6.1 ALL SOURCE RFP

The All-Source RFP was conducted according to the schedule outlined in Figure 6-1. More details on the steps included in the RFP timeline are described below.

Figure 6-1 RFP Timeline

Step	Completed/Proposed Date
RFP Issued	Wednesday, June 12, 2019
Notice of Intent, RFP NDA and Respondent Pre-Qualification Application Due	5:00 p.m. CDT, Thursday, June 27, 2019
Respondents Notified of Results of Pre-Qualification Application Review	5:00 p.m. CDT, Wednesday, July 10, 2019
Proposal Submittal Due Date	5:00 p.m. CDT, Friday, August 9, 2019
Initial Proposal Review and Evaluation Period	Friday, August 9, 2019 – Wednesday, September 18, 2019
Proposal Evaluation Completion Target and Input to Vectren	2nd Quarter, 2020
Due Diligence and Negotiations Period	Mid 2020
Definitive agreement(s) Executed (subject to regulatory approvals) with Selected Respondent(s)	Late 2020
Petitions (if required) filed with the IURC, the Federal Energy Regulatory Commission (FERC), or any other required agency/commission	TBD

6.1.1 RFP Issued

Burns & McDonnell issued the All-Source RFP on behalf of Vectren on Wednesday, June 12, 2019 (http://vectrenrfp.rfpmanager.biz/default.aspx). Notice was sent to all known IRP stakeholders and posted on www.vectren.com/IRP. The RFP was advertised across multiple media outlets, including Megawatt Daily (~20,000 recipients), North American Energy Markets Association (NAEMA) (150 members) and Midwest Energy Efficiency Alliance (MEEA) Minute (161 members). It was also sent directly via e-mail to participants of Vectren's 2017 RFP, an internal Burns & McDonnell RFP contact list (>450 industry contacts) and Vectren industry contacts. While the RFP included general requirements and communicated that Proposals which do not meet the general requirements may be subject to disqualification, all were included for evaluation. For more details please refer to the submitted Vectren 2019 All-Source RFP in Technical Appendix Attachment 6.3.

6.1.2 Notice of Intent

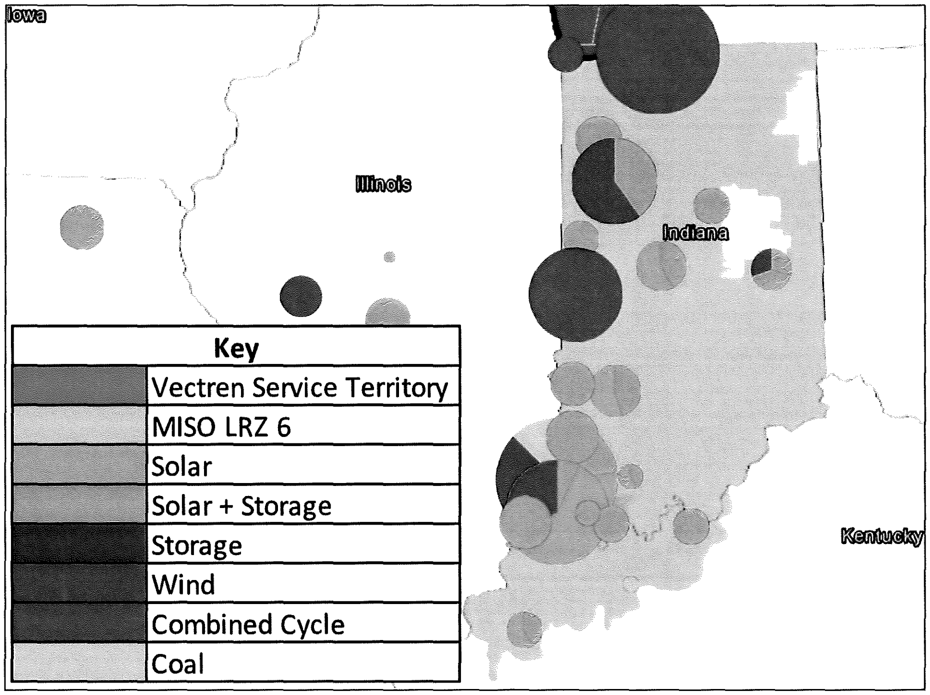
Respondents were given more than two weeks to submit a Notice of Intent to participate in the RFP process, sign the Non-Disclosure Agreement and complete the Pre-Qualification Application. The purpose of the Pre-Qualification Application is to verify that Respondents have adequate experience and financial capability to support their Proposal(s).

6.1.3 Proposal Review

The Proposal Submittal Due Date was Friday, August 9, 2019. After all Proposals had been received, Burns & McDonnell began the Initial Proposal Review. While Proposals were being reviewed, information was clarified with Respondents to confirm Proposals were interpreted as intended.

A total of 110 Proposals were received from 22 Respondents. The Proposals comprised eight battery storage, two coal, seven combined cycle gas, one LMR/DR, 57 solar, 19 solar plus storage, three system energy and 13 wind. Of the 110 Proposals, 91 were in Indiana. The Proposals contained approximately 21 GW of total installed capacity; however, many of the projects were included in multiple proposals. There was approximately 10 GW of unique project installed capacity after accounting for double counting. For example, a single 100 MW wind farm project could be offered as a purchase option or various PPA options. A graphical overview of all Proposals received is shown in Figure 6-2.

Figure 6-2 Map of Proposals Received



6.1.4 MISO Interconnection

The appropriate MISO DPP Generation Interconnection Study Group was identified for each of the respective Proposals. For the Proposals that reside in Study Groups with posted DPP reports, the identified NU and associated costs were used.

For the proposals that reside in Study Groups without posted DPP reports, Burns & McDonnell performed a steady state analysis using the appropriate DPP Study Group cases and auxiliary files. These selections were evaluated against the impact criteria defined in Section 6.1.1.1.8 of MISO's BPM-015 (Business Practices Manual), including the cumulative impact criteria.

Finally, for those selections that have not entered the queue or did not have a DPP Study Group case available, the most recent DPP Study Group case was used for the evaluation. The same impact criteria were applied with the exclusion of the cumulative impact criteria.

Figure 6-3 - RFP Project Definitive Planning Phase (DPP) Study Groups

Number of RFP Projects in DPP Study Group	Study Group	Network Upgrade (NU) Cost From:	Burns and McDonnell Action:
1	DPP-2016-FEB Central	MISO DPP Report	1. Review Reports for total NU Costs; 2. Confirm Generator Interconnection Requests (GIRs) sharing allocations are active.
1	DPP-2016-AUG Central	MISO DPP Report	1. Review Reports for total NU Costs; 2. Confirm GIRs sharing allocations are active.
4	DPP-2017-FEB Central	MISO DPP Report	1. Review Reports for total NU Costs; 2. Confirm GIRs sharing allocations are active.
10	DPP-2017-AUG Central	MISO DPP Report	1. Review Reports for total NU Costs; 2. Confirm GIRs sharing allocations are active.
5	DPP-2018-APR Central	MISO DPP Report	1. Review Reports for total NU Costs; 2. Confirm GIRs sharing allocations are active.
1	DPP-2018-APR West	Project Group Analysis	1. Perform Project Group analysis to determine potential NU costs for ERIS analysis; 2. Allocate costs to GIRs based on full reconductor/replacement cost estimates.
18	DPP-2019-Cycle1 Central	Project Group Analysis	1. Perform Project Group analysis to determine potential NU costs for ERIS analysis; 2. Allocate costs to GIRs based on full reconductor/replacement cost estimates.

For any impacts reported, without any information on the limitation of the facility, Burns & McDonnell assumed a full rebuild scope and cost of the facility. NU costs for the reported impacts were developed using MISO's MTEP transmission cost estimation guide. These NU costs were considered for the evaluation of each proposal. Many Proposals included allowances for NU costs or indicated all NU were included in their Proposal and these nuances were accounted for during the analysis.

6.1.5 Grouping

Proposals were divided into groups based on characteristics such as technology type, ownership structure and contract duration. Aggregated cost and performance information from the RFP Proposals was provided to the IRP team to facilitate portfolio modeling. There are many benefits to modeling the RFP bids in Groups. These benefits include allowing the IRP modeling to help evaluate the technology, size, duration and mix of resources which would be included in the Preferred Portfolio. Given the volume of proposals received as part of the IRP, it may not have been possible and would not have been practical to model each individual project. Moreover, it would be difficult to maintain confidentiality of individual projects. IRP modeling of individual projects does not holistically evaluate all relevant factors, such as locational differences of wholesale market pricing and potential congestion impacts. Using a grouping method allows for IRP inputs to reflect anticipated project costs.

Proposals were divided into two tiers, based on factors that could add cost risk to Vectren customers. Tier 1 Proposals were those that included binding pricing and delivery of energy to SIGE.SIGW (Vectren's load node) or were physically located in Vectren's service territory. Tier 2 included the remaining Proposals that were not classified as Tier 1. Tier 2 Proposals generally did not provide a binding bid price and/or were located off Vectren's system, which increases cost risk due to congestion. Despite these risks, several were still analyzed and considered during the RFP evaluation process; however, Vectren wanted, to the extent possible, to include bids with more price certainty within the IRP modeling in order to protect customers from price volatility.

Seventeen (17) groups were formed. This resulted in data from 49 Tier 1 Proposals being used in IRP analysis. A summary of the Proposal grouping is shown in Figure 6-4. As seen in Figure 6-4, the energy-only Proposals were not put into a group because they did not meet the capacity requirement of the RFP. Due to a high quantity of bids in the group and to provide additional granularity in IRP modeling, groups 15 and 17 were split into high and low-cost groups.

Figure 6-4 Proposal Grouping

Grouping		RFP Count	Tier 1	Tier 2
1	Coal PPA	2	0	2
2	LMR/DR PPA	1	1	0
3	CCGT PPA	2	0	2
4	CCGT Purchase	5	0	5
5	Wind Purchase	2	0	2
6	12-15 Year Wind PPA	9	4	5
7	20 Year Wind PPA	2	1	1
8	Storage Purchase	4	4	0
9	Storage PPA	4	4	0
10	Solar + Storage PPA	6	5	1
11	Solar + Storage Purchase	9	5	4
12	Solar + Storage Purchase/PPA	4	1	3
13	Solar Purchase/PPA	6	1	5
14	12-15 Year Solar PPA	8	3	5
15	20 Year Solar PPA	16	10	6
16	25-30 Year Solar PPA	9	3	6
17	Solar Purchase	18	7	11
N/A	Energy Only	3	0	3
	Total	**110**	**49**	**61**

The costs for Tier 1 Proposals are outlined in Figure 6-5. Costs were not shown for groups that contained only one project to ensure confidentiality.

Figure 6-5 - Tier 1 Cost Summary[23]

	Group	# Proposals	# Projects	Proposal ICAP (MW)	Project ICAP (MW)	Capacity Weighted Average LCOE ($2019/MWh)	Capacity Weighted Purchase Price ($/kW)[2]
1	Coal PPA	0					
2	LMR/DR PPA	1	1	50	50		
3	CCGT PPA	0					
4	CCGT Purchase	0					
5	Wind Purchase	0					
6	12-15 Year Wind PPA	4	1	800	200		
7	20 Year Wind PPA	1	1	300	300		
8	Storage Purchase	4	2	305	152	$157	
9	Storage PPA	4	2	305	152	$135	
10	Solar + Storage PPA	5	3	902	526	$44	
11	Solar + Storage Purchase	5	3	862	486	TBD[1]	$1,417[3]
12	Solar + Storage Purchase/PPA	1	1	110	110		
13	Solar Purchase/PPA	1	1	80	80		
14	12-15 Year Solar PPA	3	2	350	225	$32	
15	20 Year Solar PPA	10	8	1,522	1,227	$35	
16	25-30 Year Solar PPA	3	2	400	275	$34	
17	Solar Purchase	7	6	902	732	TBD[1]	$1,262

1. The method for realizing tax incentives is being reviewed by Vectren
2. $/kW costs are in COD$, purchase option cost is the purchase price unsubsidized by applicable tax incentives and does not reflect ongoing operations and maintenance costs
3. Cost based on simultaneous MW injectable to the grid

6.1.6 Evaluation of Proposals

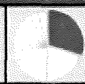
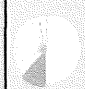
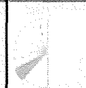
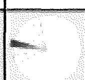
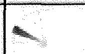
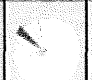
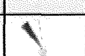
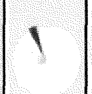
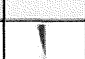
Burns & McDonnell quantitatively and qualitatively evaluated all conforming generation facility Proposals. Proposals were evaluated relative to others within the same grouping

[23] Note that proposals based on one project do not include capacity weighted Average LCOE or Capacity Weighted Purchase Price to maintain confidentiality of the bid.

using the scoring criteria set forth in the RFP. The scoring criteria included four major categories: LCOE, energy settlement location, interconnection/development status and local clearing requirement and project risk factors.

Scoring of the individual RFP Proposals was not part of the IRP process. Scoring criteria has been provided for transparency to respondents and to demonstrate that Vectren is serious about pursuing projects following the completion of the IRP analysis. Vectren does not believe that RFP's should be conducted just to obtain market data. The Proposals were scored to aid in the selection process after the preferred portfolio results were provided from the IRP. The Proposals were scored according to the criteria shown in Figure 6-6.

Figure 6-6 Scoring Summary

Scoring Criteria Name	Points		Scoring Method	Definition	Importance
LCOE Evaluation	150		Curve	$/MWh calculation within asset class	An LCOE evaluation comparing similar resource groups will help to show which Project(s) may provide lower cost energy to Vectren's customers.
Energy Settlement Location	100		Binary	Proposals that include all costs to have energy financially settled or directly delivered to Vectren's load node (SIGE.SIGW)	Having financial settlement or direct delivery to Vectren's load node provides Project's true resource cost to Vectren's customers, eliminating risks/costs associated with the delivery of energy.
Interconnection and Development Status	60		Binary	Executed a pro-forma MISO Service Agreement and Interconnection Construction Services Agreement (12 points) Completed a MISO Facilities Study (12 points) Completed a MISO System Impact Study (12 points) Achieved site control and completed zoning requirements (12 points) EPC Contract awarded (12 points)	These points are for completion of various critical milestones in the interconnection and development process. Projects which are further through the interconnection and development process will receive more points as cost certainty improves.
Local Clearing Area Requirement	30		Binary	Physically and electrically located in LRZ 6	Being located in LRZ 6 provides greater certainty that asset capacity can be deliverable to Vectren and fall within LCR requirements through entire life or contract term.
Credit and Financial Plan	20		Curve	Vectren will be reviewing the credit rating and financing capabilities in relation to a Bidder's Project.	Projects which lack the financial wherewithal to ensure development pose a significant risk to Vectren and their customers.
Development Experience	20		Curve	Scored based on 1,500 MW of relevant development experience	Relevant technology experience is important when looking at asset purchases or PPA's for facilities which are not in service. A Bidder's track record of project completion is a benefit to the Project's scoring.
Sole Ownership/Partial Owner	20		Binary	Being a sole owner would allow full site and dispatch rights/preferences	Being able to solely own, operate, and maintain a Project lowers risks for Vectren and their customers.
Ownership Structure (Purchase/PPA)	20		Binary	Vectren has a preference for ownership	Owning an asset and having control with regards to dispatch, maintenance, and operation of the facility lowers risks for Vectren and their customers.
Operational Control	20		Binary	Dispatch parameters used for the scheduling of energy into MISO and approval for maintenance outage periods	Operational control provides the ability to make prudent operational decisions when it makes economic sense for Vectren's customers.
Fuel Risk	20		Binary	Sites having firm and reliable fuel supply	Having fuel restrictions or a lack of reliable fuel could effect the operation of the Project and be a risk to the owner/off taker.
Delivery Date	20		Curve	For each year prior or after MISO PY 2023/2024, 25% of the points will be deducted	To the extent resources are brought on-line before potential Vectren unit retirements, Vectren customers could pay for duplicative capacity and/or energy; while there may be reasons to proceed with such projects, in recognition of their incremental costs, it is appropriate for such projects to not score as well in terms of timing.
Site Control	20		Binary	Proper rights to the site in which the facility will be located	Without proper permitting and permissions from the owner, there is a risk that the project may not move forward or could experience significant delays.

RFP bids were rank ordered consistent with the evaluation criteria and will be considered based on the RFP evaluation and the IRP determined need. Projects consistent with the

IRP have undergone further due diligence and have led to negotiations with bidders. As such, there is no assurance that the individual, highest-scoring qualified Proposal(s) will be selected. For further discussion of the evaluation criteria and results see Technical Appendix 6.9.

6.1.7 Challenges with Conducting an All-Source RFP within an IRP

While there are advantages to conducting an All-Source RFP as part of the IRP process, there are several challenges that must be considered, particularly the long lead time. Developers prefer certainty on project selection to minimize project development cost risk. Conducting an RFP as an input to the IRP necessitates a long process. Vectren believes that, at a minimum, a year is needed to conduct an IRP analysis. While Vectren asked bidders to keep bids open for a year after bid submittal, this does not mean that developers are able to wait until the process is complete.

As a result, some bids were withdrawn from Vectren's RFP during the IRP because the projects were acquired by other load serving entities. This delay has hurt the ability to act on proposals before they are acquired. During this IRP, at least one project, was purchased by another utility. Competition for projects in MISO zone 6 is steep with many utilities (NIPSCO, IPL, Hoosier Energy, IMPA and Vectren) currently all vying for announced projects that have more certainty of being developed.

Vectren has also had several attractive local wind and solar projects drop out of the MISO Generation Interconnection queue due to commitments/costs required from interconnection studies and they are no longer available at this time. Often projects are speculative. Developers apply with MISO to develop a project and are put in the MISO queue, as a series of studies is conducted. Each study requires more money from the developer in the form of milestone payments. Early studies put less money at risk for the developer. As interconnection costs for a project are identified the developer must make a choice to stay in the queue or drop out. Without certainty of an off taker, many projects drop. Long lead times increase this risk.

Additionally, some initial cost estimates have proved to be too low. As a project moves along, several issues can arise, including: updated engineering identifying new costs, environmental permitting, local pushback, local permitting, updated interconnection costs, updated risk assessments by the developers, etc.

6.2 CURRENT RESOURCE MIX

Generating units are often categorized as either base load, intermediate, or peaking units. This characterization has more to do with the economic dispatch of the units and how much service time they operate rather than unique design characteristics, outside of intermittent renewables, which do not have variable fuel costs. Base load units generally have the lowest energy costs per kWh and tend to operate most of the time, thereby providing the base of the generating supply stack after intermittent renewables, which operate as available and typically unrelated to market prices and conditions. The supply stack is the variable cost of production of power by each generating unit, stacked from least cost to most cost. In general, units that cost less to run are dispatched before units that cost more. Vectren's larger coal units have historically operated as base load units but with low natural gas prices and the introduction of more renewables into the market, capacity factors have decreased. Vectren's coal units more recently have operated more like intermediate units, particularly in shoulder months during Spring and Fall seasons. Intermediate units may cycle on and off frequently and may sit idle seasonally. Vectren's current peaking units have relatively high energy costs per kWh and are typically only started when energy demand exceeds 24/7 baseload capacity. Currently, Vectren's gas turbines are dispatched during these peak periods to assure reliability. These small peaking units may only run for a few hours and remain idle for long periods of time until called on.

Vectren's current generation mix consists of approximately 1,280 megawatts (MW) of installed capacity. This capacity consists of approximately 1,000 MW of coal-fired generation, 160 MW of gas fired peaking generation, 3 MW of renewable landfill gas generation, 4 MW of solar, Purchase Power Agreements (PPA's totaling 80 MW from wind) and a 1.5% ownership share of Ohio Valley Electric Corporation (OVEC) which equates to approximately 32 MW.

Figure 6.7 below references both Installed Capacity (ICAP) and Unforced Capacity (UCAP). Installed capacity is also referred to as nameplate capacity. This is the maximum output that can be expected from a resource. Unforced capacity is the amount of capacity that can be relied upon to meet peak load. MISO uses UCAP for planning purposes. The UCAP accreditation recognizes that all resources are not equally reliable or, in some cases, capable of achieving their design output. MISO uses a three-year reliability history and a weather normalized capability verification to determine the UCAP accreditation of each unit. Vectren used historical data and MISO's current methodology for thermal units to determine seasonal accreditation values along with the MISO UCAP planning reserve margin requirements (8.9% PRM[24]) in the current IRP. This information was utilized to help ensure that all portfolios met MISO obligations on a seasonal basis.

Figure 6.7 – Vectren Generating Units

Unit	Installed Capacity ICAP (MW)	Summer Unforced Capacity UCAP (MW)	Winter Unforced Capacity UCAP (MW)	Primary Fuel	Year Unit First In-Service
A.B. Brown 1	245	197	235	Coal	1979
A.B. Brown 2	245	232	221	Coal	1986
F.B. Culley 2	90	85	84	Coal	1966
F.B. Culley 3	270	261	263	Coal	1973
Warrick 4	150	133	137	Coal	1970
A.B. Brown 3	80	73	90*	Gas	1991

[24] Planning Year 2020-2021 Load of Load Expectations Report; MISO; https://cdn.misoenergy.org/2020%20LOLE%20Study%20Report397064.pdf; 11/01/2019; page 5

Unit	Installed Capacity ICAP (MW)	Summer Unforced Capacity UCAP (MW)	Winter Unforced Capacity UCAP (MW)	Primary Fuel	Year Unit First In-Service
A.B. Brown 4	80	72	82*	Gas	2002
Blackfoot	3	N/A[25]	N/A[26]	Landfill Gas	2009
Oak Hill Solar	2	N/A[22]	N/A[25]	Sun	2018
Volkman Road Solar	2	N/A[25]	N/A[25]	Sun	2018

*Installed capacity shown at 59°F, winter UCAP shown at 20°F

6.2.1 Coal

The A.B. Brown Generating Station (ABB), located in Mt. Vernon, IN, consists of two coal fired units, each with an installed capacity of 245 MW. ABB Unit 1 began commercial operation in 1979, while ABB Unit 2 became operational in 1986. Over the last three years these units have operated at an average capacity factor of 53%.

Both A.B. Brown units are scrubbed for sulfur dioxide (SO_2) emissions, utilizing a dual-alkali Flue Gas Desulfurization (FGD) process. The FGD systems were included as part of the original unit design and construction. Sulfur trioxide (SO_3) is removed via Sodium Based Sorbents (SBS) injection systems installed on both units in 2015. ABB is also scrubbed for nitrogen oxides (NO_x) with Selective Catalytic Reduction (SCR) systems having been installed on Unit 2 in 2004 and on Unit 1 in 2005. Mercury (Hg) removal is accomplished on both units as a co-benefit of SCR and FGD operations as well as through the addition of organosulfide injection systems installed in 2015. Particulate matter (PM) is captured via an electrostatic precipitator (ESP) on Unit 2. PM control at Unit 1 was upgraded to a fabric filter in 2004. The PM that is captured, also known as fly

[25] The Blackfoot landfill gas generator and 2 MW solar installations are connected at the distribution level and are not part of the transmission connected generation network managed by MISO. Therefore, they are not assigned a MISO UCAP value.

ash, is part of Vectren's beneficial reuse program and is shipped, via barge, to a facility near St. Louis, MO where it is used in the manufacture of cement.

While the A.B. Brown units began commercial operation after the Culley units, the dual-alkali scrubbers on these units present several operational challenges. First, based on historical costs the variable production cost associated with the scrubbers is approximately six times greater than the limestone-based scrubber installed on the Culley units. Also, the dual-alkali process is corrosive which results in high maintenance costs to keep the FGD's and associated equipment operational. And finally, these FGD's are the last dual-alkali scrubbers in operation in the U.S. and are nearing the end of their useful life. This can lead to challenges obtaining operational support and replacement parts when needed.

A.B. Brown Units 1 and 2 burn Illinois basin bituminous coal, which is mined in Knox County, IN and is delivered via rail.

The A.B. Brown plant site also has two natural gas turbine generators which are discussed in Section 6.2.2, Natural Gas.

The F.B. Culley Generating Station (FBC), located near Newburgh, IN, is a two-unit, coal fired facility. FBC Unit 2 has an installed generating capacity of 90 MW and came online in 1966, while FBC Unit 3 has an installed capacity of 270 MW and became operational in 1973. Over the last three years Unit 2 has operated at an annual capacity factor of 23% while Unit 3 was 65%.

FBC is scrubbed for Sulfur Dioxide (SO_2) emissions, utilizing an FGD process which is shared by both units and was retrofitted in 1994. This standard technology is much more cost effective than A.B. Brown's scrubber. The captured SO_2 is converted into synthetic gypsum within the system and, as part of Vectren's beneficial reuse program, is shipped, via barge, to a facility near New Orleans, LA and is shipped via truck to a facility near

Shoals, IN where it is used in the manufacture of drywall. Sulfur trioxide (SO_3) is removed from FBC Unit 3 via a Dry Sorbent Injection (DSI) system installed in 2015. FBC Unit 3 is also scrubbed for NO_x with a Selective Catalytic Reduction (SCR) system that was installed in 2003. NO_x control on FBC Unit 2 is provided by low NO_x burners. Mercury removal is accomplished on both units as a co-benefit of SCR & FGD operation as well as through the addition of organosulfide injection systems installed in 2015. PM is captured via an ESP retrofitted on Unit 2 in 1972. Unit 3 was upgraded to a fabric filter for PM control in 2006. The PM that is captured, also known as fly ash, is part of Vectren's beneficial reuse program and is shipped, via barge, to a facility near St. Louis, MO where it is used in the manufacture of cement.

The F.B. Culley units burn Illinois basin bituminous coal, which is mined in Knox County, IN and delivered via truck. F.B. Culley 3 is Vectren's most efficient coal unit with an industry standard scrubber, which has much lower variable costs than ABB1 and ABB2. As such F.B. Culley 3 is in the process of upgrades to comply with EPAs ELG rule.

Warrick Unit 4 (Warrick) located near Newburgh, IN is a coal fired unit operated and maintained by Alcoa Power Generating Inc. Vectren maintains 50% ownership of Warrick Unit 4. It has an installed capacity of 300 MW which began commercial operation in 1970. Vectren's 50% interest is equal to 150 MW. Over the last three years this unit has operated at a capacity factor of 62%.

Warrick Unit 4 is scrubbed for SO_2 emissions, utilizing a FGD process which was retrofitted in 2009. The captured SO_2 is converted into synthetic gypsum within the system and (as part of Vectren's beneficial reuse program) is shipped via truck to a facility near Shoals, IN where it is used in the manufacture of drywall. SO_3 is removed via a DSI system installed in 2010. Unit 4 is also scrubbed for NO_x with a SCR system which was retrofitted in 2004. Mercury removal is accomplished as a co-benefit of SCR and FGD operation as well as through the addition of organosulfide injection systems installed in 2015. PM is captured via an ESP. The PM that is captured, also known as fly ash, is part of Vectren's beneficial reuse program and is shipped, via barge, to a facility near St. Louis, MO where it is used in the manufacture of cement.

Warrick Unit 4 burns Illinois basin bituminous coal. Vectren purchases coal for its share of Warrick Unit 4, which is mined in Knox County, IN and is delivered by rail.

6.2.2 Natural Gas

The A.B. Brown Generating Station has two natural gas fired Simple Cycle Gas Turbine (SCGT) peaking units. Each has an installed capacity of 80 MW. ABB Unit 3 began commercial operation in 1991, while ABB Unit 4 became operational in 2002. Over the last three years Unit 3 has operated at a capacity factor of 1% with Unit 4 at 2%.

6.2.3 Renewables

The Blackfoot Clean Energy Facility located in Winslow, IN is a base load facility consisting of two Internal Combustion (IC) landfill methane gas fired units. Blackfoot Units 1 & 2 became operational in 2009 and are capable of producing 1.5 MW each. Over the last three years these units have operated at a capacity factor of 42%.

The Oak Hill and Volkman Road universal solar projects in Evansville, IN became operational in 2018 with each location having an installed solar capacity of 2 MW. In addition to the solar capacity the Volkman Road site includes 1 MW of battery storage. These assets are located on the distribution system and are therefore netted out of Vectren load for this analysis. In 2019 the solar installations operated at an average annual capacity factor of 21%. The average annual capacity factor is affected by hours of daylight, cloud cover, temperature, etc. This installation was available over most hours in 2019.

A third solar facility is under development near Troy, IN and will have an installed capacity near 50 MW. It is expected to be operational in early 2021.

6.2.4 Energy Efficiency

Vectren utilizes a portfolio of Demand Side Management (DSM) programs to achieve demand reductions and energy savings, thereby providing reliable electric service to its customers. Vectren's DSM programs have been approved by the Commission and implemented pursuant to various IURC orders over the years.

Since 1992, Vectren has operated a Direct Load Control (DLC) program called Summer Cycler that reduces residential and small commercial air-conditioning and water heating electricity loads during summer peak hours. A description of the program is included below. While this technology can still be reliably counted on to help lower demand for electricity at times of peak load, this aging technology will be phased out over time. Vectren's Summer Cycler program has served Vectren and its customers well for more than two decades, but emerging technology is now making the program obsolete. Between 2010 and 2018, Vectren's DSM programs reduced demand by approximately 69,000 kW and provided annual incremental gross energy savings of approximately 360,000,000 kWh.

The table below outlines the estimated program penetration on a yearly basis since Vectren programs began in 2010. Gross cumulative savings below, are shown as a percent of eligible retail sales. Note that historical DSM savings are implicitly included in the load forecast as these savings are embedded in the historical sales data.

Figure 6.8 Gross Cumulative Savings

Year	Eligible Retail Sales (GWh)	Gross Cumulative Savings (GWh) *	Gross Cumulative Savings (GW) *	Percent of Sales Achieved (Cumulative)
2010	5,616.87	2.53	.00051	0.04%
2011	5,594.84	19.40	.00331	0.35%
2012	5,464.75	66.95	.01212	1.23%
2013	5,459.11	128.64	.02271	2.36%

Year	Eligible Retail Sales (GWh)	Gross Cumulative Savings (GWh) *	Gross Cumulative Savings (GW) *	Percent of Sales Achieved (Cumulative)
2014**	3,498.69	175.98	.03053	5.03%
2015	3,223.81	202.82	.03552	6.29%
2016	3,256.3	236.40	.04336	7.26%
2017	3,280.7	268.86	.05005	8.20%
2018	3,490.7	309.28	.05759	8.86%

*Gross Cumulative Savings are adjusted for Residential Behavioral, which has a one-year program life therefore not cumulative in nature.

**Statewide DSM programs ended in 2013. The drop in eligible sales is attributed to industrial customers opting-out of DSM programs effective July 1, 2014.

6.2.4.1 2018-2020 Plan Overview

Consistent with the 2016 IRP, the framework for the 2018-2020 EE Plan was modeled at a savings level of 1% of retail sales adjusted for an opt-out rate of 77% of eligible load. Below is a listing of residential and commercial & industrial programs offered in 2018-2020. For full program descriptions including the customer class, end use of each program and participant incentives provided by the programs, please refer to the 2018-2020 EE Plan detail found in the Technical Appendix Attachment 6.2 Vectren Electric 2018-2020 DSM Plan.

Residential Programs

- Residential Lighting
- Home Energy Assessments and Weatherization
- Income Qualified Weatherization
- Appliance Recycling
- Energy Efficient Schools
- Residential Prescriptive
- Residential New Construction
- Residential Behavior Savings
- Residential Smart Thermostat Demand Response (Incentives only)
- Bring Your Own Thermostat (BYOT)

- Food Bank – LED Bulb Distribution
- Conservation Voltage Reduction (CVR) Residential

Commercial & Industrial Programs

- Small Business Direct Install
- Commercial & Industrial Prescriptive
- Commercial & Industrial New Construction
- Commercial & Industrial Custom
- Building Tune-Up
- Multi-Family Retrofit
- Conservation Voltage Reduction - Commercial

The 2018-2020 plan was included an existing resource in the 2019/2020 IRP and has an assumed average measure life of 12 years. The table below shows the amount of net savings included in the IRP as a resource (gross savings can be found in Technical Appendix Attachment 6.2 Vectren Electric 2018-2020 DSM Plan).

Figure 6.9 2018-2020 Energy Efficiency Savings

	2018*		2019**		2020***	
Sector	Net MWh Energy Savings	Net MW Demand Savings	Net MWh Energy Savings	Net MW Demand Savings	Net MWh Energy Savings	Net MW Demand Savings
Residential	19,241	4.0	19,129	4.0	15,821	4.7
Commercial & Industrial	21,602	3.2	16,495	3.4	16,208	1.7
Total	40,843	8.5	35,624	7.4	32,029	6.4

* 2018 Evaluation Results used for 2018
** 2019 Operating Plan used for 2019 savings and Net to Gross (NTG) Factors
*** 2018-2020 Filed Plan used for 2020 Savings and NTG Factors

6.2.5 Demand Response

Vectren's tariff currently includes two active demand response programs: 1) the Direct Load Control and 2) interruptible options for larger customers. Demand response programs allow Vectren to curtail load for reliability purposes. Vectren's tariff also includes a MISO demand response tariff, in which no customers are currently enrolled given the absence of an active demand response program within the MISO market at this time.

6.2.5.1 Current DLC (Summer Cycler)

The DLC program provides remote dispatch control for residential and small commercial air conditioning, electric water heating and pool pumps through radio-controlled load management receivers. Under the program, Vectren compensates customers in exchange for the right to initiate events to reduce air-conditioning and water-heating electric loads during summer peak hours. Vectren can initiate a load control event for several reasons, including: to balance utility system supply and demand, to alleviate transmission or distribution constraints, or to respond to load curtailment requests from MISO.

Vectren manages the program internally and utilizes outside vendors for support services, including equipment installation and maintenance. Prospective goals for the program consist of maintaining load reduction capability and program participation while achieving high customer satisfaction. Vectren also utilizes an outside vendor, The Cadmus Group, to evaluate the DLC program and provide unbiased demand and energy savings estimates.

In 2020 Cadmus predicted that the DLC Program was capable of generating approximately 8.3 MWs of peak demand savings from residential air-conditioning load control and residential water heating load control. This is roughly half of prior predictions, which were used for IRP modeling.

Until recently, DLC switches have been the default choice for residential load control programs. Vectren has had a DLC program since the early 1990's and as of 2019 had approximately 21,000 residential customers with 27,000 switches participating in the program. However, with the advent of smart thermostats and the myriad of benefits they offer for both EE and DR, Vectren plans to begin replacing DLC switches with smart thermostats.

6.2.5.2 Current Interruptible Load

Vectren makes available a credit for qualified commercial and industrial customers to curtail demand under certain conditions. Vectren included three customers who were participating for a total demand reduction of 35 MW. New MISO testing requirements are currently being put into place to ensure these DR resources are available throughout the year. MISO is proposing interruptible resource accreditation based on the amount of interruptions and available hours to curtail. MISO has already implemented mandatory annual testing for the first time that will require load interruptions to meet the test requirements. Prior to January 31, 2019, Vectren had never been requested by MISO to deploy LMRs, thereby interrupting customer load. Because of these changes that will now require annual interruptions that are likely to increase in occurrence and duration, Vectren expects some, if not all, of its currently enrolled customers to drop out, as frequent interruptions in service can be very costly to industrial customers' operations. Since implemented, one customer (~7MWs) has left the program. While aggressive, Vectren maintained industrial interruptible load at the 35 MWs within the model throughout the analysis period. Given Vectren's mix of industrial customers, it is unlikely that new customers will sign up for this program. As such, Vectren did not allow the model to select additional interruptible DR.

6.2.5.3 Smart Thermostats

Vectren launched its pilot Smart Wi-Fi Thermostat program in 2016, by installing 2,000 smart Wi-Fi enabled thermostats in homes in its service territory. As an alternative to DLC switches, smart thermostats can optimize heating and cooling of a home to reduce energy usage and control load while learning from occupant behavior/preference, adjusting Heating, Ventilation and Air Conditioning ("HVAC") settings. Preliminary evaluation results are showing significantly more load reduction delivered by smart thermostats. The current DLC switch program is a well-established means for Vectren to shed load during