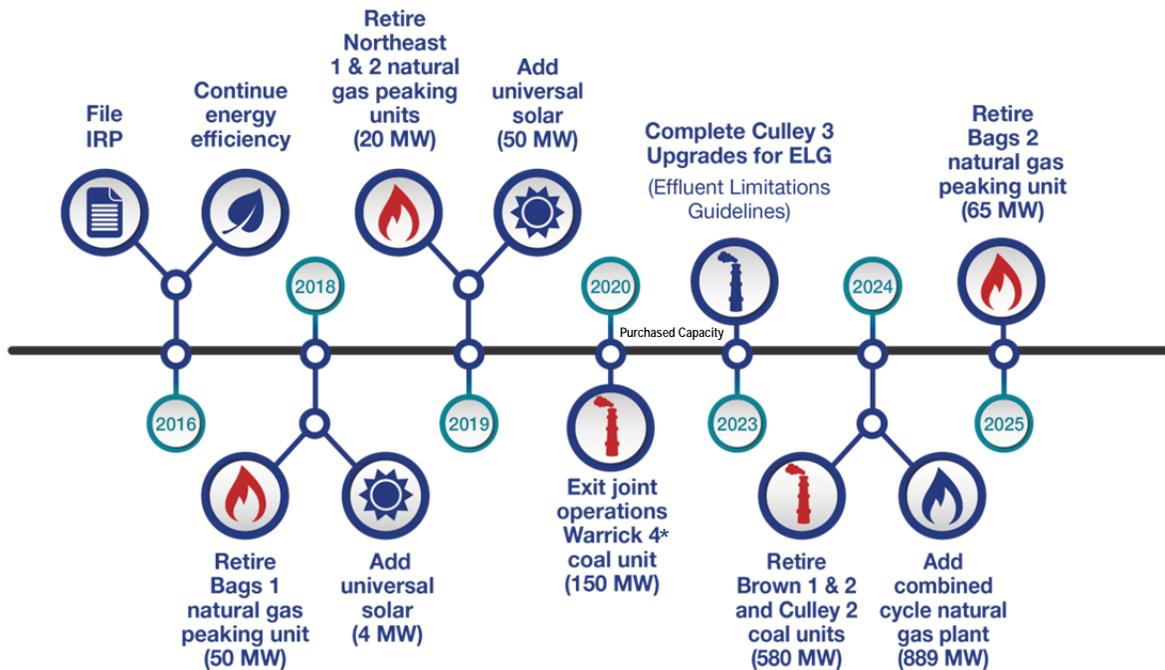
On February 3, 2016 Vectren participated in the Joint Utilities Stakeholder Education Session with other Indiana investor-owned utilities. After that, Vectren hosted three public stakeholder meetings at its headquarters in Evansville, IN. Dates and topics covered are listed below:

- April 7, 2016 – Vectren Public IRP Stakeholder Meeting
 - Vectren IRP Process Overview
 - Gathered Stakeholder Input on Uncertainties
 - Long-term Energy and Demand Forecast
 - Customer-Owned Distributed Generation
 - 2016 IRP Technology Assessment Generation Resource Alternatives
 - Generation Retrofit Alternatives
 - Energy Efficiency Modeling Discussion
- July 22, 2016 – Vectren Public IRP Stakeholder Meeting
 - Environmental Compliance
 - Base Case/Modeling Inputs
 - Resource Screening Analysis and Optimization Modeling
 - Scenario Development
 - Gathered Stakeholder Input to Portfolio Selection
- November 29, 2016 – Vectren Public IRP Stakeholder Meeting
 - Recap of Vectren IRP analysis
 - Presentation of the Preferred Portfolio

- Existing EPA Regulations
- Optimization Modeling Results and Portfolio Development
- Risk Analysis Results

In addition to these public meetings, Vectren met with the Vectren Oversight Board and staff from the Indiana Utility Regulatory Commission to discuss energy efficiency modeling for the 2016 IRP on October 14, 2016. All Vectren stakeholders were invited to participate via webinar.

VI. The Preferred Portfolio

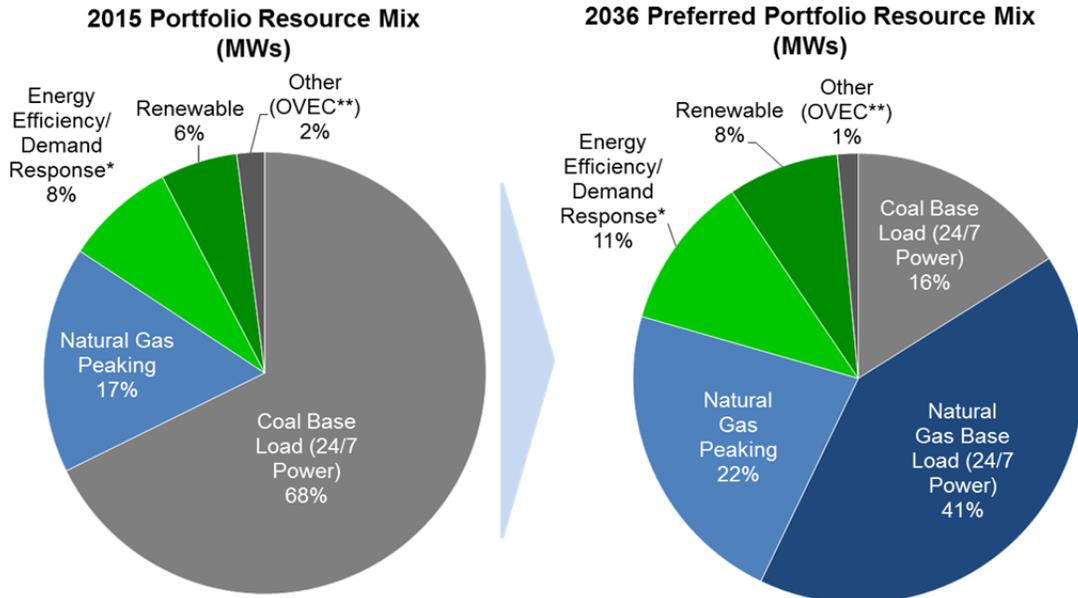


* Warrick 4 jointly owned with Alcoa, which is in the midst of transition. Vectren continues to discuss the future of Warrick 4 with Alcoa.

Based on the analysis Vectren conducted, Vectren has identified a preferred portfolio that consists of continued energy efficiency, retirement of existing coal and some gas units (Bags Units 1 and 2, Brown Units 1 and 2, FB Culley Unit 2, and Northeast Units 1 and 2), exiting joint operations of Warrick Unit 4, and construction of a combined cycle natural gas plant and solar generation. This preferred portfolio:

- Is among the best performing portfolios across multiple measures on the balanced scorecard.
- Is among the lower cost portfolios (within 4% of the lowest cost portfolio).
- Leads to a lower carbon future – Achieves almost 50% reduction in carbon (base year 2012) by 2024, which exceeds the Clean Power Plan (CPP) requirements – carbon emissions reduction from 2005 levels would be almost 60%.
- Brings renewables into the portfolio by 2019. Renewables and ongoing Energy Efficiency account for approximately 20% of total capacity by 2036.
- Provides low-cost peaking generation through duct-firing⁵ that enhances opportunities for economic development and wholesale sales, which lowers customer bills.
- Avoids reliance on a single fuel and provides a balanced mix of coal, gas, and renewables. While reliance on gas is significant, a duct-fired plant would allow for back up of further variable renewable resources in the long term.
- Is among the best portfolios in terms of limiting negative economic impact from job loss and local tax base. University of Evansville professors concluded that the economic ripple effect of losing 82 FB Culley jobs equates to 189 additional job losses in the community. Total state and local tax impact would be approximately 7 million dollars annually. Moreover, to the extent a new gas unit is built at the AB Brown site, over 100 total jobs are expected to be retained in the community. Total state and local tax impact would be approximately 4 million dollars annually.
- Reduces dependence on coal-fired generation over time and provides flexibility to adapt to changes in technology.
- Takes advantage of tax incentives for solar power plants.

⁵ Depending on set up, Duct-firing can provide approximately 200 MWs (Installed Capacity) of efficient peaking capacity capability through gas burners located within the heat recovery steam generator. These burners can be fired to generate more power when needed.



*Cumulative Demand Response & Net Energy Efficiency

**Vectren's 1.5% ownership of Ohio Valley Electric Corporation (OVEC) coal units. Per contractual obligations, all portfolios include OVEC.

VII. Next Steps

The preferred portfolio calls for Vectren to make changes to its generation fleet. Some of these changes require action in the near term. First, the IRP calls for continuation of energy efficiency. Vectren's current authority related to energy efficiency initiatives expires on December 31, 2017. Vectren will file for authority necessary to facilitate continuation of energy efficiency early in 2017 so that programs continue to be available. Second, Vectren must comply with ELG requirements, as currently written, by the end of 2023. As such, Vectren plans plant upgrades for FB Culley 3 for conversion of dry bottom ash and flue gas desulfurization waste treatment. The preferred portfolio calls for construction of a new combined cycle gas turbine in lieu of further investments in Brown Units 1 and 2, FB Culley Unit 2, and Warrick Unit 4 to ensure compliance. IURC approvals will need to be sought in the near future. Third, Vectren intends to pursue solar projects in 2017 and 2019. These filings will be consistent with the preferred portfolio. However, the assumptions included in any IRP can change over time, causing possible changes to resource planning. Changes in

commodities, regulations, political policies, and other assumptions could warrant deviations from the preferred plan.

Following the outcome of the recent presidential election, there is potential for industry change over the next several years. For example, the EPA's Clean Power Plan may be rescinded or modified. Additionally, Clean-Energy Tax incentives may be at risk. Even in the midst of possible industry change, other rules like ELG/CCR, which are the main drivers of closing Vectren coal plants, will be much more difficult to change.

Vectren is confident in the need for new gas generation in 2024. Under all scenario modeling, a natural gas-fired plant was selected, including the low regulatory scenario. While future carbon regulations are less certain than prior to the election, it is likely that new administrations will continue to pursue a long term lower carbon future. Vectren's preferred portfolio positions the company to meet that expectation.

Other aspects of the preferred portfolio are less certain. For example, the timing of exiting joint operations of the Warrick 4 coal plant could change. The plant is jointly owned with Alcoa, which recently went through a corporate reorganization and remains in the midst of transition. Given the plant, absent incremental investment, does not comply with the CCR and ELG requirement, Vectren continues to talk to Alcoa about the timing of possible closure. Additionally, Vectren plans to add 50 MW of solar in 2019, which corresponds with clean energy tax incentives. Timing of this solar plant may change should these incentives not be available.