Draft Director's Report

For Hoosier Energy's 's 2020 Integrated Resource Plan

August 26, 2021

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on behalf of the Indiana Utility Regulatory Commission

TABLE OF CONTENTS

Draft Director's Report Applicable to Hoosier Energy's 2020 Integrated Resource Plan and Planning Process

I. PURPOSE OF IRPS

Hoosier Energy Rural Electric Cooperative's (Hoosier Energy's) 2020 integrated resource plan (IRP) was submitted on Nov. 2, 2020. By statute[1] and rule, integrated resource planning requires each utility that owns generating facilities to prepare an IRP and make continuing improvements to its planning as part of its obligation to ensure reliable and economical power supply to the citizens of Indiana. A primary goal is a well-reasoned, transparent, and comprehensive IRP that will ultimately benefit customers, the utility, and the utility's investors. At the outset, it is important to emphasize that these are the utilities' plans. The Director's report does not endorse the IRP nor comment on the desirability of the utility's "preferred resource portfolio" or any proposed resource action.[2]

The essential overarching purpose of the IRP is to develop a long-term power system resource plan that will guide investments to provide safe and reliable electric power at the lowest delivered cost reasonably possible. Because of uncertainties and accompanying risks, these plans need to be flexible as well as support the unprecedented pace of change currently occurring in the production, delivery, and use of electricity. IRPs may also be used to inform public policies and are updated regularly.

IRPs are intended to be a systematic approach to better understand the complexities of an uncertain future, so utilities can maintain maximum flexibility to address resource requirements. Inherently, IRPs are technical and complex in their use of mathematical modeling that integrates statistics, engineering, and economics to formulate a wide range of possible narratives about plausible futures. The utilities should utilize IRPs to explore the possible implications of a variety of alternative resource decisions. Because of the complexities of IRP, it is unreasonable to expect absolutely accurate resource planning 20 or more years into the future. Rather, the objective of an IRP is to bolster credibility in a utility's efforts to understand the broad range of possible risks that utilities are confronting.[3] By identifying uncertainties and their associated risks, utilities will be better able to make timely adjustments to their long-term resource portfolio to maintain reliable service at the lowest reasonable cost to customers.

Hoosier Energy, like every Indiana utility and stakeholder, anticipates substantial changes in the state's resource mix due to several factors[4] and, increasingly, Indiana's electric utilities are using

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[1] Indiana Code § 8-1-8.5-3.

[2] 170 IAC 4-7-2.2(g)(3).

[3] In addition to forecasting changes in customer use of electricity (load forecasting), IRPs must address uncertainties pertaining to the fuel markets, the future cost of resources and technological improvements in resources, changes in public policy, and the increasing ability to transmit energy over vast distances to access economical and reliable resources due to the operations of the Midcontinent Independent System Operator (MISO) and PJM Interconnection, LLC (PJM).

[4] A primary driver of the change in resource mix is due to relatively low-cost natural gas and long-term projections for the cost of natural gas to be lower than coal due to fracking and improved technologies. As a

IRPs as a foundation for their business plans. Since Indiana is part of a vast interconnected power system, Indiana is affected by the enormity of changes throughout the region and nation.

The resource portfolios emanating from the IRPs should not be regarded as being the definitive long-term plan that a utility commits to undertake. Rather, IRPs should be regarded as illustrative or an ongoing effort that is based on the best information and judgment at the time the analysis is undertaken. The illustrative plan should provide off-ramps to give utilities maximum optionality to adjust to inevitable changing conditions (e.g., fuel prices, environmental regulations, public policy, technological changes that change the cost effectiveness of various resources, customer needs, etc.) and make appropriate and timely course corrections to alter their resource portfolios.

II. INTRODUCTION AND BACKGROUND

Hoosier Energy is comprised of 17 rural electric membership cooperatives (REMCs) or "distribution cooperatives" serving 48 counties located in central and southern Indiana and 11 counties in southeastern Illinois. *(Hoosier Energy IRP pages 7-8)* The number of residential customers increased from 263,908 in 2007 to 283,538 in 2017. Hoosier Energy projects that the number of residential customers will increase 13 percent to 320,354 by 2038. The total number of commercial and other consumers grew from 14,067 in 2007 to 18,979 in 2017. The number of commercial and other consumers is forecasted to increase 17.2 percent to 22,245 in 2038. The total number of consumers from the industrial sector, which is defined as loads requiring transformation greater than 1,000 kVA, increased from 190 to 213 during the 2007 through 2017 period, for a net gain of 12.1 percent. The forecast number of 231 consumers in the year 2038 indicates an increase of 8.5 percent. *(Hoosier Energy IRP pages 9-10)*

Hoosier Energy operates within both the Midcontinent Independent System Operator (MISO) and the PJM Interconnection, LLC (PJM) regional transmission organizations (RTOs) to provide reliable and economic power that Hoosier energy could not achieve on its own. Hoosier Energy stated, "Membership in the regional transmission organizations allows reliance upon the RTOs' reliability tools, such as the state estimator, real-time contingency analysis and regional outage coordination. In addition, membership in the RTOs allows management of generation facilities that are connected to other RTO utilities but still benefit Hoosier Energy." (*Hoosier Energy IRP page 104)*

III. FOUR PRIMARY AREAS OF FOCUS

Consistent with Hoosier Energy's comment about significant challenges, the Director's primary areas of focus include the interrelated topics of load forecasting; demand-side management (DSM), which includes energy efficiency (EE) and demand response (DR), and risk / scenario analysis. Throughout, there will be a discussion of continual improvements for all aspects of the IRP.

The continual improvements include enhancements to load forecasting, the modeling of changing technologies, and risk analysis. IRP improvements should include an expansive definition of DERs that subsume DSM as well as other resources such as rooftop solar, combined heat and power,

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result, coal-fired generating units are not as fully dispatched (or run as often) by MISO or PJM. The aging of Indiana's coal fleet, the dramatic decline in the cost of renewable resources, the increasing cost-effectiveness of energy efficiency as a resource, and environmental policies over the last several decades that reduced emissions from coal-fired plants are also drivers of change.

microgrids, and storage which might be part of hybrid energy systems (HES). Because electric vehicles (EVs) have the potential for affecting resource requirements, it is imperative that Hoosier Energy understand the ramifications for Hoosier Energy and its members. For both DERs and EVs it is also necessary for Hoosier Energy to develop full avoided costs to determine the benefits and costs of DERs and EVs and to integrate DERs and EVs.

A. Load Forecast

Hoosier Energy said its Board of Directors'-approved load forecast complies with the Rural Utilities Service (RUS) requirements for a *Power Requirements Study* (PRS) that is done on a two-year cycle. The development of the PRS is a joint effort between Hoosier Energy's staff and its member systems, with contributions and review from RUS. The PRS provides an analysis of the need for electric energy and demand for the territory served by the Hoosier Energy's member systems over a 20-year period. *(Hoosier Energy IRP page 16)*

Hoosier Energy's stated goal is to satisfy the RUS requirement that generation and transmission cooperatives understand their system's requirements and those of its member systems. The RUS approved forecast determines the amount and types of resources required to serve its members reliably and economically. *(Hoosier Energy IRP page 16)*

The PRS was subject to approval of each member system's Board of Directors and by the Hoosier Energy Board of Directors. The PRS was approved at the November 2020 meeting. Since the final 2020 PRS had not been completed at the time that Charles River Associates (CRA) conducted the modeling used in the IRP studies, the preliminary PRS was used as an alternate load forecast. That is, for this IRP, a 20-year forecast (2019-2038) is based upon the preliminary 2020 PRS. Hoosier Energy states there is little difference in the demand and energy forecasts provided by both versions of the PRS, with any the difference between annual growth rates considered immaterial. For purposes of the IRP, Hoosier Energy assumed summer peak demand growth of 0.6% in 2039 and 0.7% in 2040, which is an extension of the expected growth rates from 2037 and 2038. *(Hoosier Energy IRP page 16)*

Hoosier Energy's projected demands and energy sales are depicted in the following graphs. (*Hoosier Energy IRP pages 36-37*)

Hoosier Energy REC, Inc.
Base Scenario including DSM (at Generation)[1]
For Calendar Years 2018 - 2040

	Winter Peak Demand (MW)	Winter Peak Growth (%)	Summer Peak Demand (MW)	Summer Peak Growth (%)	Energy (MWh)	Energy Growth (%)
2018	1,547		1,492		7,904,522	
2019	1,561	0.9%	1,507	1.0%	7,982,827	1.0%
2020	1,583	1.4%	1,532	1.6%	8,089,092	1.3%
2021	1,604	1.3%	1,556	1.6%	8,197,035	1.3%
2022	1,615	0.7%	1,570	0.9%	8,253,958	0.7%
2023	1,623	0.5%	1,581	0.7%	8,299,656	0.6%
2024	1,629	0.4%	1,605	1.5%	8,349,908	0.6%
2025	1,637	0.5%	1,617	0.7%	8,395,223	0.5%
2026	1,643	0.4%	1,627	0.6%	8,428,316	0.4%
2027	1,651	0.5%	1,636	0.6%	8,459,600	0.4%
2028	1,648	-0.2%	1,632	-0.3%	8,416,065	-0.5%
2029	1,653	0.3%	1,637	0.3%	8,429,186	0.2%
2030	1,668	0.9%	1,653	1.0%	8,497,658	0.8%
2031	1,684	1.0%	1,669	0.9%	8,558,138	0.7%
2032	1,695	0.7%	1,679	0.6%	8,592,293	0.4%
2033	1,697	0.1%	1,682	0.2%	8,586,544	-0.1%
2034	1,708	0.6%	1,692	0.6%	8,622,966	0.4%
2035	1,717	0.5%	1,700	0.5%	8,666,809	0.5%
2036	1,725	0.5%	1,709	0.5%	8,707,211	0.5%
2037	1,737	0.7%	1,722	0.7%	8,762,637	0.6%
2038	1,747	0.6%	1,732	0.6%	8,812,550	0.6%
2039	1,759	0.7%	1,744	0.7%	8,873,003	0.7%
2040	1,770	0.6%	1,755	0.6%	8,918,650	0.5%
CAGR %		0.6%		0.8%		0.5%

1 - Energy forecasts include forecasted Demand Side Management/Energy Eficiency impacts.

Breakdown of Forecasted Energy Requirements by Customer Class (MWh)[1]

	Residential	Commercial	Industrial	Other	Distribution System Losses	Transmission System Losses	Total Energy Requirements
2018	4,337,165	960,896	2,186,282	60,523	324,319	359,656	7,904,522
2019	4,372,573	969,395	2,237,077	60,520	328,096	343,262	7,982,827
2020	4,218,245	935,872	2,197,188	57,921	332,035	347,831	8,089,092
2021	4,253,071	943,930	2,253,557	57,921	336,082	352,474	8,197,035
2022	4,283,831	951,940	2,266,896	57,921	338,450	354,920	8,253,958
2023	4,313,914	959,916	2,270,717	57,921	340,304	356,885	8,299,656
2024	4,336,780	968,635	2,286,679	57,921	340,847	359,046	8,349,908
2025	4,358,874	980,751	2,293,960	57,921	342,723	360,995	8,395,223
2026	4,382,915	991,041	2,289,878	57,921	344,145	362,417	8,428,316
2027	4,412,055	1,002,626	2,277,534	57,921	345,701	363,763	8,459,600
2028	4,436,877	1,015,471	2,199,389	57,921	344,517	361,890	8,416,065
2029	4,462,268	1,028,743	2,172,940	57,921	344,859	362,455	8,429,186
2030	4,494,030	1,049,845	2,182,730	57,921	347,732	365,399	8,497,658
2031	4,527,600	1,071,590	2,182,730	57,921	350,298	367,999	8,558,138
2032	4,563,037	1,087,742	2,162,262	57,921	351,862	369,469	8,592,293
2033	4,592,806	1,098,327	2,116,213	57,921	352,055	369,222	8,586,544
2034	4,625,993	1,108,923	2,106,042	57,921	353,299	370,789	8,622,966
2035	4,670,587	1,119,618	2,090,748	57,921	355,263	372,673	8,666,809
2036	4,715,836	1,130,424	2,071,373	57,921	357,246	374,410	8,707,211
2037	4,760,622	1,141,335	2,066,279	57,921	359,687	376,794	8,762,637
2038	4,804,967	1,152,358	2,056,489	57,921	361,876	378,939	8,812,550
2039	4,838,062	1,160,396	2,070,727	57,921	364,358	381,538	8,873,003
2040	4,863,051	1,166,466	2,081,478	57,921	366,233	383,501	8,918,650

1 - Energy forecasts include forecasted Demand Side Management/Energy Efficiency impacts.

Alternative Forecast Scenarios
The PRS is "ranged based", rather than predicated upon a single value forecast. Several forecast scenarios are, then, developed allowing for review of the model's sensitivity to different economic and weather input assumptions. For the most recent PRS, Hoosier Energy developed five alternative energy forecasts: Base, Base-Severe, Base-Mild, Low Economic and High Economic Cases. Generally, for the residential sector forecasts, the scenarios are differentiated based upon fluctuation of population, real per capita income, fuel prices, and weather. For the commercial and industrial sectors, the scenarios were differentiated based upon variation in the number of consumers and energy growth rates. *(Hoosier Energy IRP page 24)*

Residential Forecast
More specifically, Hoosier Energy's Residential Sales Model is the summation of each individual member's econometric residential model. Each member's model has three equations which are solved simultaneously. These equations include average use per consumer per month, real average residential price of electricity, and the number of residential customers. The average use per consumer per month equation is a function of average use lagged, real average residential electricity price, real average per capita income, Heating Degree Days (HDD), Cooling Degree Days (CDD), and other variables such as alternative fuel prices and agricultural production. The real average residential price of electricity equation is a function of use per customer, actual real cost to operate and maintain the distribution system excluding wholesale power costs, and the average real wholesale cost of electricity paid by the cooperative. The residential customer equation is a function of population and other variables that may affect customers. *(Hoosier Energy IRP page 17)*

Commercial, Industrial and Other
Hoosier Energy's Commercial, Industrial and Other Energy Sales Model (HECIO) is the summation of the individual member system's results for these classes. Professional judgment was used to develop the load forecast because the highly erratic past patterns of class consumption and composition make econometric modeling difficult. Hoosier Energy and its members believe they are in the best position to evaluate past patterns, existing and near-term developments, and expected future growth patterns. *(Hoosier Energy IRP pages 18 -19)*

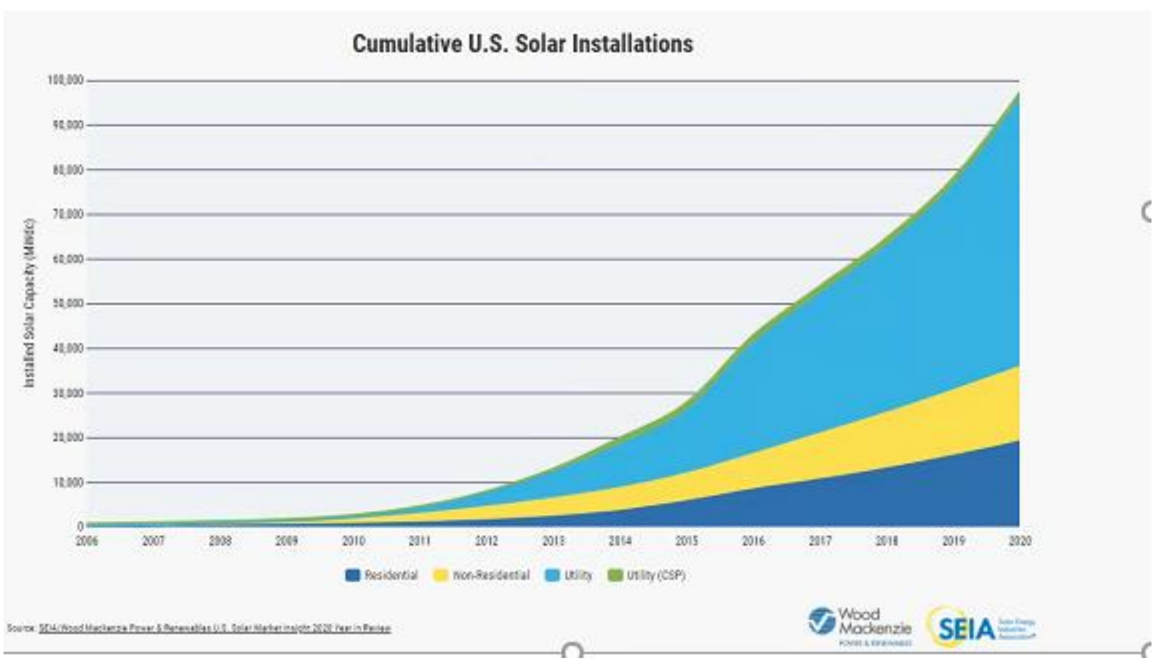
Description of the Demand Models
Hoosier Energy gathers historical coincident and non-coincident summer and winter peaks and total annual electric sales for each member. A coincident factor analysis is performed to calculate load factor, seasonal adjustment factor and coincident factors which are then used along with information from the REMC/REC representatives to forecast each member's system peak demand. The member system demands are then aggregated; a 60-minute to 30-minute time ratio adjustment and an estimate loss factor are applied to ultimately arrive at the Hoosier Energy peak demand.

Next, Hoosier Energy adjusts the total by the estimated demand loss factor. *(Hoosier energy IRP pages 19-20)* Historical demand loss factors represent the annual average demand loss factors which is calculated as the annual average of the monthly demand losses experienced. Monthly demand loss factors are determined by dividing the difference between the 60-minute demands with losses and actual 60-minute demands without losses by the actual 60-minute demands with losses. After the 60-minute demand values without losses are calculated and a demand loss factor is determined, the final Hoosier Energy 60-minute peak demand with losses included is determined. *(Hoosier Energy IRP pages 21)* The forecast Hoosier Energy peak seasonal demands created by single temperature extremes represent the "Extreme Case" demand forecast. In contrast, the forecast of Hoosier Energy's peak seasonal demands created by expected, or normal, temperatures represent the "Normal Case" demand forecast. *(Hoosier Energy IRP pages 22)*

Director’s Comments – Load Forecasting

“Hoosier Energy’s ultimate goal in making changes to the variable assumptions was to establish alternative scenarios that represent conditions that could realistically occur.” *(Hoosier Energy IRP page 24)* Hoosier Energy mentioned the five scenarios were based on expected growth that represent a realistic future of these sectors (residential, commercial, industrial). (*Hoosier Energy IRP page 19)* These statements, taken together, suggest the RUS PRS had a narrower range of scenarios than was contemplated by the IRP rule. To reiterate, Hoosier Energy did not consider assumptions and variables that might result in higher or lower load forecast than what Hoosier Energy believes is “realistic,” (Hoosier Energy IRP page 98) but could provide useful information to Hoosier Energy, its members, and the RUS.

DERs and EVs
There was almost no mention of the potential implications of all forms of DERs and EVs beyond the mention that Hoosier Energy’s wholesale tariffs are intended to facilitate customer-owned distributed energy resources that could reduce the energy use and the demand forecast. Hoosier Energy offers wholesale tariffs that are intended to provide consumers with options to manage their energy costs and to help Hoosier Energy to manage periods of higher demand and market prices. *(Hoosier Energy IRP page 47)* The following graphic from Wood Mackenzie and the Solar Energy Industry Association in 2020 illustrates the need for Hoosier Energy to establish a datum for roof-top solar because of its precipitous projected increases. Hoosier Energy is undoubtedly aware of other DERs and EVs graphics that show significant upward trajectories that warrant analysis by Hoosier Energy.



For EVs, the only mention by Hoosier Energy was in a MISO analysis,[5] as part of a more general analysis of MISO’s discussion of DERs and emerging technologies. Hoosier Energy seems to rely

[5] 2019 MISO Transmission Expansion Plan (MTEP 19) *MISO’s Load Growth and Shape assumptions.* “Distributed and Emerging Technologies (DET) - captures the effects of a mid-high economic growth rate

solely on MISO's analysis of EVs without any analysis of the potential changes in load characteristics. The Director appreciates that EVs have limited penetration and may have a low trajectory growth rate, but Hoosier Energy and its members need to attempt to predict the growth of EVs and understand the ramifications for Hoosier Energy and its member distribution systems (e.g., the charging infrastructure's effects on the operation and planning of distribution systems).

Hoosier Energy's load forecasting methodology remains unchanged from recent previous IRPs. The Commercial and Industrial load forecast is largely based upon informed judgement, Hoosier Energy places considerable reliance on input from Hoosier Energy's members, perhaps an over-reliance on each member's load forecast. The varying degrees of rigor for each member's input is inherent in the Hoosier Energy load forecast. It is also concerning that significant reliance on heuristic methods has a limited value for load forecasts, especially long-term forecasts that will have to forecast and integrate new technologies. However, given the current data constraints, Hoosier Energy's load forecast seems reasonable for this IRP.

Hoosier Energy mentioned the increasing importance of forecasting larger customers, relative to residential customers. Hoosier Energy also recognized the diversity of usage characteristics of larger customers added complexity to their forecasting. Hoosier Energy should also be concerned that commercial and other customers may integrate DERs and EVs into their operations. Despite the recognition of the growing importance of larger customers and their usage variability, there is little change in Hoosier energy's commercial, industrial, and others forecast methods. The lack of change in C&I methodology further diminishes the value of Hoosier Energy's reliance on professional judgment and increases the importance of increasing the efficacy of new forecast processes.

With regards to the alternative forecast scenarios (Base-Severe and Base-Mild Scenarios), it appears that Hoosier Energy assumes that every year of the forecast will have severe (or mild) weather. While it may be useful to look at the effect of a single extreme weather year in both directions, it is extremely unlikely that you would see that 20 years in a row. *(Hoosier Energy IRP page 25)* The treatment of more extreme weather for IRPs warrants more critical review.

Hoosier Energy, in Section 2.7, discusses some of the ramifications of the COVID-19 pandemic on the load forecasts. The IRP does not include any specific affects or adjustments due to the COVID-19 pandemic as the forecast used in the CRA's modeling was completed in mid-2019, prior to the pandemic's arrival in the United States. However, as part of its IRP, Hoosier Energy provides a Low Economic Forecast that could provide insight into potential implications of the lingering effects of the pandemic, future pandemics, or other calamities. Hoosier Energy said it will continue to assess the short-term effect of the virus and will reexamine the long-term load forecast in the 2022 PRS.

Hoosier Energy addressed trying to account for the impact of demand-side management activity on the load forecast, but the discussion was general and provided limited understanding to a reader as to how DSM was dealt with in the load forecast. For example:

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reflecting broader-scale adoption of electric vehicles, especially later in the study period. Fleet evolution trends continue, primarily driven by local policies and emerging technology adoption. State-level policies reflect desires for local reliability and optionality. Renewable energy is modeled to serve 25% of MISO energy by 2033 with 5% coming from solar photovoltaic (PV)." *(Hoosier Energy IRP page 82)*

> To stay abreast of Demand-Side Management (DSM) activity, Hoosier Energy collects information per program per member system annually. This information is applied where necessary to the historical operational data streams in order to understand the DSM impacts on energy and demand, as well as to properly model historical relationships. In order to attain an accurate DSM program performance forecast for the future, Hoosier Energy uses a two-part approach. The first part requires estimating a realistic forecast on a short-term base tied to the most recent study completed by an outside consulting firm. This study incorporates data updated with actual DSM performance through the most recently completed year and the addition of new programs. The second part incorporates Hoosier Marketing Department staff meeting with each of the member systems to develop estimated forecasts, making adjustments as needed, and discussion of long-term forecast impacts. *(Hoosier Energy IRP page 30)*

According to Hoosier Energy, "The Base forecasts include the expected impacts of Hoosier Energy's Demand Side Management and Energy Efficiency efforts." *(Hoosier Energy IRP page 35)*

As to future load forecasting improvements Hoosier Energy recognizes the need to make improvements to better account for the long-term impacts of DSM, but the lack of specificity as to how DSM is accounted for in the current forecast makes it difficult to place future intentions into a fuller understanding by the reader.

> Methodologies of incorporating the initial and long-term impact of demand side management programs on energy and demand levels will also be reviewed in the model review process. Because of a lack of information in the past, the impacts of these types of programs were analyzed only at the Hoosier Energy system level. Since 2011, they were incorporated into the member system forecasts to produce final forecasts with DSM. There will be continued dialogue between the member systems and Hoosier Energy to ensure that the PRS review, data development and revisions reflect a consensus.
>
> The approach chosen in the PRS is one of many forecast methodologies used by electric utilities. As the electric market becomes more competitive, new DSM programs are introduced, along with the structure of the market being altered; methodologies on how to incorporate these effects of these programs into existing and/or new modeling techniques for all classifications must be explored. There will be continuing evaluation of possible alternative methodologies to be used in forecasting energy and demand values. *(Hoosier Energy IRP page 35)*

To prevent any misunderstanding, the Director looks forward to the improvements discussed by Hoosier Energy. The Director's main concern is the lack of detail as to how DSM impacts are being accounted for in the current IRP. This is a complex area of analysis with numerous approaches.

Hoosier Energy's external data sources are reasonable for this forecast but should continually improve with the incorporation of advanced metering infrastructure (AMI) and other customer data. Hoosier Energy may also benefit from sharing information with other Indiana utilities, MISO, and other generation and transmission cooperatives such as Hoory Electric Cooperative in South Carolina. Hoosier Energy also utilized operating statistics are from RUS and CFC Form 7s and United States Department of Agriculture Rural Electrification Informational Publication 201-1. Weather data is from NOAA. Fuel prices are from the U.S. Energy Information Administration (EIA) and the U.S. Department of Energy. Agricultural variables are from Indiana Agricultural Statistics and Illinois Agricultural Statistics. Other variable sources include STATS Indiana and the Illinois Department of Commerce and Economic Opportunity.

The Director has some questions that Hoosier Energy should clarify.

1. Hoosier Energy's calculation of demand is normalized using a "typical" load factor. However, it is not clear how a typical load factor is determined? Is it some type of average (mean/median) or analyst judgment? *(Hoosier Energy IRP page 28)*

2. Section 2.2 Methodology – The electricity price equation seems odd. The drivers of price are use per customer, distribution system costs, wholesale costs, and "other variables that may affect price." There is no further explanation of what these variables are. Also note that the variables are in log form except for the "other variables" variable. Further note that other equations have similar unexplained catchall variables.

3. The C&I forecasts were developed by surveying individual members (survey forecasts tend to be inaccurate in the long term because those surveyed have no basis for long-term changes). They indicate that these were reviewed and checked for being realistic, but there is no indication of what standard was used for realism and what steps were taken if any were found to be unrealistic.

4. Section 2.2 Methodology - In the residential customers model one of the drivers listed is "Other variables that may affect customers". What are some examples of these variables, how significant were these other variables, and why didn't Hoosier Energy specify them?

5. Section 2.2.6 Weather Normalization – Hoosier Energy refers to the historical period for determining normal weather (including ranges) and extreme weather but does not say what that period is. Is the period 20 years? 30 years? Something else?

B. Energy Efficiency

Hoosier Energy segmented its analysis into three parts. Volume I included a brief explanation of the DSM modeling process. Volume II includes the reports "2019 Demand Side Management Annual Report" and "Demand-Side Resource Modeling Assumptions." Volume III are presentations to Hoosier Energy's Board.

<u>Volume I</u> provided an analysis of the historical and forecast levels of peak demand and energy usage, assessment of existing resources, and the elimination of nonviable resource alternatives. CRA used AURORA to evaluate supply and demand side resources in an effort to minimize costs while maintaining reliability requirements. Hoosier Energy's DSM forecast relies heavily on information and data from its members and is similar to the 2017 IRP. The DSM programs considered in this IRP are the result of the work conducted by GDS associates consulting firm and presented in the "2016 Update of Avoided Costs and DSM Modeling Assumptions" report. According to Hoosier Energy, this study will be updated later in 2020 but was not completed in time for this IRP.

Hoosier Energy will continue to review the methodologies of incorporating the initial and long-term effects of DSM programs on energy and demand levels. Previously, impacts of DSM programs were analyzed only at the Hoosier Energy system level. However, since 2011 they were included into the member system forecasts to then produce the final forecast with DSM.

Hoosier Energy added the following programs to the DSM program portfolio for 2021 and beyond: Residential HVAC Tune-Up incentive pilot, Indoor Horticulture/Load Growth incentive pilot, Electric Lawn Equipment incentive pilot, and the Smart Thermostat with Demand Response capability pilot expansion. Furthermore, future DSM programs are anticipated to be based heavily on the introduction of a new/revised wholesale structure and a push for load growth within its beneficial electrification initiatives with emerging technologies. The structure of wholesale tariffs design is also intended to encourage DR participation.

Volume II details member EE and DR programs including Residential Lighting, Commercial & Industrial, Energy Management Savings Switch, Energy Efficiency Kits, Residential HVAC, Appliance Recycling and LED Security Lighting. An analysis of measures installed during the period 2009-2019, states the average lifetime cost of energy conserved by DSM is approximately $0.021 per kWh. The Total Resource Cost (TRC) test which considers the avoided supply costs (e.g. reductions in capital and O&M cost for generation, transmission, and distribution facilities and operations) as benefits detailed in this test. Hoosier Energy's IRP relies on analysis by GDS consultants in its "2016 Update of Avoided Costs and DSM Modeling Assumptions."

Volume III CRA's 2019 Long Range Resource Planning (LRRP) analysis included a discussion of CRA Scenario D which makes the argument that customer behavior is a primary driver of the combined set of fundamental market modeling inputs. "Hoosier Energy will continue to work with Member Systems to offer a menu of demand-side measures to promote the efficient use of resources. [6] This includes the wholesale tariff, which was updated in 2019 and provides incentives for both demand response program participation and load shifting." *(Hoosier Energy IRP pages 11)* Hoosier Energy also offers wholesale tariffs to provide appropriate incentives for customer-owned distributed energy resources to help the G&T to manage costs during periods of high demand and market prices. *(Hoosier Energy IRP page 47)*

All member systems have installed advanced metering [7] infrastructure or AMI. Some Hoosier Energy members will use AMI to facilitate their DSM programs and for other purposes. The DSM programs include a load control program that briefly cycles customer's air conditioners, water

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[6] DSM analysis: Further detail on the energy efficiency and demand response programs can be found in the 2019 Demand Side Management Report, which is included in this IRP as Appendix F. The DSM programs result from work with GDS Associates and Summit Blue Consulting to develop the Energy Efficiency & Demand Response Potential Report, which was originally constructed in 2009. The Potential Report, which was most recently updated in 2016, provides detailed descriptions and analysis of all demand-side programs considered and recommended for Hoosier Energy. The Potential Report is scheduled to be updated later in 2020. Hoosier Energy's demand response and energy efficiency market potential study remains an integral part of the Plan. As discussed above, this study will be updated later in 2020 and its results will provide direction for Hoosier Energy's future demand-side efforts.

[7] Hoosier Energy typically obtains load data on 30 – 60 minute intervals. Future IRPs should use shorter time intervals from AMI, perhaps as low as 1 minute for certain purposes like real-time pricing, calculating dynamic avoided costs). Especially for customers like DERs and EVs, shorter time intervals provide the near-real time information necessary to value DERs /EVs . *(Hoosier Energy IRP pages 18-19)*

heaters, pool pumps and irrigation systems during peak demand periods. Member system participation is encouraged through price signals from the Standard Wholesale Tariff and Member Systems may also provide incentives to retail customers through bill credits or rebates. Hoosier Energy's wholesale tariffs are designed to encourage demand response participation by the member systems and to introduce time-of-use energy pricing (updated for implementation in April 2019). *(Hoosier Energy IRP page 46)*

Director's Comments – Energy Efficiency

The Director recognizes that the organizational structure of the Hoosier Energy system depends, largely, on coordination with its member cooperatives and, ultimately, on their customers in the planning and operations of DSM programs. In contrast, vertically integrated utilities have a more direct organizational structure that may facilitate DSM and other cost-effective DERs. To be clear, this observation is not intended to be a criticism of the organizational structure of REMCs. Regardless of the different organizational structures, all electric utilities need to improve the modeling of DSM and other DERs and EVs, as well as increase the coordination of data, planning, programs, and operations with their RTO to satisfy their customers' changing requirements.

It does not appear that energy efficiency and demand response are selectable resources in the resource optimization model. (*Hoosier Energy IRP page 59-60)* If DSM was able to be selected and treated on a comparable basis with other resources, it is unclear how DSM resources were considered, especially within the AURORA portfolio optimization model. It appears DSM resources were just included in the preferred plan without optimizing.

It appears the individual measures recommended in the 2016 CRA Update document and approved through a collaboration with Hoosier Energy's member systems, are intended to be directly offered to customers through the DSM programs. However, it is not clear these programs have been selected by the optimization model. That is, the list of potential resource options, included in the portfolio modeling scenarios developed by CRA, may be different than Hoosier Energy's current DSM offerings.

Accurate assessment of relevant costs to establish the dynamic values of EE and DR by time and location is necessary for Hoosier Energy and its members to calculate a more accurate value for DSM (including all DERs). Hoosier Energy seems to have developed avoided costs that gave some effect to the avoided generation, transmission, and distribution cost but it did not reflect the changing avoided costs due to time and location. *(Hoosier Energy IRP page 52 -53)* We believe Hoosier Energy's discussion of avoided cost is somewhat out of date since Hoosier Energy refers to GDS consulting that was presented in the "2016 Update of Avoided Costs and DSM Modeling Assumptions" which might have utilized 2015 data. Future IRPs need to consider all avoided costs which include dynamic changes due to time and location of generation, transmission, and distribution systems. The evolutionary development of a more robust analysis of avoided costs, benefiting from AMI, should be reflected in future IRPs.

The IRP review raised the following questions:

- When Hoosier Energy says that the DSM short-term forecast uses a recent study completed by a consulting firm, does it refer to the "2016 Update of Avoided Costs and DSM Modeling Assumptions" document?
- Has Hoosier Energy updated the DSM costs and modeling assumptions in advance of the IRP?

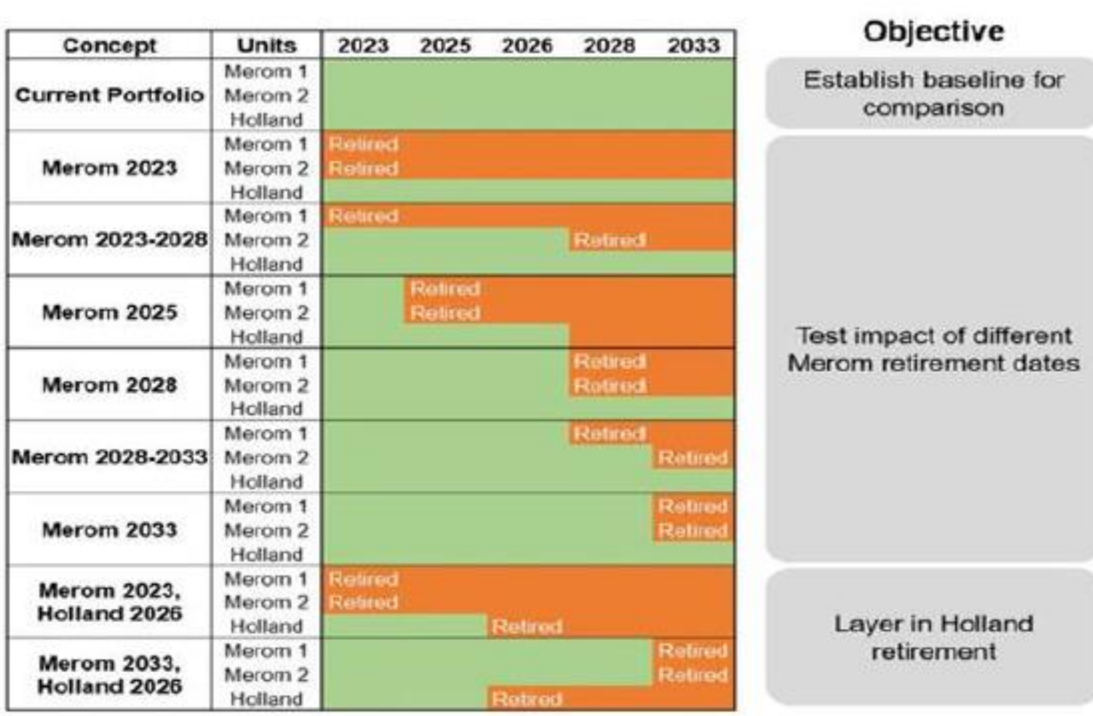
- What is meant by "applied where necessary" *(HE's IRP page 30*) Further clarification about this step and the overall methodology would help explain Hoosier Energy's DSM modeling process.

C. Resource Optimization and Risk Analysis

Charles River Associates (CRA) was hired by Hoosier Energy to conduct the IRP modeling. AURORA was used to perform system optimization of Hoosier Energy's portfolio options within the MISO power market. The model helps develop least-cost portfolio concepts under various scenarios using a variety of constraints. Both supply side and demand side resources were evaluated in the portfolio optimization framework. A proprietary model called PERFORM was created by CRA to estimate revenue requirements.

Method

Hoosier Energy started with identifying significant factors to consider in designing future portfolios. Then metrics were selected to quantify the portfolio objectives. In total, six scenarios were developed by Hoosier Energy and CRA. There is a Base Case which represents the current, most likely outlook for key market drivers. A set of alternative scenarios were then formed as follows. They are Stagnating Economy, U.S. Economy Decarbonizes, Customers in Control, Challenged Gas Economy and Flat Gas. Then, Hoosier Energy identified eight specific retirement concepts to test, using a combination of prospective early retirement combinations of Merom Unit 1, Merom Unit 2 and Holland. *(Hoosier Energy IRP graphic page 89)*



Based on early retirement test results using Base case assumptions, four retirement concepts were left. These concepts represent the Current Portfolio plus the three concepts with the lowest Net

Present Value of Revenue Requirements (PVRR) from the initial round of modeling. The concepts remaining under consideration were:

1. Current Portfolio
2. Merom 2023 retirement
3. Merom 2023 – 2028 retirement
4. Merom 2023, Holland 2026 retirement

These concepts were tested against a group of portfolios with varying coal retirement dates and a broad range of resource alternatives within the portfolios. A description of each of the portfolios *(Hoosier Energy IRP Table 17 graphic page 91)* is provided here:

#	Portfolio	Description
0	Current Portfolio	No changes to existing portfolio, solar is added to meet load growth
1	Solar Heavy	2023 Merom retirement with solar heavy replacement mix. (Portfolio optimized using annual constraints only)
2	Wind/Solar Balanced	2023 Merom retirement with more balanced wind and solar replacement mix. (Portfolio optimized using monthly peak constraints)
2a	Merom Energy Complex	Portfolio 2 with owned peaking capacity at Merom Energy Complex. (Will not differ in energy performance but will study ownership impact)
3	Gas Focused	2023 Merom retirement replaced with combined cycle and gas peaking capacity and wind heavy renewable mix
4	All Renewable	2023 Merom retirement replaced entirely with solar, wind storage, and capacity purchases.
5	Merom Conversion	2023 Merom retirement with Unit 2 coal-to-gas conversion and even split of wind and solar for energy generation.
6	Staggered Early	Merom 1 retired in 2023 and Merom 2 retired in 2025.
7	Staggered Late	Merom 1 retired in 2023 and Merom 2 retired in 2028.
8	Merom + Holland	2023 Merom retirement and 2026 Holland retirement.

Following a review of the initial portfolio optimization runs and prior to conducting the final round of portfolio optimization modeling, CRA changed several assumptions. The result was that Hoosier Energy was left with two early retirement options to be modeled against the replacement portfolios:

1. *Merom 2023 retirement*
2. *Merom 2025 retirement*

The final group of portfolios were developed based on a combination of least cost analysis and consideration of other scorecard objectives. A list of objectives that were modeled is provided in the following table.

#	Portfolio	Description
0	Current Portfolio	Existing portfolio with solar and storage added to meet load growth
1	Least Constrained	2023 Merom retirement with replacement mix dominated by solar - Significant capacity purchases needed to meet winter obligation
2a	No CC, Annual Balance	2023 Merom retirement - More solar energy than wind, plus balanced gas peaker and storage for capacity
2b	No CC, Monthly Balance	2023 Merom retirement - More wind energy than solar, plus balanced gas peaker and storage for capacity
3a	Small CC, Annual Balance	2023 Merom retirement replaced with 300 MW combined cycle plus gas peaker and storage - More solar energy than wind
3b	Small CC, Monthly Balance	2023 Merom retirement replaced with 300 MW combined cycle plus gas peaker and storage - More wind energy than solar
4	Large CC	2023 Merom retirement replaced with 600 MW combined cycle plus storage; Moderate wind and small solar
5	Less Storage	Portfolio 3b (Small CC, Monthly Balance) with no battery storage before 2035; batteries replaced by gas peakers
6	All Renewable	2023 Merom retirement with all renewable/storage replacement
7	2025 No CC, Monthly Balance	Concept 2b with 2025 Merom retirement (no early renewables)
8	2025 Small CC, Monthly Balance	Concept 3b with 2025 Merom retirement (no early renewables)
9	2025 All Renewable	Concept 6 with 2025 Merom retirement (no early renewables)

(Hoosier Energy IRP Table 18 page 93)

Hoosier Energy's Board of Directors established five criteria for the development of portfolios that considers cost, predictability of costs to members, reliability, resource diversity, limiting environmental risk, and addresses the potential implications of the Merom retirement for Hoosier Energy's employees. Hoosier Energy also strived to maintain sufficient flexibility to react to changes in member system needs. (*Hoosier Energy IRP page 11)*

> Based upon its current load forecast and existing and future resource assessment, Hoosier Energy' preferred course of action is to retire the Merom generating facility in 2023 and replace it with a combination of owned and purchased power resources, including wind, solar and natural-gas. The Preferred Plan is shown in Table 46 in Section 4.15. This Plan represents the portfolio that most economically serves members, while ensuring adequate reliability and minimizing risk. (*Hoosier Energy IRP page 11)*

The Director understands that Hoosier Energy's and its members' Board of Directors were intimately involved with the development of the Scorecard -Table 19 below *(Hoosier Energy IRP page 99)* This is an excellent approach.

	Low Wholesale Rates			Rate Stability & Predictability				Sustain-ability of Portfolio	Resource Diversity		Employee Impact
	Base Case 20-Yr NPV of Supply Cost	Average 2020-2030 Supply Cost	Average 2031-2040 Supply Cost	Lowest Expected 20-Yr NPV of Supply Cost	Highest Expected 20-Yr NPV of Supply Cost	Likely Range of 20-Year Supply Costs	Worst Case of 20-Year Supply Costs	2030 Carbon Reduction from Current Portfolio (Base Case)	Max Resource Type as % of Generation Mix	Maximum Unit Size	Criteria Rating (Low, High)
	$MM	$ / MWh	$ / MWh	$MM	$MM	-$MM +$MM	$MM	% reduction	%	MW	Rating
Current Portfolio	7,222	64.1	82.2	6,109	8,850	-$14 +11	7,246	-	Coal 63%	500	Low
2023 Retirement Options											
No Gas CC	6,487	63.5	62.3	6,144	7,126	-$14 +14	6,520	94%	Wind 67%	200	High
Small Gas CC	6,457	62.0	64.2	5,938	7,003	-$21 +20	6,504	81%	Wind 43%	300	High
No New Fossil	6,474	63.8	61.4	6,183	7,214	-$10 +8	6,496	96%	Wind 73%	200	High
2025 Retirement Options											
No Gas CC	6,769	65.3	67.3	6,416	7,452	-$15 +16	6,810	94%	Wind 69%	200	High
Small Gas CC	6,795	64.0	70.2	6,155	7,306	-$22 +22	6,850	82%	Wind 41%	300	High
No New Fossil	6,804	65.4	67.9	6,463	7,567	-$10 +10	6,834	96%	Wind 68%	200	High

Director's Comments – Resource Optimization and Risk Analysis

Risk analysis was conducted with a variety of appropriate analytical tools including AURORA. The methodology for evaluating the efficacy of retirement decisions seems reasonably structured to thoroughly evaluate the implications of resource decisions, including the Board of Director's acceptance of the Scorecard. However, it is important to keep in mind that retirement and build decisions, at the market level, will drive the future market prices. As was seen in other IRPs, this can be a crucial driver of resource selections. Low market prices, for instance, mean the plan relies very heavily on market purchases (see Duke's 2018 IRP). High market prices, in contrast, can cause the IRP to build excess capacity to sell on the market (see I&M's 2018 IRP). Since the market prices are redacted (section 4.10.7, page 87), it is not possible to check directly. However, in Table 22 (section 4.15.1, page 103) it looks like Hoosier Energy is hitting the 20 percent constraint on net exports in the last two years, as calculated by (spot sales minus spot purchases) / member sales. This happens using resources that have been added during the forecast period. Note that total output from existing units is less than half of the net sales. So, to some degree, it appears Hoosier Energy, intentionally or not, may be overbuilding to sell on the market. *(Hoosier Energy IRP page 72)*

There are serious problems with Hoosier Energy's scenarios analysis that may have unduly limited the range of risks that Hoosier Energy might confront. As a result, Hoosier Energy's Board of Directors and Member Boards may have been deprived of useful information to help the Board(s) evaluate potential risks. These include:

- Hoosier Energy's narrative detailing the comparison between the base case to the other scenarios was very confusing.

- Hoosier Energy limited the range of scenarios to include only events that were deemed most likely to occur. Hoosier Energy's decision to restrict the range of risks to those most likely to occur limited potentially valuable information. Hoosier Energy's decision to truncate risk analysis, without articulating what types of events constitute most likely, is also concerning.

- All of the 12 candidate portfolios in the final modeling process included many predetermined factors and constraints including the retirement dates of Merom and Holland facilities.

- Hoosier Energy should have developed optimized portfolios from various scenarios as candidate portfolios.

- Hoosier Energy's final group of portfolios were developed based on a combination of least cost analysis and consideration of other scorecard objectives. It is not clear if the Board(s) initially understood the scenarios and resulting portfolios were significantly constrained and influenced the optimization processes.

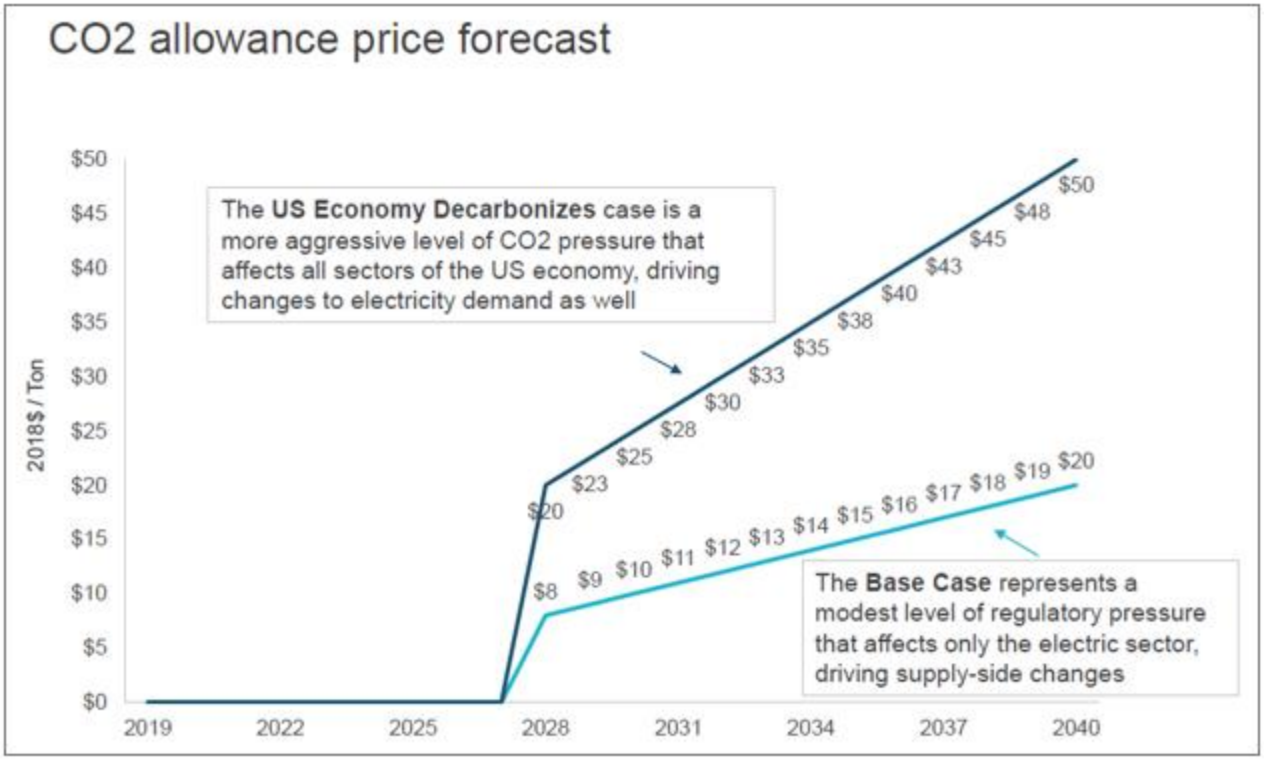
- In the final state of portfolio development, the IRP analysis is not clear that intervening portfolio optimization was done. Hoosier Energy then tested the final portfolios against various scenarios and considered this step as part of the scenario analysis. In fact, this appears to be more like a sensitivity analysis.

- The lack of clarity made it difficult to assess whether there was useful information and whether the range of risk was significant. [8] Hoosier Energy's decision to constrain the scenario analysis, to those that were reasonably likely, may have unduly limited risk.

- A major factor in the development of the Hoosier Energy's Preferred Plan was the effect of potential CO_2 legislation and/or regulatory changes. For example, additional environmental restrictions have the potential to further affect cost assumption tradeoffs between the type, quality and availability of fuel burned and the allowable emissions level at existing and future generating stations.

[8] The narrative said there were seven scenarios but only 5 (*Hoosier Energy IRP page 24*) provided any detail. The narrative is not very clear on what assumptions were used and how they were compared to the base case. As a result, it is difficult to know whether the risk boundaries were significant.

The following graphic is found on Appendix 3 page 13 of the Charles River Associates (CRA)



No carbon cost in 4/6 scenarios – only in base case and decarbonization

Question for Hoosier Energy from the Director: *Did Hoosier Energy build this carbon price forecast into any of the scenarios? If so, did Hoosier Energy adjust costs for resource capacity (renewables - $/kw) in their model?*

It is not clear what Hoosier Energy assumed for the Unforced Capacity (UCAP) contribution of future resources, especially wind and solar. Given that Hoosier Energy is anticipating a significant change in the resource mix and the speculative nature of the replacement resources, it seems inappropriate to redact this information in Appendix C without a clear justification. *(Hoosier Energy IRP page 67)*

D. FUTURE ENHANCEMENTS TO Hoosier Energy's IRP PROCESSES

It is commendable that Hoosier Energy and its member cooperatives have installed AMI. In the next IRP, the Director urges Hoosier Energy to provide a detailed discussion of how Hoosier Energy and its members intend to utilize AMI. The discussion, while recognizing that Hoosier Energy is heavily reliant on its members for data, should discuss how AMI will be used for improving rate design, load forecasting, DSM/other DERs, understanding the potential ramifications for EVs, the ability to refine reliability metrics and other potential benefits.

Director's Comments – Future Enhancements

Hoosier Energy addressed the avoided cost elements "As defined by 170 IAC 4-7-1 (b),[9] 'avoided cost' means the incremental or marginal cost to a utility of energy or capacity, or both, not incurred by a utility if an alternative supply-side resource or demand-side resource is included in the utility's IRP." From the Director's perspective, Hoosier Energy 's interpretation, while a correct citation, should be taking a broad view of avoided costs that does not give appropriate effect to the discrete and dynamic avoided costs of all forms of DERs. EVs will, over time, also necessitate assessing changes in usage and demand (load shapes) due to avoided costs. Especially since Hoosier Energy now has AMI data that can provide more granular (almost real-time) information on the actual costs that are avoidable, it is important for Hoosier Energy and its members to include all generation, transmission, and distribution costs. AMI will provide information for the changing value of integrating all resources. Eventually, AMI data may be useful for understanding the avoided cost of ancillary services.

The Director requests that Hoosier Energy's next IRP include a discussion of the expected near and long-term uses of AMI and the ability to manage the massive data. The Director also continues to urge Hoosier Energy and its member systems to improve the quality and quantity of information from customer surveys. As noted previously, Hoosier Energy's heuristic approach that depends on member information and speculation is particularly unsuitable for long-term forecasts, developing more accurate rate structures, and predicting the implications of DERs and EVs.[10] The example of Hoory Electric Cooperative (below) is illustrative of the type of customer information that provides a more detailed understanding of its customers' needs and preferences.

Among several utilities (see below graphics from Lawrence Berkeley National Laboratory), Hoory Electric Cooperative participated in the LBNL AMI load shape effort. Hoory mentioned different types of homes (e.g., mobile homes, multi-family single family attached, single family detached). In all types of homes, information on the fuel types used by customers are also obtained. The following residential end-uses are monitored: heating, cooling, heating ventilation and air-conditioning fan pump, vent fans, water heating, pool hot tub, well pump, cooking range, dishwasher, clothes dryer, clothes washer, freezer, extra refrigerator, plug loads, exterior lighting, interior lighting. For Hoosier Energy, this list of monitored end-uses would provide useful information for forecasting customer use, aide in developing cost-effective DSM and other DERs, as well as EVs. With the expectation of growing Commercial and Industrial use, Hoosier Energy would also benefit from more discrete data.

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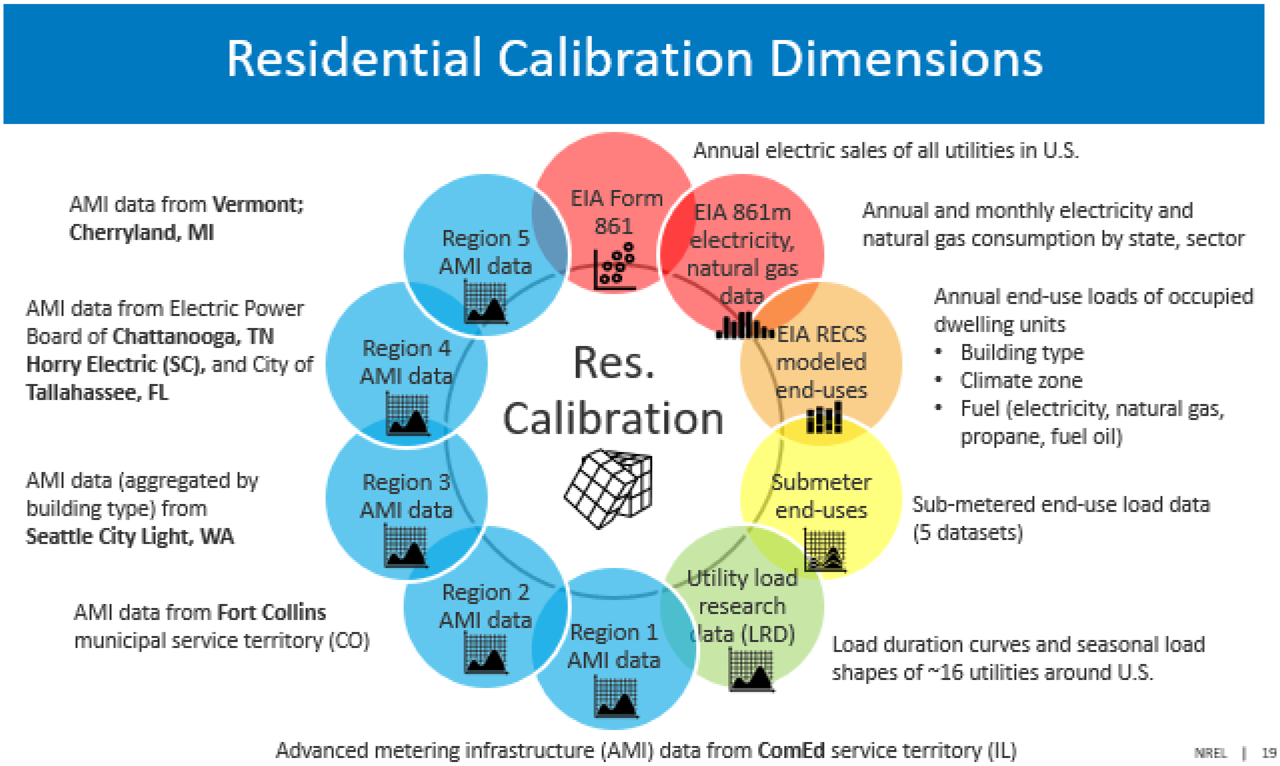
[9] Hoosier Energy cites "avoided cost" means the incremental or marginal cost to a utility of energy or capacity, or both, not incurred by a utility if an alternative supply-side resource or demand-side resource is included in the utility's IRP." This is a reasonable first step but full avoided costs also include a time and location dynamic.

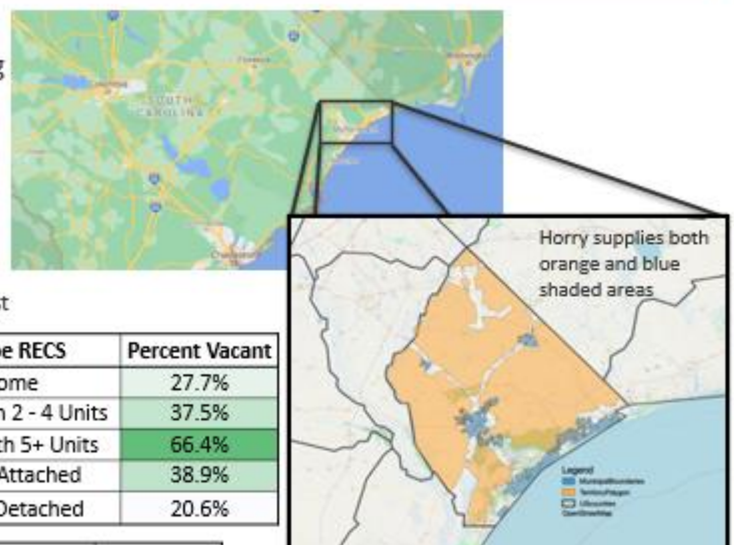
[10] Lawrence Berkeley National Laboratory continues to develop end-use load shapes for a wide array of residential and commercial and load shapes (including DERs and EVs). The work by LBNL and others, combined with weather data and enhanced customer survey information, should provide a foundation for future IRPs. Recognizing that NAICS is primarily limited to describing the type of commercial and industrial company, Hoosier Energy should consider developing a check list of desired customer information (e.g., type of building from NAICS, square footage, end-uses within buildings, age of building, operational schedule, number of employees, etc.).

The following graphic is from Lawrence Berkeley National Laboratory 2021



Region 4 – Horry Electric Cooperative

- Serves ~68,000 customers in SC
- Serves most of Horry County, including several municipalities via franchise agreements
- Used AMI data from 2018
- Compared to previous regions:
  - Higher % electric heating
  - Higher % of vacant/vacation units
  - Large fraction of population is near the coast



Building Type RECS	Saturation
Mobile Home	15.0%
Multi-Family with 2 - 4 Units	5.0%
Multi-Family with 5+ Units	18.0%
Single-Family Attached	4.5%
Single-Family Detached	57.4%

Building Type RECS	Percent Vacant
Mobile Home	27.7%
Multi-Family with 2 - 4 Units	37.5%
Multi-Family with 5+ Units	66.4%
Single-Family Attached	38.9%
Single-Family Detached	20.6%

Heating Fuel	Electricity	Fuel Oil	Natural Gas	None	Propane
Saturation	94.5%	0.1%	3.0%	0.1%	2.3%

NREL | 49

For Commercial customers, that have a wide variety of uses, some utilities are using AMI for the following types of customers and their end-uses: Full-service and small and quick restaurants, hospitals, out-patient offices, large, medium, and small hotels / motels, large, medium and small offices, primary, middle schools, high schools, colleges, retail shops, strip malls, warehouses, grocery stores and convenience stores, government offices including water pumping loads and lighting, farm including grain drying and dairies, churches, and other significant customers that are specific to the utility. Hoosier Energy said its Preferred Plan "does consider the relatively high-risk environment created by customer interest in self-generation." Hoosier Energy's primary concern seems to be the potential effects of a utility's obligation to serve retail load. (*Hoosier Energy IRP page 12)* While Hoosier Energy recognizes the likely increases in DERs (and EVs), interest in the integration of these technologies should be pursued because it is in the customers' interests which HE seems to[11] regard as beyond Hoosier Energy's obligation to serve.

In future IRPs, Hoosier Energy indicates it will review its methodologies of incorporating the initial and long-term effects of DSM programs on energy and demand levels. Hoosier Energy also intends to work with its members to increase the DSM options for their ultimate customers. Some of these DSM programs are pilot programs.

Hoosier Energy should develop a more expansive list of potential risks. Understanding the possible ramifications of these risks and how they might be integrated into the IRPs will be beneficial to Hoosier Energy and its members.

IV. SUMMARY

Consistent with the IRP rule, the Director does not approve or disapprove Hoosier Energy's preferred plan and certainly does not prejudge any resource decision. The Director commends Hoosier Energy and its members for developing the tools, analysis, and processes to provide very difficult but objective analysis to consider the retirement of the coal-fired Merom facility. Hoosier Energy's analysis seems to be consistent with the Board-approved Scorecard that provided useful criteria for Hoosier Energy's management to evaluate all resource decisions and approach resource decisions objectively and with compassion.

Hoosier Energy's load forecast in this IRP did not evidence any significant enhancements to the methodology or the data used by Hoosier Energy. Hoosier Energy relies too heavily on judgement, which is particularly problematic for long-term forecasts.

With Hoosier Energy's members' installation of AMI, future forecasts should increasingly benefit from a vast amount of high-quality load data as well as more detailed information about Hoosier energy's members' customers. It was understandable that Hoosier Energy relied on the RUS approved load forecast, but it is not clear that Hoosier Energy's RUS forecast is entirely consistent with the Commission's IRP rule and the requirement for continued improvements. The need for future enhancements to Hoosier Energy's load forecast should increasingly address the potential ramifications of DERs and EVs.

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[11] "This Plan contemplates no significant changes to the current integrated retail market, which could affect Hoosier Energy's Members. However, the plan does consider the relatively high-risk environment created by customer interest in self-generation and its impact on a utility's obligation to serve retail load." *(Hoosier Energy IRP page 12)*

Hoosier Energy's commitments to expand the DSM programs and conduct pilot programs recognizes the opportunities to develop well-designed rates due to the installation of AMI. AMI also provides the requisite information for innovative rates and beginning the effort to calculate full avoided costs (generation, transmission, and distribution) by location and using short-interval time to increasingly capture the dynamics of avoided cost. Empirical and high-quality data is the bedrock for rates that foster cost-effective DERs and for locating EVs infrastructure. The substantially enhanced data will also allow Hoosier Energy to develop more tailored rate design that is more accurate, efficient, understandable, and fair. Discrete AMI data may also be used to improve reliability and inform Hoosier Energy and its members on the avoided cost of outages.

Hoosier Energy's use of the AURORA planning model and enlisting well-regarded consultants provided additional credibility to Hoosier Energy's IRP. However, it seems the planning models were adversely affected by predetermined modeling decisions. If so, this IRP may not have provided the Board(s) of Directors with the most relevant and important information.

The risk and uncertainty analysis seemed to unduly constrain the range of risks by only looking at risks that, in Hoosier Energy's view, are more likely to occur. The load forecasts seemingly had a narrow risk bandwidth and did not consider lower probability events that, if they occurred, would be highly consequential. Hoosier Energy correctly noted the low probability but devastating ramifications of the pandemic which should be a basis for more analysis. Consistent with Hoosier Energy only considering likely events, it appears that Hoosier Energy also may have constrained other variables that were also more likely events. Finally, it was not clear how the optimization occurred or if optimization was limited to certain scenarios and portfolios.

The enhancements to Hoosier Energy's future IRPs are largely dependent on coordination with its members. Coordination with MISO is also increasingly important to address integration of renewable resources, DERs, and EVs. Given the risks and uncertainties, Hoosier Energy and its member cooperatives should recognize the significant challenges to better ensure reliable and economic benefits.