Kentucky Public Service Commission

Staff Report on the

2014 Integrated Resource Plan

of Big Rivers Electric Corporation

Case No. 2014-00166

December 2015

SECTION 1

INTRODUCTION

In 1990, the Kentucky Public Service Commission ("Commission") promulgated 807 KAR 5:058 to create an integrated resource planning process to provide for review of the long-range resource plans of Kentucky's jurisdictional electric generating utilities by Commission Staff ("Staff"). The Commission's goal was to ensure that all reasonable options for the future supply of electricity were being examined in order to provide ratepayers a reliable supply of electricity at the lowest possible cost.

Big Rivers Electric Corporation ("Big Rivers") filed its 2014 Integrated Resource Plan ("IRP") on May 15, 2014.[2] The IRP includes Big Rivers' plan to meet its customers' electricity requirements for the period 2014-2028. Big Rivers is a generation and transmission ("G&T") cooperative located in Henderson, Kentucky. It supplies electricity to three distribution cooperatives that provide service in 22 western Kentucky counties. These member cooperatives, Kenergy Corp. ("Kenergy"), Meade County Rural Electric Cooperative Corporation ("Meade"), and Jackson Purchase Energy Corporation ("JPEC"), serve approximately 113,000 customers, of which nearly 90 percent are residential. Since filing its last IRP in 2010, Big Rivers' load requirements have been reduced by more than 800 megawatts ("MW") and 7,000,000 megawatt-hours ("MWh") because it no longer supplies power to two aluminum smelters.

Big Rivers owns 1,444 MW of generating capacity at four generating stations: Reid, Coleman, Green, and Wilson. Since May 2014, Big Rivers' Coleman Generating Station has been idled. Big Rivers has 197 MW of capacity available from Henderson Municipal Power & Light ("HMP&L") and 178 MW from the Southeastern Power Administration ("SEPA"). The total capacity available to Big Rivers is approximately 1,819 MW.[3]

Big Rivers is a member of the Midcontinent Independent System Operator, Inc. ("MISO"). MISO directs Big Rivers' generation's dispatch and determines the reserves required to maintain resource adequacy within its multi-state footprint.

The Commission established a procedural schedule for this case[4] which allowed for two rounds of data requests to Big Rivers, intervenor comments and reply comments by Big Rivers. Intervenors are the Attorney General of the Commonwealth of Kentucky, by and through his Office of Rate Intervention ("AG"), the Kentucky Industrial Utility Customers, Inc. ("KIUC"), and Ben Taylor and the Sierra Club ("Sierra Club").

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[2] Big Rivers was assisted in the preparation of its IRP by GDS Associates, Inc. ("GDS").

[3] Available capacity is currently reduced by 178 MW, to 1,641 MW, due to *force majeure* conditions on the SEPA system. SEPA is expected to return to full capacity sometime in 2015.

[4] The procedural schedule was amended by Orders issued June 30, 2014, and October 27, 2014.

Big Rivers responded to two rounds of data requests from Staff and each of the intervenors. The AG and Sierra Club submitted written comments to which Big Rivers filed reply comments. KIUC filed no comments on Big Rivers' IRP.

The purpose of this report is to review and evaluate Big Rivers' 2014 IRP in accordance with 807 KAR 5:058, Section 11(3), which requires Staff to issue a report summarizing its review of each IRP filing and make suggestions and recommendations to be considered in future IRP filings. Staff recognizes that resource planning is a dynamic, ongoing process. Specifically, the Staff's goals are to ensure that:

- All resource options are adequately and fairly evaluated;
- Critical data, assumptions and methodologies for all aspects of the plan are adequately documented and are reasonable; and
- The report includes an incremental component, noting any significant changes from Big Rivers' most recent IRP, filed in 2010.

In the current IRP, Big Rivers states that its primary planning goal is to provide for its customers' electricity needs over the next 15 years through a mix of supply and demand-side options at the lowest reasonable cost. To meet this goal, Big Rivers identified the following planning objectives:[5]

- Maintain a current and reliable load forecast;
- Continue offering cost-effective DSM programs;
- Identify potential new supply side resources and DSM programs;
- Provide competitively priced power to its members;
- Maximize reliability while ensuring safety, minimizing costs, risks, and environmental impacts;
- Meet North American Electric Reliability Corporation ("NERC") guidelines and requirements.

Big Rivers projects adding replacement load by 2028 sufficient to offset the loss of the approximately 800 MW combined load of the two aluminum smelters. Its existing native load peak is expected to increase from 632 MW in 2013 to 694 MW in 2028, reflecting an average growth rate of 0.4 percent.[6] Building in the projected replacement load, the 2028 peak is forecast to be 1,571 MW.[7] Energy requirements for Big Rivers' native load are projected to increase from 3,345,932 MWh in 2013 to 3,623,312 MWh in

[5] Big Rivers' IRP at 9.

[6] Big Rivers' IRP, Load Forecast ("Load Forecast"), Appendix B, Table at B-2.

[7] *Id.*, Table at B-4.

2028, also reflecting a 0.4 percent annual growth rate.[8] Incorporating the projected replacement load results in total energy requirements in 2028 of 9,072,444 MWh.[9]

Big Rivers' IRP was developed based on the planning reserve margins contained in the 2014 MISO Loss of Load Expectation Study. This study, which covers the ten years from 2014 to 2023, includes reserve margin values ranging from 14.8 percent in 2014 to 17.3 percent in 2023. Big Rivers maintained the 2023 value of 17.3 percent for the IRP years of 2024 through 2028. Based on DSM/Energy Efficiency ("EE") programs it has established since 2011, Big Rivers expects to save a cumulative 48,251 MWh by 2028, with a 14 MW reduction in both its winter and summer peak demands.[10] Big Rivers' base case resource plan requires no capacity additions over the 15-year planning horizon to maintain a planning reserve margin of 14.8 to 17.3 percent.

The remainder of this report is organized as follows:

- Section 2, Load Forecasting, reviews Big Rivers' projected load growth and load forecasting methodology.
- Section 3, Demand-Side Management and Energy Efficiency, summarizes Big Rivers' evaluation of DSM opportunities.
- Section 4, Supply-Side Resources and Environmental Compliance, focuses on supply resources available to meet Big Rivers' load requirements and environmental compliance planning.
- Section 5, Integration and Plan Optimization, discusses Big Rivers' overall assessment of supply-side and demand-side options and their integration into an overall resource plan.

It must be noted that departures from the filing schedule in 807 KAR 5:058 have caused overlaps of IRP filings. To help minimize future overlaps, Staff recommends to the Commission a filing date for Big Rivers' next IRP of September 21, 2017.

[8] *Id.*, Table at B-1. Big Rivers' native load consists of 21 direct-serve large commercial and industrial customers and the remaining customers on its system, which make up the rural system.

[9] *Id.*, Table at B-3.

[10] *Id.*, Tables at B-1 and B-2.

SECTION 2

LOAD FORECASTING

INTRODUCTION

Big Rivers provides power to three distribution cooperatives that provide service in 22 counties where 90 percent of customer accounts are classified as residential. Big Rivers' forecasts of energy consumption for major customer classes were developed using both short-term and long-term econometric models, statistically adjusted end-use ("SAE") models, exponential smoothing and historical trending. GDS developed the forecasting assumptions which were then discussed with Big Rivers' management.

The forecast's economic outlook was based on data from Moody's Analytics. Additional data was collected from RUS Form 7, the U.S. Census, the U.S. Department of Energy's Energy Information Administration ("EIA"), and the National Oceanic and Atmospheric Administration ("NOAA").[11] Based on the requirements of the Rural Utilities Service ("RUS"), Big Rivers prepares a load forecast every two years. The 2013 load forecast, which was completed in April and approved by RUS in June of 2013, was used by Big Rivers for this IRP. RUS accepts a 20-year historical period as the basis for normal weather, and Big Rivers used this for its weather normalization. Weather data was gathered from the Paducah, Kentucky, and Evansville, Indiana, weather stations. For the forecast period, the number of households in Big Rivers' service area is projected to grow at an average rate of 0.4 percent. Employment is projected to increase at an average rate of 0.5 percent annually, real household income at an average rate of 1.9 percent annually, gross regional output at an average annual rate of 2.3 percent, and retail sales at an average annual rate of 1.4 percent.[12]

Prior to Big Rivers' preparation of its 2013 load forecast, projections of its members' contributions to the rural system peak demand were based on projections of rural system energy requirements and assumed load factors. For the 2013 load forecast, an econometric model was developed to project the rural system peak demand by month and then aggregated based on coincidence factors for each member cooperative.

The 2013 forecast was reviewed in conjunction with preparation of the 2014 IRP. The review included an analysis and comparison of energy and peak demand projections for 2013 to the actual values for 2013. While the forecast was not changed as part of this review, a number of additional sensitivities were developed. The forecast reflects retail rate increases of nearly 40 percent for rural system customers during the period 2014-2016. For those customers, the elasticity of consumption relative to price is

[11] Big Rivers' IRP, Table 4.13 at 47.

[12] Big Rivers' Load Forecast at 3.

-0.18, which was determined using the regression models developed to forecast average energy consumption for each of the three member distribution cooperatives.[13]

FORECASTING APPROACH AND MODELS

A "bottom-up" approach is used in developing the load forecast, as projections are developed for each of the three member owners and then aggregated to Big Rivers' level.[14] Projections are developed for two customer classifications: rural system and direct serve. The rural system consists of residential, commercial, and other customers served at the retail level by the member owners. The direct-serve class includes all large commercial and industrial customers directly served from Big Rivers' facilities.

Weather Impacts

Heating and cooling parameters are represented as a combination of degree days, equipment market share, and equipment efficiency. In this manner, the three factors can be quantified in one variable. In this way, degree days take their respective unit values, equipment market shares (percent of customers with electric heating or cooling equipment) take respective unit values between 0.00 and 1.00, and equipment efficiencies take values between 1.00 and 0.00, which is computed as the inverse of the average efficiency in each year since 1991. The inverse of the relative efficiency is used to develop the data series because it decreases over time and reflects the theoretical assumption that energy consumption declines as equipment efficiency increases.[15] For the forecast period, normal weather was modeled using data from NOAA for the 20-year period ended in 2012 based on temperatures recorded at the Evansville, Indiana, and Paducah, Kentucky, airports.[16]

Economic Outlook

Big Rivers' management concluded that economic activity over the forecast period was reasonably represented in the projections obtained from Moody's Analytics. Economic outlooks were developed individually for each member cooperative and quantified in the forecasting models. The economic outlook presented in the base case forecast reflects a continuing relatively slow recovery from the 2008-2009 recession followed by moderate growth over the extended long-term.[17]

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[13] Big Rivers' IRP at 12.

[14] Big Rivers' Load Forecast at 20.

[15] Big Rivers' IRP at 54.

[16] Big Rivers' Load Forecast at 15.

[17] *Id.* at 14.

Price Elasticity

The real price of electricity is expressed in annual amounts to mitigate monthly variations in the average price. The elasticity of demand with respect to price is not an independent variable, but is derived via a regression model. For Big Rivers' members, consumption is virtually inelastic with respect to price. Based on a 1 percent increase in price, the IRP reflected elasticity coefficients of demand of -.21 percent for Kenergy and -.16 percent for Meade and JPEC. Elasticities of -.15 from EIA, -.30 from the Rand Journal of Economics, and -.27 from the National Renewable Energy Laboratory were provided for comparison.[18]

Short-Term Models

The forecast contains short-term and long-term forecasts. The short-term forecast projects monthly energy and demand requirements over the 2013–2017 period. It includes projections of rural system energy sales, rural system coincident peak demand, total system energy sales, and total system non-coincident peak demand. Regression models are used to project monthly energy use and number of customers for the rural system for each of the three member cooperatives and aggregated to the G&T level. Energy sales projections for the direct-serve class were developed individually by customers based on historic trends, operating characteristics, and information provided the cooperatives by individual customers.[19]

Projections of rural system coincident peak ("CP") demand are developed on a monthly basis using an econometric model. Projections of direct-serve peak demand are based on historic trends, operating characteristics, and information made available to the member cooperatives by individual customers. Total system non-coincident peak ("NCP") demand is equal to the sum of the rural system CP demand and the direct-serve NCP demands. Native system CP is equal to rural system CP plus an estimate of direct-serve CP.[20]

Long-Term Models

The primary driver of growth in rural system sales over the forecast period is projected to be increases in the number of customers. The long-term forecast was developed using both econometric models and informed judgment. Econometric models were used to project the number of customers and average energy consumption per customer for the rural system class. Informed judgment was used to forecast energy sales and peak demand for each large customer included in the direct- serve class. After an econometric model was developed to project rural system CP demand for the period 2013-2017, the resulting 2017 load factor was applied to the long-term rural system energy forecast to project the rural system peak demand for the years 2018-2028.[21]

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[18] Big Rivers' IRP at 53.

[19] Big Rivers' Load Forecast at 18.

[20] *Id.*

[21] *Id.* at 19.

RESIDENTIAL ENERGY SALES

Residential sales for Big Rivers' three member cooperatives are projected to increase at an average annual rate of 0.7 percent over the forecast period. Sales are projected to decline during 2014-2016, as customers are expected to reduce usage in response to the nearly 40 percent increases in rates referenced earlier in the report. Beyond 2016, residential sales are expected to grow at an average annual rate of 1.1 percent. Energy sales are projected to grow from 1,476,266 MWh in 2014 to 1,647,478 MWh in 2028. Customer growth, projected at 0.8 percent per year, is the primary driver in the forecasted increase. Use per customer is projected to be flat over the forecast period, going from 1,246 kWh per month in 2014 to 1,241 kWh per month in 2028.[22]

COMMERCIAL AND INDUSTRIAL ENERGY SALES

This classification is broken down into small commercial and industrial, which is made up of all commercial and industrial customers that are not direct-serve customers, and large commercial and industrial, which consists of the direct-serve customers. Sales for the small commercial and industrial class are projected to increase at a rate of 0.7 percent per year from 2013 to 2028. This results in an increase in annual sales from 724,071 MWh in 2014 to 791,234 MWh in 2028.[23] Growth in the number of customers, projected at 0.8 percent annually, is the primary driver of growth in sales. Consumption is projected to be relatively flat, increasing at an average annual rate of 0.3 percent over the forecast period.

The large commercial and industrial class customers tend to be large enough to have an annual peak demand equal to or exceeding 1 MW. Sales for this class are projected to be virtually flat during the forecast period as the forecast includes no new customers within this classification. Energy sales are projected to go from 981,796 MWh in 2014 to 982,555 MWh in 2028.[24]

OTHER ENERGY SALES

Other energy includes sales for street lighting and irrigation. The combined sales for these categories, which account for less than 0.1 percent of total sales, are projected to grow at an average annual rate of 0.8 percent over the forecast period. This rate of growth will increase these sales from 3,883 MWh in 2014 to 4,205 MWh in 2028.[25]

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[22] Big Rivers' IRP at 34.

[23] *Id.* at 35.

[24] *Id.* at 36.

[25] *Id.* at 39.

REPLACEMENT LOAD

As stated previously, since its last IRP was filed in 2010, Big Rivers has lost the load of two aluminum smelters from its system after the smelters elected to terminate their service contracts. The smelters had a combined demand of approximately 800 MW and combined energy requirements of approximately 7,000,000 MWh annually.[26]

Big Rivers identified the steps taken to mitigate the smelter contract terminations, including implementing a Load Concentration Analysis and Mitigation Plan ("Mitigation Plan").[27] The Mitigation Plan calls for Big Rivers to enact several steps, as follows:

- Seek rate increases to offset loss of the revenue provided by the smelters;
- Sell excess power when market prices exceed its marginal generation costs;
- Idle or reduce generation when market prices do not support generating;
- Find load to replace that load previously consumed by the aluminum smelters; and
- Consider the possibility of selling or leasing some of its generating units.

Big Rivers idled its Coleman generating units in May 2014.[28] Replacement load enters its load forecast in 2016 with a demand of 106 MW and a 75 percent load factor. The replacement-load demand increases steadily to 827 MW (including losses) in 2021 and remains at that level with a 75 percent load factor for the rest of the forecast period. The replacement load is included in the base case and all scenarios and sensitivities in the IRP.[29] Replacement-load energy sales are projected to be 658,800 MWh in 2016 and increase to 5,270,400 MWh by the end of the forecast period in 2028.[30]

TOTAL SYSTEM ENERGY REQUIREMENTS

Total energy requirements for the Big Rivers system in 2014, including losses and the HMP&L load, are projected to be 4,036,693 MWh in the base case forecast. With the projected replacement load to be added beginning in 2016, total system energy requirements in the base case forecast are projected to increase to 9,778,266 MWh by 2028.[31]

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[26] The aluminum smelters operated at load factors of approximately 99 percent.

[27] Big Rivers' IRP at 37.

[28] Big Rivers had also intended to idle the Wilson unit in 2014; however, Big Rivers has entered into forward power sales under which the Wilson unit will operate at least through the end of 2015.

[29] Big Rivers' IRP at 38.

[30] *Id.*

[31] *Id.* at 30.

PEAK DEMAND

Big Rivers forecasts rural system CP demand, native system CP demand, and total system NCP demand. Rural CP demand is the maximum simultaneous load of all rural substations on the Big Rivers system. Native system CP demand is the sum of the rural system CP demand plus direct-serve CP demand. Total system NCP in the forecast is represented as the sum of native system CP, total direct serve NCP, and the projected replacement load discussed in the previous section. Under normal peaking weather conditions, Big Rivers is projected to be a summer peaking system throughout the forecast period; however, if colder than normal conditions occur during peak periods of the winter season, its annual peak could be set during that season.

Rural system peak demand is projected to increase at a 0.9 percent annual average rate over the forecast period, starting at 511 MW in 2014 and reaching 583 MW in 2028.[32] Direct-serve peak demand is projected to be flat over the forecast period, ranging from 125 to 126 MW. Total system peak demand, including replacement load, HMP&L, and system losses, is projected to increase from 775 MW in 2014 to 1,682 MW in 2028.[33]

RANGE FORECASTS

Big Rivers' base case forecast reflects expected economic growth, average weather conditions, and current Environmental Protection Agency ("EPA") regulations. To address the uncertainty related to these factors, high- and low-range projections were developed. These high and low long-term range forecasts were developed to reflect the energy and demand requirements corresponding to: (1) more optimistic or pessimistic economic growth; (2) mild or extreme weather conditions; and (3) potential EPA and other environmental regulations.[34] In addition, sensitivities were performed on fuel prices, energy market and capacity market prices, replacement load, and a potential renewable portfolio standard load.[35]

Economic Growth Scenarios

The two economic drivers in the forecasting models, number of households and average household income, are adjusted from the base case values to produce the optimistic and pessimistic forecast scenarios. In the optimistic scenario, in 2028, total system energy requirements are projected at 9,947,574 MWh, while in the pessimistic scenario they are projected at 9,287,248 MWh, compared to the base case level of

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[32] *Id.* at 31.

[33] *Id.*

[34] *Id.* at 54.

[35] *Id.* at 103.

9,778,266 MWh. Peak demands under the optimistic and pessimistic scenarios in 2028 are 1,712 MW and 1,597 MW, respectively, compared to the base case of 1,682 MW.[36]

Weather Scenarios

To develop weather scenarios, Big Rivers used the actual historical values of degree days from past years when degree days reached their highest recorded totals. For the mild case, degree days were set at the 1990 level; for the extreme case they were set at 1980 level. In the mild weather scenario, total system energy requirements in 2028 are projected at 9,680,213 MWh, while in the extreme weather scenario they are projected at 9,904,391 MWH, compared to the base case level of 9,778,266 MWh. Peak demand under the mild- and extreme-weather scenarios are 1,617 MW and 1,702 MW, respectively, compared to the base case peak demand forecast of 1,682 MW.[37]

Environmental Regulation Scenarios

Big Rivers developed two environmental scenarios: One includes environmental-related costs except for those costs associated with complying with the Cross State Air Pollution Rule ("CSAPR") and with regulation of carbon. The second scenario includes CSAPR cost but excludes carbon regulation. Under both scenarios, the retail price of electricity is projected to be higher than in Big Rivers' base case. In Scenario 1, total system energy requirements in 2028 are projected to be 9,674,875 MWh, while in Scenario 2 they are projected to be 9,619,944 MWh in 2028. With higher prices, each of the scenarios' forecast is less than the 9,778,266 MWh included in the base case. Peak demand is also projected to be less in 2028 in both scenarios, compared to the base case. Compared to the base case peak demand of 1,682 MW, the peak demands in the scenarios are 1,664 and 1,654 MW in Scenario 1 and Scenario 2, respectively.[38]

Big Rivers also developed a carbon-tax scenario which used 2020 as the year in which the impacts of a carbon tax would begin to be realized. The scenario included a $10 fee per metric ton of carbon dioxide ("CO_2") and a $30 fee per metric ton of CO_2. The impacts of both carbon tax scenarios are lower total system energy requirements and lower peak demands in 2028. Total system energy requirements are projected to be 9,671,515 MWh and 9,434,166 MWh, respectively, under the $10 scenario and the $30 fee scenarios, compared to the base case level of 9,778,266 MWh. Compared to the base case peak demand of 1,682 MW, the peak demands under the $10 and $30 scenarios are 1,661 MW and 1,616 MW, respectively.[39]

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[36] Big Rivers' Load Forecast at 55.

[37] *Id.*

[38] *Id.* at 56.

[39] *Id.* at 57.

SIGNIFICANT CHANGES

Big Rivers filed its previous IRP, its 2010 IRP, in November of 2010. One month later, it became a transmission-owning member of MISO. In 2013 and 2014, the two aluminum smelters served by Big Rivers terminated their power supply contracts, which reduced Big Rivers' system load by more than 800 MW. The smelters have continued to operate under contracts which permit them to purchase energy at market-based rates while they continue to receive transmission service from Big Rivers. In response to these events, Big Rivers' Coleman Generating Station has been idled since May 2014.

Big Rivers has updated portions of its load forecasting methodology since its last IRP was filed. Projections of the member systems' contributions to the rural system peak demand were based on projections of rural system energy requirements and assumed load factors. For the load forecast included in this IRP, an econometric model was developed to project Big Rivers' rural system peak demand, by month, and then aggregated based on coincidence factors developed by each member system.[40]

Less growth in the number of households and a leveling of average energy use in recent years due to increases in appliance efficiencies and energy conservation have resulted in lower total energy requirements in the current forecast, compared to previous forecasts.[41] Along with reduced energy requirements, projections in the current forecast reflect lower peak demands than in earlier forecasts.[42]

INTERVENOR COMMENTS AND BIG RIVERS' REPLY

Among the intervenors, only the AG and the Sierra Club submitted comments on the Big Rivers IRP. KIUC did not file comments.

AG's Comments

The AG's comments focus on the Mitigation Plan discussed earlier in this section under the heading REPLACEMENT LOAD, the amount by which Big Rivers' generating capacity exceeds its native load, and the potential sale of the Coleman Station. Citing the Commission's April 25, 2014 Order in Case No. 2013-00199,[43] Big Rivers' most recent rate case, in which "selling generation assets" was identified as an issue to be considered in the focused management audit the Commission ordered, the AG opines that Big Rivers has not adequately considered a possible sale of the Coleman Station.[44]

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[40] *Id.* at 22.

[41] The impacts of new EE programs are also included in the forecast.

[42] Big Rivers' IRP at 23.

[43] Case No. 2013-00199, *Application of Big Rivers Electric Corporation for a General Adjustment in Rates Supported by Fully Forecasted Test Period* (Ky. PSC June 6, 2014).

[44] Attorney General's Comments ("AG Comments") at 5.

The AG refers to the Coleman Station as the lynchpin in BREC's IRP and states that Big Rivers "should have conducted a detailed assessment of potentially cost-effective options for this resource."[45] The AG goes on to argue, "The future of the Coleman units are so critically interwoven to the company's overall future that the company should have included in the filing a Net Present Value Revenue Requirements ("NPVRR") analysis regarding Coleman's value to BREC's three member-owner cooperatives."[46] The AG included an NPVRR analysis with its comments, from which it concluded that even if Big Rivers were to sell the Coleman units at an amount greatly below their net book value, Big Rivers would still realize a net gain over the actual value the units are expected to generate over the IRP planning horizon.[47]

The AG claims that "Big Rivers' continued adherence to its position that it must obtain Coleman's book value is preventing the company from seeking the best least-cost solution for its members and their ratepayers."[48] He also states that "if Big Rivers is going to continue to model and project its Mitigation Plan, it should also model scenarios for the sale of Coleman which, after all, is a potential event contemplate in the Mitigation Plan itself."[49]

Sierra Club's Comments

The Sierra Club submitted written comments as well as a report prepared for it by Synapse Energy Economics ("Synapse Report") critiquing Big Rivers' IRP. The Sierra Club states that Big Rivers' IRP is flawed because:

- Every scenario assumes the continuation of all of Big Rivers' existing coal-fired generating units through 2028, rather than evaluating whether retiring, repowering, or selling one or more units would be a lower cost/lower risk resource option.
- Every scenario assumed Big Rivers would acquire 800 MW of replacement load as called for in its Mitigation Plan, rather than evaluating the likelihood or impact of being able to acquire only a lower level of replacement load.
- Big Rivers overstated the value of its existing generation resources by highly overestimating likely capacity prices.[50]
- Big Rivers' IRP included unreasonable assumptions for future coal prices.

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[45] *Id.*

[46] *Id.*

[47] *Id.* at 7.

[48] *Id.* at 7–8.

[49] *Id.* at 8–9.

[50] The Synapse Report also criticizes use of the Wood Mackenzie energy price forecast relied upon by Big Rivers, claiming there may be a double counting of capacity price revenues as a result.

- Big Rivers failed to evaluate options for reducing its carbon emissions and failed to incorporate a carbon price into its base case as well as most of the scenarios it modeled.
- Big Rivers failed to evaluate, much less propose, including higher levels of EE that its own consultant has identified as achievable and has estimated could provide between $63 and $270 million in net benefits.[51]

The Sierra Club states that until these shortcomings have been remedied, the reasonableness of Big Rivers' future actions which rely on this IRP will be suspect. It asserts that the Staff should find the IRP to be inadequate and require Big Rivers to address each of its shortcomings in all future resource planning and decision making.[52]

Citing Big Rivers' assumptions that: (1) it would acquire 800 MW of replacement load in all 18 of the scenarios presented in the IRP; and (2) in all 18 of its scenarios, all four of its coal-fired power plants would operate for the entire planning period, which it described as "fundamentally flawed," the Sierra Club claims that Big Rivers' approach to its IRP was inadequate.[53] The Sierra Club cites to the fact that the scenario analyses performed by Big Rivers varied a single assumption contained in the Base Case, stating that "The scenarios are examined only one at a time, as if multiple deviations from the company's base case are not conceivable."[54] The Sierra Club states that Big Rivers identified a single resource portfolio and simply modeled the impacts to ratepayers of the resource plan if conditions were mildly different from those assumed in Big Rivers' base case. It also asserts that Big Rivers assumed, in every scenario, that its Mitigation Plan would succeed, rather than testing that assumption or evaluating the impacts if the Mitigation Plan did not succeed.[55]

The Sierra Club argues, using the potential costs that were identified by Big Rivers to achieve compliance with CSAPR, that if the Coleman units were to return to service, given the likely need to lower its highest-in-the-nation carbon emission rate in order to comply with EPA's Clean Power Plan ("CPP"), Big Rivers should have evaluated whether restarting the Coleman units or continuing to operate the Wilson unit was in the best interests of its ratepayers.[56] Referring to Big Rivers' excess capacity, the Sierra Club claims that "a prudent utility would openly and transparently evaluate both the likelihood of success and cost of acquiring replacement load for that capacity, in comparison to the option of retiring or selling such excess capacity. . .however, Big

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[51] Sierra Club's Comments on the 2014 Integrated Resource Plan of Big Rivers Electric Corporation ("Sierra Club Comments") at 2.

[52] *Id.* at 2–3.

[53] *Id.* at 9–10.

[54] Synapse Report at 16–17.

[55] Sierra Club Comments at 9.

[56] *Id.* at 10.

Rivers simply swept all of those questions under the rug and presented its desired resource plan as a *fait accompli* in the IRP."[57]

Citing the Synapse report, Sierra Club states that, "Big Rivers' decision not to include a CO_2 price in the Company's base case prevents them from being able to properly mitigate risk. This type of planning can lead to unnecessary, unanticipated costs which its rural customers cannot afford, and its industrial customers will not willingly accept."[58] Sierra Club went on to state, "The Company's decision to neither allow the model to reduce carbon emissions by retiring coal plants nor to include a reasonable CO_2 price in most of their modeling runs will ultimately result in endorsement of resource choices that are not in the best interest of its members or in the interest of the long term financial health of the company. Delaying action to reduce CO_2 emissions only makes future emissions mitigation more costly."[59]

Citing the Commission's Order in Case No. 2013-00199 calling for a management audit focused on Big Rivers' Mitigation Plan and its implementation to date of the plan, the Sierra Club points to the following issues identified in the Commission's Request for Proposals to perform the audit:

- Whether Big Rivers' coal-fired generating fleet can be competitive and make sales of capacity and energy in the wholesale markets and offset Big Rivers' fixed costs.
- The potential sale or lease of one or more of Big Rivers' coal-fired generating units.
- Whether environmental compliance is adequately reflected in the Mitigation Plan.
- The potential for debt restructuring and/or refinancing.

With such issues, the Sierra Club argues that an assessment is required of whether Big Rivers' resource plan "is in the best interest of ratepayers, or whether some other option (such as retiring or selling one or more coal units) would be a lower cost/lower risk approach. As such, Sierra Club urges the independent auditor to carefully consider and incorporate the points raised in these comments and the Synapse Report as part of assessing the reasonableness of the Mitigation Plan."[60]

Big Rivers' Reply to Intervenor Comments

In response to intervenor comments stating that selling the Coleman units (or other generating units), should have been modeled and evaluated in its IRP, Big Rivers states that at the time it began working on its IRP in late 2013, it was facing tremendous

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[57] *Id.* at 11.

[58] Synapse Report at 14.

[59] *Id.*

[60] Sierra Club Comments at 12.

uncertainty on many fronts. Those included: (1) the outcome of its 2012 and 2013 rate cases; (2) evaluating whether the Coleman and Wilson units should continue to operate; (3) attempting to idle the Coleman units; (4) pursuing sales that would enable the Wilson unit to continue operating; (5) negotiating sales agreements with a Nebraska consortium; (6) pursuing other replacement load opportunities; (7) pursuing opportunities to sell or lease the Coleman and Wilson units; and (8) environmental regulations regarding CSAPR and EPA's CPP.[61] Big Rivers contends that "[g]iven the uncertainty that existed at the time and the need to pursue the Mitigation Plan strategies to determine the value of the available opportunities, including more definitive analyses in the IRP was just not a reasonable possibility."[62]

Big Rivers also states that "[i]n light of all this uncertainty, Big Rivers' management prudently did not discard its Wilson and Coleman Stations in a knee-jerk reaction to the smelter contract terminations, and instead appropriately investigated the Mitigation Plan strategies for maximizing the value of the Wilson and Coleman Stations for the benefit of Big Rivers' members and their retail customers."[63] It further claims that "[b]y not simply throwing away valuable generating assets, Big Rivers is able to keep Coleman on its system for only the cost of maintaining it in an idled state while more certainty is achieved regarding market prices and environmental regulations."[64] Big Rivers also argues that "[m]aking definitive plans to retire plants or to sell them at a loss without additional certainty would not maximize the value of the plants, and it would not be in the best interests of Big Rivers' members or their retail customers."[65]

On criticisms of its assumption that it would secure 800 MW of replacement load in every scenario it modeled, Big Rivers states that its management used informed judgment to develop the assumption that it would obtain the amount of replacement load over a five-year period. Big Rivers also states that because it has made no permanent decisions on its plans for the Coleman and Wilson Stations, it modeled the possibilities about the future of those facilities "that it considered reasonable."[66] Big Rivers goes on to state that "[I]t is clearly not in Big Rivers' members best interest to retire Coleman and Wilson Station or to sell them as a significant loss while Big Rivers is in the process of achieving more clarity on future environmental regulations and energy and capacity market prices."[67]

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[61] Response of Big Rivers Electric Corporation to the Comments filed by the Attorney General and Sierra Club ("Big Rivers' Reply") at 4.

[62] *Id.* at 5.

[63] *Id.* at 4.

[64] *Id.* at 5.

[65] *Id.* at 5-6.

[66] *Id.* at 6.

[67] *Id.*

In response to Sierra Club comments critical of its forecast of capacity prices, Big Rivers states that the capacity price forecast it relied upon is supported by MISO's estimation of increasing capacity shortfalls continuing through 2023-2024.[68] Regarding the possibility that its use of the Wood Mackenzie energy price forecast may result in a double counting of capacity price revenues, Big Rivers asserts that the specific energy market curves that it used in the modeling portions of its IRP did not include any capacity costs and that it was appropriate to model market capacity rates and revenues separately from energy projections.[69]

Concerning comments that are critical of the scenarios included in its IRP, Big Rivers states that its IRP includes base case and high and low sensitivities around fuel prices and energy and capacity market prices as well as high and low sensitivities of carbon prices.[70] Big Rivers asserts that it included load sensitivities for base case, mild and extreme weather and base case, optimistic, and pessimistic economic conditions, plus two sensitivities for environmental compliance costs in its IRP.[71] It avers that its IRP included sensitivity runs around each of the risks noted by the Sierra Club, and that therefore the Sierra Club's implication that the IRP did not include these cases is false.[72]

In response to the Sierra Club's criticism that it did not evaluate or propose higher levels of DSM/EE, Big Rivers claims that "[i]t is false that Big Rivers did not evaluate higher levels of demand-side management ("DSM") and energy efficiency measures."[73] It states that GDS performed a potential DSM study to evaluate a range of potential EE and Demand Response programs, and that the Sierra Club's "real complaint is that Big Rivers did not implement all of the programs the potential study found to be cost effective." Big Rivers states that implementing additional EE measures would require additional rate increases and that it decided that now was not the right time to seek additional rate increases.[74]

RESPONSE TO RECOMMENDATIONS ON 2010 IRP

The recommendations Staff made in its report on Big Rivers' 2010 IRP and Big Rivers' responses thereto, all included in Appendix C to Big Rivers' IRP, are as follows:

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[68] *Id.* at 9.

[69] *Id.* at 10.

[70] *Id.* at 11.

[71] *Id.*

[72] *Id.*

[73] *Id.* at 14.

[74] *Id.*

o *Big Rivers should present and discuss its specific models and equations with greater specificity. Underlying assumptions and modeling variables need to be explained clearly and concisely with as much detail as possible.*

"Refer to Section 4.6 for a detailed description of the forecasting models, including the theoretical assumptions supporting the model specifications and each model input."

Section 4.6 of the IRP includes discussions of the following:

1. The load forecast database;
2. Forecast model inputs;
3. Key load forecast assumptions; and
4. Forecast model specifications.

The discussion of these subjects is summarized earlier in this section under the heading FORECASTING APPROACH AND MODELS.

o *Big Rivers should consider updating its load forecasts annually.*

"Big Rivers reviews its load forecast annually and adjusts the forecast as necessary for planning purposes. When significant changes occur, Big Rivers has updated its load forecast more frequently than every two years. Big Rivers submitted an updated load forecast to RUS in January 2013 as well as May 2013, each reflecting the loss of a smelter load. In accordance with guidelines established by the RUS and with its current Load Forecast Work Plan, which is approved by RUS, Big Rivers updates and files its load forecast with RUS at least every two years."

o *Big Rivers should explicitly account for future DSM and energy efficiency programs in its load forecasts.*

"Big Rivers began explicitly accounting for future DSM and energy efficiency programs in its 2011 Load Forecast. The 2014 IRP is based on Big Rivers' 2013 Load Forecast, which also explicitly accounts for future program impacts. Refer to Appendix A, 2013 Load Forecast, Section 6.5, for details regarding how Big Rivers' future DSM and energy efficiency programs are quantified in the load forecast."

o *Big Rivers should include pending EPA regulations and any other regulations that could potentially have major impacts upon its regional and service territory economies in its sensitivity analysis.*

"Refer to Section 4.7 for a discussion of the four sensitivities developed that address potential EPA regulations."

Section 4.7 of the IRP discusses the scenarios summarized in this section under the heading Environmental Regulation Scenarios. The first sentence of that section

reads, "Big Rivers' base case forecast reflects expected economic growth, current Environmental Protection Agency ("EPA") regulations, and normal weather conditions." Later in the section, reference is made to the range projections and forecasts that were developed and that those included "potential EPA and environmental regulations."[75] Big Rivers explained that it had developed two environmental scenarios. The first included environmental-related costs, except for the cost of CSAPR compliance and the cost of complying with carbon regulation. The second scenario added the cost of complying with CSAPR to the costs included in the first scenario.

o *Big Rivers should run forecast simulations in its sensitivity analysis in order to gain a better understanding of the probability of occurrence for the various scenarios, including the potential closure of one or both of the aluminum smelters on its system.*

"In addition to the base case forecast, Big Rivers prepared forecast scenarios to evaluate the impacts of varying economic conditions, market price sensitivities, fuel price sensitivities, weather conditions, and potential environmental regulations. Key model inputs were adjusted in developing the economy, market, fuel, weather, and environmental regulation scenarios and were set to values that Big Rivers believes would be similar to the 95% and 5% points of their respective probability distributions. The scenarios developed for potential environmental regulations reflect the sensitivity of energy and peak demand to various carbon tax levels relative to the base case forecast, as well as to increased rates due to other environmental expenditures."

Staff is generally satisfied with the responses to its prior recommendations. However, as with the 2010 IRP, Staff finds troublesome Big Rivers' position that it should wait to evaluate the impacts of pending environmental requirements until those requirements are more nearly finalized. Hence, Staff concludes that Big Rivers' response to the recommendation contained in its report on Big Rivers' 2010 IRP is inadequate on this issue.

DISCUSSION OF REASONABLENESS

Based on its review of the record, including intervenor comments and Big Rivers' reply thereto, Staff is generally satisfied with most aspects of Big Rivers' forecasts for its native load.[76] Staff considers Big Rivers' discussion of how weather is treated within its forecasts and its consideration of the price elasticity of demand to be satisfactory. However, Staff would like to see an analysis, in Big Rivers' next IRP, of the impacts of

[75] Big Rivers' IRP at 54. More discussion of this can be found under *Environmental Regulation Scenarios*.

[76] Staff's *Discussion of Reasonableness* does not address every point raised in the intervenors' comments, only those points on which Staff believes Big Rivers' reply was inadequate or not persuasive.

using periods of more than and less than 20 years in the development of normal weather in Big Rivers' next IRP.[77]

In addition, Staff is less than satisfied with the following three aspects of the forecasts in Big Rivers' IRP: (1) all scenarios/sensitivities in Big Rivers' IRP assume that all existing generating units would operate for the entire planning period; (2) every one of the 18 scenarios/sensitivities include the 800 MW of replacement load that is included in Big Rivers' Mitigation Plan; and (3) the extent to which pending environmental regulations were included in the forecasts. In Staff's opinion, Big Rivers' replies to the intervenor criticisms on these three matters are inadequate and non-persuasive.

Continued Operation of All Generating Units

Big Rivers claims that, with the level of uncertainty it faced as it was preparing its IRP, "including more definitive analyses in the IRP was just not a reasonable possibility." While it was facing uncertainty, Big Rivers was able to perform 18 scenario/sensitivity analyses for it IRP. It seems quite reasonable for these analyses to have included some number of scenarios in which not all of Big Rivers' generating units operated for the entire planning period. It may not plan to "retire any generating units in the term of the IRP,"[78] but that does not obviate the need for Big Rivers' IRP to include analyses of potential future circumstances that differ from its current plans. This is particularly so given that a possible sale or retirement of some of its generating units is a component of Big Rivers' Mitigation Plan. As stated in Staff's report on Big Rivers' 2010 IRP, "One purpose of a long-range load forecast's sensitivity analysis is to investigate how a utility will be affected by adverse conditions and then to plan accordingly."[79]

In addition, it appears that Big Rivers may have misunderstood the comments on this subject. On page 4 of its reply, Big Rivers states that, given the uncertainty it faced when its IRP was being prepared, it "prudently did not discard its Wilson and Coleman Stations in a knee-jerk reaction to the smelter contract terminations." On page 5 of its reply, referring to the Coleman and Wilson units, Big Rivers states, "By not throwing away valuable generating assets...." Finally, on pages 5-6 of its reply, Big Rivers states, "Making definitive plans to retire plants or to sell them at a loss without additional certainty would not maximize the value of the plants, and it would not be in the best interests of Big Rivers' members or their retail customers." These statements imply that the intervenor comments were calling for Big Rivers to move forward with the retirement or sale of one or more of its generating units when, contrary to these statements, the intervenor comments were merely calling for Big Rivers to conduct scenario analyses in order to evaluate the impacts of retiring or selling generating units.

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[77] In response to Staff's First Request for Information ("Staff's First Request"), Item 14, Big Rivers indicated that it did not consider periods of time more or less than 20 years.

[78] Big Rivers' response to Sierra Club's Initial Information Request ("Sierra Club 1"), Item 16(g).

[79] Case No. 2010-00443, *2010 Integrated Resource Plan of Big Rivers Electric Corporation* (Ky. PSC Dec. 21, 2011).

Obtaining 800 MW of Replacement Load

Big Rivers states that it used informed judgment to develop the assumption that it would secure 800 MW of replacement load over a five-year period. It also states that, because it has made no permanent decisions for the Coleman and Wilson Stations, it modeled future possibilities for those generating stations that it believed reasonable.

Staff takes no issue with Big Rivers' use of informed judgment as the basis upon which its assumption that it would secure 800 MW of replacement load over a period of five years was developed. However, Staff must question why "informed judgment" did not cause Big Rivers to conclude, irrespective of whether it has made permanent decisions regarding the Coleman and Wilson Stations, that it would be reasonable to model future possibilities for those facilities that differ from the predicted outcome of securing 800 MW of replacement load contained in its Mitigation Plan.

The absence from Big Rivers' IRP of any analyses of scenarios in which it does not secure the desired 800 MW of replacement load clearly results in an IRP which is less reasonable and less robust than if such scenarios had been analyzed. While Staff expects that all stakeholders will view the success of Big Rivers' Mitigation Plan in a positive manner, it serves the interests of no stakeholder, including Big Rivers, to plan for the future solely based on the assumption that such success will be achieved. Big Rivers' IRP should have included tests of that assumption and analysis of the outcomes in the event the Mitigation Plan does not succeed.

Inclusion of Pending Environmental Regulations in the Forecasts

Big Rivers included two environmental sensitivities and two scenarios reflecting carbon regulation in its IRP. However, Staff finds the Sierra Club's expressed concerns that the omission of analyses to reduce emissions by possibly retiring generating units will not be in the best interests of either Big Rivers or its members to be compelling. While not necessarily in full agreement with the Sierra Club that "delaying action to reduce CO_2 emissions only makes future emissions mitigation more costly," Staff believes that a delay in such action could lead to a more costly outcome.

RECOMMENDATIONS

Staff's recommendations for Big Rivers' forecasting in its next IRP are as follows:

- *Big Rivers should develop a more diverse group of forecast scenarios which includes a meaningful number of alternatives that are not part of its Mitigation Plan.*
- *Big Rivers should include new or pending environmental regulations which may impact its generation fleet in its sensitivity analyses in a manner that shows how it may respond to such regulations.*
- *Big Rivers' next IRP should include an analysis of the impacts of using time periods less than and greater than 20 years in the development of normal weather for use in its load forecasts.*

SECTION 3

DEMAND-SIDE MANAGEMENT AND ENERGY EFFICIENCY

INTRODUCTION

This section discusses the DSM/EE portion of Big Rivers' 2014 IRP. Since the 2010 IRP was filed, Big Rivers has made significant progress in developing and implementing its DSM/EE portfolio in conjunction with its DSM/EE Working Group ("Working Group")[80] and its member cooperatives.

Big Rivers has been offering residential and commercial EE programs since October 2011 in addition to EE consumer education. The programs operate within an annual budget of $1 million collected in base rates through the Rural Delivery Service ("RDS") rate schedule.[81] Initial programs were tariffed in early 2012, and two additional programs were added in mid 2013. 2014 was the first year all programs were expected to be offered through the entire calendar year.[82]

Based upon the DSM/EE market potential study ("Study") performed by GDS in preparation of the 2010 IRP and collaborations of the Working Group, Big Rivers launched eight DSM/EE pilot programs in 2011. In Case No. 2011-00036,[83] Big Rivers was granted Commission approval to increase its annual DSM/EE expenditures to $1 million. The Commission also ordered DSM/EE reporting requirements for Big Rivers. In Case No. 2012-00142,[84] the Commission approved ten DSM/EE programs as proposed by Big Rivers. In Case No. 2013-00099,[85] the Commission approved two new DSM/EE programs and various modifications to the ten existing programs.

In conjunction with this IRP, GDS performed a DSM/EE and demand response analysis.[86] The analysis was based on an updated market potential study for DSM/EE and demand response measures for 2014 through 2023, although the primary analytical

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[80] The Working Group began meeting in 2009 to evaluate, design, and implement functional and cost-effective DSM programs that reduce winter and summer peak demand and energy consumption. It is composed of representatives from Big Rivers and from its three member distribution cooperatives.

[81] Big Rivers' IRP, Appendix C, at C-2.

[82] *Id.*

[83] Case No. 2011-00036, *Application of Big Rivers Electric Corporation for a General Adjustment in Rates* (Ky. PSC, Nov. 17, 2011).

[84] Case No. 2012-00142, *Tariff Filing of Big Rivers Electric Corporation to Implement Demand Side Management Programs* (Ky. PSC, Aug. 22, 2012).

[85] Case No. 2013-00099, *Tariff Filing of Big Rivers Electric Corporation to Revise and Implement Demand-Side Management Programs* (Ky. PSC June 6, 2013).

[86] Big Rivers hired GDS in October 2013 to perform a market potential study of DSM/EE measures and demand response.

focus for DSM programs was the first three years.[87] The results were projected for the 15-year IRP forecast period. As a result of the analysis, new measures were incorporated into existing programs, but no new programs were added to the portfolio. The analysis also found that most demand response programs are not cost-effective at this time, and those that are cost-effective are either too difficult to implement or are only marginally cost effective; therefore, GDS suggested that Big Rivers would be better served by using its DSM/EE budget to pursue higher value EE programs.[88]

Based upon a $1 million annual budget, Big Rivers expects to achieve energy savings from new and increased DSM/EE programs of 86,065 MWh, with corresponding summer and winter peak savings of 4.8 MW and 6.7 MW, respectively, by 2028.[89]

DSM/EE PROGRAM SCREENING & EVALUATION PROCESS

GDS evaluated five different scenarios in its EE potential study: technical potential, economic potential, achievable potential, program potential with a $2 million annual budget and program potential with a $1 million annual budget. Technical and economic efficiency potential provide a theoretical upper bound for energy savings, while achievable and program efficiency potential attempt to estimate what may realistically be achieved, when it can be captured, and the cost to do so.

Under the achievable potential scenario, the benefit/cost ratio was 2.14, with net benefits totaling over $270 million.[90] Total estimated energy savings from this scenario was 368,891 MWh with a corresponding reduction in peak winter demand of 65 MW and summer peak demand of 64 MW by the end of 2023.[91]

Under the program potential scenario with a $2 million annual budget, the benefit/cost ratio was 2.24, with net benefits over $63 million.[92] Total estimated energy savings from this scenario was 109,776 MWh, with a corresponding reduction in peak winter demand of 12 MW and summer peak demand of 18 MW by the end of 2023.[93]

In the DSM/EE Study, measure lists were created to address different customer classifications and end-use types. Estimates of annual measure savings, costs, and

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[87] Big Rivers' IRP, at 18.

[88] *Id.* at 69.

[89] *Id.* at 42.

[90] *Id.* at 60.

[91] Appendix B, DSM Potential Study at 4.

[92] Big Rivers' IRP at 60.

[93] Appendix B, DSM Potential Study at 4.

useful lives were developed using technical reference manuals, energy modeling software ("REM/Rate") energy calculations, evaluation reports, and other sources.[94] Participation rates were developed using various data sources, including building characteristic data from current Big Rivers' appliance saturation studies, EIA regional data, and budgeting parameters, such as incentives to be paid to retail members for installing EE measures through Big Rivers' DSM/EE programs.[95]

In the evaluation of the cost-effectiveness of specific DSM/EE measures, Big Rivers uses a cost-benefit analysis which measures the net present value of cost against the benefits of its projected load impacts. Measures were screened using the GDS Benefit/Cost Screening Model, which is designed to evaluate the costs, benefits, and risks of DSM programs and services.[96] Included in the benefits are avoided electric supply costs, the reduction in transmission, distribution, generation, and capacity costs valued at the marginal cost for the period when there is an electric load reduction, and the savings of other resources such as fossil fuels and water.[97] Included in the costs are all equipment costs, installation, operation and maintenance, tax credits, cost of removal, and administration costs.[98]

The primary test used to screen DSM measures was the Total Resource Cost Test, which measures the net costs of an energy measure or program as a resource option based on the total costs of the program, including the participant's and the utility's costs. The typical California tests were considered in the screening process.[99] New measures which are found to be cost-effective and viable are recommended for approval, and existing programs are recommended for extension of operation based primarily on prospective cost-effective performance.

The GDS study concluded that significant cost-effective savings remain available in Big River's members' territories[100] and recommended that Big Rivers review the program level spending and savings for a $1 million incentive scenario, compared to a $2 million incentive scenario, determine which level of incentive investment it plans to commit in the future, and then modify its DSM programs to align with the programs included in the program potential evaluation in the study.[101] The $2 million incentive

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[94] Big Rivers' IRP at 17.

[95] *Id.* at 17–18.

[96] *Id.* at 18.

[97] *Id.*

[98] *Id.*

[99] *Id.*

[100] *Id.* at 60.

[101] *Id.*, Appendix B, at 71.

scenario showed significantly higher net benefits compared to the $1 million incentive scenario.[102] Big Rivers stated that it has not yet determined if a change in program level spending is appropriate.[103]

EXISTING DSM PROGRAMS

Big Rivers identified nine programs in its IRP that are currently offered to its member cooperatives' retail customers.[104] Following are the existing programs and activities which are intended to reduce electric consumption and peak demand throughout Big Rivers' members' service territories:

Residential ProgramsResidential Lighting Program;

1. Residential Efficient Appliances Program;
2. Residential HVAC Program;
3. Residential Weatherization Program;
4. Residential New Construction Program;
5. Residential HVAC Tune-Up Program;

Commercial/Industrial ("C&I") Programs

6. C&I Prescriptive Lighting Program;
7. C&I Prescriptive HVAC Program;
8. C&I Prescriptive General Program.

PROGRAM DESCRIPTIONS

Following are brief descriptions of each of Big Rivers' existing DSM programs:

1. Residential Lighting Program – This program offers a residential lighting replacement program to Big Rivers' members. It promotes distribution of compact fluorescent light ("CFL") bulbs by providing reimbursement to members who purchase CFL bulbs. In the GDS market potential study, a recommendation was made to begin to offer rebates for light-emitting diode ("LED") bulbs, as their cost-effectiveness and market share are expected to increase in the next several years.

2. Residential Efficient Appliances Program – Big Rivers provides multiple residential efficient-appliances programs to its members. The program promotes installation of efficient clothes washers and refrigerators and the removal and recycling of older inefficient refrigerators.

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[102] *Id.* at 60.

[103] Big Rivers' Response to Commission Staff's Initial Request for Information ("Staff First Request"), Item 34.

[104] Big Rivers' Response to Staff's First Request, Item 20. Twelve tariffs address Big Rivers' nine DSM/EE programs.

3. Residential HVAC Program – This program offers a residential heating, ventilation, and air conditioning ("HVAC") replacement program. It promotes purchase of high-efficiency HVAC systems with significant energy savings potential.

4. Residential Weatherization Program – This program promotes the implementation of weatherization measures among the retail members of Big Rivers' member cooperatives by providing reimbursement to the retail members for undertaking weatherization improvements at their homes.

5. Residential New Construction Program – This program provides incentives to home owners and builders to use energy efficient building standards as outlined in the Touchstone Energy® certification program. The objective of this program is to support energy efficient design and installation of energy efficient appliances during the construction of new residences.

6. Residential HVAC Tune-Up Program – This program promotes the initiation of annual maintenance on heating and air conditioning equipment by providing reimbursement to retail members of the member cooperatives who have their heating and air cooling systems professionally cleaned and serviced.

7. Commercial/Industrial Prescriptive Lighting Program – This program provides an incentive to commercial and industrial consumers who take service under Big Rivers' RDS Tariff to upgrade poorly designed and low-efficiency lighting systems.

8. Commercial/Industrial Prescriptive HVAC Program – This program provides an incentive to commercial and industrial retail members to upgrade inefficient HVAC equipment and to maintain and tune-up their existing equipment.

9. Commercial/Industrial Prescriptive General Program – This program provides an incentive to commercial and industrial customers served under Big Rivers' RDS Tariff to upgrade all aspects of cost-effective EE achievable in individual facilities.

OTHER PROGRAMS

Big Rivers also has a number of EE programs it does not track because they are educational in nature and/or not easily quantifiable. Following are the descriptions of those programs.

Member Websites

Each of the Big Rivers' member distribution cooperative websites provides easy-to-use Home Energy Suites that provide education and calculation methods to improve efficiency and save energy in the home. Adjustable inputs specific to a home allow customers to compare current energy use to estimated energy use resulting from various improvements in efficiency.

Energy Use Assessments

Assessments are provided to commercial and industrial customers upon request. Walk-through energy audits help identify simple and low cost efficiency measures that customers can install or implement themselves. Third party service providers such as the Kentucky Pollution Prevention Center and Department of Energy Development and Independence assist customers in achieving energy reduction goals. Education programs are also available for employees of commercial and industrial members.

Renewable Energy

Big Rivers offers renewable energy to its members. It purchases energy from an ENERGY STAR® certified Combined Heat and Power project operated by Domtar, Inc., a specialty paper manufacturer. The power is generated from wood chips that are waste byproducts of the paper manufacturing process. Customers wishing to purchase this renewable energy can contract with any of the members.

Energy Savings Analysis

Big Rivers provides energy savings analysis to industrial and large commercial customers by combining efforts with its members, the Department of Energy and the University of Louisville's Kentucky Pollution Prevention Center.

Power Factor Correction

Members provide assistance to correct lagging power factors at commercial or industrial facilities. These corrections save customers money and improve efficiency of both transmission and distribution facilities.

Technology Evaluation

Members assist in the evaluation and implementation of technologies that benefit the productivity, profitability, and EE of a commercial or industrial facility.

RESPONSE TO RECOMMENDATIONS ON 2010 IRP

The last Big Rivers IRP evaluated by Staff was filed in Case No. 2010-00443. Staff's report in that case contained the following seven recommendations on DSM/EE:

- *Big Rivers should include environmental costs in future DSM evaluations and evaluate DSM as an environmental compliance option in addition to a resource option.*
- *Big Rivers should aggressively pursue its new DSM programs in order to achieve the results projected in the IRP.*
- *Big Rivers should evaluate the feasibility of bundling measures that are marginally cost-effective into programs.*
- *Big Rivers should take into consideration in future DSM analyses how its off-system sales can be affected by demand and energy reductions achieved through DSM programs.*
- *Big Rivers should include the impact of tax credits (if available) in future DSM evaluations.*

- *Big Rivers should continue to monitor opportunities for demand response.*
- *As an education tool, Big Rivers should consider developing a DSM education program for middle school students.*

In response to each of the recommendations in the 2010 IRP report, Big Rivers provided the following information.

Big Rivers stated that environmental costs were considered in the DSM evaluation for the current IRP. It further stated that there has been no federal or state carbon emission legislation passed since 2010; therefore, the DSM evaluation assumed a cost of $0 per ton for carbon emissions in the avoided energy and capacity costs.[105] In addition, Big Rivers states that it evaluated environmental scenarios in the resource selection portion of the IRP process, including high and low projections of costs associated with carbon emissions.[106]

Big Rivers has expanded the number of new programs as well as increasing measures in existing programs since 2011. Spending has increased from approximately $109,000 to more than $1.3 million in 2013, and estimated energy savings have increased form 1,100 MWh in 2011 to nearly 14,000 MWh in 2013.[107] Big Rivers will continue with its DSM/EE programs with an annual budget of $1 million collected in base rates through the RDS rate schedule.

Big Rivers stated that its Residential Weatherization Program and New Construction Program currently bundle measures that are marginally cost-effective.[108] It also stated that the bundling approach provides greater flexibility within the weatherization program to implement additional measures on a project-by-project basis.[109]

Big Rivers stated that it factored in the effect of demand and energy reductions through DSM programs by valuing EE that uses avoided costs that are based on market prices. Big Rivers contends that by valuing energy efficiency with market prices, any potential DSM savings that may result in excess generation and capacity are being valued similarly to any off-system sales possibilities.[110]

Big Rivers stated that its DSM evaluation conducted for the 2014 IRP included all known federal and state tax credits when performing the measure-level screening

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[105] Big Rivers' IRP, Exhibit C, at C-2.

[106] *Id.*

[107] *Id.*

[108] *Id.* at 3.

[109] *Id.*

[110] *Id.*

analysis and when calculating the portfolio-level cost-effectiveness results.[111] Several measures were impacted by the assumed tax credit availability including: geothermal heat pumps, heat pump water heaters, solar water heaters, air-source heat pumps, central air conditioners, and dual fuel heat pumps.[112]

Big Rivers' DSM evaluation included a study of possible demand response opportunities, but concluded they were not currently cost-effective. Nonetheless, as Big Rivers points out, through its Staff and Member Cooperatives, the DSM Working Group continues to monitor advancements in demand response technology and Automated Meter Infrastructure ("AMI"). In 2013, the Working Group visited three regional Generation and Transmission Cooperatives to discuss and evaluate their demand response programs, heard presentations from vendors associated with installed AMI at two of the member cooperatives, and visited Duke Energy's Envision Center.[113]

Big Rivers stated that it did consider developing a DSM/EE education program for middle school students, but concluded that its limited resources could be used more effectively to address a larger group of members through other forms of education, such as website modules and mass-media promotion.[114] In addition, GDS looked into the feasibility of quantifying the measure savings from an educational program and found that such programs are typically employed to drive uptake in other EE programs or measures, but that measuring the direct impacts of these types of programs may be too difficult, given the extensive information and labor requirements to generate reliable savings estimates.[115]

INTERVENOR COMMENTS AND BIG RIVERS' REPLY

Only the Sierra Club provided comments on Big Rivers' DSM/EE plans. Neither the AG nor KIUC filed comments regarding DSM/EE.

Sierra Club's Comments

The Sierra Club engaged Synapse Energy Economics to prepare a report ("Synapse Report") on Big Rivers' 2014 IRP. With respect to DSM/EE, the Synapse Report concluded that "Big Rivers failed to evaluate, much less propose as part of its preferred resource plan, the inclusion of higher levels of energy efficiency that the Company's own consultant has identified as achievable and has estimated could provide between $63 million and $270 million in net benefits."[116] Synapse goes on to

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[111] *Id.*

[112] *Id.*

[113] *Id.*

[114] *Id.*

[115] *Id.* at 3–4.

[116] Sierra Club Comments at 2.

state that despite Big Rivers' claim that it is focusing on DSM/EE, the Company is foregoing opportunities for additional member savings by not pursuing the more aggressive DSM/EE plan it modeled during the IRP process and recommends this issue be addressed in the independent management audit.[117]

Big Rivers' Reply to Intervenor Comments

Big Rivers maintains the Sierra Club has falsely stated it did not evaluate higher levels of DSM/EE programs. Big Rivers states that it did have a study performed and the Sierra Club found no deficiency with that study. Big Rivers states that the Sierra Club's real complaint is that it did not implement all of the programs the study found cost-effective.[118] Big Rivers states that it has been offering DSM/EE programs since 2011, and that since then a number of modifications have been made and are currently being considered to effectively meet retail member needs. Big Rivers believes that implementing additional EE measures would require additional rate increases, and that now is not the right time to ask for additional rate increases.[119] Big Rivers maintains that its DSM/EE budget is based on the $1 million budget included in its base rates from its last rate case, and it is focusing on improving the effectiveness of the approved amount of dollars spent on existing programs and the number of retail customers impacted.[120]

DISCUSSION OF REASONABLENESS

Staff recognizes Big Rivers, Big Rivers' Working Group, and its member cooperatives for their efforts in developing and implementing Big Rivers' DSM/EE portfolio and is somewhat satisfied with its DSM/EE and demand response analysis. Staff believes that the GDS Study provided a sound basis for evaluating proposed EE programs and their cost-effectiveness. Staff continues to believe that Big Rivers' development of the analysis in conjunction with its three member distribution cooperatives should aid in making its DSM programs successful. However, Staff is concerned that there is too large a gap between the level of DSM/EE Big Rivers has proposed based on a $1 million annual budget and the achievable potential amounts as shown in the GDS Study. This was also a concern of the Sierra Club in its comments on the IRP. In addition, Staff believes that Big Rivers should endeavor to provide DSM/EE opportunities to residential, commercial, and industrial customers and increase its efforts to promote its programs by educating customers on the benefits of DSM/EE.

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[117] Synapse Report at 19 and 21.

[118] Big Rivers' Reply at 14.

[119] *Id.*

[120] *Id.*

Staff encourages Big Rivers to pursue potential cost-effective industrial programs, even though the opt-out provision exists in KRS 278.285(3).[121]

Staff believes that Big Rivers should be aggressive in implementing its DSM/EE programs in order to achieve the targets set in the IRP and that emphasis should be placed on educating potential DSM/EE customers and marketing the programs. Staff believes that marginally cost-effective programs should be reviewed in light of any changes in environmental or other major costs, and that the ability of DSM/EE to increase Big Rivers' ability to make off-system sales should be considered in all future DSM/EE analyses. Staff also believes that opportunities for demand-response should continue to be explored by Big Rivers.

The expectation that utilities such as Big Rivers, which rely heavily on coal-fired generation, will incur significant cost increases due to stricter environmental regulations is an additional factor that Big Rivers should consider in its future analysis of DSM/EE and EE opportunities. Big Rivers continues to lag behind the other major electric utilities under the Commission's jurisdiction in DSM/EE programs. Staff believes Big Rivers' present circumstance of having excess capacity for the near future should not deter Big Rivers from aggressively pursuing DSM/EE programs.

RECOMMENDATIONS

Following are Staff's recommendations for DSM/EE for Big Rivers' next IRP:

- *Include estimates of costs associated with proposed and potential environmental rules in future DSM/EE benefit/cost analyses;*
- *Research and report on best practices for DSM/EE program promotion, educational programs, and innovative marketing opportunities;*
- *Research and report on possible partnering with its member cooperatives in order to enhance marketing and reduce advertising costs;*
- *Report on the work undertaken to enhance the evaluation, measurement, and verification procedures to ensure DSM/EE programs are achieving expected goals;*
- *Continue to monitor opportunities for demand response.*
- *Consider developing a DSM education program similar to that offered by Duke Energy Kentucky, Inc. ("Duke Kentucky"). Duke Kentucky provides the Energy Education for Schools Program, which educates students about EE in homes and in schools through an EE curriculum. The program is operated under contract by National Energy Education Development ("NEED") and enables eligible students to complete a paper or online energy audit of their homes. Each eligible student who completes a*

[121] The Commission has directed Kentucky Utilities Company and Louisville Gas and Electric Company to conduct an industrial DSM study, develop a definition of the term "industrial" as that term is used in KRS 278.285(3) and develop criteria which will be used to determine whether an industrial customer qualifies for the DSM exemption under KRS 278.285(3). *See* Final Orders in Case No. 2014-00371, *Application of Kentucky Utilities Company for an Adjustment of its Electric Rates* (Ky. PSC June 30, 2015); and Case No. 2014-00372, *Application of Louisville Gas and Electric Company for an Adjustment of its Electric and Gas Rates* (Ky. PSC June 30, 2015).

home energy audit receives home EE measures, such as a package of CFL bulbs or an EE starter kit.[122]

[122] Case No. 2014-00280, *Application of Duke Energy Kentucky, Inc. to Amend Its Demand-Side Management Programs* (Ky. PSC Jan. 28, 2015).

SECTION 4

SUPPLY-SIDE RESOURCE ASSESSMENT

INTRODUCTION

This section summarizes, reviews, and comments on Big Rivers' evaluation of existing and future supply-side resources. In addition, it includes discussion on various aspects of Big Rivers' environmental compliance planning.

EXISTING CAPACITY

Big Rivers has access to 1,819 MW of total generating capacity. It owns and operates 1,444 MW of predominately coal-fired generation and has an additional 197 MW available from coal-fired units which are owned by HMP&L and operated by Big Rivers. Another 178 MW are available from two hydro-electric power plants operated by SEPA. *Force majeure* conditions on the SEPA capacity have limited its contribution, yet these limitations are expected to be lifted sometime in 2015.[123]

Big Rivers' predominately coal-fired generating facilities reside at three locations: the Sebree Station located in Sebree, Kentucky, D. B. Wilson Station located near Centertown, Kentucky, and the Kenneth C. Coleman Station near Hawesville, Kentucky.

The Sebree Station consists of six generating units with a combined capacity of 896 MW. Included are Green Unit 1, a MW coal-fired generator commissioned in 1979 and Green Unit 2, a 223 MW coal-fired generator brought on line in 1981. For pollution control, the Green units are fitted with a Flue Gas Desulfurization Unit ("FGD") for SO_2 removal and a precipitator for reducing emission particulate matter. Also at the station are Reid Unit 1, a 65 MW coal/gas-fired generator commissioned in 1966 and the Reid Combustion Turbine, a 65 MW natural gas/fuel oil-fired generator brought on line in 1976.[124] For pollution control, Reid Unit 1 is able to burn natural gas for SO_2 and NO_X control and is fitted with a precipitator to reduce emission particulate matter. There are also HMP&L Unit 1, a 153 MW coal-fired generator commissioned in 1973 and HMP&L Unit 2, a coal-fired 159 MW generator brought on line in 1974. For emissions, the HMP&L units are retrofitted with an FGD for SO_2 control and a Selective Catalytic Reduction ("SCR") system to reduce NO_X.[125]

The Wilson Station has a single 417 MW coal-fired generating unit commissioned in 1986. For emissions, it is fitted with an FGD to reduce SO_2, an SCR for NO_X limitation, and an electrostatic precipitator for particulate matter control.[126]

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[123] Big Rivers' IRP at 3.

[124] The unit was retrofitted in 2001 to burn natural gas.

[125] Big Rivers' IRP at 5, Figure 1.2b.

[126] *Id.* at 4.

The Coleman station is currently idled.[127] It contains three units with a combined generating capacity of 443 MW. Coleman 1 is a 150 MW coal-fired unit commissioned in 1969. Coleman 2 is a 138 MW coal-fired generator commissioned in 1970. Coleman 3 is a 155 MW coal-fired generator that came on line in 1972. Emissions from the three generating units pass through a single FGD absorber.[128]

As to SEPA, safety issues resulted in a *force majeure* while the Army Corps of Engineers ("Corps") repaired the Center Hill and Wolf Creek dams. A biological survey found the duskytail darter, considered endangered under the Endangered Species Act, in the waters. Before generating power from the SEPA facilities, the Corps sought a Biological Opinion from the U.S. Fish and Wildlife Services on the darter. Receipt of the opinion in 2014 cleared the way for normal operation at the dams. For planning purposes, Big Rivers assumed the return of full SEPA capabilities in mid-2015.[129]

Table 4.1 shows Big Rivers' generation fleet, year of operation, years in service, capacity, fuel supply, and emission control equipment. The two HMP&L units are included at their maximum capacity values.

Table 4.1[130]

Unit	Operation	Capacity (MW)	Fuel	SO_2 Control	NO_x control	Particulate Control
Coleman 1	1969	150	Pulverized Coal	FGD	Low Nox Burners Overfire Air	Precipitator
Coleman 2	1970	138	Pulverized Coal	FGD	Low Nox Burners Overfire Air	Precipitator
Coleman 3	1972	155	Pulverized Coal	FGD	Low Nox Burners Overfire Air	Precipitator
Green 1	1979	231	Pulverized Coal	FGD	Low Nox Burners	Precipitator
Green 2	1981	223	Pulverized Coal	FGD	Low Nox Burners	Precipitator
HMP&L 1	1973	153	Pulverized Coal	FGD	SCR	Precipitator
HMP&L 2	1974	159	Pulverized Coal	FGD	SCR	Precipitator
Reid 1	1996	65	Coal Natural gas	Burn Medium Sulfur Coal	Burn Natural Gas	Precipitator
Reid CT	1976	65	#2 Oil Natural Gas	NA	SCR	NA
Wilson 1	1986	417	Pulverized Coal	FGD	SCR	Precipitator

[127] *Id.* at 21. According to EIA, idled capacity is a component of operable capacity that is not in operation and not under active repair, but capable of being placed in operation within 30 days; or capacity not in operation but under active repair that can be completed within 90 days.

[128] *Id.* at 6, Figure 1.2.c.

[129] *Id.* at 99.

[130] *Id.* at 4–6.

Big Rivers states that no additional capacity resources are required for this IRP planning period in order to maintain adequate reliability. In fact, with the loss of the approximately 850 MW and 7,300 GWh annual smelter load,[131] Big Rivers foresees no generating capacity added during the 15-year planning period.[132] Further, Big Rivers, as a MISO member, has access to both the MISO energy market — and other markets — to acquire and sell power as needed.[133]

Historically, 70 percent of the energy Big Rivers generated flowed, via Kenergy, to the two aluminum smelters. Since the smelters terminated their contracts in August 2013 and January 2014, respectively, Big Rivers no longer provides them power from its generating facilities, but continues to serve them over its transmission system. Big Rivers opines that over the IRP's 15-year planning period, the majority of the lost smelter load will be made up through replacement load and will make up 62 percent of total system sales.[134]

Big Rivers considers energy and peak demand in two classes, rural and large industrial. The rural class primarily consists of residential, commercial, and industrial customers served by Big Rivers' members. This class comprises up to 90 percent of the accounts served, and sales to this class as a percentage of total sales are projected to grow from 14 percent in 2012 to 19 percent by 2028.[135] The large industrial class includes 21 large commercial and industrial customers, and this segment is projected to show a modest 3 percent growth over the planning period.[136]

Big Rivers' number of consumers, total energy requirements, and peak demand for selected years from 2012 to 2028 are shown below in table 4.2.[137]

Table 4.2

Year	Consumers	Total system energy (GWh)	Total system peak (MW)
2012	113,131	10,831	1,528
2017	117,835	4,733	897
2022	122,754	8,911	1,539
2028	128,156	9,072	1,571

[131] *Id.* at 22.

[132] *Id.* at 28.

[133] *Id.* at 13.

[134] *Id.* at 8.

[135] *Id.*

[136] *Id.* at 36.

[137] Big Rivers' Load Forecast, at 2.

Reliability Criteria

As a MISO member, Big Rivers is required to follow MISO's tariff requirements. Among its MISO obligations is that of maintaining system reliability in operating and planning while offering service at the lowest cost. The resource adequacy principals developed by MISO contain three primary points: a footprint-wide resource planning reserve margin, standardized capacity resource qualifications, and member entities complying with load serving entities' requirements.[138]

A reserve margin is the quantity of capacity in excess of that required to satisfy the projected peak load. A reserve margin is crucial to reduce risks that are posed by forced outages, transmission constraints, load forecast deviations, or other unforeseen events that could prevent a utility from being able to meet its native load requirements.

To determine the required annual reserve margin, MISO completes a system-wide resource adequacy study and determines a reserve requirement based on its currently projected overall system peak.[139] The procedures used to calculate its reserve requirements are in the MISO Business Practices Manual ("BPM") and apply equally to all MISO members. The BPM-calculated Installed Capacity ("ICAP") planning reserve margin for members in planning year 2014–2015 is 14.8 percent. The calculated Unforced Capacity planning reserve margin is 7.3 percent for that planning year.[140]

While a formal report was not produced as recommended in the Staff Report on its 2010 IRP, Big Rivers engaged GDS to perform a reserve margin study for this IRP.[141] The study found that Big Rivers' reserve margin exceeds MISO's planning reserve.[142] The Ventex Promod IV simulation tool was used to model excess capacity and the probability of sales within the MISO market. The review simulated projected MISO capacity prices Big Rivers could anticipate receiving versus the cost incurred to supply capacity. The results were analyzed to determine Big Rivers' optimal capacity reserve operating level. Within the study's parameters, Big Rivers assumed that its generation would be available for its use or could be sold into the market. The results showed that keeping a lower capacity reserve margin lowered Big Rivers' overall costs, and that reliability was not at risk at these lower levels due to its MISO membership. Big Rivers' reserve margin study determined that it was prudent to adopt the MISO planning reserve margin of 14.8 percent in 2014, ranging to 17.3 percent by 2024, and then remaining at 17.3 percent throughout the rest of this IRP planning period.[143]

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[138] Big Rivers' IRP at 78.

[139] *Id.*

[140] *Id.* at 81.

[141] Big Rivers' Response to Staff's First Request, Item 28.

[142] Big Rivers' IRP at 83.

[143] *Id.* at 110.

See Table 4.3 below for Big Rivers' and MISO's anticipated reserve margins:

Table 4.3[144]

Year	Base Case Reserve Margin Percentage	MISO ICAP Planning Reserve Margin Percentage
2014	124.18	14.8
2015	151.99	14.9
2016	121.73	15.0
2017	97.34	15.1
2018	78.12	15.1
2019	62.28	15.6
2020	38.11	16.0
2021	20.16	16.4
2022	19.81	16.8
2023	19.47	17.3
2024	19.08	17.3
2025	18.68	17.3
2026	18.28	17.3
2027	17.88	17.3
2028	17.47	17.3

Supply-Side Resources

Big Rivers' resource assessment was developed using the Strategist Integrated Planning System ("SIPS") model and the 2013 load forecast.[145] The model, which is licensed to GDS by Ventyx, uses specific Big Rivers inputs to compare and develop least cost expansion plans. Potential resource additions are compared, and the lowest-cost portfolio is chosen.

The production simulation and expansion planning analysis was conducted for Big Rivers' Base Case, which includes: (1) the Base Load and Energy Forecast; (2) DSM and EE Programs included in the $1 million annual EE expenditure case; (3) base fuel price projections; (4) base expectations of resource operating parameters and costs; and (5) base market price projections as a source of energy purchases.

During the SIPS model runs, internal sensitivities for resource assessments were adjusted by GDS. These adjustments included: (1) high load and energy projections; (2) fuel cost variances; (3) enactment of Renewable Portfolio benchmarks; (4) environmental regulation uncertainties; and (5) MISO resource adequacy guidelines. These individual model adjustments to the Big Rivers system give GDS scenarios for maximizing available resources.

[144] Big Rivers' Response to Staff's First Request, Item 28, Attachment 2.

[145] Big Rivers' IRP at 103.

Based on the model's output, Big Rivers and GDS chose the mix of expansion units necessary to achieve the lowest cost while continuing to meet MISO's planning reserve margin criteria. Based on current natural gas cost projections, the analysis points to a natural gas-fired, combined cycle unit as the future generator of choice. However, due to recent weather and environmental issues and fluctuation in natural gas prices, questions are beginning to arise concerning its cost and availability.[146]

While generation is currently not needed by Big Rivers, if it is necessary in the future from a reliability standpoint, Big Rivers will begin its studies analyzing the portfolio addition of a gas-fired combined cycle unit.[147]

Assessment of Non-Utility Generation – Cogeneration, Renewables, and Other Sources

Cogeneration

Big Rivers' IRP includes capacity and energy from SEPA and notes that it contains no other new generation sources, including renewable resources, cogeneration or non-utility sources in the plan.[148] In performing resource analyses for this IRP as it relates to cogeneration, Big Rivers scrutinized characteristics like capital requirements, resource availability, fuel requirements, and non-fuel operating costs and determined that if cogenerated power could be offered to Big Rivers at a price-point comparable to either self-supply or purchased power, it would be considered.

Big Rivers has a renewable energy tariff on file with the Commission and makes Energy Star certified renewable power available to its three member cooperatives, which in turn offer the power to their members. The certified power is generated from a paper manufacturing process.[149]

Big Rivers developed its least-cost Renewable Portfolio Standard ("RPS") using the SIPS. It used the base load and energy forecast, and base market price projections and addressed uncertainties using a sensitivity case approach. Its Base Case assumptions were used for all variables with the exceptions of a 15 percent RPS by 2018, 20 percent by 2023, and 25 percent by 2028. The specific breakdown of the renewable energy sources modeled include 80 percent wind, 15 percent biomass, and 5 percent provided by photovoltaic sources.[150]

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[146] *Id.* at 110.

[147] *Id.*

[148] Big Rivers' Response to Staff's First Request, Item 26.

[149] Big Rivers' IRP at 43

[150] *Id.* at 106.

The dam repairs referred to earlier have returned Lake Cumberland to normal levels, which will permit SEPA to provide power at normal levels. See Table 4.4 below:[151]

Table 4.4[152]

	SEPA Capacity (MW)	SEPA Energy (GWh)
2014	0	342
2015	190	285
2016	190	285
2017	190	285
2018	190	285
2019	190	285
2020	190	285
2021	190	285
2022	190	285
2023	190	285
2024	190	285
2025	190	285
2026	190	285
2027	190	285
2028	190	285

Compliance Planning

Big Rivers has continually monitored EPA's proposed and enacted environmental regulations since its last IRP, which was filed in 2010, and, as a result, its generating units have remained in compliance. EPA's existing and/or new regulations will have enormous impact on generation facilities and fuel sources, particularly coal, as those regulations' compliance dates come about.

EPA's Cross State Air Pollution Rule ("CSAPR") replaces the Clean Air Interstate Rule ("CAIR") and requires 23 states to reduce annual SO_2 and NO_X emissions to help downwind regions attain 24-hour and/or annual National Ambient Air Quality Standards ("NAAQS"). CSAPR provides allowances to utilities, but trading of those allowances is limited and restricted to a geographical area. Under CAIR, Big Rivers has historically had to purchase annual NO_X allowances, since its allocations are around 8 percent less than its emissions. However, for Big Rivers the impact of CSAPR will be limited as long as it owns the Coleman Station and the station remains idled.[153]

[151] *Id.* at 99.

[152] These SEPA levels include both the Big Rivers and HMP&L shares.

[153] Big Rivers' IRP at 85.

Big Rivers currently utilizes and has included the estimated costs associated with the operation of compliance systems on all of its coal-fired units except the Coleman and Reid Stations. Big Rivers intends to convert Reid Unit 1 to natural gas in order to comply with the EPA's Mercury and Air Toxics Standards ("MATS").[154] The remaining compliance strategy systems include FGDs ("scrubbers"), SCR units, activated carbon injection systems, dry sorbent injection technologies, low NO_X burners, over-fired air utilization, and coal re-burn systems to assure SO_2 and NO_X emission compliance.[155] Big Rivers is procuring and installing monitoring equipment to verify compliance at the Sebree and Wilson stations. As the Coleman Station is idled, installation of control equipment and monitors will be required before it is placed back into service.

With an April 16, 2015 compliance date, the MATS regulation finalized standards for reducing air pollution from coal and oil-fired generating units ("EGU") with a capacity of 25 MW and greater. Big Rivers conducted extensive testing to determine the type of control equipment needed for its units to meet the MATS requirements. Since the Coleman Station is idled and the Wilson Station could be idled, Big Rivers sought a one-year extension of its MATS compliance from the Kentucky Division for Air Quality.[156] Big Rivers faces numerous decisions related to EPA regulation compliance, and the impact on its generating fleet that may involve plant retrofits, purchasing/not purchasing allotments, fuel supply changes, and/or retiring coal-fired generation. Concurrently, if other EGUs retire coal-fired plants and decide to buy power on the open market, it is probable that the cost of purchased power will rise. If a number of coal-fired plants are reconfigured to burn natural gas, then fuel costs will change.

Coal Combustion Residuals ("CCR") are the waste products remaining from the combustion of coal in an electric generating facility. These residuals include: fly ash particles, which are particles entrained in the flue gas; bottom ash, which is the heavier ash that settles to the bottom of boilers; scrubber residuals, which are synthetic gypsum resulting from wet FGD systems; and the remains of dry injected chemicals when those processes are used. CCRs are regulated by Kentucky as Special Wastes and are considered non-hazardous waste by EPA.[157] To dispose of CCRs, Big Rivers operates two special waste landfills and ash ponds at three of its facilities. Depending on the final versions of proposed regulations, all the landfills and ponds may need to be lined. It is possible the ash ponds will be converted from wet to dry systems instead of being lined to meet some requirements.[158] In addition, EPA is developing new rules and limit

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[154] *Id.* at 84 and Big Rivers' Response to AG's Initial Request for Information ("AG's First Request"), Item 30.

[155] Big Rivers' IRP at 85.

[156] *Id.* at 86.

[157] *Id.* at 87.

[158] *Id.*

requirements for effluent discharges of the wastewater streams from the above residual handling and processing.

The Clean Water Act addresses cooling water intake structures in Section 316(b) and limits the number of fish that can be killed or impinged against intake screens by limiting water velocity and/or the amount of water needed once cooling is complete. The Coleman and Reid intake structures would be required to meet this regulation. Any new electric generating capacity would require closed cycle cooling technology.[159]

Big Rivers participates in current studies concerning greenhouse gases ("GHG") and in a consortium studying carbon reduction headed by the UK Center for Applied Energy Research. The Carbon Management Research Group is looking for ways to reduce and manage CO_2 in coal-fired generating plants. Big Rivers did not include CO_2 compliance in this IRP due to uncertainties surrounding actions of EPA and/or actions of Congress as it attempts to lower CO_2 emissions. GHG reductions, beyond improving generation efficiency, could be very costly and could affect the long term viability of existing coal-fired units; however, the idling of the Coleman Station and possible idling of the Wilson Station could enable Big Rivers to comply with future GHG regulations.[160]

As to environmental compliance, Big Rivers states that it "has made significant investments in pollution control equipment, which will be beneficial in continued compliance, as well as meeting future regulations. Big Rivers is well positioned to meet future challenges that will be faced by all coal-fired generating stations."[161]

Generator Efficiency Improvements

Big Rivers regained control of its units in 2009, and "[b]ase load unit heat rate has improved 420 BTU/kWh, or 3.8%, in the 4-year period from 2009 to 2013."[162] This greater efficiency helps to advance Big Rivers' objective to provide reliable power at the lowest possible cost.[163] It is imperative that Big Rivers operate its generation units safely and reliably and with the highest efficiency. Recent generation efficiency improvement activities are: control room operator training simulators; control instrument tuning and optimization; tighter monitoring to control losses; efficiency-focused maintenance activities; and coal pulverizer tuning.[164] Big Rivers focuses on ongoing plant maintenance in order that it maintains the highest turbine cycle efficiency. Since early 2014, it has endeavored to perform all scheduled and required generator

[159] *Id.* at 90.

[160] *Id.*

[161] *Id.* at 92 and Big Rivers' Response to AG's First Request, Item 20.

[162] *Id.* at 15.

[163] The Coleman Station received Navigant's Operation Excellence Award for 2011 and 2012. Navigant provides benchmarking services with data from over 70 percent of U.S. coal generators.

[164] Big Rivers' IRP at 94–95.

maintenance with no deferrals.[165] Big Rivers' maintenance of its coal-fired units is vitally important to help avoid forced outages which require that units be removed from service at inopportune times.

Transmission

Big Rivers owns and operates a transmission system containing 80 substations and 1,262 miles of line. Its system consists of facilities necessary to adequately supply capacity for reliable transport of generating resources to interconnection points from which its member distribution cooperatives serve their customers, and to third parties and other MISO members through its Open Access Transmission Tariff.

Big Rivers consistently looks for ways to improve and upgrade its transmission system facilities, which are designed to meet all industry standards, including those set forth by the North American Electric Reliability Corporation ("NERC") and the Southeast Electric Reliability Corporation. Its system optimization and expansion entailed "the improvement and more efficient utilization of existing Big Rivers transmission facilities during the period from 2009 through August of 2014, Big Rivers constructed and placed in service approximately 0.3 miles of new 69 kV transmission line to serve seven new delivery point substations of its members. An additional 20 miles of 69 kV and 6 miles of 161 kV lines were constructed to strengthen the transmission network and thus improve reliability. To increase transmission line current ratings, approximately 7 miles of 69 kV and 28 miles of 161 kV lines were reconductored with higher current capacity conductors. A new 345 kV interconnect between Big Rivers' existing Reid EHV substation and Vectren Corporation's A. B. Brown substation was energized. . . ."[166]

As a MISO member, Big Rivers participates in MISO's Midwest Transmission Expansion Planning ("MTEP") process. MTEP is a multi-state, region-wide transmission planning and allocation process that ensures reliable transmission operation, supports governmental energy policies, enables a competitive energy market, and therefore could impact Big Rivers' future transmission planning and cost allocation.[167]

Big Rivers states that it continually assesses its ability to sufficiently transfer power in and out of its system. If required, it can import 900 MW of net power, enough to meet its system demands. "Further, the existing transmission system is sufficient to support the export of all Big Rivers' generation power greater than the amount required to serve native load."[168] Nineteen projects were completed from 2009 through August,

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[165] Case No. 2013-00199, *Application of Big Rivers Electric Corporation for a General Adjustment in Rates Supported by Fully Forecasted Test Period,* Response to Item 27.e. of the Attorney General's Second Request for Information, and Rebuttal Testimony of Ted J. Kelly at page 13.

[166] Big Rivers' IRP at 76.

[167] *Id.* at 75.

[168] *Id.* at 76 and Big Rivers' Response to AG's First Request, Item 15.

2014 to improve, optimize, and expand Big Rivers' transmission system. Its planned transmission system projects for 2014-2018 are listed in Table 4.5.[169]

Table 4.5

Planned Transmission System Additions (2014 – 2018)	Year
Paradise 161 kV reconductor from new tap point	2014
Buttermilk 69 kV Service	2014
Cumberland – Caldwell Springs 69 kV line	2014
Hancock County 69 kV mobile capacitor bank	2014
White Oak 161/69 kV substation addition	2015
Irvington Substation switching and metering	2015
Meade County 161/69 kV transformer replacements (2)	2015
West Owensboro 69 kV reconductor	2016
KU Matanzas – New Hardinsburg/Paradise 161 kV tap line	2016
Wilson – Sacramento 69 kV line addition	2018
Thruston Junction – East Owensboro 69 kV reconductor	2018
Rome Junction – Philpot Tap 69 kV reconductor	2018
HMP&L Sub 4 161/69 kV transformer addition	2018

Distribution System

Big Rivers, a G&T cooperative, provides energy to three distribution cooperatives. It does not own any distribution facilities.

RESPONSE TO RECOMMENDATIONS ON 2010 IRP

In its report on Big Rivers' prior IRP in Case No. 2010-00443, Staff made the following six recommendations concerning supply-side resources.

- *Big Rivers should perform a utility-specific reserve margin study.*
- *Big Rivers should continue to include consideration of renewable generation in its modeling and provide in-depth discussion of such.*
- *Big Rivers should consider and discuss the consideration given to distributed generation.*

[169] *Id.* at 77 and Big Rivers' Response to AG's First Request, Items 21 and 22.

- *Big Rivers is to describe and discuss all options considered for inclusion in the plan, including improvements to and more efficient utilization of existing utility generation, transmission and distribution facilities.*
- *Big Rivers should provide a detailed discussion of the specific generation efficiency improvement activities it has undertaken.*
- *A complete discussion of Big Rivers' compliance actions and plans relating to current and pending environmental regulations should be included in its next IRP.*

In responding to these recommendations, Big Rivers provided the information summarized below, which is also noted and detailed in other portions of this report.

As a MISO member, Big Rivers uses the MISO procedures, which apply to all members, to calculate its reserve requirements. For the 2014-2015 planning year, the MISO planning reserve margin is 14.8 percent, and Big Rivers exceeds that.

As Big Rivers has no generation needs, the IRP includes no new generation sources, including renewable, cogeneration, non-utility, or distributed generation.

Generation efficiency improvement activities included operator training, control instrument tuning and optimization, tighter monitoring of operating variables to control losses, efficiency-focused maintenance activities, and coal pulverizer tuning. Big Rivers focused on transmission improvements and more efficient utilization of its existing facilities for power transmission.

Big Rivers continues to monitor and address environmental regulation activities and lists these in detail, which are noted in the compliance planning section of this report. Due to its efforts, Big Rivers' generating units have remained in compliance.

DISCUSSION OF REASONABLENESS

The Staff considers Big Rivers' supply-side resource assessment reasonable only if its load replacement goals materialize, which is too narrow a focus for a planning document such as an IRP. During the 15-year period covered by this IRP, Big Rivers will have excess generation and can maintain a 14.8 percent planning reserve margin, which increases to 17.3 percent in later years, without adding supply-side resources.[170] Additionally, there are several issues the Staff finds Big Rivers should address in greater detail in its next IRP. Staff's recommendations are set forth below.

[170] *Id.* at 110.

RECOMMENDATIONS

Supply-Side Resource Assessment

An IRP should emphasize the strongest resource and business plan determined from a wide range of possible expectations from future scenarios. It seems reasonable that there might be scenarios presented by Big Rivers where one or more existing coal-fired units are retired, converted to use alternate fuels, or sold.

- *Big Rivers next IRP should include scenarios where one or more existing coal-fired units are retired, converted to use alternate fuels, or sold.*

Reserve Margin

It is known that Big Rivers has undergone several significant changes since 2009. It completed an unwind transaction which returned 1,444 MW of generation to its control. In addition, pursuant to the Commission's authorization, Big Rivers has joined MISO which now controls the dispatch of Big Rivers' generating units. MISO also requires that Big Rivers maintain a certain reserve margin differing somewhat from the traditional reserve margin used for Kentucky planning purposes. Therefore, even though at this time Big Rivers has shown that it can easily maintain an adequate reserve margin throughout the period of this IRP, Staff believes that it is important that Big Rivers periodically perform utility specific reserve margin studies. Since it appears that many years have passed since the last specific reserve margin study was completed, the next IRP period would be suitable for the next study to be performed.

- *Big Rivers should perform a utility specific reserve margin study, as has been requested previously.*

Renewable Generation and Distributed Generation

While it does not currently need additional generation, Big Rivers should provide information on renewable generation and distributed generation, and customer interest in, and use of, net metering in the future. It should continue to include consideration of renewable generation in its modeling and provide an in-depth discussion of its consideration of renewable power in its next IRP, especially in considering the impact of possible GHG/carbon regulation and related costs per ton of CO_2.[171] Big Rivers should also consider and discuss the possibility of distributed generation in future IRPs.

- *Big Rivers should continue to include consideration of renewable generation in its modeling and provide a discussion of its assessment of renewable power in its next IRP, especially when considering the future impact of GHG/carbon regulation and related costs per ton of CO_2.*
- *Big Rivers should include a discussion of its consideration of distributed generation in its next IRP.*

[171] Big Rivers' Response to the AG's First Request, Items 20 and 23.

- *Big Rivers should provide information from its member-owner cooperatives on their customers' net metering statistics and activities in its next IRP.*

Generation Efficiency

Section 8(2) of 807 KAR 5:058 requires that utilities describe and discuss all options considered for inclusion in an IRP, including improvements to and more efficient utilization of existing utility generation and transmission facilities. In addition, the Commission in an earlier Administrative Case[172] specifically notes this requirement and directed the "jurisdictional generators to focus greater research into cost-effective generation efficiency initiatives and to include a full, detailed discussion of such efforts in subsequent IRPs in accordance with Section 8(2)(a)."

In its next IRP, Big Rivers should continue to provide a detailed discussion of the specific generation efficiency improvements and the activities it has undertaken. Such discussions of endeavors to achieve increases in G&T efficiency, and the efforts instituted to comply with environmental regulations are of utmost importance in Big Rivers' next IRP submittal's being adequate in meeting the Commission's IRP regulation.

- *In its next IRP, Big Rivers should continue to provide a detailed discussion of specific generation efficiency improvements and activities undertaken.*
- *The discussion in the next IRP of endeavors to increase generation and transmission efficiency should include the impact of the efforts instituted to comply with environmental regulations.*

Compliance Planning

Section 8(5)(f) of 807 KAR 5:058 requires that utilities include a description and discussion of actions to be undertaken during the 15 years covered by the plan to meet the requirements of the Clean Air Act and amendments, and how these actions affect the utility's resource assessment. EPA had proposed a CPP, which Big Rivers did not address in its IRP because the requirements were not finalized; however, even though Big Rivers has not, or cannot, develop a complete compliance strategy, it should provide reasonable preliminary options being considered to address the impact of new regulations. Big Rivers stated that modifications and additions to existing environmental controls will be needed depending upon the final regulations.

- *Big Rivers should develop a comprehensive list of options, plans, and costs to achieve compliance with existing, proposed, and anticipated environmental regulations in its next IRP.*

As with any significant action or expenditure, the Staff recognizes the need to take a reasoned approach to address the proposed regulations. The Staff notes that Big Rivers is approaching compliance planning cautiously because some regulations are not yet final and because of the financial impact of any actions Big Rivers may take.

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[172] Case No. 2007-00300, *Consideration of the Requirements of the Federal Energy Policy Act of 2005 Regarding Fuel Sources and Fossil Fuel Generation Efficiency* (Ky. PSC Aug. 25, 2009) at 23.

However, Staff believes that Big Rivers' approach may be too cautious and, therefore, unduly limit its ability to (1) consider all or many of the available options and (2) develop the most cost-effective compliance strategy.

Staff takes this opportunity to reinforce the Commission's expectation that environmental planning be performed on a comprehensive basis, taking into account not only existing and pending regulations, but also those reasonably anticipated to be enacted. Only by demonstrating such a degree of comprehensive planning can the Commission adequately perform its statutory duties to determine that new controls and/or facilities are needed and that the costs are appropriate and result in rates that are fair, just, and reasonable.

o *A full and detailed discussion of compliance actions relating to current and pending environmental regulations should be included in Big Rivers' next IRP.*

SECTION 5

INTEGRATION AND PLAN OPTIMIZATION

The final step in the IRP process is the integration of supply-side and demand-side options to achieve an optimal resource plan. This section discusses the integration process and the resulting Big Rivers plan.

PLANNING GOALS AND OBJECTIVES

Big Rivers stated that the primary planning goal in its 2014 IRP was to reliably provide for its customers' electricity needs over the 15-year planning horizon with an appropriate mix of supply-side and demand-side resources at the lowest reasonable cost. To meet its goal, Big Rivers established the following planning objectives:[173]

- Maintain a current and reliable load forecast;
- Continue to offer cost-effective DSM programs to its members;
- Identify potential new supply side resources and DSM programs;
- Provide competitively priced power to its members;
- Maintain adequate planning reserve margins;
- Maximize reliability while ensuring safety and minimizing costs, risks and environmental impacts; and
- Meet North American Electric Reliability Corporation ("NERC") guidelines and requirements.

THE INTEGRATION PROCESS

A resource assessment and acquisition plan was developed based on minimizing expected costs over the 15-year planning horizon. As stated earlier, Big Rivers developed its resource assessment using the SIPS model, which has the capability to simulate production operations and develop least cost expansion plans. The production operations simulation establishes the optimal dispatch of generating resources and calculates the associated costs. Operating characteristics and associated costs for supply-side resources were taken primarily from EIA's 2014 Annual Energy Outlook with some variables modified based on GDS's involvement in recent generation feasibility analyses and construction monitoring. EE measures were screened using GDS's Benefit/Cost Screening Model, an analysis tool designed to evaluate the costs, benefits, and risks of DSM programs and services. Big Rivers' existing generating resources, which were modeled using the Strategist Generation and Fuel module, were dispatched against its 2013 load and energy forecast. The development of a least-cost expansion

[173] Big Rivers' IRP at 9.

plan includes comparisons of potential resource additions to determine the necessary portfolio of expansion units at the lowest cost.[174]

Base Case and Sensitivity Cases

The Base Case included: the base load and energy forecasts; DSM programs included in the $1 million annual EE plan; base fuel price projections; base expectations of resource operating parameters and cost; and base market price projections as a source of economy energy purchases and as a potential source of economy energy sales.[175] Changes in variables were addressed by conducting the production simulation and expansion planning analysis for both the Base Case and several sensitivity cases. The following sensitivity cases were developed by Big Rivers:

1. High Coal Price Case – uses base case assumptions except for 20 percent increase in coal prices.
2. Low Coal Price Case – uses base case assumptions except for 20 percent decrease in coal prices.
3. High Market Energy Price Case – uses base case assumptions except for a 20 percent increase in market energy prices.
4. Low Market Energy Price Case – uses base case assumptions except for a 20 percent decrease in market energy prices.
5. Extreme Weather Case – uses base case assumptions except for extreme cooling and heating degree days and low system load factor.
6. Mild Weather Case – uses base case assumptions except for mild cooling and heating degree days and high system load factor.
7. Early Replacement Sales Case – uses base case assumptions except that replacement sales begin two years earlier than in the base case.
8. Late Replacement Sales Case – uses base case assumptions except that replacement sales are delayed by two years compared to the base case.
9. High Economics Case – uses base case assumptions except for forecast based on increases in number of households and higher average income.
10. Low economics case – uses base case assumptions except for forecast based on decreases in number of households and lower average income.
11. Environmental Case 1 – uses base case assumptions except for impact on load and energy forecasts of equipment added to comply with CCRs, MATS, Steam Effluent Guidelines, and Clean Water Act-Sect. 316(b); and increase in variable costs related to environmental controls installed at Coleman, Green, and HMP&L units.
12. Environmental Case 2 – uses base case assumptions except for impact on load and energy forecasts of equipment added to comply with CSAPR; and increase in variable costs related to environmental controls installed at Coleman, Green and HMP&L units.
13. High CO_2 Cost Case – uses base case assumptions except for $30/ton CO_2 cost beginning in 2020 and escalating at 5 percent annually thereafter; and increase in market energy prices equivalent to 50 percent of assumed carbon tax.

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[174] *Id.* at 18–19.

[175] *Id.* at 103.

14. Low CO_2 Cost Case – uses base case assumptions except for $10/ton CO_2 cost beginning in 2020 and escalating at 5 percent annually thereafter; and increase in market energy prices equivalent to 50 percent of assumed carbon tax.

15. High Market Capacity Price Case – uses base case assumptions except for 20 percent increase in market capacity prices.

16. Low Market Capacity Price Case – uses base case assumptions except for 20 percent decrease in market capacity prices.

17. Renewable Portfolio Standards ("RPS") Case – uses base case assumptions except for:

a) RPS requirements of:
   (1) 15 percent of total energy from renewable resources by 2018.
   (2) 20 percent of total energy from renewable resources by 2023.
   (3) 25 percent of total energy from renewable resources by 2028.

b) Specific renewable resources as sources of energy:
   (1) 80 percent of RPS energy generated by wind projects.
   (2) 15 percent of RPS energy generated by biomass projects.
   (3) 5 percent of RPS energy generated by photovoltaic projects.

Overall Integration

With a 2014 reserve margin above 125 percent and forecasted reserve margins above MISO's planning reserve margin for the full 15-year period of this IRP, Big Rivers has no need for new capacity in the foreseeable future. Its existing DSM programs are included in its Base Case, but Big Rivers performed no sensitivities to reflect different levels of DSM/EE programs. Furthermore, as noted in the Load Forecasting Section of this report, Big Rivers performed no sensitivities to reflect replacement load levels other than the 800 MW in its Mitigation Plan. Also, as noted by the Sierra Club via the Synapse Report, the scenario analyses contained in the IRP did not consider multiple variations from the Base Case, only individual variations.

RESPONSE TO RECOMMENDATIONS ON 2010 IRP

Staff made three recommendations regarding integration issues in its report on Big Rivers' 2010 IRP. Those recommendations and Big Rivers' responses thereto, all of which are contained in Appendix C to the IRP, are addressed below:

o *Big Rivers' next IRP should include a more comprehensive assessment of alternative resources considered and environmental compliance strategies.*

"Biomass, landfill gas, wind and photovoltaic resources were included in the list of potential resources in the preparation of this IRP. These resources were modeled in the same manner and at the same level of detail as the traditional supply-side options that were analyzed. Costs (both operating and capital) and operating parameters for the renewable and traditional resources were developed using information from the

Energy Information Administration's 2014 Annual Energy Outlook as well as information found in SNL Financial operating data. The Strategist system considered the renewable alternatives in the same manner in which the traditional resources were considered."

- *Big Rivers should be more proactive in considering potential environmental regulations and more explicitly addressing them in future IRP filings.*

"The development of the 2014 IRP included analyses of several sensitivity cases that address potential environmental regulations. These sensitivity cases are based on load and energy forecasts developed specifically for each case, changes in operating costs at Big Rivers' generating units associated with implementation of environmental controls, and the inclusion of effluent specific costs."

- *In future IRPs, Big Rivers should develop an optimal expansion plan based on the integration of supply-side and demand-side resources to produce the lowest cost plan.*

"As discussed in the IRP, the Base Case and all sensitivity cases include Big Rivers' $1 million DSM portfolio. Also, with the exception of the Extreme Weather and High Economics cases, no new resources or load reductions are required in order to meet the reserve margin criteria used by the Strategist system. The Strategist system bases its selection of new resources on the least cost combination of existing and new resources that maintain minimum reserve criteria."

Staff is satisfied with the responses to its prior recommendations. Concerning the third recommendation, it is clear, as Big Rivers' reply to the Sierra Club's comments stated, that implementing new EE measures above the $1 million annual budget would require increasing rates and it determined that now was not the time for rate increases.

DISCUSSION OF REASONABLENESS

Staff is generally satisfied with the information contained in Big Rivers' IRP and the process it used to integrate all aspects of the IRP. It appears that Big Rivers has refined its processes since its 2010 IRP. However, the assumptions and choices on which its analyses are based do not reflect a reasonable approach to planning for its future and affect the overall value of the IRP (see earlier Overall Integration discussion).

RECOMMENDATIONS

Staff has the following recommendations for Big Rivers next IRP:

- *Big Rivers' optimization and integration analysis should be broadened to include alternatives containing levels of replacement load other than the full amount of its planned replacement load.*

- *Given the timing of its next IRP, Big Rivers should not be constrained in considering increased levels of DSM/EE programs as it was with this IRP. Hence, the optimization and integration analysis in the next IRP should include increased DSM/EE levels.*

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