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James Gardner  
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Charles R. Borders  
Commissioner

December 12, 2011

## PARTIES OF RECORD

Re: Case No. 2010-00443

Enclosed please find a memorandum that has been filed in the record of the above referenced case for issuance of the Commission Staff's Report on Big Rivers Electric Corporation's 2010 Integrated Resource Plan. Any comments regarding the Staff Report's content should be submitted to the Commission within five days of receipt of this letter. Questions regarding this Staff Report should be directed to Jeff Shaw of the Commission Staff at 502/564-3940, ext. 237.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeff Derotien".

Jeff Derotien  
Executive Director

Enclosure



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## MEMORANDUM

### KENTUCKY PUBLIC SERVICE COMMISSION

**TO:** Main Case File – Case No. 2010-00443

**FROM:** Jeff Shaw, Division of Financial Analysis

**DATE:** *JS* November 28, 2011

**SUBJECT:** Commission Staff's Report on the 2010 Integrated Resource Plan of Big Rivers Electric Corporation

Pursuant to 807 KAR 5:058, the Commission Staff has prepared its report on the 2010 Integrated Resource Plan of Big Rivers Electric Corporation. The report, attached to this memorandum, is being filed in the record of this case. The filing of this report constitutes the final substantive action in Case No. 2010-00443. Final administrative action in the case will be an Order which will close the case and remove it from the Commission's docket. Such an Order will be issued in the near future.

Attachment

# **Kentucky Public Service Commission**

## **Staff Report On the 2010 Integrated Resource Plan of Big Rivers Electric Corporation**

**Case No. 2010-00443**

**December 2011**

## SECTION 1

### INTRODUCTION

Administrative Regulation 807 KAR 5:058, promulgated in 1990 and amended in 1995 by the Kentucky Public Service Commission (“Commission”), established an integrated resource planning (“IRP”) process that provides for regular review by the Commission Staff (“Staff”) of the long-range resource plans of the Commonwealth’s six major jurisdictional electric utilities. The goal of the Commission in establishing the IRP process was to ensure that all reasonable options for the future supply of electricity were being examined and pursued and that ratepayers were being provided a reliable supply of electricity at the lowest possible cost.

Big Rivers Electric Corporation (“Big Rivers”) submitted its 2010 IRP to the Commission on November 15, 2010.<sup>1</sup> The IRP includes Big Rivers’ plan for meeting its customers’ electricity requirements for the period 2011-2025. Big Rivers is a generation and transmission cooperative headquartered in Henderson, Kentucky. It provides all of the power requirements of three distribution cooperatives, which provide service in 22 counties located in western Kentucky. These member cooperatives, Jackson Purchase Energy Corporation (“JPEC”), Kenergy Corp., and Meade County Rural Electric Cooperative, serve primarily residential customers, which account for nearly 90 percent of their approximately 113,000 customers. While the majority of customers on the Big Rivers’ system are residential, the majority of its load is industrial, with the most unusual feature being its service to two aluminum smelters, which can have a combined peak in excess of 800 MW and which can consume over 7,000,000 MWh annually.

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<sup>1</sup> GDS Associates, Inc. (“GDS”), an outside consulting firm, performed much of the work involved in preparing Big Rivers’ 2010 IRP.

Big Rivers owns and operates 1,444 MW of generating capacity at four generating stations: Reid, Coleman, Green, and Wilson. It has an additional 207 MW 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 1,839 MW.<sup>2</sup>

In 2010, Big Rivers received Commission approval to transfer functional control of its transmission system to the Midwest Independent Transmission System Operator, Inc. (“Midwest ISO”).<sup>3</sup> The Midwest ISO directs the dispatch of Big Rivers’ generation resources and determines reserves required to maintain resource adequacy within the Midwest ISO’s multi-state footprint. Big Rivers’ 1,262-mile transmission system consists primarily of 69-kV and 161-kV lines, but also includes relatively small lengths of 138-kV and 345-kV line.

The purpose of this report is to review and evaluate Big Rivers’ IRP in accordance with 807 KAR 5:058, Section 12(3), which requires Staff to issue a report summarizing its review of each IRP filing made with the Commission and make suggestions and recommendations to be considered in future IRP filings. The Staff recognizes that resource planning is a dynamic ongoing process. Thus, this review is designed to offer suggestions and recommendations to Big Rivers on how to improve its resource plan in the future.

Specifically, the Staff’s goals are to ensure that:

- All resource options are adequately and fairly evaluated;

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<sup>2</sup> The available capacity is currently reduced by 93 MW, to 1,746, due to force majeure conditions on the SEPA system and limitations on Big Rivers’ Reid Unit 1.

<sup>3</sup> Case No. 2010-00043, Application of Big Rivers Electric Corporation for Approval to Transfer Functional Control of its Transmission System to Midwest Independent Transmission System Operator, Inc. (Ky. PSC Nov. 1, 2010).

- 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 2002. Big Rivers submitted an IRP in 2005 but, due to activities associated with the unwind of the 1998 lease arrangement under which Big Rivers' generating facilities were leased to and operated by the E.ON U.S. subsidiary, Western Kentucky Energy Corp., the Commission granted Big Rivers' request to dismiss the proceeding docketed to review the 2005 IRP.<sup>4</sup> As a condition of the Commission's approval of the transaction to unwind the 1998 lease, Big Rivers was required to file a new IRP in November 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:

- Maintain a current and reliable load forecast;
- Consider expanding Demand-Side Management ("DSM") programs;
- Identify potential supply side resources and DSM programs;
- Provide competitively priced power to its members;
- Maximize reliability while minimizing costs, risks and environmental impacts;
- Maintain adequate planning reserve margins; and
- Provide assistance to its member cooperatives regarding new technologies, mapping and planning, safety training and programs, economic development and customer support.

Big Rivers' winter peak load is expected to increase from 1,476 MW in 2008 to 1,595 MW in 2023, reflecting a growth rate of 0.5 percent per year. Its summer peak

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<sup>4</sup> Case No. 2005-00485, The 2005 Integrated Resource Plan of Big Rivers Electric Corporation (Ky. PSC Aug. 5, 2009).

load is expected to increase from 1,475 MW to 1,578 MW over the same period, also reflecting a growth rate of 0.5 percent. Energy requirements are projected to increase from 10,747,493 MWh in 2008 to 11,214,923 MWh in 2023, which reflects an annual growth rate of 0.4 percent.<sup>5</sup>

Big Rivers' IRP was developed based on a minimum reserve margin criterion of 14 percent. Based on DSM programs it plans to launch in 2011, Big Rivers expects to save a cumulative 49,160 MWh by 2025, with a 14 MW reduction in winter peak demand and a 10 MW reduction in summer peak demand. Big Rivers' base case resource plan includes the addition of 50 MW of peaking capacity in 2022, most likely in the form of a gas-fired combustion turbine, in order to maintain a planning reserve margin of 14 percent. Big Rivers noted that, if its planning reserve margin were reduced to 12 percent, no capacity additions would be needed over the 15-year planning horizon of the IRP.

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, summarizes Big Rivers' evaluation of DSM opportunities.
- Section 4, Supply-Side Resource Assessment, 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.

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<sup>5</sup> Big Rivers' IRP Plan Summary, page 5-8, Table 5-1. These demand and energy requirements include the smelter loads, which were not included in Big Rivers' detailed load forecasts – see Section 2 of this report.

## SECTION 2

### LOAD FORECASTING

#### INTRODUCTION

Big Rivers provides wholesale power to three member distribution cooperatives that provide retail service to customers in 22 western Kentucky counties. Within this 22-county service area, 89 percent of the customer accounts are residential accounts. Big Rivers' forecasts of energy consumption for the 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 economic outlook for the base case forecast was based upon data gathered from Woods & Poole Economics, NPA Data Services, and the University of Louisville. Additional historical data was collected from the Rural Utilities Service ("RUS") Form 7, the U.S. Bureau of Labor Statistics, Moody's Economy.com, the U.S. Department of Energy/Energy Information Administration ("DOE/EIA"), the U.S. Census Bureau, and the National Oceanic and Atmospheric Administration.<sup>6</sup> RUS accepts a 20-year historical period as the basis for normal weather and Big Rivers adopted this practice for its weather normalization.<sup>7</sup> Weather data was gathered from Paducah, Kentucky and Evansville, Indiana weather stations. For the 2008–2023 period, Big Rivers' service

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<sup>6</sup> Big Rivers' Load Forecast 2009, pages 2 and 13.

<sup>7</sup> Response to Staff's Second Data Request, Item 31.a, page 1 of 3.



territory population is projected to grow at the annual compound rate of 0.2 percent.<sup>8</sup> Similarly, households and employment are projected to increase at an average rate of 0.5 percent annually, real household income at an average of 0.4 percent annually, gross regional output at an average annual rate of 1.1 percent, and retail sales at an average annual rate of 1.3 percent. Real electricity prices for the residential and small commercial customers are projected to increase at an average annual rate between 0.5 and 0.9 percent annually. Natural gas and liquid propane are the primary alternatives to electricity and these prices are projected to decrease slightly over the 2008–2023 period.<sup>9</sup>

Because the Big Rivers distribution cooperatives serve retail customers across multiple portions of Kentucky counties, weighting factors were developed to represent each distribution cooperative's market share (proportion of county households served) of each county served. The county weight is equal to the number of residential customers served divided by the total number of households in the county.<sup>10</sup> Each of Big Rivers' distribution cooperatives supplied customer class data including the number of customers by class, kWh sales by class, class sales revenue, total system peak demand and rural system peak demand. Each member cooperative also provided final forecasts of energy sales and peak demand for every direct-serve and large commercial

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<sup>8</sup> This planning period reflects that Big Rivers' load forecast was prepared in early 2009, before it regained control of its generating facilities under the unwind transaction and before it again assumed responsibility for serving the aluminum smelters' loads.

<sup>9</sup> Big Rivers' Load Forecast 2009, pages 15–17, and Response to Staff's First Data Request, Item 20. Real electricity prices were not projected for large commercial and industrial direct-serve customers. It was assumed that real electricity prices for these customers would not change significantly over the forecast horizon.

<sup>10</sup> Id., page 14, and Response to Staff's First Data Request, Item 18.

customer, defined as customers whose energy consumption is greater than or equal to 1 MW. Big Rivers also conducted a Residential End-Use and Energy Efficiency Survey in 2007. The survey documented the type and number of appliances used in homes. The data is the basis for calculating electric market shares and was input into the residential energy forecast model.<sup>11</sup>

### SHORT-TERM FORECASTING MODELS

The short-term forecast projects both monthly energy and demand requirements over the 2009–2010 periods. SAE and econometric models were developed for each member system to forecast monthly sales for the residential and small commercial customer classes. Short-term residential use per customer forecasts are a function of a time trend, and heating and cooling degree days. The heating and cooling degree day variables are expressed on a monthly billing cycle basis and are the averages of the current and previous month's values. The short-term residential customer growth forecast is a function of recent year customer trends.<sup>12</sup>

Similarly, short-term small commercial use per customer forecasts are a function of a time trend and heating and cooling degree days. Theoretically, total employment and the number of households are the best predictors of short-term small commercial customer growth. In practice, basing the small commercial customer forecasts on a customer trend variable yielded better results. Short-term energy sales are a product of

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<sup>11</sup> Response to Staff's First Data Request, Item 22.b. and c., pages 3-4 of 5.

<sup>12</sup> Id., Item 22, pages 1-2, and Response to Staff's Second Data Request, Item 29.

energy use per customer and the number of customers.<sup>13</sup> Energy sales for the large commercial class were developed for each consumer by its member cooperative's management based on historic trends, operating characteristics and information provided by each individual consumer. Forecasts of public lighting are based on historical trends. Rural system energy sales are obtained by subtracting direct-serve customer sales from total system energy sales.<sup>14</sup> Final monthly and annual energy sales forecasts are based upon regression outputs that have been calibrated to the 2008 base year. For the residential and small commercial models, the calibration factor applied to initial forecast values is equal to the actual 2008 base year value divided by the model estimate for 2008.<sup>15</sup>

For each of Big Rivers' member systems, rural system demand represents the highest 60-minute rural system level of demand during the month. Rural system peak demand for Big Rivers represents the highest rural system level demand during the month. Member systems' peaks are not necessarily coincident with Big Rivers' rural system peak. Big Rivers' average coincidence factor is calculated as its rural system peak divided by the sum of the member systems' rural system peaks. From 2001 through 2008, Big Rivers' average coincidence factor was 99.2 percent in the summer and 99.1 percent in the winter. Forecasts of Big Rivers' rural system peak demand

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<sup>13</sup> Id.

<sup>14</sup> Big Rivers' Load Forecast 2009, Section 5.1, page 19.

<sup>15</sup> Response to Staff's First Data Request, Item 22, page 2 of 5.

were divided by the respective coincidence factors to produce forecasts of its non-coincident peak rural system peak demand for the summer and winter seasons.<sup>16</sup>

### LONG-TERM FORECASTING MODELS

Long-term energy and peak demand forecasts are obtained using econometric and SAE models and historical trends. Aggregate sales forecasts were developed for each of Big Rivers' three member cooperatives. The energy forecasts for the 2011–2023 long term forecasts are based upon results from the long-term models which have been calibrated to the results from the short-term models. Each member cooperative's long-term model was calibrated by applying the projected growth rate from each respective long-term model to projected values from the short-term model from the prior year.<sup>17</sup>

SAE models were used to forecast residential energy use per customer. Econometric models were used to project the number of residential and small commercial customers and energy sales for the small commercial class. Projections for the large commercial class (including direct-serve customers) were based on informed judgment, historical trends and information provided by individual customers.<sup>18</sup> Street lighting, irrigation and public buildings forecasts were based on historical trends. Total energy sales are based on a bottoms-up approach with projections developed at the customer class level and then summed across classes. Also, econometric models were

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<sup>16</sup> Big Rivers' Load Forecast 2009, Section 5.2, pages 19–20 and Response to Staff's First Data Request, Item 22.d., pages 4-5 of 5.

<sup>17</sup> Response to Staff's Second Data Request, Item 31.a., page 2 of 3.

<sup>18</sup> The real price of electricity was not a factor in the long-range forecasts of this customer class as it was for the Residential and Small Commercial classes. See Response to Staff's First Data Request, Item 20, page 1.

used to forecast rural system coincident peak. Peak demand forecasts were developed at the total system and rural system levels.<sup>19</sup>

Big Rivers' rural system load requirements reflect the load requirements of the member cooperatives. Distribution losses are factored into each member system's sales. However, member system energy sales do not include the large industrial direct serve customers. Over the historical period 1995–2008, rural system load grew from 1,665 GWH to 2,400 GWH, which represents an average annual increase of 3.4 percent. Over the 2008–2023 period, rural system load is projected to grow from 2,400 GWH to 2,955 GWH, representing an average annual increase of 1.5 percent.<sup>20</sup>

Big Rivers' total system load requirements over the period 1993–2008 reflect a significant decline in the large industrial direct-serve customer load, declining from 8,689 GWH in 1993 to 3,340.3 GWH in 2008.<sup>21</sup> Over the 2008–2023 period, total native load requirements, excluding the smelter loads, are projected to grow from 3,370.5 GWH to 3,936.3 GWH, which represents an average annual increase of 1.1 percent.<sup>22</sup>

### Residential Energy Sales

The residential class accounts for roughly 64 percent of rural system energy sales. The long-term residential use per customer model for each of the member cooperatives specifies the relationship between energy use and three index variables representing a base level of consumption, and heating and cooling consumption.

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<sup>19</sup> Big Rivers' Load Forecast 2009, Section 6.1, pages 21–22.

<sup>20</sup> Id., Appendix C, page C-5.

<sup>21</sup> This reflects the fact that the base loads of the two aluminum smelters were not supplied by Big Rivers from 1998 through 2008.

<sup>22</sup> Big Rivers' Load Forecast 2009, page C-1.

Residential energy sales are forecasted using two models: 1) the projected number of residential customers, and 2) the projected usage per customer. Total projected sales are the product of projected use per customer and the projected number of customers. The energy use per customer is a function of household income, electricity prices, weather (heating and cooling degree days), electric market share (heating, cooling and water heating), appliance efficiencies, home size and home thermal efficiency. For each member system, the use model may also contain a lagged dependent variable, binary variables and autoregressive parameters to correct for serial correlation.<sup>23</sup>

Specifically, the residential end-use model reflects average monthly residential consumption as a function of three index variables: space heating (“SHIndex”), air conditioning (“ACIndex”) and base load appliances (“BaseIndex”). SHIndex is a function of the market share of electric space heating devices, average device efficiency, effective size of home envelope (to gauge home heat loss), home thermal heat loss characteristics, real retail electric price, household income, and heating degree days. Similarly, ACIndex is a function of market share of air conditioning devices, average device efficiency, effective size of home envelope (to gauge home heat gain), home thermal heat gain characteristics, real retail electric price, household income, and cooling degree days. BaseIndex is constructed to capture the general trend in appliance saturation levels of water heaters, refrigerators, separate freezers, electric ranges and ovens, electric clothes washers and driers, dishwashers, television

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<sup>23</sup> Id., Section 6.2.1, pages 22–23, and Response to Staff’s First Data Request, Item 23.

sets, and lighting. BaseIndex is also a function of the price of electricity, household income, and household size.<sup>24</sup>

From 1993 to 2008, Big Rivers' residential energy sales grew from 1,052 GWH to 1,529.5 GWH, which represents an average annual growth rate of 3.0 percent. Over the short-term 2008–2013 forecast period, Big Rivers' residential energy sales are projected to grow from 1,529.5 GWH to 1,610.4 GWH, which represents an average annual growth rate of 1.0 percent. Over the long-term 2008–2023 period, residential energy sales are projected to grow from 1,529.5 GWH to 1,860.8 GWH, which represents an annual average growth rate of 1.3 percent.<sup>25</sup>

### Commercial Energy Sales

This customer group contains all commercial and industrial customers that are not direct-serve customers and accounts for approximately 31 percent of rural system energy sales. Econometric models were developed for each member cooperative to forecast sales for customers with peak demand below 1,000 kW. For this group, energy sales are a function of historical monthly sales, the ratio of real retail sales to employment, heating degree days and cooling degree days. The number of customers forecast is a function of the historical number of consumers and employment. For each member system, the use model may also contain a lagged dependent variable, binary variables and autoregressive parameters to correct for serial correlation.<sup>26</sup>

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<sup>24</sup> Id., Section 8.3, pages 33–35.

<sup>25</sup> Id., Appendix C, page C-9.

<sup>26</sup> Id., Section 6.2.2, page 23, and Response to First Staff Data Request, Item 23, page 2 of 3.

For those customers with peak demand greater than 1,000 kW, energy sales projections were derived for each individual customer based upon historical trends and input from the local member cooperative regarding anticipated changes in customer operations. The number of customers in this class is not expected to grow over the forecast period.

From 1995 through 2008, Big Rivers' small commercial energy sales grew from 448.8 GWH to 749.6 GWH, which represents an average annual growth rate of 5.1 percent. Over the short-term forecast period 2008–2013, Big Rivers' small commercial energy sales are projected to increase from 749.6 GWH to 788.3 GWH, which represents an average annual growth rate of 1.0 percent. Over the longer term period 2008–2023, small commercial sales are projected to grow from 749.6 GWH to 946.4 GWH, an average annual growth rate of 1.6 percent.<sup>27</sup>

#### Direct-Serve Customer Energy Sales

Over the historical period 1995–2008, Big Rivers' direct-serve large industrial load declined significantly. In 1995, this customer class purchased 7,150.8 GWH. By 2008, this sales load declined to 933.6 GWH.<sup>28</sup> Large industrial direct-serve customers' energy sales are projected to remain flat over the forecast periods. In 2008, energy sales were 933.6 GWH. Excluding the aluminum smelters, energy sales to this class are forecast to hold constant at 950.5 GWH from 2009–2023.<sup>29</sup>

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<sup>27</sup> Id., Appendix C, page C-10.

<sup>28</sup> See Footnote No. 21.

<sup>29</sup> Big Rivers' Load Forecast 2009, Page C-11.



### All Other Internal Energy Sales

This category is made up of public street lighting and irrigation sales. For street lighting over the historical period 1993–2008, this customer class has shown slow, steady growth from 2.4 GWH to 3.3 GWH, which represents an average annual growth rate of 2.4 percent. Over the short-term forecast period 2008–2013, street lighting energy sales are projected to grow from 3.3 GWH to 3.6 GWH, which represents an average annual growth rate of 1.7 percent. Over the long-term period 2008–2023, energy sales are projected to grow from 3.3 GWH to 4.1 GWH, which represents an average annual growth rate of 1.5 percent.<sup>30</sup> Irrigation sales are an insignificant part of Big Rivers' system load. Irrigation sales are projected to hold constant at 179 MWH.<sup>31</sup>

Member cooperative system distribution losses are factored into each system's sales forecast. Transmission losses are accounted for separately and are projected to be 0.78 percent annually over the forecast period.

### SEASONAL PEAK DEMAND

Big Rivers forecasts rural system coincident peak, rural system non-coincident peak, and total system non-coincident peak. Coincident peak demand is maximum simultaneous load of all rural substations on the Big Rivers system. Rural system non-coincident peak demand is the sum of the highest rural system substation demand in a given month.

Regression models were developed at the total system level to forecast seasonal rural system coincident peak. Peak demand is a function of historical trends, energy

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<sup>30</sup> Id., page C-12.

<sup>31</sup> Id., page C-13.

requirements and extreme temperatures. As a test of reasonableness of the peak demand forecast, projected load factors were computed using the energy and demand forecasts and then compared to historical trends. For projected rural system non-coincident peak, a historical coincidence factor was applied to the projected rural system coincident peak. Historically, Big River's coincident summer peak demand has been slightly larger than its winter peak. However, Big Rivers has recently experienced a larger winter peak and that is expected to continue over the forecast period.

Over the historical period 1995–2008, both summer and winter peak demand mirror the loss of large industrial load. In 1995, summer peak load was 1,166 MW and winter peak was 1,080 MW. In 2008, peak demand had fallen to 616.3 MW in the summer and 618.7 MW in the winter. Over the 2008–2023 period, Big Rivers' winter coincident peak is slightly larger than its summer peak. By 2023, the summer peak demand is forecast to grow to 734.1 MW, which represents an average annual growth rate of 1.2 percent. Similarly, the 2023 winter peak is expected to grow to 745.8 MW, which represents an average annual growth rate of 1.3 percent.<sup>32 33</sup>

### RANGE FORECASTS

Big Rivers' base case forecasts reflect expected economic growth and average weather conditions. Four high and low long-term range forecasts were developed in an effort to address uncertainty surrounding these factors: base case economics with mild weather, base case economics with extreme weather, optimistic economics with expected weather and pessimistic economics with expected weather. Energy sales for

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<sup>32</sup> Id., pages C-2 and 3.

<sup>33</sup> None of the demand forecasts include the smelter loads. The smelter loads were added at a later date. See Section 1 of the Staff Report, pages 4-5.

the large commercial customers, including direct-serve customers, public, street and highway lighting, and irrigation sales were assumed to be non-weather sensitive.<sup>34</sup>

### WEATHER SCENARIOS

Big Rivers used the individual member cooperative energy sales models for the residential and small commercial classes for its uncertainty analysis. Either extreme or mild weather (in terms of heating and cooling degree days) was used in place of normal weather. The large commercial and industrial direct-serve customers, public, street and highway lighting, and irrigation customers are assumed to be non-weather sensitive.

In the base case, Big Rivers' total system load is projected to grow from 3,340.3 GWH in 2008 to 3,936.3 GWH in 2023, which represents an average annual growth rate of 1.1 percent. Under extreme weather conditions, total system energy sales are projected to increase to 4,051.4 GWH by 2023 representing an average annual growth rate of 1.3 percent. Under mild weather conditions, total system requirements increase to 3,842.2 GWH in 2023 representing an average annual growth rate of 0.9 percent.<sup>35</sup>

Big Rivers' summer coincident peak base case demand increases from 616.3 MW in 2008 to 734.1 MW in 2023 representing an average annual growth rate of 1.2 percent. By 2023, under extreme weather conditions, summer coincident peak grows to 776 MW representing an average annual growth rate of 1.5 percent. Similarly, under mild weather conditions, by 2023, summer coincident peak demand grows to 696.6 MW representing an average annual growth rate of 0.8 percent.<sup>36</sup>

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<sup>34</sup> Big Rivers' Load Forecast 2009, Section 7.1.1, page 25.

<sup>35</sup> Id., Appendix C, page C-1.

<sup>36</sup> Id., page C-2.

In the base case, Big Rivers' total system winter coincident peak is projected to grow from 618.7 MW in 2008 to 745.8 MW in 2023 representing an average annual growth rate of 1.3 percent. By 2023, under extreme weather conditions, the winter coincident peak grows to 813.3 MW representing an average annual growth rate of 1.8 percent. Similarly, under mild weather conditions, the coincident peak grows to 688.6 MW representing an average annual growth rate of 0.7 percent.<sup>37</sup>

### ECONOMIC SCENARIOS

National event economic drivers are not figured into Big Rivers' economic scenario forecasts. Big Rivers' high and low economic forecasts are the sum of the individual member system energy sales forecasts. Projected growth rates in local household income, population, number of households, employment, gross regional product, and retail sales were adjusted up (optimistic) or down (pessimistic) to account for local economic events within the service territory.<sup>38</sup>

Again in the base case, Big Rivers' total system load is projected to grow from 3,340.3 GWH in 2008 to 3,936.3 GWH in 2023, which represents an average annual growth rate of 1.1 percent. Under optimistic economic conditions, total system energy sales are projected to increase to 4,279.5 GWH by 2023 representing an average annual growth rate of 1.7 percent. Under pessimistic economic conditions, total system

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<sup>37</sup> Id., page C-3.

<sup>38</sup> Model simulations were not run. However, the base case represents economic assumptions that Big Rivers thought most likely to occur and represents a 50:50 probability forecast. The four scenarios were based in large part on extreme values that have occurred over the last 20 years. The weather and economic scenarios are assumed to closely resemble a 90 percent bandwidth around the base case. Big Rivers' Load Forecast 2009, Section 7.2 and Response to Staff's First Data Request, Item 26.

requirements increase to 3,742.9 GWH in 2023 representing an average annual growth rate of 0.8 percent.<sup>39</sup>

Big Rivers' summer coincident peak base case demand increases from 616.3 MW in 2008 to 734.1 MW in 2023 representing an average annual growth rate of 1.2 percent. By 2023, under optimistic economic conditions, summer coincident peak grows to 798.2 MW representing an average annual growth rate of 1.7 percent. Similarly, under pessimistic conditions, by 2023, summer coincident peak demand grows to 698.1 MW representing an average annual growth rate of 0.8 percent.<sup>40</sup>

In the base case, Big Rivers' total system winter coincident peak is projected to grow from 618.7 MW in 2008 to 745.8 MW in 2023 representing an average annual growth rate of 1.3 percent. By 2023, under optimistic economic conditions, the winter coincident peak grows to 810.8 MW representing an average annual growth rate of 1.8 percent. Similarly, under pessimistic economic conditions, the coincident peak grows to 709.2 MW representing an average annual growth rate of 0.9 percent.<sup>41</sup>

### SIGNIFICANT CHANGES

Even though Big Rives has not filed an IRP with the Commission in many years, it completes a load forecast every two years. Its prior load forecast was completed in 2007. Big Rivers' 2009 load forecast projects lower growth rates across all customer classifications than its 2007 load forecast. Rural system energy requirements are projected to grow at an annual rate of 1.5 percent in the 2009 forecast versus 2.1

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<sup>39</sup> Big Rivers' Load Forecast 2009, Appendix C, page C-1.

<sup>40</sup> Id., page C-2.

<sup>41</sup> Id., page C-3.

percent in the 2007 forecast. Similarly, rural system peak demand is projected to grow at an annual rate of 1.4 percent versus 2.2 percent. Residential energy sales grow at the annual rate of 1.4 percent in the 2009 forecast versus 2.0 percent in the 2007 forecast. Small commercial energy sales grow at the annual rate of 1.6 percent (2009) versus 2.4 percent (2007). The decline in growth rates is largely the result of the economic downturn experienced since 2008.

#### DISCUSSION OF REASONABLENESS, OBSERVATIONS & RECOMMENDATIONS

Staff makes the following observations of Big Rivers' forecasting in its 2010 IRP and recommendations for its next IRP filing.

##### Observations

Big Rivers has not accounted for pending Environmental Protection Agency ("EPA") air and water quality rules in its load forecasts. Neither has Big Rivers explicitly accounted for any DSM programs in its load forecasts.<sup>42</sup> Big Rivers is clearly aware of the pending regulations and has thought through what must be done in order to meet new standards.<sup>43</sup> However, this awareness and planning has not carried over to its load forecasting. Big Rivers states that the load forecast is updated every two years and will account for the new EPA regulations as they become established. Also, it argues that it

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<sup>42</sup> Big Rivers states that, when its load forecast was prepared in early 2009, no new DSM programs were due to be implemented by any of its member cooperatives. Any existing DSM and energy efficiency programs were already reflected in the energy sales data. The effects of any new programs would be accounted for in post-modeling forecasts. See Response to Staff's First Data Request, Item 21.e., page 2 of 3.

<sup>43</sup> Responses to Staff's First Data Request, Item 19, and Staff's Second Data Request, Items 20 and 27.

does not know the impact of pending EPA regulations on electricity prices, other than that consumption will be negatively affected if prices rise.<sup>44</sup>

Big Rivers has experienced large declines in the demand for electricity in the past and is well aware of the price sensitivity of its direct-serve customers and other large customers. 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. The EPA has been openly working on implementing new air and water quality regulations for some time. It seems short-sighted to update the load forecast biennially only and to not attempt to incorporate the effects of these new regulations, the effects of which could have serious impacts on Big Rivers' regional economy and on Big Rivers' service territory specifically. Waiting until events are known tends to defeat the purpose of prudent risk analysis and planning.

Big Rivers' base case load forecast appears to be reasonable. Section 8 of the 2009 load forecast contains a good general description of its forecast methodology. The results of the specific regression runs and additional information regarding the methodology were also provided through data requests. However, the explanations do not always provide a level of detail sufficient to thoroughly understand the basis of underlying modeling assumptions and how model variables were constructed. For example, three indices were constructed and used in the SAE models. The indices are independent variables in the SAE regression equations and incorporate information from a variety of sources. Big Rivers did not provide a clear explanation of how the indices were constructed. Therefore, it is unclear how changes to underlying variables

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<sup>44</sup> Response to Staff's First Data Request, Items 19 and 21.

in each index could affect the index value which, in turn, could affect the resulting coefficients in the regression equation.

Big Rivers' sensitivity analysis models two extreme weather scenarios and two extreme economic scenarios. In the absence of EPA actions, the sensitivity analysis appears reasonable. However, the basis for the underlying assumptions was not clearly explained.

### Recommendations

- 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.
- Big Rivers should consider updating its load forecasts annually.
- Big Rivers should explicitly account for future DSM and energy efficiency programs in its load forecasts.
- 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.
- 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.



## SECTION 3

### DEMAND-SIDE MANAGEMENT

#### INTRODUCTION

This section discusses the DSM portion of Big Rivers' IRP. Historically, Big Rivers and its three member distribution cooperatives have provided DSM programs that are primarily educational in nature, the exception being the distribution of Compact Fluorescent Lights ("CFLs") to the three member cooperatives' retail customers. In conjunction with this IRP, Big Rivers elected to evaluate several new DSM programs which were selected based on the results of a DSM Potential Report ("Report") prepared for Big Rivers by GDS.<sup>45</sup> The programs are based on the results of the energy efficiency savings potential analysis contained in the Report, the possible widespread application of the measures identified, and a review of energy efficiency programs currently offered by other electric cooperatives, investor-owned electric utilities, and energy efficiency organizations located in or around Kentucky.

#### EXISTING DSM PROGRAMS

Big Rivers identified 11 programs that are currently offered to its member cooperatives' retail customers. Following are the existing activities and programs which are intended to educate and inform the customers of available energy efficiency opportunities.

1. Distribution cooperative websites;
2. Marketing and promotion;
3. Home energy efficiency expo;
4. Distribution of DOE/EPA "Home Efficiency Tips" booklet;

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<sup>45</sup> Big Rivers hired GDS in December 2009 to perform a potential study of energy efficiency, demand response and demand-side management measures.

5. CFL distribution;
6. Energy use assessments;
7. Renewable energy from Domtar, Inc. ("Domtar");
8. JPEC and Big Rivers facility lighting upgrade;
9. Energy savings analysis to industrial and large commercial members;
10. Construction of high performance schools; and
11. Combined heat and power project for reliability support and backup power at Domtar.

Due to their largely informational and/or educational nature, the IRP did not include load impacts, tables, or benefit/cost analyses of existing programs; however, descriptions of the existing programs were provided.

#### PROGRAM DESCRIPTIONS

Following is a brief description of each of the existing DSM programs:

##### Distribution Cooperative Websites

Each of the distribution cooperative websites provides easy-to-use Home Energy Suites with adjustable inputs specific to a home, which allows customers to compare current energy use to estimated energy use resulting from various improvements in efficiency.

##### Marketing and Promotion

This program focuses on energy efficiency education and advertising efforts promoting Touchstone Energy Homes and the use of Energy Star appliances and lighting, insulation, and high efficiency HVAC.

##### Home Energy Efficiency Expo

Each of the member cooperatives hosts residential energy efficiency expos that provide education and outreach to customers focusing on energy efficiency in the home.

### Distribution of DOE/EPA Booklets

The member cooperatives have provided thousands of DOE/EPA “Home Efficiency Tips” booklets to new and existing customers that visit the cooperatives’ offices. They have also used this information for training their customer service representatives.

### CFL Distribution

CFLs are distributed to customers of the distribution member cooperatives who visit their offices or attend their annual meetings. To date, approximately 109,000 CFL bulbs have been provided to retail customers at no cost.

### Energy Use Assessments

Energy Use Assessments are provided to commercial and industrial customers through energy audits and education programs that help customers identify simple and low-cost efficiency measures.

### Renewable Energy from Domtar

Big Rivers offers renewable energy to its member cooperatives and their customers from an Energy Star Combined Heat and Power (“CHP”) project operated by Domtar which generates electricity using wood chips that are waste by-products of the paper manufacturing process.

### Facility Lighting Upgrade

JPEC and Big Rivers upgraded their facility lighting to high efficiency electronic ballasts and fluorescent lighting.

### Industrial and Commercial Energy Savings Analyses

Big Rivers provides energy savings analyses to industrial and large commercial members by combining efforts with its member systems, DOE, and the University of Louisville's Kentucky Pollution Prevention Center.

### Construction of High Performance Schools

Big Rivers provides support to member system school districts to promote the construction of high performance (high efficiency) schools. The Hancock County school district renovated three older schools with a focus on energy efficiency and completed a new high performance school in 2006. The Meade County school district completed a new high performance school in 2006 as well.

### Combined Heat and Power Project at Domtar

Big Rivers provided assistance to develop and continues to provide reliability support and backup power for the Domtar combined heat and power project in Hancock County. The 50 MW renewable generator produces electricity from waste wood chips produced in the process of manufacturing paper. The project won the 2005 Energy Star CHP award for efficiency.

### ANALYSIS OF NEW DSM PROGRAMS

The Report evaluated over 40 residential energy efficiency programs or measures and more than 80 commercial and industrial energy efficiency programs or measures. The list of energy efficiency measures examined was developed based on review of the measures and programs included in other technical potential studies in Kentucky and similar climate regions, as well as other energy efficiency technical potential studies that have been conducted throughout the country. The set of energy

efficiency programs or measures considered was pre-screened to only include those measures that are currently commercially available.

The Report was developed by GDS using customized residential and commercial/industrial (“C&I”) sector level potential assessment computer models and company-specific cost-effectiveness criteria including the most recent Big Rivers avoided cost projections for electricity. Measure saturation data was primarily obtained from the 2007 Big Rivers End-Use and Energy Efficiency Survey for residential customers and the 2003 EIA Commercial Building Consumption Survey. The results of the analysis provided detailed information on energy efficiency measures that would be the most cost-effective and that have the greatest potential kWh and kW savings.

The energy efficiency measures selected for consideration in the Report were evaluated using the traditional “California Tests.”<sup>46</sup> To determine the cost-effectiveness of energy efficiency measures, the Report primarily used the Total Resource Cost (“TRC”) test. The TRC test evaluates the net cost of a measure as a resource option based on the measure’s total costs, including those of participants, the utility, and non-participants. Only cost-effective DSM measures were chosen for implementation.<sup>47</sup>

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<sup>46</sup> California Public Utilities Commission and California Energy Commission, “Standard Practice Manual for Economic Analysis of Demand-Side Management Programs”, Document Number P400-87-006, December 1987. The standard tests are the Utility Test, the Participant Test, the Ratepayer Impact Measure, and the Total Resource Cost test.

<sup>47</sup> The Report stated that “[t]he authors of this report emphasize that only energy efficiency measures that cost less than new power supply resource are considered to be cost effective.” In response to Item 32 of Staff’s Second Data Request, this was clarified to state that “[t]he authors of this report emphasize that only energy efficiency measures that cost less than the avoided capital and operating costs of power supply resource are considered to be cost effective.”

However, some marginally cost-effective energy efficiency measures were not chosen for implementation.

The Report identified four different types of efficiency potential: technical, economic, achievable, and program. Technical and economic efficiency potential provide a theoretical upper boundary 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. Ultimately, the Report utilized program efficiency potential as the target for its DSM programs based on a specific amount of funding. Big Rivers' funding for DSM programs in 2011 will be \$1 million, with that amount increasing 2.5 percent per year through 2020.<sup>48</sup> Total resources required by Big Rivers and its three member-owners to implement the final DSM plan resulting from the pilot programs currently underway will be determined through the evaluation of those pilot projects.<sup>49</sup>

Total energy savings for 2011 are projected to be 3,767 MWH with cumulative savings reaching 49,160 MWH in 2025. The winter peak demand savings is projected to be 916 kW in the first year with cumulative savings reaching almost 14 MW in 2025. The summer peak demand savings is 623 kW in the first year with cumulative savings reaching over 10 MW in 2025.

The report included a demand response analysis. With the value associated with avoided generation and transmission capacity currently being low due to Big Rivers and the Midwest ISO being long on capacity, the demand response programs evaluated

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<sup>48</sup> One million dollars was chosen as the expenditure level as that amount approximates one percent of annual revenue from the rural customer class, the class to which the programs will apply. See Response to Staff's First Data Request, Item 28.a.

<sup>49</sup> Response to Staff's Second Data Request, Item 21.

were not cost-effective under the TRC test. Therefore, Big Rivers chose not to pursue a formal demand response program at this time.

### NEW PROGRAM DESCRIPTIONS

Big Rivers identified seven new DSM programs to consider in conjunction with its IRP consisting of five residential and two commercial and industrial programs. Big Rivers' member distribution cooperatives have agreed to offer these programs to their customers.<sup>50</sup> Following is a brief description of these new DSM programs:

1. Residential Efficient Lighting Program – this program is designed to encourage residential customers to install high efficiency bulbs in their homes, replacing incandescent bulbs.

2. Residential Efficient Products Program – this program provides financial incentives and market support via retailers to increase the market share and sales of efficient home appliances.

3. Residential Advanced Technologies Program – this program is designed to promote the purchase of efficient products with significant energy savings potential that are currently available in the market place but continue to have low market saturation.

4. Residential Weatherization Program – this program is designed to encourage residential customers to upgrade and install energy efficient building shell measures in homes that are inadequately insulated or weatherized.

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<sup>50</sup> Response to Staff's First Data Request, Item 3.a.

5. Residential New Construction 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. C&I Prescriptive Lighting Program – this program is designed to encourage commercial and industrial customers to install high efficiency lighting technologies in their businesses to replace inefficient technologies.

7. C&I Prescriptive HVAC Program – this program is designed to encourage customers to install energy efficient HVAC equipment.

Big Rivers did not incorporate the impact of new DSM programs into its load forecast, nor did it explicitly factor environmental costs into its DSM evaluation.<sup>51</sup> However, the impacts of existing programs are captured indirectly due to the use of historical data in the residential and small commercial energy models used by Big Rivers' in developing its forecasts for those customer groups.

The inclusion of environmental costs, when known, into the DSM evaluation may make marginal programs more cost-effective and/or feasible. Also, given Big Rivers' reliance on off-system sales to achieve its required margins, including the opportunity costs of lost off-system sales in its evaluation, may improve the cost-effectiveness of DSM programs in the future.

#### DISCUSSION OF REASONABLENESS

Staff recognizes the effort Big Rivers and its member cooperatives have made in developing the new DSM programs and is generally encouraged with the breadth and scope of Big Rivers' DSM analysis. Staff believes that the Report provided a sound

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<sup>51</sup> Id., Item 21.e.



basis for evaluating proposed energy efficiency programs and their cost-effectiveness and that developing the analysis in conjunction with its three member distribution cooperatives should aid in making Big Rivers' DSM programs successful.

Staff believes that Big Rivers should be aggressive in pursuing the new DSM programs in order to achieve the targets set in the IRP and that emphasis should be placed on educating potential DSM 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 to increase Big Rivers' ability to make off-system sales should be considered in all future DSM 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 and energy efficiency opportunities. While it presently lags behind the other major electric utilities under the Commission's jurisdiction in DSM programs, Staff believes Big Rivers' present circumstances (having control of its generation and not having a pressing need for additional generating capacity in the near-term) offer Big Rivers an opportunity to make reasoned and well-informed decisions on DSM. Squandering this opportunity should not be acceptable to Big Rivers, its members-owners or the retail customers of those member-owners.

## RECOMMENDATIONS

The last Big Rivers IRP evaluated by Staff was filed in case 2002-00428.<sup>52</sup> Staff's report in that case contained four recommendations on DSM. Two of the recommendations, which dealt with developing a net metering pilot program and a Green power program, have been rendered moot since the issuance of that report. Big Rivers' member cooperatives have implemented net metering tariffs and Big Rivers and its member cooperatives all have renewable energy resource service tariffs which permit customers to purchase Green power.

A third Staff recommendation in that case was for Big Rivers to evaluate DSM programs that provide increased efficiency for all customers. The programs included in the current IRP have addressed that recommendation. A fourth recommendation was for Big Rivers to inform Staff of the status of a high efficiency heating incentive program Big Rivers was pursuing at the time of its 2002 IRP. It is Staff's understanding that Big Rivers chose not to pursue that particular program. For this IRP, Staff makes the following recommendations:

- 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.

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<sup>52</sup> Case No. 2002-00428, The 2002 Integrated Resource Plan of Big Rivers Electric Corporation (Ky. PSC Apr. 12, 2004).

- 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.

## SECTION 4

### SUPPLY-SIDE RESOURCE ASSESSMENT

#### INTRODUCTION

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

#### Existing Capacity

Big Rivers is a generation and transmission utility providing wholesale electric service to its three member-owner distribution cooperatives. Even though 90 percent of its accounts are residential, Big Rivers' energy load is "lumpy," as two aluminum smelters purchase 69 percent of the power. Residential customers represent 15 percent of sales, with seven percent of its sales to small commercial customers and nine percent sold to large commercial and industrial customers.<sup>53</sup>

Big Rivers has access to 1,829 MW of total generating capacity,<sup>54</sup> yet, due to constraints discussed later, the current total capacity is limited to 1,736 MW. Big Rivers owns and operates 1,444 MW of predominately coal-fired generation and has an additional 207 MW available from two coal-fired units owned by HMP&L which are operated by Big Rivers. An additional 178 MW are available from two hydro-electric power plants operated by SEPA.

Big Rivers' Reid Unit 1, with a maximum capacity of 65 MW, has been configured to burn coal or gas; however, the gas line to the unit is not in service. This reduces the

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<sup>53</sup> Plan Summary, Section 5-1 including Figure 5.1.

<sup>54</sup> Id., Section 5-1.

unit's output capacity from 65 MW to 50 MW. Safety issues at the Center Hill and Wolf Creek Dams triggered SEPA to issue a force majeure through midyear 2013 when the Army Corp of Engineers estimates repairs on the dams will be complete. This reduces the current available hydro power output of these plants to approximately 100 MW. These two situations reduce the power available to Big Rivers by approximately 93 MW, to a present total available capacity of 1,736 MW.<sup>55</sup>

Table 4.1 presents a description of Big Rivers' fleet of generating facilities, age, years in service, output capacity, fuel supply, and installed emission control equipment. Note that two of the units Big Rivers operates are owned by HMP&L and are included at their maximum capacity values.

Table 4.1

Unit	Operation	Yrs in Service	Cap (MW)	Fuel	SO2 Control	NOx control	Particulate Control
Coleman 1	1969	41	150	Pulverized Coal	FGD	Low Nox Burners Overfire Air	Precipitator
Coleman 2	1970	40	138	Pulverized Coal	FGD	Low Nox Burners Overfire Air	Precipitator
Coleman 3	1972	38	155	Pulverized Coal	FGD	Low Nox Burners Overfire Air	Precipitator
Green 1	1979	31	231	Pulverized Coal	FGD	Low Nox Burners	Precipitator
Green 2	1981	29	223	Pulverized Coal	FGD	Low Nox Burners	Precipitator
HMP&L 1	1973	37	153	Pulverized Coal	FGD	SCR	Precipitator
HMP&L 2	1974	36	159	Pulverized Coal	FGD	SCR	Precipitator
Reid 1	1996	44	65	Coal Natural gas	Burn Medium Sulfur Coal	Burn Natural Gas	Precipitator
Reid CT	1976	34	65	#2 Oil Natural Gas	NA	SCR	NA
Wilson 1	1986	24	417	Pulverized Coal	FGD	SCR	Precipitator

Big Rivers states that minimal new capacity is required for this IRP planning period to maintain adequate reliability.<sup>56</sup> Big Rivers foresees adding no generation capacity until 2022, when its Base Case acquisition plan calls for 50 MW of CT capacity

<sup>55</sup> Executive Summary, i and ii.

<sup>56</sup> Plan Summary, Section 5-11 (5).

to maintain a planning reserve margin of 14 percent. However, if Big Rivers were to reduce its reserve margin to 12 percent, no capacity additions are needed during the 15 year period of the IRP. Further, Big Rivers, as a member of the Midwest ISO, has access to the Midwest ISO energy market, and other markets, to acquire and sell power as needed.<sup>57</sup>

Table 4.2 includes Big Rivers' projected capacity and peak demand requirements.<sup>58</sup>

Table 4.2

Year	System Peak Demand (MW)	Energy Efficiency Programs (MW)	Owned Capacity (MW)	SEPA Maximum Capacity (MW)	Total Capacity (MW)	Capacity Surplus (MW)
2011	1,498	(1.00)	1,632	100	1,732	235
2012	1,504	(2.07)	1,626	100	1,726	223
2013	1,510	(3.19)	1,544	178	1,722	215
2014	1,517	(4.21)	1,616	178	1,794	281
2015	1,525	(5.26)	1,616	178	1,794	274
2016	1,533	(6.33)	1,616	178	1,794	267
2017	1,542	(7.41)	1,616	178	1,794	259
2018	1,551	(8.35)	1,616	178	1,794	251
2019	1,560	(9.34)	1,616	178	1,794	243
2020	1,568	(10.28)	1,616	178	1,794	236
2021	1,578	(11.21)	1,616	178	1,794	228
2022	1,587	(12.05)	1,666	178	1,844	270
2023	1,595	(12.90)	1,666	178	1,844	262
2024	1,604	(13.76)	1,666	178	1,844	254
2025	1,613	(14.64)	1,666	178	1,844	246

Energy and peak demand requirements are projected to increase at average compound rates of 0.4 percent and 0.5 percent, respectively, per year, from 2011 to 2025, reaching 1,613 MW winter peak demand as shown below. The relatively low

<sup>57</sup> Id., Section 5-3 at 5-9.

<sup>58</sup> Id., Section 5-4, Table 5.2 at 5-10.

growth rates are greatly influenced by the two aluminum smelters, whose combined load is projected to remain level at 850 MW throughout the forecast horizon. Peak demand is projected to increase by approximately 8 MW per year from 2010 to 2025.<sup>59</sup>

The forecast is influenced by the large commercial and industrial class, which represents nearly two-thirds of total system peak demand and energy requirements. The growth in the residential class is influenced by increases in the number of households, which is projected to increase 0.5 percent per year through 2025. Growth in the number of small commercial customers is driven by employment, which is also projected to increase at an average rate of 0.5 percent per year.<sup>60</sup>

Big Rivers' projected peak demand and energy requirements can be seen in Table 4.3.<sup>61</sup>

Table 4.3

Year	Total energy requirements (MWh)	Winter Peak Demand (MW)	Summer Peak Demand (MW)
2011	10,729,241	1,498	1,485
2012	10,782,940	1,504	1,491
2013	10,793,126	1,510	1,497
2014	10,827,941	1,517	1,503
2015	10,867,352	1,525	1,511
2016	10,926,611	1,533	1,519
2017	10,951,812	1,542	1,527
2018	10,996,403	1,551	1,536
2019	11,041,551	1,560	1,544
2020	11,101,517	1,568	1,552
2021	11,127,454	1,578	1,561
2022	11,171,403	1,587	1,569
2023	11,214,923	1,595	1,578
2024	11,278,601	1,604	1,586
2025	11,323,317	1,613	1,595

<sup>59</sup> Id., Section 5-3 at 5-7.

<sup>60</sup> Id., Section 5-3 at 5-8.

<sup>61</sup> Id., Section 5-3, Table 5.1 at 5-8.

## Reliability Criteria

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

Big Rivers has performed no reserve margin studies in the past 10 years<sup>62</sup> and, as a Midwest ISO member, intends to stay within that organization's resource adequacy guidelines and not perform a study before its next IRP.<sup>63</sup> Its reserve requirements are in the Midwest ISO Business Practices Manual ("BPM") and are not Big Rivers-specific, yet apply equally to all Midwest ISO members. The BPM reserve margin pertaining to Big Rivers is 4.5 percent and it proposes to take advantage of the efficiencies that come with collective Independent System Operator membership.<sup>64</sup> Further, Big Rivers does not anticipate any system reliability issues as it meets the proposed EPA regulations.<sup>65</sup>

Big Rivers states that it has seen little change in the first few months of its integration into the Midwest ISO and is uncertain how its units will be dispatched or how its generation efficiency will be affected.<sup>66</sup> Even though the Midwest ISO provides for an exception to its margin requirement if a state establishes its own reserve margin,<sup>67</sup>

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<sup>62</sup> Response to Staff's Second Data Request, Item 5(a).

<sup>63</sup> Id., Item 5(b).

<sup>64</sup> Id.

<sup>65</sup> Response to the Attorney General's ("AG") Data Request, Item 15.

<sup>66</sup> Response to Staff's Second Data Request, Item 6.

<sup>67</sup> Id., Item 4.



Big Rivers believes that if it were mandated by this Commission to maintain a reserve margin above the reserve margin required by the Midwest ISO the result would be increased costs which would place Big Rivers and its excess power at an economic disadvantage relative to other Midwest ISO members.<sup>68</sup>

One of Big Rivers' planning objectives is to "[m]eet North American Electric Reliability Corporation ("NERC") guidelines and requirements." In NERC's 2009 Long-Term Reliability Assessment, a 15 percent reserve margin was identified as the target for predominately thermal systems.<sup>69</sup> This target reserve margin is not based on a specific study for Big Rivers; however, Big Rivers stated that it determined it wise to use the NERC 15 percent value, as neither the Commission nor the Southeastern Electric Reliability Corporation require a specific reserve margin.<sup>70</sup> While Big Rivers used a 15 percent reserve margin target, a minimum acceptable margin of 14 percent was utilized in the modeling process to show that actual annual margins could vary above and below the target during the term of the IRP.<sup>71</sup>

#### Supply-Side Resources

Big Rivers canceled its power purchase agreement with LG&E Energy Marketing ("LEM") in the Unwind Transaction and regained control of its generating assets in 2009. From 1997 through 2009, the Big Rivers and HMP&L generating units were operated by subsidiaries of E.ON U.S., LLC. Except for the power from SEPA, Big

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<sup>68</sup> Response to Staff's Second Data Request, Item 5(b).

<sup>69</sup> Plan Summary, Section 8-2.

<sup>70</sup> Response to Staff's Second Data Request, Item 2(a).

<sup>71</sup> Id., Item 2(b).

Rivers' power requirements were provided through its purchased power agreement with LEM. Big Rivers was required to file an IRP with the Commission by November 15, 2010 as a result of the Unwind. Big Rivers engaged GDS to prepare the IRP while relying on its own employees and its three member-owned cooperatives for input.<sup>72</sup>

Big Rivers' resource assessment was developed using the Strategist Integrated Planning System ("SIPS"). The model, which is licensed to GDS by Ventyx, utilizes specific Big Rivers inputs to compare and develop least-cost expansion plans. Potential resource additions are compared and the lowest-cost portfolio is chosen.<sup>73</sup>

The production simulation and expansion planning analysis was conducted for the Base Case which includes (1) the Base Load and Energy Forecast, (2) Energy Efficiency ("EE") Programs included in the \$1 million annual EE expenditure case, (3) base fuel price projections, and (4) base market price projections as a source of energy purchases.<sup>74</sup>

During the distinct SIPS model runs, internal sensitivities for resource assessment were adjusted by GDS. Adjustments included those to (1) high load and energy projections, (2) fuel cost variances, (3) the enactment of Renewable Portfolio benchmarks, (4) environmental regulation uncertainties, and (5) Midwest ISO resource adequacy guidelines. These individual model adjustments to the Big Rivers system provided GDS scenarios for maximizing available resources.<sup>75</sup>

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<sup>72</sup> Plan Summary, Section 4-2 at 4-1.

<sup>73</sup> Id., Section 5-2 at 5-4 and 5-5.

<sup>74</sup> Id., Section 5-5.

<sup>75</sup> Id., Section 5-2 at 5-5 and 5-6.

In addition to changing the sensitivities, GDS developed a list of potential resource additions for evaluation. The options modeled include renewable supply-side options, traditional supply side options, and energy efficiency initiatives. The list includes: (1) Biomass; (2) Landfill Gas; (3) Wind; (4) Photovoltaic; (5) Coal bed Methane; (6) Nuclear; (7) Coal; (8) Gas-fired Combined Cycle; (9) Gas-fired Combustion Turbine; and (10) an Energy Efficiency Portfolio.<sup>76</sup> In Kentucky, nuclear is not an option as it is prohibited by state law.<sup>77</sup>

Big Rivers and GDS reviewed the output from the model and chose the assortment of expansion units necessary to achieve the lowest cost while meeting the planning reserve margin criteria.<sup>78</sup> Also, if Big Rivers were to switch fuels due to EPA regulations, such switching could trigger an EPA “New Source Review”<sup>79</sup> and affect Big Rivers’ Title V permit under the 1990 Clean Air Act amendments.<sup>80</sup>

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

##### 1. Cogeneration

Big Rivers’ IRP includes capacity and energy from its members’ SEPA allocations and notes that it contains no other renewable resources, cogeneration or non-utility sources in the plan.<sup>81</sup> In performing resource analysis for this IRP as it

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<sup>76</sup> Id., Section 5-4 at 5-10.

<sup>77</sup> Id., Section 8-25.

<sup>78</sup> Id., Section 5-2 at 5-5.

<sup>79</sup> Response to AG’s Data Request, Item. 17.

<sup>80</sup> Id., Item. 4.

<sup>81</sup> Plan Summary, Section 8-3(d) at 8-8.

relates to cogeneration, Big Rivers scrutinized characteristics such as capital requirements, resource availability, fuel-requirements, and non-fuel operating costs and determined that, if cogenerated power could be offered to it at a price-point comparable to either self-supply or purchase power, it would be considered.<sup>82</sup>

## 2. Renewables

Big Rivers has a renewable tariff on file with the Commission<sup>83</sup> and makes Energy Star certified renewable power available to its three member cooperatives, which in turn offer that power to their members. The certified power is generated from burning waste products in a paper manufacturing process.

Big Rivers' least-cost Renewable Portfolio Standard ("RPS") sensitivity case was also developed using SIPS. Big Rivers used the base load and energy forecast and base market price projections and addressed uncertainties using a sensitivity case approach. The base case assumptions were used for all variables with the exceptions of a 15 percent RPS by 2015, 20 percent RPS by 2020, and 25 percent RPS by 2025. The specific energy sources modeled include 80 percent wind, 15 percent biomass, and 5 percent photovoltaic sources.<sup>84</sup>

SEPA provides hydro-electric power to Big Rivers, yet the amount of power is currently constrained due to safety issues at the Wolf Creek and Center Hill Dams near Jamestown, Kentucky and Lancaster, Tennessee. The Army Corps of Engineers

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<sup>82</sup> Response to Staff's Second Data Request, Item 8.

<sup>83</sup> Big Rivers 2009 Load forecast, Section 2.4, Power Supply at 10-11.

<sup>84</sup> Plan Summary, Section 8, page 8-1.

anticipates repairing the dams in mid-year 2013.<sup>85</sup> Big Rivers does not foresee having to pay a higher cost for the power as a renewable resource under future EPA rulings, as the rates for the SEPA power are cost-based.<sup>86</sup> Table 4.4 shows the expected SEPA capacity and energy that will be available to Big Rivers.<sup>87</sup>

Table 4.4

Year	SEPA Capacity (MW)	SEPA Energy (MWh)
2011	100	301,930
2012	100	301,930
2013	100	292,889
2014	178	267,000
2015	178	267,000
2016	178	267,000
2017	178	267,000
2018	178	267,000
2019	178	267,000
2020	178	267,000
2021	178	267,000
2022	178	267,000
2023	178	267,000
2024	178	267,000
2025	178	267,000

### 3. Other Non-Utility Sources

Big Rivers offers energy from SEPA and certified Energy Star power from the Domtar paper mill as the only non-utility power sources.

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<sup>85</sup> Executive Summary at i and ii.

<sup>86</sup> Response to AG's Data Request, Item 3.

<sup>87</sup> Plan Summary, Section 8-3(d) at 8-9, Table 8.5.

## Compliance Planning

Since last filing its IRP in 2005, Big Rivers has stayed abreast of environmental regulations and its plants have remained in compliance. Table 4.1 shown earlier in this section identifies the state of Big Rivers' seven coal-fired generating units and one combustion turbine unit, along with the two HMP&L coal-fired units.

At the time Big Rivers filed this IRP with the Commission, the EPA had proposed but not finalized new regulations which will have enormous impact on generation facilities and fuel sources, particularly coal. As the guidelines are preliminary and still evolving, Big Rivers did not specifically address the EPA's proposed findings for this IRP filing<sup>88</sup> and will not take any firm action on the proposed EPA regulations until the rules are final.<sup>89</sup>

Big Rivers finds it prudent to wait for final EPA rules before making a host of decisions which impact its generation fleet. Some of those decisions involve multi-million dollar plant retrofits, purchasing or not purchasing allotments, changing fuel supplies, or retiring coal-fired power plants. Big Rivers finds it fundamental to have firm costs in hand versus projections. Concurrently, if all generating companies retire plants and decide to buy power on the open market, it is probable that the cost for purchased power will rise. If all coal-fired plants are reconfigured to burn natural gas, then fuel costs will change.

Big Rivers has investigated and is participating in the current studies surrounding CO<sub>2</sub>. It is a partner in a consortium headed by the University of Kentucky Center for

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<sup>88</sup> Response to AG's Data Request, Items 9 and 10.

<sup>89</sup> Id., Item 8.

Applied Energy Research that is studying carbon reduction.<sup>90</sup> The Carbon Management Research Group is looking for ways to reduce and manage CO<sub>2</sub> in coal-fired generating plants. For this IRP, Big Rivers did not include a CO<sub>2</sub> compliance plan<sup>91</sup> due to the uncertainties surrounding actions of the EPA and other actions Congress may take as it reins in CO<sub>2</sub> emissions.

At the time Big Rivers filed this IRP, the EPA had finalized its agency's endangerment finding utilizing the Clean Air Act to regulate green house gases on automobiles, yet had not finalized rules on power production.<sup>92</sup>

The EPA is mandated to have final rules in place by November 2011 to regulate hazardous air pollutants. The Maximum Available Control Technology rules are to be published in early 2012 and the EPA will expect compliance within three years for many airborne noxious pollutants, including mercury.<sup>93</sup> If the rules mandate compliance on a plant-by-plant basis, as opposed to a fleet basis, each of Big Rivers' coal-fired units could require additional equipment.

The Clean Air Interstate Rule was overturned and remanded in 2008, but the courts temporarily kept its regulations in place as the EPA reworked it for compliance. As a substitute, in 2010, the EPA released the Clean Air Transport Rule ("CATR") designed to address the deterioration of air quality downwind from emitting sources.<sup>94</sup>

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<sup>90</sup> Plan Summary, Section 8-5(f) at 8-25

<sup>91</sup> Id., at 8-26.

<sup>92</sup> Id., at 8-25.

<sup>93</sup> Id., Section 8-26.

<sup>94</sup> EPA finalized these rules on July 6, 2011 and renamed them CSAPR.

CATR is to become effective in January 2012 and will address SO<sub>2</sub> and NO<sub>x</sub> emissions. At this time, Big Rivers' fleet is in compliance<sup>95</sup> and has surplus allowances as it currently has scrubbers on all of its generating units, with the exception of Reid Unit 1 and the Reid combustion turbine. When the proposed rules and associated allowances are finalized, Big Rivers will determine if its generating facilities meet the compliance standards or if they require modification. Big Rivers has proactively investigated several scenarios to satisfy the rules and anticipates possibly shutting down the coal-fired Reid Unit 1 and further reducing generation at one or more coal-fired units in its generation fleet.<sup>96</sup> Further, if Big Rivers is not allocated adequate allowances, it will determine whether it is more efficient to purchase allowances or retrofit its generating units with additional emission controls.<sup>97</sup>

If the proposed CATR rules are put into place as currently proposed, Big Rivers would reduce generation or purchase allowance allotments, if the allowances are affordable. Big Rivers assumes that it will have four years to design, permit, and construct the systems necessary to meet new compliance standards. In the interim, Big Rivers is secure that it will remain in compliance with the current rules.<sup>98</sup>

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<sup>95</sup> Plan Summary, Section 8-28.

<sup>96</sup> Response to Staff's Second Data Request, Item 27. These actions will allow Big Rivers the flexibility to meet the 2012 CATR NO<sub>x</sub> allocations.

<sup>97</sup> Plan Summary, Section 8-27.

<sup>98</sup> Response to Staff's First Data Request, Item 15.



Table 4.5 contains the proposed allowances for the Big Rivers fleet.<sup>99</sup>

Table 4.5

Resource	2012 SO <sub>2</sub> Allocation (Tons)	Annual NO <sub>x</sub> Allocation (Tons)	Ozone Season NO <sub>x</sub> Allocations (Tons)	2014 and Beyond SO <sub>2</sub> Allocation (Tons)
Coleman 1	624	1,646	704	1,569
Coleman 2	854	1,671	715	1,569
Coleman 3	1,003	1,713	733	1,621
Green 1	1,774	1,530	595	1,018
Green 2	1,352	1,505	585	1,027
Reid 1	1,136	734	585	1,872
Reid GT 1	0	0	0	0
DB Wilson	8,195	697	305	7,866
HMP&L Henderson 2-1	1,647	293	114	959
HMP&L Henderson 2-2	2,750	305	118	997

Big Rivers used SIPS to also model its Environmental Compliance sensitivity case. It used base case assumptions for all variables with the exception of a proposed carbon reduction cost enacted in 2015. It further reduced by 1 percent the capacity at the R.D. Green Units 1 and 2 and the K.C. Coleman Units 1, 2, and 3 so that Selective Catalytic Reduction units (“SCRs”) could be added.<sup>100</sup>

#### Generator Efficiency Improvements

Big Rivers’ objective as a generation and transmission cooperative is to provide reliable power to its three member-owners at the lowest possible cost. In today’s environment, it is imperative that Big Rivers operate its generation units safely and reliably and with the highest efficiency. Each year, Big Rivers publishes a rolling four-

<sup>99</sup> Plan Summary, Section 8-27, Table 8.22.

<sup>100</sup> Id., Section 8, Page 8-1.

year production work plan which includes unit- and plant-specific operation and maintenance strategy. The plan sets explicit benchmarks for a number of plant-specific operations.<sup>101</sup>

To further improve its efficiency, after closing on the Unwind, Big Rivers created a new position – Manager of Production Service – with the primary responsibility of developing a standardized performance improvement plan and monitoring the heat rate of Big Rivers’ coal-fired generating plants. Big Rivers also hired Black and Veatch, an engineering consultant firm, to measure generator performance in connection with each planned outage to ensure that the expected performance improvement is being achieved. In addition, Black and Veatch has been engaged to monitor and seek higher performance for the HMP&L and Big Rivers units before and after each unforced outage.<sup>102</sup> Big Rivers plans to increase its ongoing plant maintenance and inspection process and to overhaul its entire turbine fleet during the period covered by this IRP in order that it may maintain the highest turbine cycle efficiency.<sup>103</sup>

Coal-fired utilities rank performance and efficiency using the Equivalent Forced Outage Rate (“EFOR”).<sup>104</sup> This NERC based standard allows one utility to compare its plants to another utility’s plants through EFOR values. To illustrate its efficiency and reliability, Big Rivers states that its EFOR was 3.7 percent in 2009, which compares to

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<sup>101</sup> Response to Staff’s Second Data Request, Item 1(a).

<sup>102</sup> Id.

<sup>103</sup> Id., Item 1(c).

<sup>104</sup> EFOR is the time (as a percentage) a generator is unexpectedly out of service. The more time out of service, the larger the EFOR.

the 6.9 percent industry average.<sup>105</sup> Big Rivers can also use other common industry standards such as Equivalent Availability Factor (“EAF”)<sup>106</sup> and net Capacity Factor (“NCF”)<sup>107</sup> for comparisons with utilities and energy companies considered its peers.

Big Rivers completed a benchmarking study in 2011, and its units performed well above the median for all the units in the study. The performance statistics for the units are shown in Table 4.6.<sup>108</sup>

Table 4.6

**Performance Statistic through September 2010**

<b><u>Big Rivers Unit</u></b>		<b><u>Peer Group</u></b>
EFOR 4.37%	(lower is better)	EFOR 6.47%
EAF 89.02%	(higher is better)	EAF 86.65%
NCF 81.05%	(higher is better)	NCF 70.57%

The performances of Big Rivers’ generating units, based on the same measures, from the closing of the Unwind Transaction through the end of calendar year 2010 are shown on the following page in Table 4.7.<sup>109</sup>

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<sup>105</sup> Executive Summary, ii.

<sup>106</sup> The percent of time a generator is available for service.

<sup>107</sup> An indicator of a generator’s energy production.

<sup>108</sup> Response to Staff’s Second Data Request, Item 1(d).

<sup>109</sup> Id.

Table 4.7

**Big Rivers Generating Units Performance Statistic**

<b><u>July – Dec 2009</u></b>	<b><u>Full Year 2010</u></b>
EFOR 3.71%	EFOR 3.58%
EAF 85.90%	EAF 93.65%
NCF 73.74%	NCF 84.02%

Big Rivers realizes that generation outage planning is important to its reliability plan. These planned outages allow Big Rivers to pull a generating unit from service to perform work on pre-determined specific components. Maintenance of the coal-fired generating units is vital to this process and helps avoid forced outages which require that a unit be removed from service unexpectedly and immediately. Big Rivers has created a maintenance schedule for its generating units.<sup>110</sup>

In its 2011 general rate case,<sup>111</sup> Big Rivers informed the Commission that it had postponed maintenance on several of its generating facilities in 2010 and 2011 so that it could meet loan covenants.<sup>112</sup> It further stated that it will complete all of its deferred and scheduled maintenance by the end of 2012 if it receives the rates it requested; but, that if the rates received are not adequate, it will be forced to reduce scheduled outages and the ensuing maintenance.<sup>113</sup>

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<sup>110</sup> Response to Staff's Second Data Request, Item 1(e).

<sup>111</sup> Case No. 2011-00036, Application of Big River Electric Corporation For a General Adjustment of Rates (Ky. PSC Nov. 17, 2011).

<sup>112</sup> Id., Exhibit 48, page 4.

<sup>113</sup> Id., page 6.

## Transmission

Big Rivers' transmission system is designed to adequately supply capacity for reliable transport of generating resources to its member cooperatives and third parties by way of its Open Access Transmission Tariff.<sup>114</sup> Big Rivers owns and operates a transmission system containing 1,262 miles of transmission line and 80 substations.<sup>115</sup>

Big Rivers is constantly looking to improve and upgrade its transmission system. From 2005 through 2010, it placed in service 17 miles of 69kV load-serving transmission which was necessary to connect six new delivery point substations to its member systems. Big Rivers also reconducted approximately 27 miles of 161kV line and 25 miles of 69kV line that allowed the lines to carry higher current levels.<sup>116</sup>

Big Rivers also completed transmission projects for interconnection or import/export capability. The 345 kV "Wilson to Coleman" Extra-High Voltage line allowed interconnection with Kentucky Utilities Company at the new Davies County EHV substation. This transmission line addition increases Big Rivers' capacity for off-system sales.<sup>117</sup> Big Rivers does not anticipate the acceleration of any transmission projects being constructed to meet current or anticipated EPA regulations.<sup>118</sup>

Big Rivers recently joined the Midwest ISO and participates as a transmission owner in the Midwest ISO's Midwest Transmission Expansion Plan ("MTEP") process.

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<sup>114</sup> Plan Summary, Section 5-1 at 5-3.

<sup>115</sup> Executive Summary, ii.

<sup>116</sup> Plan Summary, Section 6 at 6-3.

<sup>117</sup> Id., Section 6-3.

<sup>118</sup> Response to AG's Data Request, Item 19.

MTEP is a multi-state, region-wide transmission planning and allocation process that could impact Big Rivers' future transmission planning and cost allocation.

Big Rivers future transmission line projects are shown in Table 4.8.<sup>119</sup>

Table 4.8

Planned Transmission System Additions (2010 – 2024)	Year
Falls of Rough – McDaniels 69 kV line addition	2010
Wilson – New Hardinsburg/Paradise 161 kV tap line	2011
Paradise 161 kV reconductor from new tap point	2011
Wilson 161 kV terminal for new tap line	2011
Wilson 161/69 kV transformer addition	2012
Wilson – Centertown 69 kV line	2012
Meade - Garrett 69 kV line reconductor	2012
Payneville area tap line & metering	2013
Cumberland – Caldwell Springs 69 kV line	2013
Garrett – Flaherty 69 kV line project	2013
White Oak 161/69 kV substation addition	2013
Rome Junction – West Owensboro 69 kV reconductor	2017
Hardinsburg 161/69 kV transformer replacement (2)	2017
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
Meade County 161/69 kV transformer addition	2020
Brandenburg area 69 kV capacitor addition	2020
Ensor 161/69 kV substation addition	2022
Reid EHV 161/69 kV transformer addition	2022
Hardinsburg No. 1 to Harned 69 kV line reconductor	2022
White Oak 161/69 kV transformer addition	2024

In response to a Big Rivers inquiry, the Midwest ISO stated that it will not allocate any funding to complete the planned load serving transmission additions set forth

<sup>119</sup> Plan Summary, Section 6, Table 6.2, at 6.4

above.<sup>120</sup> MTEP has specific guidelines and criteria for transmission selected for cost allocation and most of the above projects are required for native load serving functions.

### Distribution System

Big Rivers is a Generation and Transmission Cooperative providing energy to three distribution cooperatives, owning no distribution facilities.

### Discussion of Reasonableness

The Staff considers Big Rivers' supply-side resource assessment reasonable considering the fact that during the 15-year period covered by this IRP, Big Rivers can maintain a 12 percent reserve margin without additional supply-side resources. There are, however, several issues that the Staff finds Big Rivers should address in greater detail in its next IRP. The Staff recommendations are set forth below:

## RECOMMENDATIONS

### Reserve Margin

Staff recommends that Big Rivers perform a utility-specific reserve margin study. As Big Rivers notes in response to a Staff information request, it has not performed a reserve margin study in the past 10 years. With two direct-serve customers that account for 69 percent of its power sales, Big Rivers is unique among Kentucky's jurisdictional generators. In addition, Big Rivers has undergone several significant changes since 2009. It has completed the unwind transaction, which returned 1,444 MW of generation to Big Rivers' control. In addition, pursuant to the Commission's authorization, Big Rivers has joined the Midwest ISO, which now controls the dispatch of Big Rivers' generating units. The Midwest ISO also requires that Big Rivers maintain

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<sup>120</sup> Response to AG's Data Request, Item 18.

a reserve margin (currently 4.5 percent) that differs somewhat from the traditional reserve margin used for Kentucky planning purposes (currently 14 percent) with which the Staff is familiar. Therefore, even though Big Rivers has demonstrated that it can maintain a 12 percent reserve margin throughout the period of this IRP, Staff believes that it is important that Big Rivers perform a utility-specific reserve margin study.

#### Renewable Generation and Distributed Generation

Big Rivers 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. Big Rivers should also consider and discuss the consideration given to distributed generation in the resource plan.

#### Generation Efficiency

Section 8(2) of 807 KAR 5:058 requires the utilities 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. In addition, the Commission, in its August 25, 2009 Order in Administrative Case No. 2007-00300, 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).”<sup>121</sup>

Big Rivers did not initially provide the required discussion and, for all practical purposes, it failed to comply with the requirement of the IRP regulation and the specific

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<sup>121</sup> 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.



directive of the Commission in Administrative Case No. 2007-00300. The brief general discussion summarized earlier in this report was only provided in response to questions in Staff's Second Information Request.

Big Rivers, in its response, generally explained that it had created a new manager position with the primary responsibility of addressing generation performance improvement and monitoring heat rate, had employed an engineering consultant to assist in monitoring performance, had reviewed a third-party benchmarking study, referenced its performance statistics, and developed maintenance schedules for its generating units. It did not, however, provide any detailed discussion of work undertaken or the actual improvement for any of its generating units.

Given Big Rivers' statement in the Unwind case regarding unit efficiency and performance, Staff is concerned that Big Rivers has deferred some maintenance in both 2010 and 2011. The fact that Big Rivers recognized that the deferral may have a negative impact on generation reliability but failed to divulge this information in its IRP raises the concern of the Staff to a much higher degree.

In its next IRP, Big Rivers should provide a detailed discussion of the specific generation efficiency improvement activities it has undertaken. The absence of such a discussion could potentially result in Big Rivers' next IRP being found not in compliance with the Commission's IRP regulation.

#### Compliance Planning

Section 8(5)(f) of 807 KAR 5:058 requires the utilities to include a description and discussion of actions to be undertaken during the fifteen (15) years covered by the plan to meet the requirements of the Clean Air Act amendments of 1990, and how these

actions affect the utility's resource assessment. The EPA has proposed new regulations which, as previously stated, Big Rivers did not specifically address in this IRP. However, even though Big Rivers has not developed a final compliance strategy, as Staff notes in the Compliance Planning Section, Big Rivers has given preliminary consideration to the impact of the new regulations.

In a March 30, 2011 letter, following Big Rivers' October 2010 presentation of the potential impact of the new regulations, the Commission's Executive Director expressed the need to continue discussion of related issues.<sup>122</sup> In a response dated April 14, 2011, Big Rivers stated that it did not plan to construct new generation as a result of the proposed regulations but that modifications to existing environmental permits may be needed depending upon the final regulations. In addition, Big Rivers noted that it intended to engage an outside firm to review its existing control equipment, and to develop a comprehensive list of options and a plan to achieve compliance with the currently proposed regulations.<sup>123</sup>

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 all regulations are not yet final and because of the financial impact of any actions Big Rivers may take. However, we believe a balance must be struck between being cautious and being

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<sup>122</sup> Letter of Executive Director to Mark Bailey, President and CEO, Big Rivers, March 30, 2011.

<sup>123</sup> Letter of Mark Bailey to Jeff DeRouen, Executive Director, Kentucky Public Service Commission, April 14, 2011.

proactive; if it is overly cautious, Big Rivers may not have the ability to consider all options and develop the most cost-effective compliance strategy.

Staff believes that Big Rivers' decision to employ an outside firm to provide expertise in developing a compliance strategy is appropriate. Staff does, however, have concerns regarding compliance planning that relate to the timeliness of Big Rivers' planning decisions and the comprehensive nature of its planning.

As stated earlier in this report, Big Rivers is waiting for final EPA rules before making a number of planning decisions. As it states, if the CATR rules are put into place as proposed, Big Rivers assumes that it will have four years to comply. However, if the EPA remains firm with the short timeframe to comply with MACT rules, the need for rapid deployment will escalate the construction cost. Therefore, as stated above, Staff believes it is appropriate that Big Rivers balance caution with the need to move more expeditiously to preserve the broadest menu of options to address its compliance.

Staff also 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. Comprehensive planning is absolutely essential to ensure that compliance measures proposed to be implemented in the near and mid term will not be rendered ineffective and useless long before they reach the end of their useful lives. Only by demonstrating this degree of comprehensive planning can the Commission

perform its statutory duties to determine that new facilities are needed and that rates are fair, just, and reasonable.”<sup>124</sup>

A complete discussion of Big Rivers’ compliance actions and plans relating to current and pending environmental regulations should be included in its next IRP.

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<sup>124</sup> Letter of Executive Director to Mark Bailey, President and CEO, March 30, 2011.

## 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 2011 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:

- Maintain a current and reliable load forecast
- Consider expanding its DSM programs
- Identify potential new supply-side resources and DSM programs
- Provide competitively priced power to its members
- Maintain adequate planning reserve margins
- Maximize reliability while minimizing costs, risks and environmental impacts
- Meet NERC guidelines and requirements
- Provide assistance to its member cooperatives regarding new technologies, mapping and planning, safety training and programs, economic development, and customer support

#### THE INTEGRATION PROCESS

A resource assessment and acquisition plan was developed based on minimizing expected costs over the 2011-2025 planning horizon. For modeling purposes, Big Rivers used the *Strategist Integrated Planning System*, which provides the ability to compare combinations of potential resource additions in order to determine the portfolio

necessary to achieve the planning reserve margin criteria at the lowest cost.<sup>125</sup> Big Rivers' existing generating resources, which were modeled using the *Strategist GAF module*, were dispatched against its 2010 load and energy forecast.<sup>126</sup> Changes in a number of variables were addressed by conducting the production simulation and expansion planning analysis for a Base Case and several sensitivity cases.

#### Base Case and Sensitivity Cases

The Base Case included: the base load and energy forecast; new DSM programs included in the \$1 million energy efficiency plan; base fuel price projections; and base market price projections. Big Rivers also developed the following sensitivity cases:

1. High fuel price case – uses base case assumptions except for a 20 percent increase in fuel prices and market prices.
2. High load case – uses base case assumptions except for a high load and energy requirements forecast.
3. Renewable portfolio case – uses base case assumptions except for:
  - a) RPS requirements of:
    - 1) 15 percent of total energy from renewable resources by 2015.
    - 2) 20 percent of total energy from renewable resources by 2020.
    - 3) 25 percent of total energy from renewable resources by 2025.
  - 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.

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<sup>125</sup> As discussed in the Supply-Side section of this report, relying on the 15 percent target reserve margin contained in NERC's 2009 Long-Term Reliability Assessment, Big Rivers used a 14 percent minimum acceptable reserve margin for modeling purposes.

<sup>126</sup> As discussed in the Load Forecast section of this report, for the 2008-2023 planning horizon, Big Rivers forecasts its energy and peak demand requirements to increase at annual growth rates of 0.4 percent and 0.5 percent, respectively.

- c) Carbon reduction costs are assumed to be in place starting in 2015.
- 4. Environmental compliance case – uses base case assumptions except:
  - a) Carbon reduction costs are assumed to be in place starting in 2015.
  - b) There is a one percent reduction in capacity at Green Units 1 and 2 and at Coleman Units 1, 2, and 3 to account for installation of SCRs.
  - c) Reid Unit 1 is retired at the end of 2011.
- 5. Midwest ISO case – uses base case assumptions except:
  - a) Generating capacities are adjusted for purposes of reserve margin calculations according to Midwest ISO defined EFORs.
  - b) Planning reserve margin used in the expansion plan is 4.5 percent, the Midwest ISO's non-coincident load based on a planning reserve margin as defined in Midwest ISO's Business Practices Manual: Resource Adequacy effective June 1, 2010.

#### Potential Resources

For the development of its Base Case and the five sensitivity cases, Big Rivers considered the following resource options:

1. Nuclear
2. Coal-fired
3. Gas-fired simple cycle CT
4. Gas-fired combined cycle CT
5. Biomass
6. Landfill gas
7. Wind
8. Photovoltaic
9. Coal bed methane
10. EE program portfolio

Operating characteristics and associated costs for supply-side resources were taken primarily from EIA's 2010 Annual Energy Outlook. Energy efficiency measures

were screened using GDS's Benefit/Cost Screening Model, an analysis tool designed to evaluate costs, benefits, and risks of DSM programs and services. Measures were restricted to those that are currently commercially available.

#### Base Case and Sensitivity Case Results

Big Rivers' Base Case optimal expansion plan includes the addition of a 50 MW CT in 2022, which is necessary in order to maintain a 14 percent planning reserve margin. The high fuel and Midwest ISO cases' resulting plans also include a 50 MW CT late in the 15-year planning horizon period. The high load and environmental cases have between 50 and 65 MW of capacity added in the first three years of the planning period with 50 MW of capacity also added 10 years into the planning period. The RPS case calls for the addition of more than 1,000 MW of renewable resources in blocks that correspond with the years 2015, 2020 and 2025 shown in the assumptions for the case. Overall, all cases except the RPS case include a 50 MW CT as a resource addition.

#### Overall Integration

With a 2010 planning reserve margin in excess of 18 percent and with low growth forecast for peak demand, at this time, Big Rivers has little need for new DSM programs from a capacity perspective. As its new DSM programs are being started as small-scale pilots, it was not necessary that Big Rivers perform a Net Present Value analysis of its optimal expansion plan to determine whether the plan was lower cost with or without the new DSM programs included. In that sense, Big Rivers' optimal plan does not reflect the integration of supply-side and demand-side resources, based on producing the lowest cost plan, which it typically performed within the IRP process.



## DISCUSSION OF REASONABLENESS

There were no recommendations regarding integration issues in Staff's report on Big Rivers' 2002 IRP. Accordingly, this report contains no discussion of the response thereto by Big Rivers.

## RECOMMENDATIONS

While Staff is generally satisfied with Big Rivers' IRP and the information contained therein, it believes there are a number of areas in which Big Rivers can make improvements in future IRP filings. Those improvements, which are in addition to the improvements recommended in Sections 2, 3, and 4 of this report, are as follows:

- Big Rivers' next IRP should include a more comprehensive assessment of alternative resources considered and environmental compliance strategies.
- Big Rivers should be more proactive in considering potential environmental regulations and more explicitly addressing them in future IRP filings.
- 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.