

**COMMONWEALTH OF KENTUCKY  
BEFORE THE PUBLIC SERVICE COMMISSION**

In the Matter of:

APPLICATION OF KENTUCKY POWER COMPANY )  
FOR APPROVAL OF ITS 2011 ENVIRONMENTAL )  
COMPLIANCE PLAN, FOR APPROVAL OF ITS AMENDED )  
ENVIRONMENTAL COST RECOVERY SURCHARGE )  
TARIFF, AND FOR THE GRANT OF A CERTIFICATE OF )  
PUBLIC CONVIENENCE AND NECESSITY FOR THE )  
CONSTRUCTION AND )  
ACQUISITION OF RELATED FACILITIES )

Case No. 2011-00401

**Direct Testimony of  
J. Richard Hornby**

**On Behalf of  
Sierra Club**

**March 12, 2012**

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1 **1. INTRODUCTION**

2 **Q. Please state your name and occupation.**

3 A. My name is J. Richard Hornby. I am a Senior Consultant at Synapse Energy Economics,  
4 485 Massachusetts Avenue, Cambridge, MA 02139.

5 **Q. Please describe Synapse Energy Economics.**

6 A. Synapse Energy Economics (“Synapse”) is a research and consulting firm specializing in energy  
7 and environmental issues. Its primary focus is on electricity resource planning and regulation  
8 including computer modeling, service reliability, resource portfolios, financial and economic  
9 risks, transmission planning, renewable energy portfolio standards, energy efficiency, and  
10 ratemaking. Synapse works for a wide range of clients including attorneys general, offices of  
11 consumer advocates, public utility commissions, environmental groups, U.S. Environmental  
12 Protection Agency, Department of Energy, Department of Justice, Federal Trade Commission and  
13 National Association of Regulatory Utility Commissioners. Synapse has over twenty  
14 professional staff with extensive experience in the electricity industry.

15 **2. BACKGROUND**

16 **Q. Please summarize your educational background.**

17 A. I have a Bachelor of Industrial Engineering from the Technical University of Nova  
18 Scotia, now the School of Engineering at Dalhousie University, and a Master of Science  
19 in Energy Technology and Policy from the Massachusetts Institute of Technology (MIT).

20 **Q. Please summarize your work experience.**

21 A. I have over thirty years of experience in in the energy industry, primarily in utility regulation and  
22 energy policy. Since 1986, as a regulatory consultant I have provided expert testimony and  
23 litigation support on natural gas and electric utility resource planning, cost allocation and rate  
24 design issues in over 120 proceedings in the United States and Canada. During that period my  
25 clients have included utility regulators, consumer advocates, environmental groups, energy  
26 marketers, gas producers, and utilities. Prior to 1986 I served as Assistant Deputy Minister of  
27 Energy for Nova Scotia where I helped prepare the province’s first comprehensive energy plan

1 and served on a federal-provincial board responsible for regulating exploration and development  
2 of offshore oil and gas reserves. I have also spent several years as a project engineer in the  
3 industrial sector.

4 I was the lead author of *Potential Impacts of a Renewable and Energy Efficiency*  
5 *Portfolio Standard in Kentucky* (January 2012) and of projections of long-term avoided  
6 energy supply costs in New England prepared 2007, 2009 and 2011. I was co-author of  
7 *Portfolio Management: How to Procure Electricity Resources to Provide Reliable, Low-*  
8 *Cost, and Efficient Electricity Services to All Retail Customers*, a 2006 report prepared  
9 for the National Association of Regulatory Utility Commissioners (NARUC).

10 My resume is attached to this testimony as Exhibit\_\_(JRH-1).

11 **Q. On whose behalf are you testifying in this case?**

12 A. I am testifying on behalf of Sierra Club.

13 **Q. Have you testified previously before the Kentucky Public Service Commission**  
14 **(Commission)?**

15 A. No, I have not.

16 **3. PURPOSE OF TESTIMONY**

17 **Q. What is the purpose of your testimony?**

18 A. The Sierra Club retained the Synapse team of Dr. Jeremy Fisher, Ms. Rachel Williams  
19 and me to assist in their review of the Kentucky Power Company's (KPCo or Company)  
20 application for a Certificate of Public Convenience and Necessity (CPCN) to retrofit Big  
21 Sandy Unit 2.

22 The purpose of my testimony is to provide an overview of our analysis of whether the  
23 Company's proposed CPCN for Big Sandy Unit 2 and associated Environmental Cost  
24 Recovery (ECR) surcharge are reasonable and cost-effective for complying with the  
25 environmental requirements the Company is facing. My testimony discusses the resource  
26 options KPCo evaluated, the range of future scenarios it used to evaluate those resource  
27 options, its projection of revenue requirements for each resource option under those

1 future scenarios and its conclusions regarding the merits of its proposed CPCN based  
2 upon its projections and analyses.

3 Synapse witness Wilson describes her review of the Company's modeling of resource  
4 options using Strategist as well as her use of Strategist to model those resource options  
5 under an additional future scenario reflecting a different projection of carbon prices.

6 Synapse witness Dr. Fisher describes his review of the Company's assumptions regarding  
7 the costs of certain resource options, certain future scenarios the Company tested in its  
8 Strategist modeling and the Company's modeling of those resource options using Aurora.

9 **Q. What data sources did you rely upon to prepare your review of the Company's**  
10 **request?**

11 A. My review relies primarily upon the direct testimonies and Exhibits of KPCo witnesses  
12 Wohnhas, Weaver and Munsey and their responses to various data requests. The specific  
13 responses I cite in this testimony are attached as Exhibit\_\_\_\_(JRH-10). In addition I  
14 reviewed KRS 278.183, referred to as the Environmental Surcharge Statute, as well as  
15 materials regarding Kentucky's energy and environmental policies and regarding  
16 strategies that companies with coal units are using to comply with environmental  
17 regulations.

#### 18 **4. SUMMARY CONCLUSIONS AND RECOMMENDATIONS**

19 **Q. Please summarize KPCo's request for a CPCN to install environmental control**  
20 **equipment on Big Sandy Unit 2 and for a rate increase to recover the costs of that**  
21 **investment.**

22 A. KPCo has requested approval for a CPCN to install environmental control equipment,  
23 primarily a Dry Flue Gas Desulfurization System ("DFGD"), on Big Sandy Unit 2 ("the  
24 Plant"). Concurrently it has requested an increase in its ECR surcharge in order to  
25 recover the cost of installing that equipment. The Company estimates the environmental  
26 control equipment, at a capital cost of \$940 million, will have an annual revenue  
27 requirement of approximately \$178 million and cause its retail rates to increase by more  
28 than 30 percent.

1 KPCo maintains that installing a DFGD on that Unit is in the long-term best interest of its  
2 customers. The Company's conclusion is based upon the results of Mr. Weaver's  
3 economic evaluation which indicates that, relative to the three other resource options it  
4 examined, retrofitting Big Sandy Unit 2 is the best option for complying with the  
5 environmental regulations the Company is facing.

6 **Q. Please summarize your major conclusions and recommendation regarding the**  
7 **Company's request.**

8 A. My first conclusion is that the Company has not demonstrated that its proposed CPCN for  
9 Big Sandy Unit 2 is reasonable and cost-effective for complying with the environmental  
10 requirements the Company is facing. That conclusion is based upon the results of our  
11 review which indicates that the Company has not evaluated the full range of resource  
12 options available to it, that its projections of revenue requirements for the resource  
13 options it did evaluate are not correct, that its evaluation of future scenarios does not  
14 include a reasonable projection of carbon prices and that its Monte Carlo risk analysis is  
15 flawed. My second, related, conclusion is that allowing KPCo to recover the costs of  
16 installing environmental control equipment on Big Sandy Unit 2 from ratepayers will not  
17 result in reasonable rates.

18 Based upon those two conclusions I recommend that the Commission not approve the  
19 Company's request for a CPCN for Big Sandy Unit 2.

20 **Q. Please summarize your conclusions and recommendations regarding ratemaking**  
21 **should the Commission decide to approve the CPCN.**

22 A. In the event that the Commission decides to approve the Company's request for a CPCN,  
23 I am sure it will limit the Company's recovery of actual costs to only the amounts it finds  
24 just and reasonable. My understanding of the ratemaking process under the  
25 Environmental Surcharge Statute is that the Commission will review the Company's  
26 actual costs every six months, and disallow actual amounts it finds that are not just and  
27 reasonable, and that it will shift recovery of amounts it does find reasonable from the  
28 surcharge into base rates every two years. However, my conclusion is that even with  
29 those measures, ratepayers will still bear the bulk of the financial risk resulting from

1 KPCo's decision to propose and pursue the CPCN since they will be paying the vast  
2 majority of, if not all, the revenue requirements resulting from KPCo's choice of that  
3 resource option.

4 Based on that conclusion, if the Commission decides to approve the CPCN, I recommend  
5 that the Commission require the Company to:

- 6 • recover its investment in environmental controls at Big Sandy Unit 2 based upon  
7 a depreciation rate consistent with generally accepted accounting principles,  
8 which would be a period of at least twenty years;
- 9 • modify its System Sales Clause to be consistent with the amount of off-system  
10 sales margin it assumed would flow to ratepayers under its modeling of the CPCN  
11 option; and
- 12 • bear the risk of carbon regulation costs in excess of the values the Company has  
13 assumed in its early carbon future scenario.

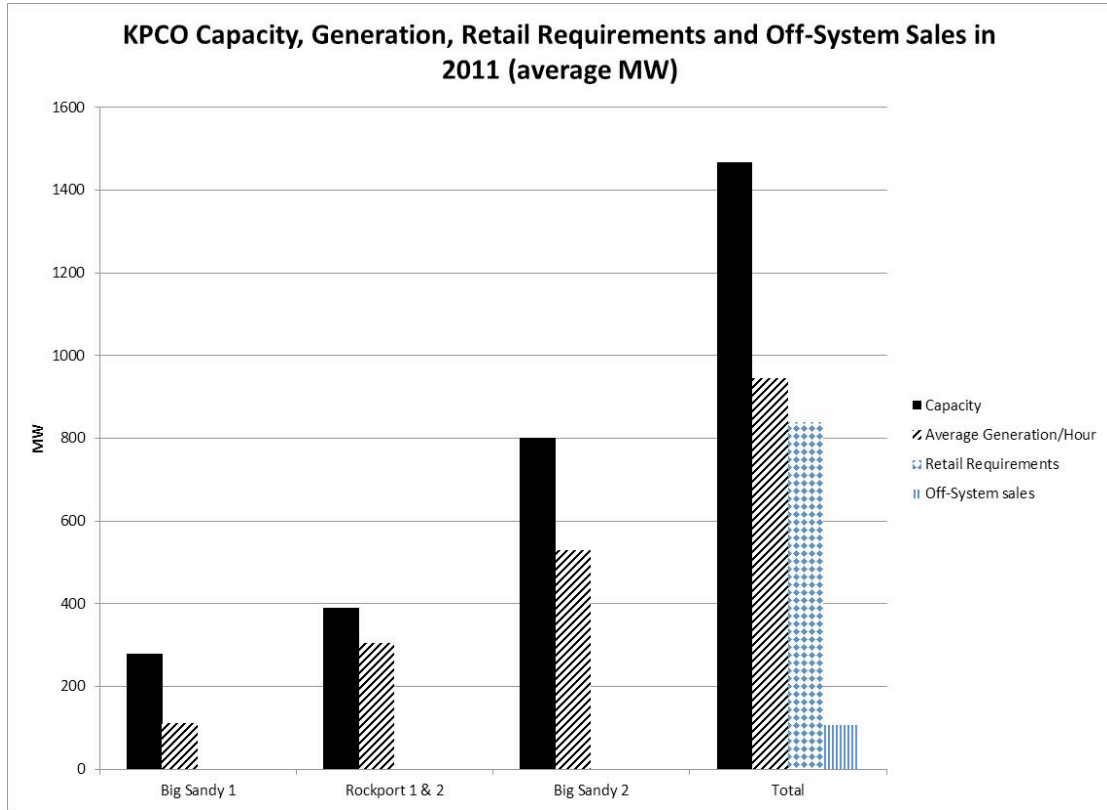
## 14 **5. APPROACH TO REVIEW OF KPCO REQUEST**

### 15 **Q. Please summarize KPCo's current mix of capacity and energy by resource.**

16 A. KPCo has modeled its future operations as if it will be operating as a stand-alone  
17 company rather than a member of the current AEP pool. As a stand-alone company  
18 KPCo is currently entirely dependent on coal units for capacity and annual generation,  
19 i.e., energy, to serve its retail load. It owns two coal fired units, Big Sandy Unit 1 and  
20 Big Sandy Unit 2. It acquires capacity and energy from two other coal-fired units,  
21 Rockport 1 and Rockport 2, through a long-term purchase power agreement which its  
22 modeling assumes will be renewed to continue through 2040

23 KPCo's mix of capacity and energy in 2011, as modeled by the Company in Strategist, is  
24 illustrated in the bar chart below from Exhibit\_\_\_(JRH-2). In that year Big Sandy Unit 2  
25 accounted for approximately 55% of the Company's total capacity and generation. In  
26 contrast, Big Sandy Unit 1 accounted for approximately 20% of the Company's capacity  
27 but provided only 12% of its annual energy. That Exhibit also indicates that the Company  
28 used approximately 10% of its total generation to make off-system sales. Under the

1 KPCo System Sales Clause, Tariff S.S.C., the Company retains forty percent of the  
2 margin revenue from off-system and credits retail customers with the remaining sixty  
3 percent.



4  
5 **Q. Please summarize KPCo’s current resource mix and the known and emerging**  
6 **environmental regulations it is facing.**

7 A. The Company is currently facing the following known and emerging environmental  
8 regulations: the Cross-State Air Pollution Rule (CSAPR), the Mercury and Air Toxics  
9 Standard, the Coal Combustion residuals rule, the Clean Water Act “316(b)” rule and  
10 expected Effluent Limitation Guidelines as well as the New Source Review consent  
11 decree. The Company expects that Big Sandy Unit1 and Big Sandy Unit 2 will need to  
12 comply with at least some of these environmental requirements by 2016.

13 **Q. Please summarize the economic evaluation KPCo conducted to evaluate its resource**  
14 **options for complying with those environmental requirements.**



1 A. According to Mr. Weaver's direct testimony, KPCo evaluated its resource options for  
2 complying with these environmental requirements in four major steps.

- 3 • First, it identified four resource options for complying with these environmental  
4 requirements.
- 5 • Second, it identified a Base Case and four additional discrete scenarios to evaluate the  
6 future conditions under which those resource options might operate.
- 7 • Third, the Company developed projections of the revenue requirements associated  
8 with each resource options over a 30-year period, 2011 to 2040, under each of the  
9 five discrete future scenarios. The Company developed those projections using the  
10 Strategist model, a computer simulation model, and a separate workbook to calculate  
11 the carrying charges of each resource option.
- 12 • Fourth, the Company used Aurora, another computer simulation model, to prepare a  
13 risk analysis of the four resource options.

14 Based upon his review of the revenue requirements of each resource option under each of  
15 the five scenarios, summarized in his Exhibit \_\_\_ (SCW-4), his review of the results from  
16 the Aurora model and other points in his direct testimony, Mr. Weaver concluded that  
17 retrofitting Big Sandy 2 with DFGD technology is in the long-term best interest of  
18 KPCo's customers.

19 **Q. Please describe the approach the Synapse team used to determine if the Company's**  
20 **proposed CPCN for Big Sandy Unit 2 and associated ECR surcharge were**  
21 **reasonable and cost-effective for complying with the environmental requirements**  
22 **the Company is facing.**

23 A. The Synapse team treated the Company's application as a request for rate relief and  
24 reviewed that request in the same level of detail as a base rate filing. Specifically we  
25 reviewed the validity of the key input assumptions underlying the Company's projection  
26 of revenue requirements for each resource option under each future scenario. Where  
27 applicable we also verified the mathematical accuracy of those revenue requirement  
28 projections.

1 We followed this rate-making proceeding approach based on the Commission's Order in  
2 Case No. 2011-00161 indicating that a proceeding under the Environmental Surcharge  
3 Statute is a rate-making alternative to a general rate case. Our approach is also based  
4 upon the Environmental Surcharge Statute requirement that the Commission must  
5 determine if the Company's proposed plan and rate surcharge are reasonable and cost-  
6 effective for complying with the environmental requirements it is facing.

7 **Q. Please contrast the magnitude of rate relief the Company is requesting in this**  
8 **proceeding with the rate relief it requested in its most recent general rate**  
9 **proceeding.**

10 A. The increase in rates the Company is requesting in this proceeding is much larger than  
11 the increase it requested in its most recent general rate proceeding. In this proceeding the  
12 Company is requesting an increase in annual revenues of \$178.8 million, or over 30  
13 percent. That amount is approximately fifty percent more than the increase of \$123.6  
14 million it requested in its 2009 general rate proceeding, Case No. 2009-00459, and  
15 approximately three times greater than the \$63.7 million increase it ultimately agreed to  
16 in the settlement of that Case.

17 **Q. Is it more difficult to assess the reasonableness of its request in this proceeding than**  
18 **its request in a general rate proceeding?**

19 A. Yes. In order to determine the reasonableness of the revenue requirements a utility  
20 requests in any type of rate proceeding parties generally follow two basic steps. They  
21 review the Company's support for the input values it has used to calculate its revenue  
22 requirements and they review the mathematical accuracy of its calculation of revenue  
23 requirements based upon those input values. While I do not wish to minimize the time  
24 and effort that parties put into verifying the reasonableness of the revenue requirements  
25 in general rate proceedings, I consider it more difficult to execute those two steps in this  
26 type of rate proceeding. In a general rate case in Kentucky, parties review a projection  
27 of revenue requirements for a historical test year, thus many of the inputs are actual or  
28 close to actual costs, and the costs are limited to one year. In contrast, in this proceeding  
29 the parties must verify the Company's support for assumptions for 30 years as well as the  
30 mathematical accuracy of its calculations using those assumptions.

1 Given the uncertainty associated with the values of key input assumptions over that  
2 planning horizon it is particularly important that all parties have a clear understanding of  
3 the basis for the Company's key input assumptions regarding resource costs and of the  
4 range of future market and regulatory conditions it may face. It is particularly important  
5 to "stress test" those assumptions under a range of realistic possible future scenarios.

6 **6. ASSESSMENT OF KPCO REQUEST FOR CPCN AND RATE INCREASE**

7 **Q. Has your team been able to confirm the validity of all key input assumptions and**  
8 **verify the Company's calculations and projections based upon those inputs?**

9 A. No. Our review has found many aspects of the Company's filing unclear, particularly in  
10 terms of documentation of key input assumptions and transparency of calculations based  
11 upon those assumptions. Ms. Wilson and Dr. Fisher discuss the lack of clarity and  
12 inconsistencies in various aspects of the Company filing. As a result we do not claim to  
13 have confirmed the validity of all key input assumptions underlying the Company's  
14 projection of revenue requirements for each resource option under each future scenario,  
15 or to have verified the mathematical accuracy of all of its projections.

16 **Q. Please list the major problems the Synapse team has found with the Company's**  
17 **economic evaluation**

18 A. Our review has identified problems with four major aspects of the Company's economic  
19 evaluation. The four major problem areas are:

- 20 i. the limited range of pre-determined resource options the Company modeled in  
21 Strategist;
- 22 ii. certain of the Company's assumptions regarding the costs of the four resource  
23 options it did evaluate were unreasonable or inconsistent, and when corrected  
24 change the projected revenue requirements of those Options;
- 25 iii. the limited range of future scenarios the Company modeled using Strategist to  
26 evaluate the four resource options, in particular its failure to evaluate scenarios  
27 that are substantively different from each other or a scenario with a reasonable  
28 projection of carbon prices; and
- 29 iv. the risk analysis the Company prepared using Aurora.

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**i. Limited Range of Pre-determined Resource Options**

**Q. Please summarize the four resource options the Company evaluated for complying with known and emerging environmental regulations at the Big Sandy plant.**

A. For Big Sandy Unit 1 the Company’s proposed environmental compliance strategy is to retire it as a coal-fired unit effective January 1, 2015. For Big Sandy Unit 2, the Company decided to choose among four possible resource options in order to determine the best environmental compliance strategy. The four resource options it evaluated were:

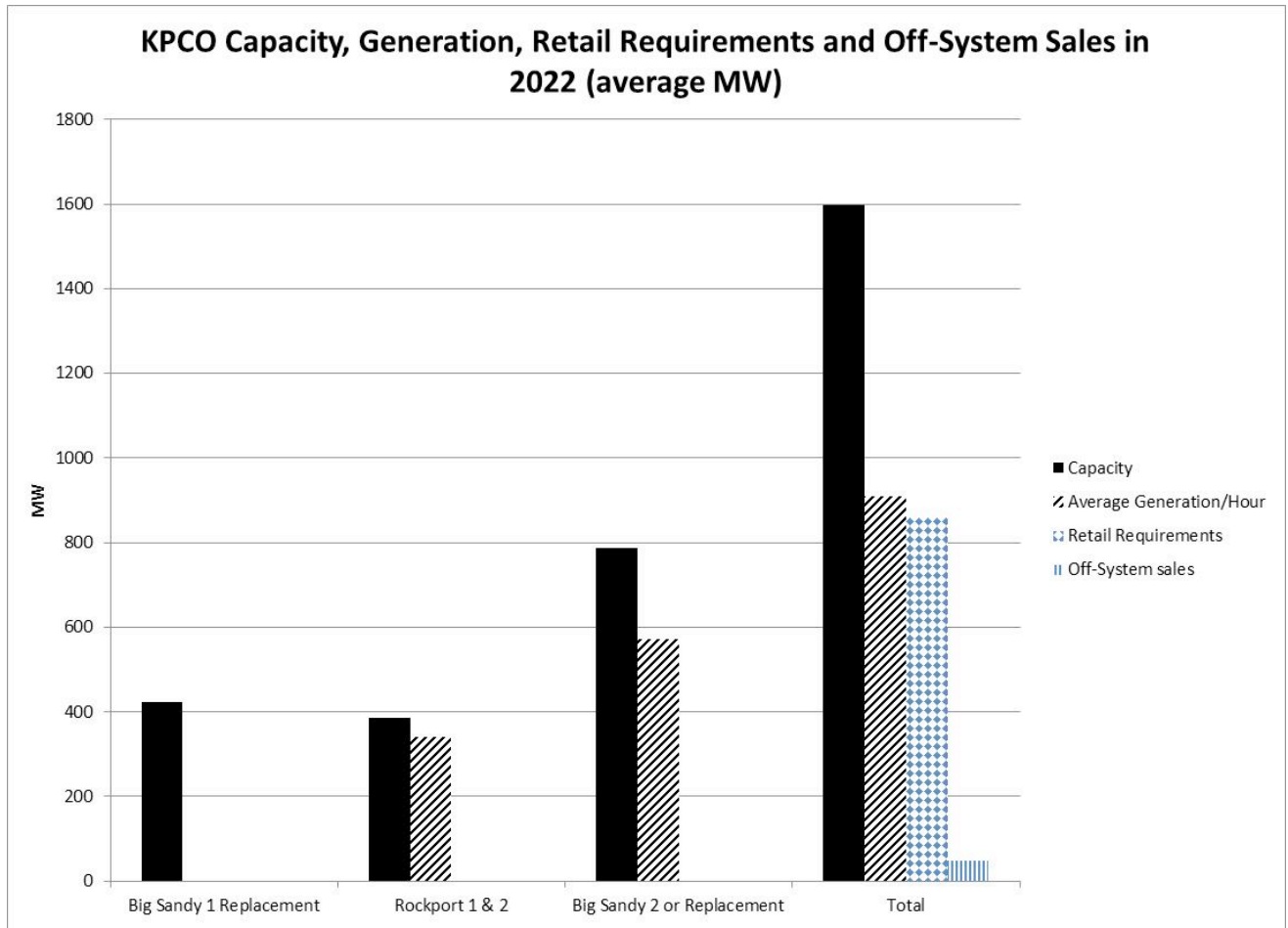
- Option 1, Retrofit Big Sandy Unit 2 with DFGD by June 2016 in order to allow it to continue operating at approximately 800 MW;
- Option 2, Retire Big Sandy Unit 2. Build a 762 MW natural gas-fired combined cycle unit (CC) by January 2016 at the Big Sandy plant site;
- Option 3, Retire Big Sandy Unit 2. Repower Big Sandy Unit 1 as a 745 MW natural gas-fired combined cycle unit (CC) by January 2016;
- Option 4, Retire Big Sandy Unit 2 and replace essentially all of its capacity and energy with purchases from the relevant PJM wholesale markets for a period of either 5 years (Option 4A) or 10 years (Option 4B) and then build or acquire replacement CC capacity.

**Q. Please comment on the Company’s choice of those four options.**

A. I have three concerns with the Company’s choice of those four options. First, it has not provided a formal analysis supporting its choice of those four options (Response to KIUC 1-29).

Second, the Company has in effect limited its evaluation to three resources, to be acquired in 2016 in “all or nothing” quantities under either full ownership or full procurement. Specifically KPCO has evaluated a single large coal unit ownership option, a single large natural gas CC ownership option (i.e., Options 2 and Option 3 are essentially the same) and an all market purchase option. The bar chart below, from Exhibit\_\_\_(JRH-3), illustrates the extent to which the Company would be dependent on whichever of those single large resource options it implemented during the period 2017 through 2024. Using 2022 as a representative year, the bar chart indicates that Big Sandy

1 Unit 2 (Option 1), or its replacement, would account for approximately 49% of the  
2 Company's total capacity and approximately 63% of its annual energy.  
3



4  
5 Third, the Company's assessment of only four options is inconsistent with the wide range  
6 of FGD designs it evaluated (Exhibit SCW-3).

7 **Q. Do those four options represent all of major resource options available to KPCo?**

8 A. No. The Company did not evaluate all of the major resource options available to it.

9 First, the Company did not explore a portfolio approach consisting of one or more  
10 alternative mixes of various types and sizes of resources, including renewable sources,  
11 energy efficiency or demand response (Responses to Sierra Club 1-52, Sierra Club 1-62).  
12 Second, KPCo did not evaluate a variation on Option 4 under which it would acquire  
13 capacity and energy through a strategy consisting of purchases from the PJM wholesale  
14 markets, long-term power purchase agreements and other hedging strategies. (That  
15 approach would address the concerns the Mr. Weaver raises regarding the Company's

1 exposure to cost uncertainty and price volatility variation under Option 4). Another  
2 approach that KPCo evaluated in its March 2011 analyses but not in this proceeding was  
3 a combination of a smaller gas CC, perhaps in the 600 MW range, plus market purchases  
4 (Response to Sierra Club 1-69). The Company maintains that Option 2 represents a  
5 proxy for the bids it would receive in response to a Request for Qualifications (RFQ) or a  
6 Request for Proposal (RFP) to buy existing gas-fired CC or CT units (Responses to Staff  
7 1-65 and 2-29). However, the Company did not evaluate a “resource blind” RFP for  
8 capacity and energy to identify the full range of fossil, renewable and efficiency  
9 resources available to replace Big Sandy Unit 2, including fractional ownership  
10 (Responses to Sierra Club 1-51 and 2-21).

11 **Q. Did the Company have the ability to evaluate a much wider range of resource**  
12 **options?**

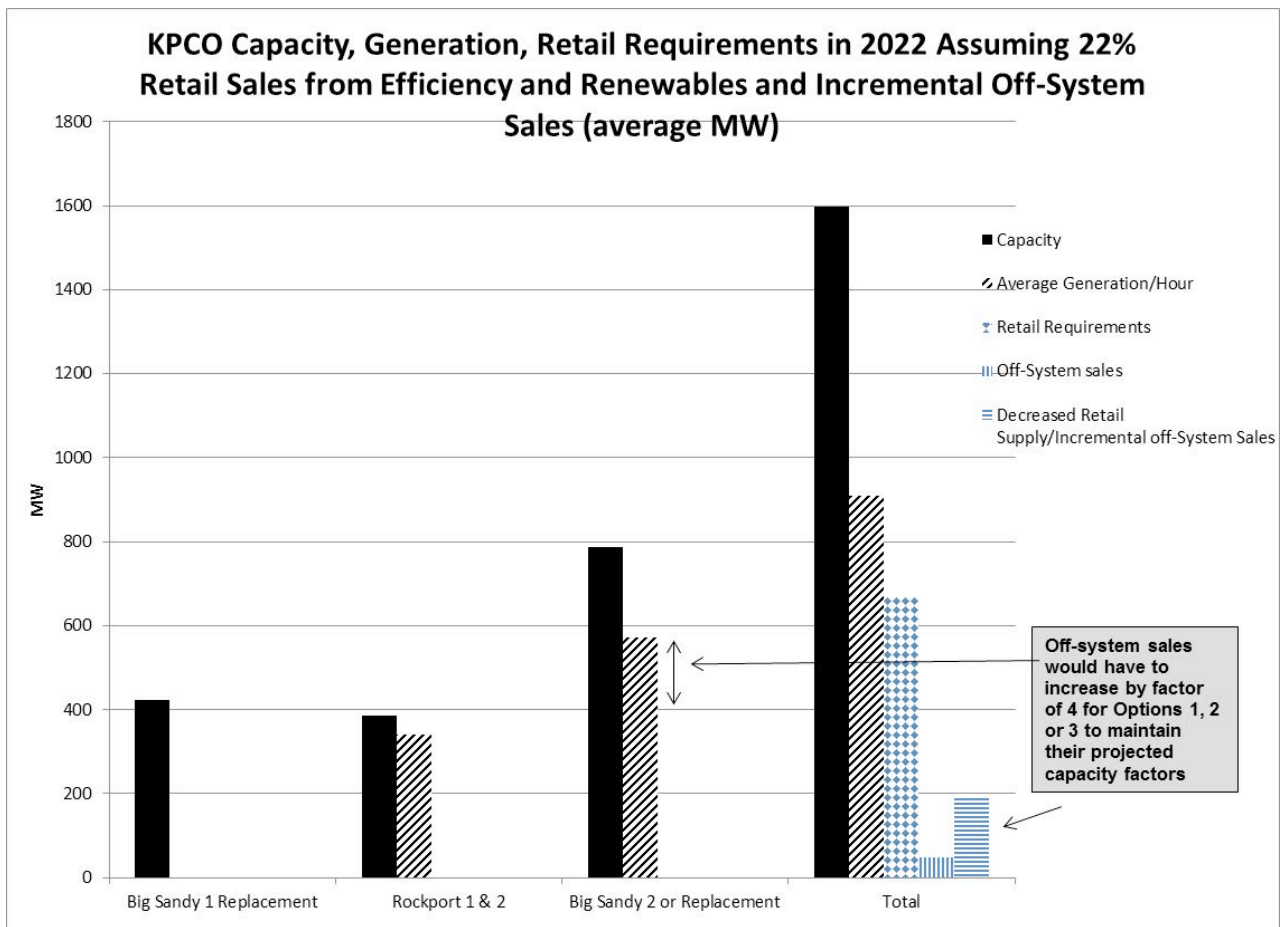
13 A. Yes. The Company could have used Strategist, its primary modeling tool, to evaluate a  
14 much broader range of supply-side and demand-side resource options. As Ms. Wilson  
15 explains, the Company had the ability to enter a broad range of available options into  
16 Strategist and to let the model choose the portfolio with the optimal, i.e., least-cost, mix  
17 of capacity and energy from that inventory of resource options.

18 **Q. Why is it so important for the Company to have evaluated a range of resource**  
19 **options?**

20 A. It is important for the Company to have evaluated a range of resource options given the  
21 magnitude of investment under consideration and the long-term risk associated with  
22 making such a large investment in one resource. As I noted earlier, there are significant  
23 uncertainties regarding how the future will unfold over the next ten years, let alone  
24 through 2040. There is tremendous value in maintaining some degree of flexibility to  
25 respond to changes in future regulatory and market conditions, and thus ensuring rates  
26 can remain reasonable as circumstances change. It is important to ensure that KPCo is not  
27 committing itself to a major investment in baseload capacity which it may not need to  
28 meet retail load in ten years or fifteen years due to major changes in the requirements of  
29 its retail customers, the relative costs of the resources available to it or future  
30 environmental regulations. Thus, it is essential that the Company demonstrate that it has  
31 thoroughly evaluated the resource portfolios which might provide it that flexibility.

1 **Q. Can you provide a simple illustration of one change in market conditions the**  
2 **Company may face?**

3 A. Yes. Legislation being introduced in the Kentucky General Assembly proposes to  
4 establish a Renewable and Energy Efficiency Portfolio Standard (REPS) for utilities in  
5 the states. Under that proposal, utilities would have to meet their retail load with  
6 increasing specific quantities of efficiency and renewables, reaching approximately 22%  
7 of their retail load by 2022. That change in energy requirements for retail load is  
8 illustrated in the bar chart in Exhibit\_\_\_(JRH-4), using 2022 as the same representative  
9 year as in the bar chart from Exhibit\_\_\_(JRH-3) shown earlier.



10 This simple illustration indicates that if KPCO implemented either of Options 1, 2 or 3  
11 and its actual retail requirements from fossil generation in 2022 proved to be over twenty  
12 per cent less than it has modeled in this proceeding, it might not have the most cost-  
13 effective mix of capacity and energy. For example, it might have too much baseload  
14 capacity and not enough peaking capacity. Admittedly this simple, one-year snapshot  
15

1 does not reflect the potential the Company might have to not renew its power purchase  
2 agreement for one of its Rockport units, or to defer its proposed addition of 407MW of  
3 capacity in 2025. However, it does illustrate the type of substantial change in conditions  
4 the Company may face over a planning horizon through 2022, let alone through 2040.

5 **Q. Does the Company's evaluation of the four resource options it considered include a**  
6 **thorough analysis of the flexibility it will have to respond to changes in market**  
7 **conditions under each of the resource options?**

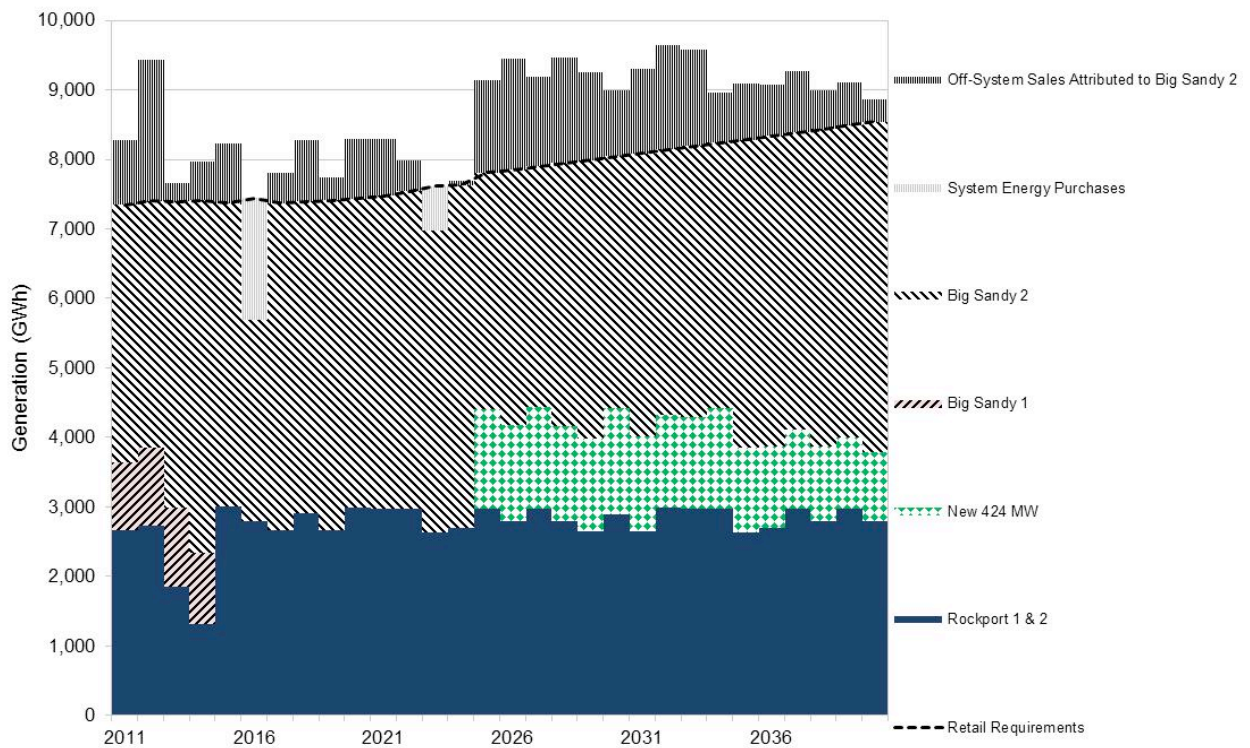
8 A. No. First, the Company has not evaluated its four resource options under a future scenario  
9 with much lower retail requirements from fossil generation (Response to Sierra Club 1 –  
10 43 and 2-25). Second, Mr. Weaver refers to the importance of planning flexibility,  
11 adaptability to risk and other planning criteria on page 7 of his testimony. However he  
12 does not provide any metrics for those criteria nor any assessments beyond those  
13 presented in his Exhibits SCW 4 and SCW 5 (Responses to Sierra Club 1-33, 1-34, 1-57,  
14 2-22 and 2-31). Finally, as I discuss later in my testimony, KPCo has not tested its four  
15 resource options against a sufficiently broad range of future scenarios.

16 **Q. Please describe the Company's projected mix of capacity and energy under the Base**  
17 **Case if Option 1 is approved.**

18 A. If Option 1 is approved, the Company will continue to be largely, if not entirely,  
19 dependent on coal units for its capacity and energy through 2040. KPCo's projected mix  
20 of capacity and energy under the Base Case if Option 1 is approved is illustrated in the  
21 chart below from Exhibit\_\_(JRH-5). That Exhibit also indicates that the Company  
22 projects it will continue to use generation from Big Sandy Unit 2 to make off-system  
23 sales in addition to supplying its retail customers.



KPCO Option 1, Base case, Generation (GWh) by Source, 2011 to 2040



1

2 **ii. Resource Option Cost Assumptions and Resulting Revenue Requirements**

3 **Q. Please summarize the Company’s projection of revenue requirements for each**  
 4 **resource option under each future scenario.**

5 A. The Company’s projection of revenue requirements for each resource option is the sum  
 6 of six major categories of projected costs. Those six categories of costs are:

- 7 i. Fuel and other variable production costs of all KPCo units, which include its  
 8 entitlement share of Rockport Units 1 and 2;
- 9 ii. Emission allowance costs of all KPCo units;
- 10 iii. Sales or purchases of market energy by or for KPCo;
- 11 iv. Sales or purchases of market capacity by or for KPCo;
- 12 v. Fixed operation and maintenance (FOM) costs for all KPCo units; and
- 13 vi. Fixed carrying charges of major incremental KPCo capital investments in  
 14 generation capacity.

1 The largest two categories of costs are variable production costs, in particular fuel, and  
2 fixed carrying charges.

3 **Q. Please summarize the models the Company used to calculate these revenue**  
4 **requirements.**

5 A. The Company used the Strategist model to project the first five categories of cost inputs  
6 to its revenue requirements, which I refer to as Net Production and FOM costs. It used  
7 only the economic dispatch and production costing functionality of the Strategist model  
8 to project these costs. Strategist develops those projections based on the numerous  
9 inputs entered by the Company including projections of retail load, generating unit heat  
10 rates, fuel prices, emission prices, and capacity and energy prices in PJM wholesale  
11 markets.

12 The Company used a separate, spreadsheet model to project the fixed carrying charges  
13 and costs of capacity purchases associated with each resource option. Finally KPCo used  
14 a Strategist Compilation Workbook to calculate the revenue requirements of each  
15 resource option, i.e., to essentially add the Net Production and FOM costs from Strategist  
16 to the fixed carrying charges and purchased capacity costs.

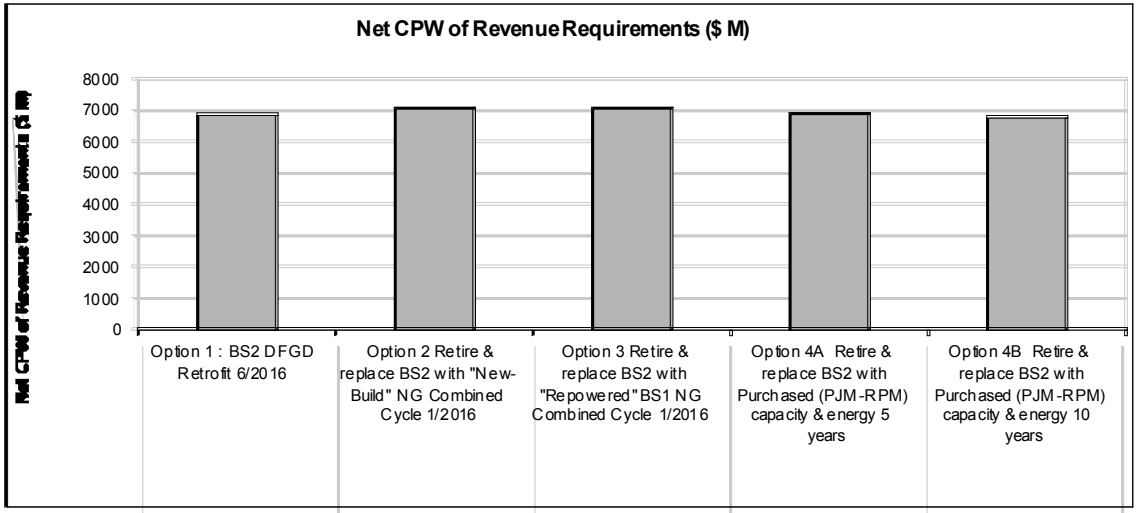
17 **Q. Did your team review the Company's estimate of net production and FOM costs**  
18 **using Strategist?**

19 A. Yes. Ms. Wilson began her review by obtaining the Company's inputs to Strategist for  
20 each of its 25 runs and using Strategist to independently reproduce and verify the  
21 Company projections for each of those runs. Ms. Wilson's testimony describes the  
22 problems she found with the Company's projections of net production and FOM costs  
23 using Strategist.

24 **Q. Please summarize the Company's projected revenue requirements for each of the**  
25 **resource options and future scenarios it considered.**

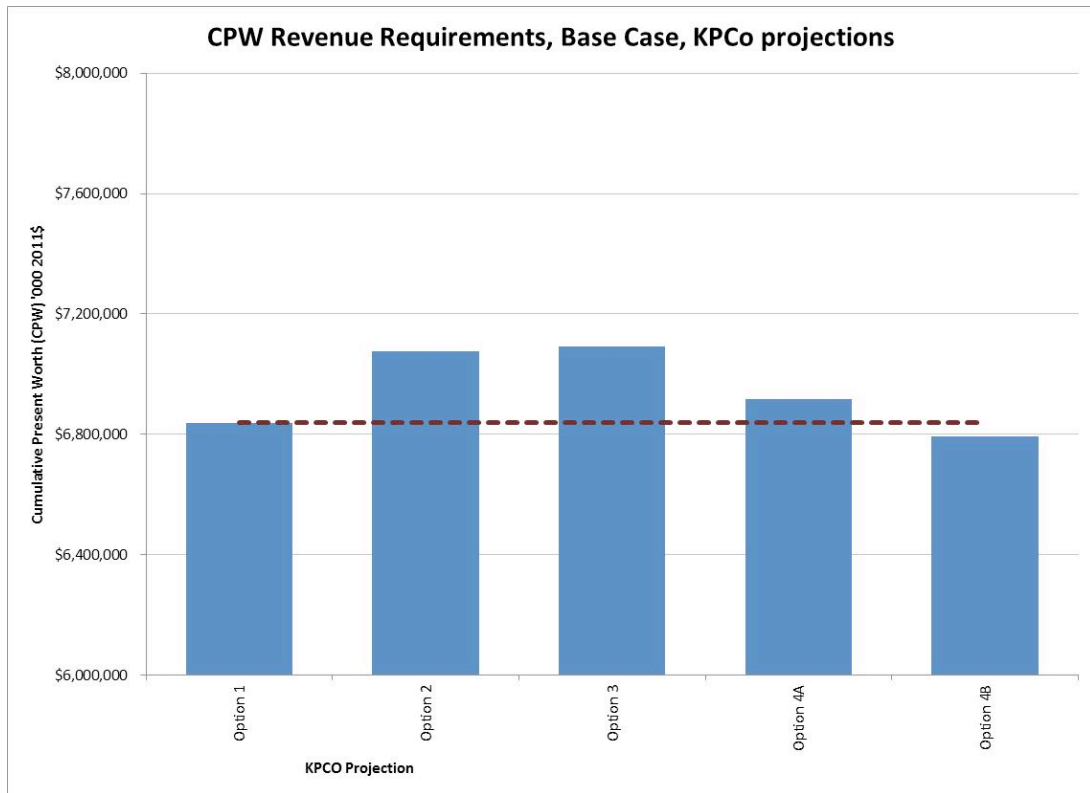
26 A. The cumulative present worth (CPW) values of the Company's projected revenue  
27 requirements for each resource option and future scenario, assuming a 15 year  
28 depreciation period for Option 1, are presented in Exhibit \_\_\_ (JRH-6). That Exhibit also  
29 presents the difference in CPW by resource option, measured relative to Option 1, for  
30 each future scenario, in absolute and percentage terms.

1 The CPW of total revenue requirements for each resource option under the Base Case are  
 2 very close, as indicated in the bar chart below taken from Exhibit\_\_\_ (JRH-6).



Net CPW of Revenue Requirements (\$ M)	\$ 6,839	\$ 7,075	\$ 7,091	\$ 6,918	\$ 6,792
Delta of Net CPW from Option 1 (\$ M)	N/A	\$236	\$252	\$79	-\$47
Delta of Net CPW from Option 1 (%)	N/A	3.5%	3.7%	1.2%	-0.7%

3  
 4 The fact that the CPWs of the resource options are relatively close may not be surprising,  
 5 given the thirty year timeframe and the inclusion of costs common to all four resource  
 6 options, i.e., the Rockport units and the 407 MW CC scheduled to be added in 2025.  
 7 However, it does require one to focus on the differences in CPW by resource option for  
 8 each future scenario as well as on other policy considerations in order to determine which  
 9 resource option is cost-effective and reasonable. The differences in the CPW of total  
 10 revenue requirements for each resource option under the Base Case are more apparent in  
 11 the bar chart below, also taken from Exhibit\_\_\_ (JRH-6).



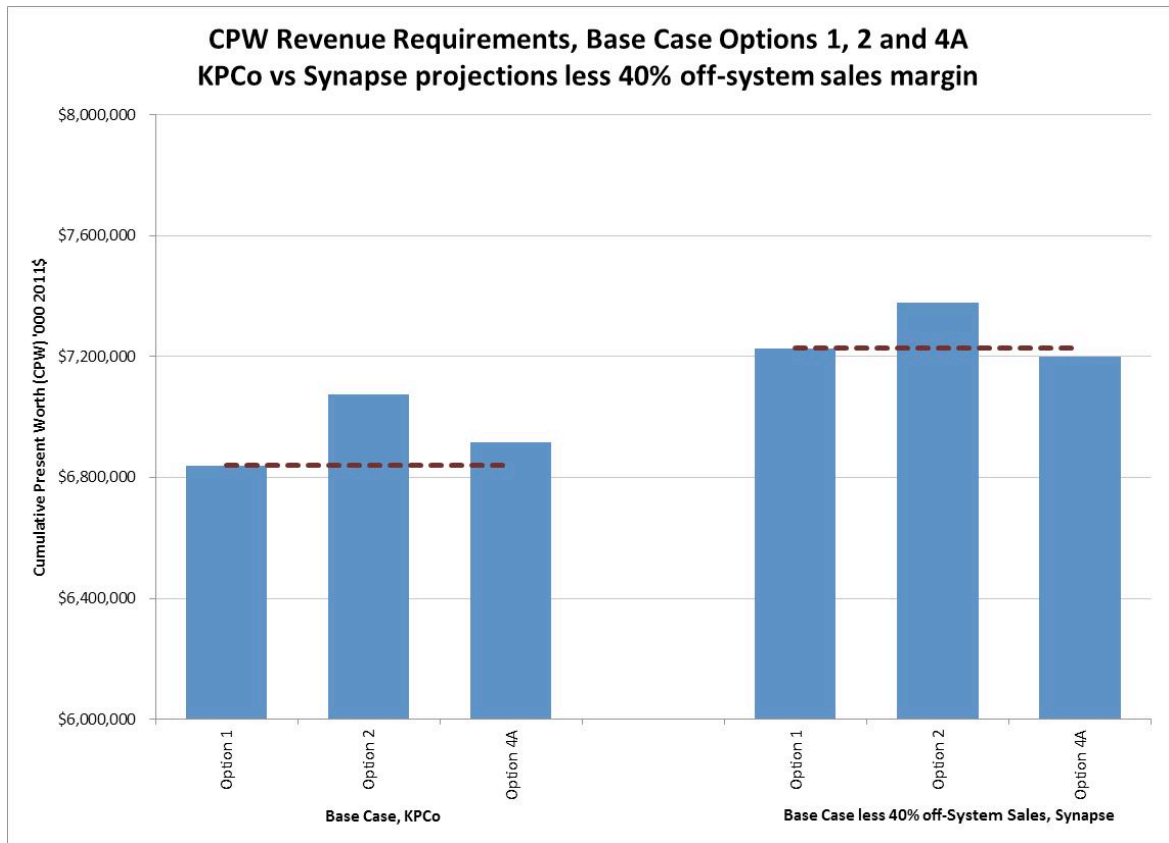
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In the balance of my testimony, I use the Company’s projections for Option 1, Option 2 and Option 4A under its Base Case to illustrate the problems we have found with its projections.

**Q. Please comment on the Company’s treatment of margin from off-system sales in its projection of revenue requirements for each resource option.**

A. As discussed in more detail by Dr. Fisher, the Company appears to have credited 100% of the margin from projected off-system sales against the projected gross revenue requirements of each resource option when calculating net revenue requirements to be recovered from retail customers. We support this treatment, but note that it is not consistent with the Company’s current System Sales Clause, under which KPCo shareholders retain 40% of margin from off-system sales.

If the Company’s projection of revenue requirements reflected a continuation of the current System Sales Clause, and credited only 60% of the margin from off-system sales against gross revenue requirements, the difference in CPW between Option 1 and the other three Options is reduced substantially. Dr. Fisher quantifies that impact, which is illustrated in the bar chart from Exhibit \_\_\_(JRH-7).



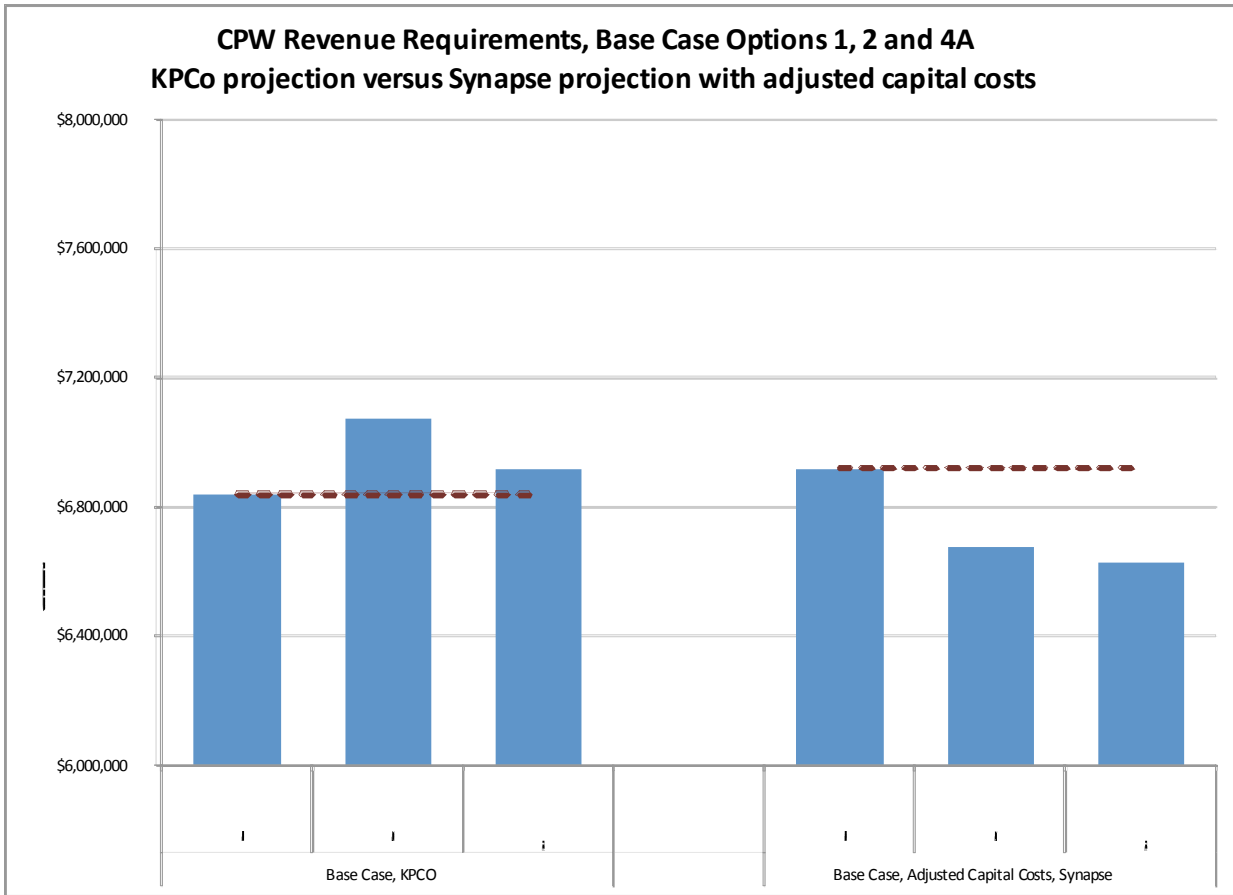
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**Q. Has your team identified problems with any of the Company’s cost assumptions for the four resource options it did evaluate?**

A. Yes. The reviews conducted by Ms. Wilson and Dr. Fisher indicate that the Company’s estimate of capital costs for Option 1 is too low. Dr. Fisher’s review indicates that estimates of capital costs for Options 2, 3 and 4 are too high. His analyses also indicate that the Company’s estimate of annual fixed operation and maintenance costs (FOM) of Option 1 from 2031 onward are too low.

**Q. Have you prepared projections of revised revenue requirements based upon corrected assumptions for the four resource options?**

A. Yes. The bar chart below, from Exhibit \_\_\_(JRH-8), illustrates the impact on revenue requirements of correcting the capital cost assumptions identified by Dr. Fisher and Ms. Wilson. Those revised projections indicate that Option 1 would have the highest revenue requirement, and as such is neither reasonable nor cost-effective.



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3 **iii. Limited Range of Future Scenarios without Reasonable Projection of Carbon Prices**

4 **Q. Please summarize the five future scenarios the Company modeled in Strategist in**  
 5 **order to evaluate the four resource options it considered.**

6 A. The Company evaluated its four resource options under a Base Case and four discrete  
 7 sensitivity scenarios. The five future scenarios it modeled are:

- 8 1. Base Fleet Transition-CSAPR. This assumes natural gas prices at Henry Hub  
 9 reach \$6.52/MMBtu by 2020 and a carbon price starting at \$15 per metric tonne  
 10 in 2022, both in nominal dollars. The carbon price is based on assumption that  
 11 carbon emissions from existing fossil generation will begin to be regulated in that  
 12 year.
- 13 2. Fleet Transition-CSAPR: Higher Band. This tests sensitivity to higher prices for  
 14 natural gas and coal, relative to Base Case levels, with no other change to Base  
 15 Case assumptions.

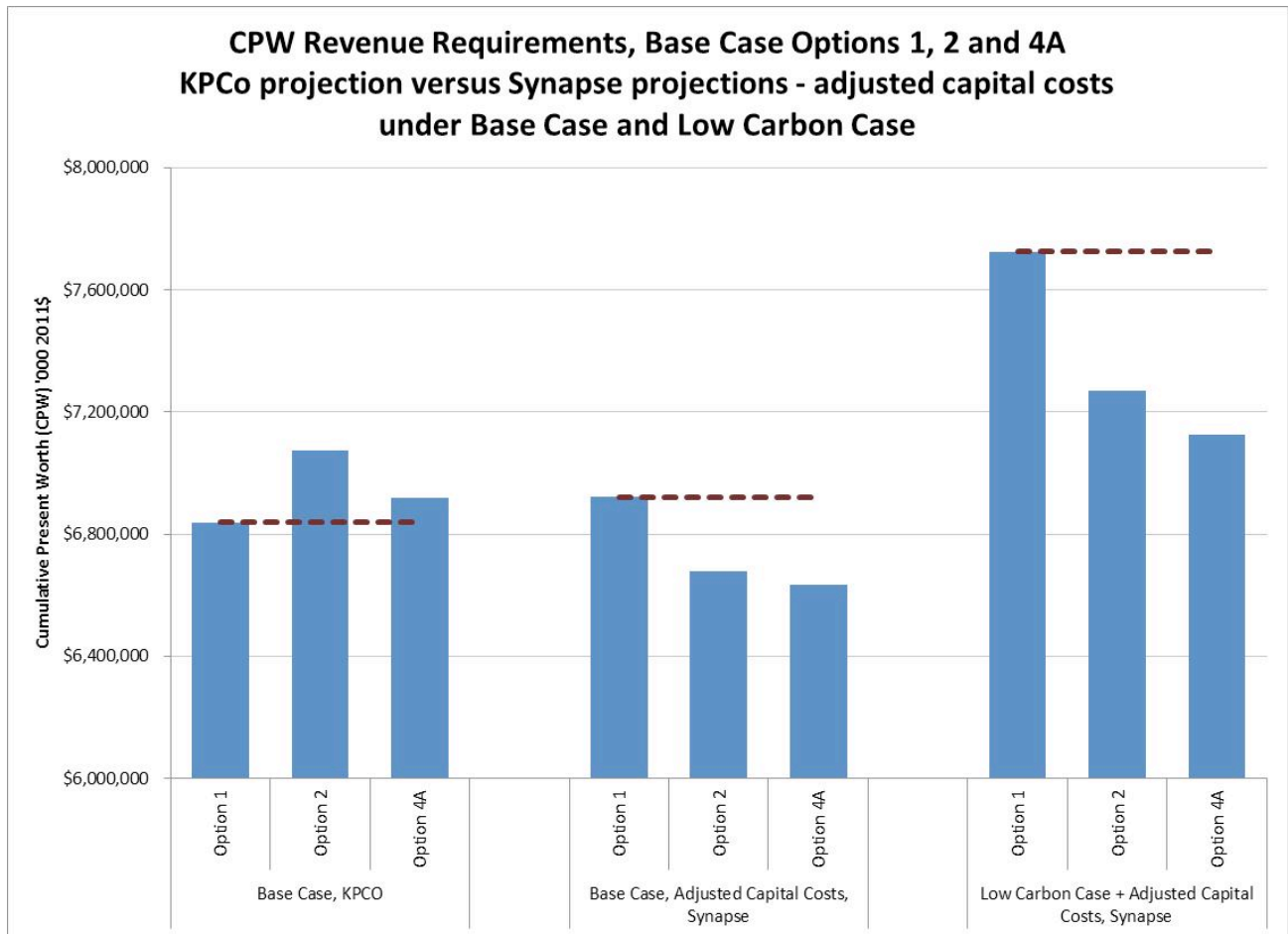
- 1           3. Fleet Transition-CSAPR: Lower Band. This tests sensitivity to lower prices for  
2           natural gas and coal, relative to Base Case levels with no other change to Base  
3           Case assumptions.
- 4           4. Fleet Transition-CSAPR: No Carbon. This tests sensitivity to zero prices for  
5           carbon, with no other change to Base Case assumptions.
- 6           5. Fleet Transition-CSAPR Early Carbon. This tests sensitivity to prices for carbon  
7           starting at \$15 per metric tonne in 2017, with no other change to Base Case  
8           assumptions.

9 **Q. Has your team identified problems with any of the Company's assumptions for**  
10 **those five future scenarios?**

11 A. Yes. Dr. Fisher's review indicates that the Company's assumption of carbon prices under  
12 its Base Case and each of its four other scenario are too low, including those in the Early  
13 Carbon scenario. In addition, his analysis indicates that the Company's assumptions  
14 regarding the relationship between natural gas and coal prices in its higher band and  
15 lower band scenarios are inconsistent with its assumption regarding the correlation of  
16 those prices in its Aurora runs. Also, as noted earlier, the Company did not test a scenario  
17 with a much lower level of retail requirements from fossil generation.

18 **Q. Have you prepared revised projections of revenue requirements using corrected**  
19 **assumptions for Options 1, 2 and 3 and a future scenario with a reasonable**  
20 **projection of carbon prices?**

21 A. Yes. Exhibit \_\_\_(JRH-9) presents projections of revised revenue requirements using  
22 corrected assumptions for options 1, 2 and 3 under the carbon scenario recommended by  
23 Dr. Fisher. Those revised projections indicate that Option 1 has the highest revenue  
24 requirement, and as such is not reasonable or cost-effective.



1

2 **iv. Risk Analysis Using Aurora**

3 **Q. Please summarize why and how the Company used the Aurora model.**

4 A. As discussed, the Company used Strategist to quantify the risk associated with each  
 5 resource option by testing the sensitivity of their projected revenue requirements under its  
 6 Base Case to four discrete changes in assumptions about the future, i.e., higher fuel  
 7 prices, lower fuel prices, higher carbon prices and zero carbon prices. The Company used  
 8 the Aurora model in an attempt to further quantify the potential risks associated with each  
 9 resource option by projecting their revenue requirements under 100 different future  
 10 scenarios. The Aurora model created the 100 different futures based on the Company’s  
 11 input assumptions regarding the relationships, or correlations, between five key input  
 12 assumptions using a “Monte Carlo” modeling technique or algorithm. The 100 futures  
 13 reflect different combinations of five key input assumptions, i.e., coal prices, natural gas  
 14 prices, carbon prices, wholesale power prices and retail demand.



1 **Q. In theory, does this type of modeling have the potential to provide useful**  
2 **information for resource planning decisions?**

3 A. Yes. For example, *Portfolio Management: How to Procure Electricity Resources to*  
4 *Provide Reliable, Low-Cost, and Efficient Electricity Services to All Retail Customers*, a  
5 2006 report that Synapse prepared for the NARUC, notes the potential benefit of using  
6 computer models such as Aurora to analyze long-term risks of alternative portfolios of  
7 resources.

8 **Q. Does the Company's application of the Aurora model in this proceeding provide a**  
9 **useful assessment of the cost risk associated with each resource option?**

10 A. No. Dr. Fisher identifies numerous problems with the Company's risk modeling using the  
11 Aurora model. Given the extent of the problems he has identified, the results from the  
12 Company's risk modeling using the Aurora model do not provide a useful assessment of  
13 the cost risk associated with each resource option.

14

15 **v. Sharing of Financial Risk between Ratepayers and Shareholders**

16 **Q. Will ratepayers bear the majority of the financial risk under any resource strategy**  
17 **that the Company ultimately implements?**

18 A. Yes. Ratepayers bear the majority of the financial risk under any resource strategy the  
19 Company ultimately implements because their rates are based upon the revenue  
20 requirements that result from that strategy.

21 Consider the allocation of financial risk under the following hypothetical. The  
22 Commission decides to approve Big Sandy Unit 2 with a 15 year depreciation and by  
23 2030 the scenario Mr. Wohnhas discusses in his testimony proves to be correct, i.e.,  
24 future increased EPA standards cause operation of Big Sandy Unit 2 not to be  
25 economically feasible. Under that hypothetical KPCo would retire Big Sandy Unit 2 in  
26 2030 and replace it with some other source of capacity and energy. Under this  
27 hypothetical the Company would have recovered its full investment in Big Sandy Unit 2,  
28 including a return on equity, by 2030 and will bear no financial risk. In contrast,  
29 ratepayers will bear all the financial risk. They will have paid the revenue requirements

1 associated with Big Sandy Unit 2 through 2030, which was approved on the assumption  
2 it was the most cost-effective option through 2040, plus they will have to pay the revenue  
3 requirements associated with the replacement capacity and energy from 2030 to 2040.

4 **Q. Please comment on the financial risks that the Company should bear if the**  
5 **Commission decides to approve KPCo's request for a CPCN**

6 A. In the event that the Commission decides to approve the Company's request for a CPCN,  
7 ratepayers will bear the vast majority of the financial risk resulting from KPCo's decision  
8 to propose and pursue that option. Since the Company apparently believes this is the best  
9 approach, it is reasonable to expect them to bear a reasonable portion of the risk  
10 associated with this investment. The Company's only rationale for fifteen 15 year  
11 depreciation appears to be to avoid exposure to absorbing any stranded investment in the  
12 Big Sandy Unit 2 DFGD (Responses to Sierra Club 2-16 and 2-18). According to  
13 generally accepted accounting principles, an investment such as this should be  
14 depreciated over its useful life (Response to Sierra Club 1-17). For the DFGD this is  
15 twenty to thirty years according to the Company's witnesses and projections.

16 The Company's projection of revenue requirements for the CPCN option assumes a  
17 significant amount of off-system sales margins will flow to ratepayers. It is reasonable  
18 for the Commission to hold the Company to those projections. Thus, the Company  
19 should be required to modify its System Sales Clause to be consistent with the off-system  
20 sales margins it has assumed would flow to ratepayers under its modeling of the CPCN  
21 option.

22 Finally, the Company asserts that it has tested its four resource options against a realistic  
23 range of carbon prices. Again, since the Company apparently believes it has evaluated the  
24 full range of these prices, it is reasonable to expect them to bear the risk of carbon  
25 regulation costs that prove to be higher than the values the Company has assumed in its  
26 projections.

1 **7. CONCLUSIONS AND RECOMMENDATIONS**

2 **Q. Please summarize the major conclusions and recommendation from your review of**  
3 **the Company's request.**

4 A. My first conclusion is that the Company has not demonstrated that its proposed CPCN for  
5 Big Sandy Unit 2 is reasonable and cost-effective for complying with the environmental  
6 requirements the Company is facing. That conclusion is based upon the results of our  
7 review, which indicates that the Company has not evaluated the full range of resource  
8 options available to it, that its projections of revenue requirements for the resource  
9 options it did evaluate are not correct, that its evaluation of future scenarios does not  
10 include a reasonable projection of carbon prices and that its Monte Carlo risk analysis is  
11 flawed. My second, related, conclusion is that allowing KPCo to recover the costs of  
12 installing environmental control equipment on Big Sandy Unit 2 from ratepayers will not  
13 result in reasonable rates.

14 Based upon those conclusions my recommendation is that the Commission not approve  
15 the Company's request for a CPCN for Big Sandy Unit 2.

16 **Q. Please summarize your conclusions and recommendation regarding ratemaking in**  
17 **the event the Commission decides to approve the Company's request.**

18 A. In the event that the Commission decides to approve the Company's request for a CPCN,  
19 I am sure it will limit the Company's recovery of actual costs to only the amounts it finds  
20 just and reasonable. My understanding of the ratemaking process under the  
21 Environmental Surcharge Statute is that the Commission will review the Company's  
22 actual costs every six months, and disallow actual amounts it finds that are not just and  
23 reasonable, and that it will shift recovery of amounts it does find reasonable from the  
24 surcharge into base rates every two years. However, my conclusion is that even with  
25 those measures, ratepayers will still bear the bulk of the financial risk resulting from  
26 KPCo's decision to propose and pursue the CPCN.

27 Based on that conclusion, I recommend that the Commission require the Company to:

- 1           • recover its investment in environmental controls at Big Sandy Unit 2 based upon  
2           a depreciation rate consistent with generally accepted accounting principles,  
3           which would be a period of at least twenty years;  
4           • modify its System Sales Clause to be consistent with the off-system sales margins  
5           the Company assumed would flow to ratepayers under its modeling of the CPCN  
6           option; and  
7           • bear the risk of carbon regulation costs in excess of the values the Company has  
8           assumed in its early carbon future scenario.

9   **Q.    Does this complete your Direct Testimony?**

10  A.    Yes.

## LIST OF EXHIBITS

- Exhibit\_\_\_(JRH-1) Resume of James Richard Hornby
- Exhibit\_\_\_(JRH-2) KPCo Capacity, Generation, Retail Requirements and Off-System Sales in 2011
- Exhibit\_\_\_(JRH-3) KPCo Capacity, Generation, Retail Requirements and Off-System Sales in 2022
- Exhibit\_\_\_(JRH-4) KPCo Capacity, Generation, Retail Requirements in 2022 assuming 22% Retail Sales from Efficiency and Renewables and Incremental Off-System Sales
- Exhibit\_\_\_(JRH-5) KPCo Option 1, Base Case, Generation (GWH) by Source, 2011 to 2040
- Exhibit\_\_\_(JRH-6) KPCo – Cumulative Present Worth (CPW) of Revenue Requirements
- Exhibit\_\_\_(JRH-7) CPW revenue requirements, Base Case, Options 1, 2, 4A – KPCO vs Synapse projections less 40% off-system sales margin
- Exhibit\_\_\_(JRH-8) CPW revenue requirements, Base Case, Options 1, 2, 4A – KPCO vs Synapse projections with adjusted capital costs
- Exhibit\_\_\_(JRH-9) CPW revenue requirements, Options 1, 2, 4A – KPCO vs Synapse projections - adjusted capital costs under Base Case and Low Carbon Case
- Exhibit\_\_\_(JRH-10) Kentucky Power Company Responses to Selected Data Requests
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