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 GRANTING OF A CERTIFICATE OF PUBLIC CONVIENENCE AND NECESSITY FOR THE CONSTRUCTION AND ACQUISITION OF RELATED FACILITIES.	)	Case No. 2011-00401

Direct Testimony of
Rachel S. Wilson

On Behalf of
Sierra Club

March 12, 2011

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1. INTRODUCTION AND QUALIFICATIONS

Q Please state your name, business address, and position.

A My name is Rachel Wilson and I am an Associate with Synapse Energy Economics, Inc. (Synapse). My business address is 485 Massachusetts Avenue, Suite 2, Cambridge, Massachusetts 02139.

Q Please describe Synapse Energy Economics.

A Synapse Energy Economics is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, ratemaking and rate design, electric industry restructuring and market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Synapse's clients include state consumer advocates, public utilities commission staff, attorneys general, environmental organizations, federal government and utilities.

Q Please summarize your work experience and educational background.

A At Synapse, I conduct research and write testimony and publications that focus on a variety of issues relating to electric utilities, including: federal and state clean air policies; emissions from electricity generation; environmental compliance technologies, strategies, and costs; integrated resource planning; valuation of environmental externalities from power plants; and the nexus between water and energy.

I also perform modeling analyses of electric power systems. I am proficient in the use of optimization and electricity dispatch models to conduct analyses of utility service territories and regional energy markets. I have experience with STRATEGIST, PROMOD, PROSYM/Market Analytics, and PLEXOS. I have participated in a series of trainings for the STRATEGIST model, both in-house and at the Atlanta headquarters of Ventyx, an ABB Company.

Prior to joining Synapse in 2008, I worked for the Analysis Group, Inc., an economic and business consulting firm, where I focused on issues relating to energy and the electric industry. I was also a Research Assistant at the Yale Center for Environmental Law and Policy and was responsible for collecting and processing data on corporate and environmental strategy, as well as environmental performance data on a country-by-country basis.

I hold a Master of Environmental Management from Yale University and a Bachelor of Arts in Environment, Economics, and Politics from Claremont McKenna College in Claremont, California.

A copy of my current resume is attached as Exhibit RSW-1.

Q On whose behalf are you testifying in this case?

A I am testifying on behalf of Sierra Club

Q Have you testified previously before the Kentucky Public Service Commission?

A Yes. On September 16, 2011, I filed direct testimony in the joint application of Kentucky Utilities/Louisville Gas & Electric for Certificate of Public Convenience and Necessity (CPCN) in similar dockets (2011-00161 and 2011-00162).

Q What is the purpose of your testimony?

A My testimony describes and evaluates the STRATEGIST modeling performed by Kentucky Power Company (KPCo) and American Electric Power (AEP) (the "Company," collectively) in this docket. I also describe my own STRATEGIST modeling efforts using the Company input data and present the results of that analysis.

Q What data sources did you rely upon in your review of the Company's STRATEGIST analysis and in preparation of your own analysis?

A In my review of the Company's STRATEGIST analysis, I relied upon the Application for CPCN with accompanying witness testimony and appendices, the STRATEGIST input and output files provided by the Company, and select spreadsheet work papers provided by the Company in response to discovery requests by Sierra Club, KIUC, and Commission Staff. My analysis also depends heavily on a telephone conversation I had with Mr. Mark A. Becker from AEP on February 24, 2012. During this conversation, Mr. Becker provided me with specific changes to the STRATEGIST input files that were required to run the model and produce the results that KPCo submitted in this docket.

2. SUMMARY AND CONCLUSIONS

Q In your opinion, does the STRATEGIST modeling performed by the Company in this docket support the decision to retrofit Big Sandy Unit 2 with a DFGD in 2016?

A No, it does not. The Company's modeling contains several errors that bias the results in favor of the retrofit and continued operation of Big Sandy Unit 2.

3. DESCRIPTION OF AEP/KPCO STRATEGIST MODELING

Q Please provide a general description of the capabilities of the STRATEGIST model.

A STRATEGIST is capable of selecting the least-cost mix of capacity and energy to meet a utility's projected peak demand and annual energy over a long-term planning horizon. It determines this least-cost mix from the range of supply- and demand-side resources the user specifies as being available during the planning horizon.

Q Please provide a general description of the Company's use of the STRATEGIST model in this proceeding.

A Rather than input various resource options and allow STRATEGIST to select the optimal mix and timing, the Company "locked-in" specific resource options in

specific years. In the period between 2011 and 2024, KPCo did not allow STRATEGIST to "build" additional capacity and instead forced it to meet any demand shortfall with market purchases.

The Company therefore only evaluates resource plans within STRATEGIST that have been preselected prior to beginning the modeling process. In describing the Company's STRATEGIST modeling in direct testimony, witness Weaver states that "the objective of this exercise was to identify the **relative least-cost alternative** among those identified in Table 1" (the five resource options described below.) A more appropriate way to state this is that the objective of the Company's STRATEGIST exercise was to identify the relative least-cost alternative **among those identified in Table 1** (emphasis added). The number of resource portfolios evaluated by STRATEGIST was so tightly constrained that it is possible, and even likely, that a lower cost resource portfolio exists that would have been identified by the model had it been allowed to perform long-term resource optimization.

Q How could the Company have done that analysis differently?

A Simply put, STRATEGIST should have been used to select the optimal resource plan from a variety of options, including construction of coal and natural-gas fired generation, a purchase-power agreement (PPA) for energy and capacity, and energy efficiency, demand response and renewable generating resources.

There are other ways in which the Big Sandy 2 retrofit, specifically, could have been modeled. STRATEGIST will not retire a unit on its own, but the model can determine whether the most economic option is to retrofit, repower, or replace a unit. The Company should have allowed the model to select the optimal resource portfolio.

4. VERIFICATION OF COMPANY MODELING

Q Did you request and receive the STRATEGIST files the Company used to produce the results it presented in this docket?

A I did request and receive the files, however, nine of the 25 files received returned the error message that "No feasible combination of resources could be found in 2015," and the model optimization stopped. Several weeks after I received the files, I was informed that certain changes were required to make the STRATEGIST files we received match the files that the Company used to produce its analysis. Mr. Mark A. Becker described the necessary changes to me during a phone conversation on February 24, 2012.

Q Please describe the changes that were necessary to execute STRATEGIST model runs.

A The Company provided us with 25 .FSV STRATEGIST input files, representing five alternative resource portfolios under five future scenarios. The alternative resource portfolios and future scenarios are described by Mr. Hornby in his testimony.

Of the 25 STRATEGIST files that I was provided, Mr. Becker indicated that I had to make changes to 16 of the files in order to reproduce the Company's analysis. For Options 1, 2, and 3 under all five of the Company's scenarios, as well as Option 4b under the No Carbon scenario, I was asked to adjust the "Minimum Reserve Margin (%)" for KPCo from 8.04% to -100% during the time periods of 2014-2025 and 2037-2040. This variable represents the minimum reserve margin that must be maintained in each year of the planning period. Per my discussion with Mr. Becker, the effect of this change is to constrain the model such that it does not add additional capacity resources beyond what the Company has "locked-in" in any given year. The STRATEGIST model can therefore only add capacity in years where the minimum reserve margin is set to 8.04%, which is between 2025 and 2037.

Q Were any other changes required in order to execute STRATEGIST model runs?

A Yes, there were two other changes. Under Option 1 in the Low Band scenario, we were asked to change the "Operating Life" of the Big Sandy Unit 2 dry flue gas desulfurization (DFGD) retrofit from 15 years to 30 years. In the original .FSV file we received from the Company, the 15 year operating life of the DFGD was causing Big Sandy Unit 2 to retire at the end of 2031. Changing the operating life to 30 years allows the unit to run through the end of the planning period.

Secondly, under Option 2 in the Low Band Scenario, the STRATEGIST model had been set to add a new 602 MW natural gas-fired combined-cycle unit in 2032. We were asked to remove this addition, and the model no longer added this 602 MW combined-cycle unit.

Q Please list the Strategist runs that you reproduced once the Company identified the changes required to the input files it provided.

A After the Company identified the required changes, I reproduced the nine runs that had previously terminated in 2015 due to an infeasible combination of resources. I re-ran an additional seven runs that had given incorrect results in absence of the required changes. The remaining nine runs appeared to have run correctly using the STRATEGIST files initially provided by the Company in response to the Sierra Club's first discovery request.

5. CONCERNS WITH THE COMPANY'S STRATEGIST MODELING

Q Did you identify any problems with the Company's STRATEGIST runs when you reproduced those runs?

A Yes, I did. The first problem I noticed is the way in which capital costs for the Big Sandy Unit 2 DFGD is represented in STRATEGIST compared to the way it is represented in the direct testimony of and discovery responses from Company Witness Scott C. Weaver. Capital costs are represented in the Proview module of STRATEGIST at a "Base Cost without AFUDC [allowance for funds used during

construction]" value of $696/kW (real 2011$)[1] for the DFGD retrofit. Table 2 of Witness Weaver's testimony indicates that the total cost of the DFGD retrofit is $948/kW (real 2011$). In the Company's response to Sierra Club Supplemental Data Request Item No. 4, it is stated that "The capital costs in Table 2 in Mr. Weaver's testimony were used as the basis for the capital costs of the four alternative options defined in the PROVIEW module of Strategist."

This appears to be untrue, however, as the capital costs included in the STRATEGIST model for the Big Sandy DFGD are much lower than the capital costs shown by the Company witness Scott C. Weaver. The manner in which these capital costs flow through the Company's analysis is discussed by my colleague, Dr. Jeremy Fisher.

The second problem I noticed was a spike in fixed O&M costs in STRATEGIST in 2040, which was due to the manner in which the Company represented end effects for that particular input variable.

In the Company STRATEGIST runs, several of the thermal units in the AEP system, including Big Sandy 2, experience a spike in fixed O&M costs in 2040, the end of the planning period. During my conversation with Mr. Becker, he stated that this spike represents the addition of the present value (in 2040) of on-going capital costs that continue on until the unit is ultimately retired. In essence, this calculation is accounting for an "end effects" period for one particular cost – fixed O&M – for specific units.

The end effects calculation in STRATEGIST is used to analyze differences between alternatives after the planning period – in this case after 2040. This is important because different resource options have different operating lives and characteristics, and the end effects calculation measures those differences in operating costs between resources after the planning period.

[1] Values are input into STRATEGIST in base year dollars – in this case 2011$. STRATEGIST then converts costs to nominal dollars based on the unit's in-service date.

KPCo did not utilize the end effects calculation capability of STRATEGIST, stating in Response to Sierra Club Data Request 39 that the planning period of 2011 to 2040 is sufficiently long to cover the life of the FGD retrofits and the majority of the life of gas replacement alternatives. In addition, KPCo expects that relative cost impacts after 2040 would be very small due to the discounting of costs.

KPCo's inclusion of on-going capital for certain units – using an end effects calculation for specific variables but not others – is flawed, and does not represent the true operating costs of a unit, especially a coal-fired unit like Big Sandy 2. Costs of CO_2 emissions are one variable where exclusion from an end effects calculation is particularly important. Allowance prices for emissions of CO_2 would have a significant effect on the operating cost of a coal-fired unit over time, particularly if those emissions costs are escalating, as might reasonably be expected as emission caps grow more stringent. Exclusion of specific variables from an end effects calculation thus biases the modeling results in favor of coal-fired generating resources.

Q Are there any other costs that are not represented in the model runs?

A Yes. Company witness Scott Weaver states in his direct testimony that it is reasonable to assume that KPCO would curtail the operation of both Big Sandy Units 1 and 2 under Cross State Air Pollution Rule (CSAPR) Phase 1 (2012-2013), and further curtail operation to meet CSAPR Phase 2 requirements (from 2014 until the Big Sandy 2 retrofit date). STRATEGIST modeling does not curtail operation of the Big Sandy units to comply with CSAPR. Table 1 shows the projected emissions of the Big Sandy units compared to the CSAPR allocation.

Table 1. Comparison of CSAPR SO_2 Allocation at Big Sandy vs. STRATEGIST Emissions Projections.

Plant Name	SO2 Allocation 2012 (tons)	SO2 Allocation 2014 (tons)	STRATEGIST Projected SO_2 Emissions (tons)					
			2011	2012	2013	2014	2015	2016
Big Sandy 1	3,399	1,462	7,356	8,341	8,593	7,731	0	0
Big Sandy 2	11,926	5,131	34,606	41,295	35,138	41,993	39,402	1,158

Depending on the number of SO_2 allowances available for purchase, the Big Sandy units may require significant curtailment to meet emission caps. Unit curtailment, or unit cycling, is likely to increase the wear and tear on the unit, driving up maintenance costs and possibly requiring replacements of various components. Some of these components may need to be replaced subsequent to the DFGD retrofit at Big Sandy Unit 2, leading to on-going capital costs that are higher than those projected in STRATEGIST. Certain of these costs are likely to be incurred in all scenarios under all options, but certain on-going capital cost replacements may be able to be avoided under a scenario that retires both Big Sandy Units 1 and 2.

KPCo may also be able to sell excess SO2 allowances in scenarios where Big Sandy is retired. This sale of allowances was not analyzed by the Company.

Q Are there any other variables that are not properly represented in STRATEGIST?

A Yes. The Mercury and Air Toxics Standards (MATS) for power plants in the United States were finalized by the U.S. Environmental Protection Agency in December 2011. The MATS rule sets a limit on emissions of mercury by fossil-fueled generators of 0.0012 lb/MBtu. The Company has stated that KPCo will be in compliance with this rule without the installation of additional pollution control equipment; however, this is not reflected in the STRATEGIST model. Emissions output for the KPCo system from the STRATEGIST run in which Big Sandy is retrofit in the base future shows emissions of mercury at 0.006 lb/MBtu or higher for all of the years in the planning period. Emissions rates are being modeled improperly, or additional pollution control equipment may in fact be needed at Big Sandy Unit 2 in order to bring the unit into compliance with MATS standards for mercury.

6. DESCRIPTION OF SYNAPSE ENERGY ECONOMICS STRATEGIST MODELING

Q Did you perform any of your own STRATEGIST modeling for this docket?

A Yes. Based upon input from Dr. Fisher, after correcting for the errors in the original STRATEGIST files we received from the Company, I created an additional scenario that utilizes the Low CO_2 price forecast from the Synapse Energy Economics *2011 Carbon Dioxide Price Forecast*. The Synapse Low forecast begins at a price of $15/ton in 2020 and rises to a price of $45/ton in 2040 (real 2010$). (In real 2010$, the Company's Base CO_2 forecast begins at $11.92/ton in 2022 and declines to $11.21/ton in 2040.) Using this Synapse Low CO_2 scenario, I then executed model runs for each of the five resource portfolios presented by the Company. The results of this modeling analysis are presented in the direct testimony of Dr. Fisher.

7. CONCLUSIONS AND RECOMMENDATIONS

Q Please summarize the conclusions and recommendations that you have developed from your review of the Company's STRATEGIST modeling.

A Based on my review, I conclude that the Company's STRATEGIST modeling does not demonstrate that the retrofit of Big Sandy Unit 2 with a DFGD is reasonable and cost-effective. The Company determined the resource portfolios to analyze rather than allowing Strategist to choose the optimal resource portfolio. KPCo only used STRATEGIST to determine the total resource cost (NPV) of each of the options under each of the scenarios.

The capital cost input value for the DFGD retrofit at Big Sandy Unit 2 appears to be too low, biasing the analysis in favor of the retrofit scenario. Uneven application of end effects calculations also biases the analysis in favor of continued operation of coal-fired generating units, as do ongoing capital costs that do not appear to be considered in the Company's modeling analysis. Correction of these errors would increase the total costs of the Option 1 portfolio, causing the portfolios that contain natural gas replacement capacity and/or capacity purchases to look more favorable by comparison.

My recommendation is that the Commission disregards the Company's STRAGEGIST analysis in its determination of whether or not to grant CPCN, as the analysis contains several errors that bias the results in favor of continued operation of Big Sandy Unit 2.