STATE OF MARYLAND

BEFORE THE

PUBLIC SERVICE COMMISSION

In the Matter of The Potomac Edison Company's Proposed: (a) Stranded Cost Quantification Mechanism; (b) Price Protection Mechanism; and (c) Unbundled Rates	* * * * *	**Case No. 8797**

TESTIMONY OF

BRUCE E. BIEWALD

ON BEHALF OF

THE MARYLAND OFFICE OF PEOPLE'S COUNSEL

JANUARY 1999

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1. Qualifications

Q. State your name, occupation and business address.

A. My name is Bruce Edward Biewald. My address is Synapse Energy Economics, Inc., 22 Crescent Street, Cambridge, Massachusetts, 02138.

Q. Please describe your current employment.

A. I am President of Synapse Energy Economics, Inc., a consulting company specializing in economic and policy analysis of electricity restructuring, particularly issues of consumer protection, market power, stranded costs, renewables, efficiency, environmental quality, and nuclear power.

Q. What are your qualifications with regard to energy policy?

A. I graduated from the Massachusetts Institute of Technology in 1981, where I studied energy use in buildings. I was employed for 15 years at the Tellus Institute, where I was Manager of the Electricity Program, responsible for studies on a broad range of electric system regulatory and policy issues. I have testified on energy issues in more than 50 regulatory proceedings in 20 states, two Canadian provinces, and before the Federal Energy Regulatory Commission. I have co-authored approximately 100 reports, including studies for the Electric Power Research Institute, the U.S. Department of Energy, U.S. Environmental Protection Agency, the Office of Technology Assessment, the New England Governors' Conference, the New England Conference of Public Utility Commissioners, and the National Association of Regulatory Utility

Commissioners. My papers have been published in the Electricity Journal, Energy Journal, Energy Policy, Public Utilities Fortnightly and numerous conference proceedings, and I have made presentations on the economic and environmental dimensions of energy throughout the U.S. and internationally. My resume is provided here as Exhibit BEB-1.

Q. What are your qualifications specifically with regard to electricity markets and electric industry restructuring?

A. I have analyzed electricity market issues in New York, New England, and PJM. I have testified on market power in the New Hampshire restructuring docket on behalf of the Consumer Advocate; in the Vermont restructuring docket on behalf of the Department of Public Service; in Consolidated Edison's restructuring case on behalf of the City of New York; in Pennsylvania on behalf of a coalition of intervenors; and in Mississippi on behalf of the Attorney General's Office.

I have conducted a simulation analysis of market power in New England on behalf of the New England Conference of Public Utility Commissioners. I was retained by the Maine Department of Attorney General in July of 1997 to work on a study of market power issues raised by the prospect of retail competition in the electric industry. My June 11, 1997 report was filed by NECPUC with its comments to FERC on market power in New England. My testimony on market power in New England was filed on January 23, 1998 in FERC Docket Nos. OA97-237-000 and ER97-1079-000.

I have analyzed the market power implications of the proposed merger of Allegheny Power System with Duquesne Light Company on behalf of the Maryland Office of People's Counsel. This analysis was presented in my testimony before the Maryland Public Service Commission (Case No. 8774) and in my Affidavit filed in the corresponding FERC docket (No. EC97-46-000).

I have been invited to speak on market power issues by the National Association of Regulatory Utility Commissioners, the New England Conference of Public Utility Commissioners, the National Consumer Law Center, and the National Association of State Utility Consumer Advocates.

Q. What is your experience with electric system simulation modeling?

A. I have applied electric system dispatch models to simulate the operations of many utility systems. The models that I have used include SYSGEN, UPLAN, ELFIN, and ELMO. The systems that I have modeled include the Kentucky utilities, the Michigan Coordinated Electric System (Consumers Power and Detroit Edison), Pacific Power and Light and Utah Power and Light (now merged to form Pacificorp), Middle South Utilities (now Entergy), Northern States Power, the Pennsylvania-Jersey-Maryland (PJM) system, Maine Public Service, the New York City portion of the New York Power Pool, and the New England Power Pool. I have also reviewed and critiqued utility applications of production costing models, including PROMOD, PROVIEW, UPLAN, MAPS, Over/Under, and others. I have provided lectures and training on electric utility modeling to staff at

the Massachusetts Division of Energy Resources and to planners from several Southeast Asian countries.

2. Summary and Recommendations

Q. What is the purpose of your testimony in this case?

A. I was retained by the Maryland Office of People's Counsel to simulate the operation of the regional electric system for the purpose of developing independent estimates of market prices for energy to be used in preparing the OPC's estimates of stranded costs and the retail shopping credit.

Q. Please provide an overview of your analysis and this testimony.

A. I begin with an overview of the appropriate methods and approaches for modeling market prices, and describe the ELFIN computer model that I used in this case to simulate the dispatching of power plants located within the ECAR region. I then describe the inputs to the ELFIN model and summarize its results, particularly the market prices. The results of my analysis were provided to Mr. Paul Chernick, who is also testifying in this case on behalf of the OPC, as inputs to his calculation of the Company's stranded costs. I also provided market price information to OPC witness Dr. Joseph Bowring, for use in his calculation of the retail shopping credit.

I also comment in this testimony on the connection between market power and market price, and on the market price analysis done by Dr. Pifer for the Company.

Q. What region did you analyze?

A. I simulated the East Central Area Reliability Coordination Agreement (ECAR) region using the Elfin model. This region, with a peak demand for electricity of

about 100 Giga-watts, is large enough to provide a good sense of the overall market value of the energy produced by the Allegheny Power Systems's (APS) generating units but not so large that transmission constraints within the region will dominate the market price results.

Q. Please summarize your conclusions.

A. My results are summarized in Exhibit___(BEB-3). Time weighted averages are listed on page 1 of the Exhibit. I find that time-weighted market prices for energy in the ECAR region increase from $27.4/MWh in the year 2000 to $42.1 in 2005. Generation-weighted averages are listed on page 2 of the Exhibit. I find that generation-weighted averages for Potomac Edison's plants increase from $29.0/MWh in 2000 to $44.4/MWh in 2005. The generation-weighted averages are higher than time-weighted averages because generators tend to run more during high load periods with higher market prices.

Q. Are the prices in Exhibit___(BEB-3) the ones that you passed to Mr. Chernick for his calculation of stranded costs?

A. Not exactly. The prices presented in Exhibit___(BEB-3) are averages. Mr. Chernick used generating-unit-specific market values for his calculation of stranded costs. These annual, generator-specific figures, including estimates of the value for unit commitment and spinning reserve, were estimated using Elfin and passed along for use in the stranded cost calculation. The prices listed in Exhibit___(BEB-3) are time-weighted and generation-weighted averages that

correspond with the generator-specific prices that I provided to Mr. Chernick.

Q. Please summarize your testimony with regard to the connection between market power and market price.

A. Market power in electricity markets will be a crucial factor in determining the level of market prices. I conducted some analysis of market power in the context of the APS-Duquesne merger case at FERC and before this Commission using Synapse's ELMO model to simulate the APS-Duquesne system. I found that market power can be expected to be a considerable problem without the merger and a much greater problem post-merger. Dr. Pifer also conducted an analysis of strategic bidding behavior using the GE-MAPS model in the merger context. While Dr. Pifer claimed that his results indicated that "bidding up" was not profitable, in fact, he had made a crucial mistake in his modeling which, when corrected, shows the opposite result. My testimony in the merger case, discussing both my analysis and Dr. Pifer's is provided here as Exhibit___(BEB-9).

The impact of market power upon market prices should not be dismissed as unimportant. While FERC can be expected to continue to consider market power in its decisions, it would be quite naïve to believe that FERC approvals will entirely eliminate market power and its effect upon market prices.

Q. Please summarize your testimony with regard to Dr. Pifer's analysis of market prices.

A. I address Dr. Pifer's analysis of market prices for Potomac Edison in Section 6

of this testimony. While I have not been able to fully review Dr. Pifer's analysis of market prices in detail due to confidentiality concerns,1 I can conclude that his analysis:

- Employs a model (GE-MAPS) that is complex, is subject to claims of confidentiality, and has in a prior case been found to contain a fundamental error (while that particular error is not a concern in this case, the possibility of other unidentified errors is a concern);
- Understates market prices relative to recent actual market experience and current futures market prices;
- Reveals a counterintuitive pattern of regional variation that conflicts with actual market data, logical expectations, and with Dr. Pifer's results using the same model in a prior case; and
- Is similar to a prior analysis by Dr. Pifer using the same model and methodology that was flatly rejected for stranded cost valuation by the Pennsylvania Public Utilities Commission in Docket R-00973981.

1 Potomac Edison and its consultants, Putnam, Hayes & Bartlett, Inc., were helpful in providing some information and in allowing my staff to visit their offices to inspect the GE-MAPS model inputs. The claimed confidentiality, however, made it quite difficult to conduct a thorough review of Dr. Pifer's application of the model in this case. For example, while my staff were allowed to look at the input data at the PHB office, they were not allowed to copy any materials or take notes on the written documents or printouts with numbers. In reviewing an application of a complex model with thousands of inputs, this is a severe limitation. In addition, while my staff were allowed to review the GE-MAPS model documentation, the text of the documentation merely described the complex systems for processing the input files to the model – it did not address the substantive issues regarding the methodology and assumptions used by the model. . In response to our data requests, Potomac Edison claimed that inputs to GE-MAPS were proprietary. These inputs include the generator forced outage rates, maintenance schedules and rates, unit operating parameters, and representation of the transmission system of thousands of buses (see PE responses to OPC Data Request No. 17 Questions 21 and 23).

Q. What do you recommend in this case with regard to market prices?

A. I recommend that the Public Service Commission recognize the limitations of projections of market operations and prices and require a true market test for the purpose of determining stranded costs and for providing a market structure to support real competition. To the extent that an administrative valuation approach is relied upon, I recommend that the Commission adopt my projection of market prices for purposes of estimating stranded costs and the retail shopping credit for Potomac Edison.

3. Market Power and Market Prices

Q. Please comment on the connection between market power and market prices.

A. Market power in electricity markets will be a crucial factor in determining the level of market prices. As the experience in the summer of 1998 indicates, "strategic behavior" of suppliers in the wholesale market is likely to be profitable in some significant number of hours of the year. That is, suppliers of generation are unlikely to behave in the manner that is assumed in the market models that are used by the Company and by me to estimate market prices in this case. Instead, it is quite likely that suppliers will find it profitable to withhold capacity from the market in some situations and/or to bid above marginal costs. Such, opportunities to profitably and legally exploit market power will serve to raise market prices and decrease stranded costs.

It is my understanding that the Commission has decided to address market power issues separately from and subsequent to this proceeding. For this reason, I have assumed that the ECAR market will operate as an ideal, fully competitive market for purposes of my testimony in this case. That is, generation suppliers are represented in my model (and in the Company's model) as bidding their resources into the energy market at variable cost, without adding any premium for market power. Capacity withholding and its upward effect on market price are not included. Indeed, even the scheduling of maintenance outages is coordinated in

Elfin, in order to avoid periods with generation shortages. It is my belief that a strong, independent ISO should have broad authority and resources to monitor and correct market power abuse.2 Nonetheless, it is also certain that some opportunities to exploit market power will arise and be realized, driving up market prices. It is my belief, based upon analyses that I have done in other cases, that market power is likely to be a very significant influence upon electricity market prices.

Q. Is it possible to use computer models of the electricity market to analyze whether and to what extent market power is likely to be present in a particular market?

A. Yes. Computer models can be very helpful in understanding the extent to which profit-maximizing companies will find it possible and attractive to exert market power. The models can also be helpful in analyzing the extent to which various monitoring and mitigation procedures might be helpful in detecting and discouraging undesired behavior by companies with market power. Such modeling should be done, but has not been done by me or by the Company in this case.

Q. Have you performed any analysis of market power in the APS area previously?

A. Yes. I conducted some analysis of market power in the context of the APS-

2 Unfortunately, it appears that it may be a long time before a strong ISO is established and functioning

Duquesne merger case at FERC (Docket No. EC97-46-000) in support of my Affidavit on behalf of the Maryland Office of People's Counsel and in the context of the APS-Duquesne merger case before this Commission (Public Service Commission of Maryland Case No. 8774). I applied the ELMO model to simulation of the APS-Duquesne system, and found that market power can be expected to be a considerable problem without the merger and a much greater problem post-merger.

Q. Has Dr. Pifer performed any analysis of market power in the APS area?

A. Yes. Dr. Pifer conducted an analysis of strategic bidding behavior using the GE-MAPS model in his testimony in support of the APS-Duquesne merger, in FERC Docket No. EC97-46 et al. While Dr. Pifer claimed that his results indicated that "bidding up" was not profitable, in fact, he had made a crucial mistake in his modeling. When corrected, the result was quite the opposite. That is, Dr. Pifer's GE-MAPS results showed that bidding above competitive levels would be quite profitable, and that bidding up by 15 percent is even more profitable than bidding up by 10 percent. Dr. Pifer's modeling error, and its implications for market power in the APS area are discussed on pages 5 through 11 of my February 9, 1998, testimony in Maryland Case No. 8774 (provided here as Exhibit___(BEB-9)).

I bring this issue up in the current case in order to emphasize that the impact of

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effectively in the region.

market power upon market prices should not be dismissed as unimportant. The experience with GE-MAPS in the merger case also indicates to me that one must be very cautious in accepting the results of a such complex model, particularly where confidentiality claims limit the ability to conduct a comprehensive review of the inputs and algorithms.

Q. Why did Dr. Pifer not consider the effects of market power upon market prices in the current case?

A. According to Potomac Edison's answer to OPC Data Request No. 11, Question No. 26, reproduced here in Exhibit___(BEB-2), Dr. Pifer's analysis does not include market power because "FERC approval of the institutional structure and operating rules of wholesale electricity markets will be contingent upon the demonstration that market power will not be an issue." I believe that this is a simplistic and unwarranted dismissal of an important determinant of market price. While FERC will require such demonstrations, it would be naïve to believe that FERC approvals will entirely eliminate market power and its effect upon market prices.

Q. What do you recommend in this case with regard to market power and market prices?

A. Market power is an issue that this Commission and the FERC will have to address before electricity markets can be expected to function in a reasonable approximation of the competitive ideal. Progress should be made toward

establishing an ISO and putting market monitoring and mitigation measures in place. However, even if this is done aggressively and thoroughly, some residual degree of market power can be expected. For purposes of stranded cost policy in this case the Public Service Commission should recognize the limitations of projections of market operations and prices and require a true market test for the purpose of determining stranded costs.

4. Electric System Modeling

Q. What is involved in simulating an electric power system?

A. Computer modeling of electric power systems involves simulating the dispatching of generating resources to meet customer loads.

Q. What inputs are required for simulation modeling of an electric power system?

A. Many types of input data are required. All of the generating resources, existing and future, are represented in the model with data specified for capacity, forced and scheduled outage, efficiency ("heat rate"), variable O&M costs, and fuel costs. To the extent that capacity expansion decisions are analyzed, the fixed costs of constructing and operating the future resource options should be included as well. Purchases from non-utility generators and from neighboring regions are included. Air emissions can be included by specifying emission rates for generators and market prices for emission allowance of various pollutant types. Customer loads are typically represented by scaling load shapes for a recent actual year upward to reflect forecast growth in customer demand for electricity.

Q. What are the outputs from electric power simulation modeling?

A. The output reports can take many forms and include varying levels of detail. Summary reports typically include capacity, generation, and costs by categories of generator types. Detailed reports can provide similar information for each generating unit. Special purpose reports such as marginal energy costs by time

period can also be produced. Data on marginal costs can serve as estimates of the market prices at the times and places where the marginal costs apply.

Q. What model did the Potomac Edison witnesses employ in this case?

A. In Potomac Edison's direct filing in this case, Dr. Howard Pifer presents simulation model results from the GE-MAPS model.

Q. What model did you employ in this case?

A. I used the Elfin model to simulate the dispatch of the ECAR system. The Elfin model was developed by the Environmental Defense Fund, and has been in use in utility system simulation studies for many years. Elfin uses the Baleriaux-Booth algorithm for representing randomly occurring generator outages. It is capable of simulating electric system dispatch at a fine level of detail and producing a range of different output reports. The model has been widely used in the US and internationally. A partial list of Elfin users is provided in Exhibit___(BEB-4).

Q. How does the Elfin model compare with the models relied upon by Potomac Edison?

A. Like the GE-MAPS model, Elfin simulates the operation of generating units to serve load. The GE-MAPS model covers a larger geographic region and represents transmission constraints. Elfin, by comparison, has a simplified representation of the dispatch and was used in this instance as a "single area" model for the ECAR region. The relative advantage of Elfin is that it is lower cost, has quicker run time, and can generate optimized system expansion plans. For the

task at hand – projecting long-run market prices for purposes of stranded cost estimation – Elfin's level of detail is appropriate.

5. Analysis of ECAR Using Elfin

Q. What input data were used in your simulation of the ECAR system?

A. The data used in my simulation of the ECAR system are summarized in Exhibit___(BEB-5). The inputs for new generators (combined-cycle and combustion turbine units) and the fuel costs for all generators were provided to me by Mr. Paul Chernick.. The bases for these inputs are described in his testimony on behalf of the People's Counsel in this case.

The other inputs were based upon various publicly available sources. The variable O&M costs by plant type are from Dr. Howard Pifer's direct testimony. The capacity ratings and heat rates of existing units are from Energy Information Administration data. The SO_2 and NO_X emission rates are from EPA data. The actual hourly loads for 1996 (filed with the Federal Energy Regulatory Commission) were converted to load duration curves and scaled upward to match peak demand and energy requirements forecasts published by the North American Electric Reliability Council. The availability and price of purchases from non-utility generators and from neighboring regions were developed based upon inspection of marginal energy cost data and NERC projections of quantities. Outage rates for existing generating units were taken from NERC Generator Availability Data System averages by fuel type and size category. As indicated in Exhibit___(BEB-5), for APS generating units some of the input data was taken information provided by the Company in this case.

Q. Why did you use these particular data sources?

A. My aim was to rely mainly upon standard industry or government sources for electric system information. The EIA collects and disseminates generator capacity data that is used widely in electric system analyses. The EPA is the logical source for power plant air emissions information. The NERC projections of supply and demand are simply the utility forecasts compiled and published on a regional basis by the reliability councils. The generator outage data collected and published by NERC as part of its Generator Availability Data System have excellent coverage of the industry, and high standards for consistency.

Q. How was the set of capacity additions for the region developed?

A. Elfin's capacity expansion capability was used to determine the additions by year. Two types of new generators were made available in the model: combustion turbines for peaking service and combined-cycle generators for intermediate and baseload operation. Both types would be fueled by natural gas. We found that "optimal" additions of new capacity would be dominated by the combustion turbine peaking units. This is consistent with information about what companies are planning to develop in the ECAR region. Current plans are predominantly for combustion turbine additions.

Q. What market prices do you project?

A. My market price projections for the ECAR region are provided in Exhibit___(BEB-3). As can be seen on page 1 of the Exhibit, the prices for energy

start at $27.4/MWh in the year 2000, increasing to $42.1/MWh in the year 2005, and to $48.6/MWh in the year 2010. These figures are "time-weighted" averages, and so are lower than the corresponding "load-weighted" or "generation-weighted" averages.

Q. Please provide your projection of "generation-weighted" market prices.

A. In Exhibit___(BEB-3), page 2, I provide the market price results from Elfin on a generation-weighted basis (for PE plants). These prices begin at $29.0/MWh in the year 2000, increase to $36.1/MWh in 2005, and then increase to $52.8/MWh in 2009.

Q. Are the figures listed in Exhibit___(BEB-3) the market prices that were used by Mr. Chernick to estimate stranded costs in this case?

A. Mr. Chernick used generator-specific market value figures that I provided to him from Elfin. Those generator-specific market prices are consistent with the time-weighted figures presented in Exhibit___(BEB-3), page 1, and the average generation-weighted figures on page 2. Indeed, the generation weighted figures on page 2 were calculated by Mr. Chernick from the generator-specific results that I provided to him.

Q. Did Mr. Chernick use your results for the year 2010?

A. No. It is my understanding that Mr. Chernick used my results through 2009, but did not use the 2010 results. In the Elfin output file that I sent to him, the results for the year 2010 showed a very high market prices for that year related to a

price spike in the peak hours, related to the very low level of capacity reserves in that year. To be conservative (i.e., to understate market prices and thus overstate stranded costs) Mr. Chernick did not use the year 2010 results. I subsequently re-ran Elfin for the year 2010 with a slightly higher level of capacity reserves (reserve margin of 12.5% instead of 11.9%, producing the market price results for the year 2010 presented in my testimony and exhibits.

Q. Are market prices sensitive to the amount of capacity reserves?

A. Yes. I have modeled ECAR as an energy market, without a capacity reserve requirement, because this is the way that Dr. Pifer represented the Midwest markets and because (unlike New England, New York, and PJM markets) there is no capacity requirement in place. Without a reserve capacity requirement, the peak hour energy prices are relied upon to create an incentive for developers to bring new generating resources online. This creates a situation in which reserves can fluctuate greatly from year-to-year, and in which prices for electricity can spike up to very high levels, particularly in periods when reserves are low.

6. Potomac Edison's Simulation of the Energy Market

Q. How do your results compare with Dr. Pifer's projection of market prices?

A. Potomac Edison witness Dr. Howard Pifer produced market price results with the GE-MAPS model and reported them in his Exhibits HWP-13, 23, 24, and 25. I have plotted Dr. Pifer's energy market price projection along with my projections in Exhibit__(BEB-3). In terms of average market prices over all hours (see page 1 of the Exhibit) my market price projection is 80 percent higher than Dr. Pifer's projection for the year 2003. (I do not make this comparison for other years because Dr. Pifer did not provide time-weighted averages for years other than 2003.) In terms of generation-weighted average market prices (see page 2 of Exhibit___(BEB-3)) my market price projection is between 40 and 94 percent higher than Dr. Pifer's in various years.

Q. Were you able to fully review the GE-MAPS model application in this case?

A. No. Potomac Edison and its consultants, Putnam, Hayes & Bartlett, Inc., were helpful in providing some information and in allowing my staff to visit their offices to inspect the GE-MAPS model inputs. The claimed confidentiality, however, made it quite difficult to conduct a thorough review of Dr. Pifer's application of the model in this case. For example, while my staff were allowed to look at the input data at the PHB office, they were not allowed to copy any

materials or take notes on the written documents or printouts with numbers. In reviewing an application of a complex model with thousands of inputs, this is a severe limitation. In addition, while my staff were allowed to review the GE-MAPS model documentation, the text of the documentation merely described the complex systems for processing the input files to the model – it did not address the substantive issues regarding the methodology and assumptions used by the model. In response to our data requests, Potomac Edison claimed that inputs to GE-MAPS were proprietary. These inputs include the generator forced outage rates, maintenance schedules and rates, unit operating parameters, and representation of the transmission system of thousands of buses (see PE responses to OPC Data Request No. 17 Questions 21 and 23).

As I discussed in Section 3 of this Testimony, I have had experience in a prior case with the GE-MAPS model in which Dr. Pifer did, in fact, make a fundamental error in modeling market behavior. I have not found a problem of this nature in his analysis in this case, but I do have concerns that there may be errors in the application of GE-MAPS that we were not able to identify due to confidentiality constraints.

Q. How do Dr. Pifer's projected market prices compare with recent actual market prices in the ECAR region?

A. Dr. Pifer's electricity market price projection for the year 2003 is $19.59/MWh on a time-weighted basis (for APS in 1997 dollars, from HWP-23). On an

generation-weighted basis his projection is for a market price of $15.50/MWh in 1999 increasing to $21.37/MWh in 2003 (for PE plants in 1997 dollars, from page 5 of Dr. Pifer's Direct Testimony). Actual prices in the region have been significantly higher than this. For example, Electric Power Daily reports that the 11 bids received by Cleveland Public Power in response to its recent RFP ranged from $39/MWh to $79/MWh (page 3, December 8, 1998, Electric Power Daily). Allegheny Energy recently posted on its web site price quotes to its regulated affiliate APS ranging from $37/MWh for the January and February 1999 period up to $155/MWh for July and August 1999. Bloomberg price data for ECAR in 1998, summarized in Exhibit___(BEB-6), show average prices for on-peak power above $50/MWh (except in the west of ECAR where the prices are about $48/MWh). While these prices are for power during peak periods, they are levels such that even when averaged in with off-peak prices, the resulting annual prices are higher than those estimated by Dr. Pifer.

Q. How do Dr. Pifer's projected market prices compare with futures markets for energy in the ECAR region?

A. Bloomberg data for "Cinergy Electricity" futures prices show summer 1999 prices above $100/MWh (for July and August, 1999 in Bloomberg Natural Gas Report, December 28, 1998, page GS6). Even when prices for off-peak periods are averaged in, the resulting annual prices are higher than those estimated by Dr. Pifer.

Q. Please comment on the geographic pattern of market prices in the region.

A. Dr. Pifer's modeling in this case shows an odd pattern of market prices geographically. The average all-hours price varies greatly for APS generators from a low of $10.18/MWh for RP Smith 3 to a high of $17.83/MWh for Mitchell 1 while the average all-hours prices for generators owned by other companies tends to range from $18/MWh up to $25/MWh (these are averages for 2001 in 1997 dollars, from Exhibit HWP-18).

This pattern can also be seen in a general way in Dr. Pifer's GE-MAPS results presented in Exhibit HWP-23, which show prices in the eastern portion of ECAR (where APS is located) that are lower than prices elsewhere in ECAR (with the exception of Southern Indiana). With average electricity prices in the PJM region, located to the east of ECAR, being higher than prices in ECAR, one would expect the market prices to rise gradually from central ECAR as one moves toward the east.

Q. Does Dr. Pifer explain this odd geographic pattern of market prices?

A. OPC Data Request No. 20, Questions 18, 19, 21, 22, 27, and 28 seek to explore this issue of the geographic pattern of market prices. Dr. Pifer's responses are reproduced here in Exhibit___(BEB-2). It appears that the phenomenon of depressed prices in the APS area is an artifact of the way in which the GE-MAPS model assigned generators to constrained transmission interfaces. In response to our Data Requests No. 20 on this topic, Dr. Pifer did not provide an example of

how the use of regional power flows might change if generation at APS's Smith plant were increased (Question 19); could not identify studies of the effect of APS generators on inter-regional transfer capability (Question 25); did not identify an economic mechanism or pricing rule that would impose this effect (Question 27); and could not identify any APS, ECAR, or VEM rules that would indicate that the claimed effect is a real factor in system operations (Question 24).

Q. Does the odd pattern of decreasing market prices in the eastern part of ECAR show up in actual market price data?

A. No. The opposite – and expected – geographic pattern emerges from the actual market price data. Average prices for seven markets in ECAR for 1998 are listed in Exhibit___(BEB-6). The data show that for the on-peak periods, the eastern part of ECAR has the highest market prices of any of the ECAR markets, averaging about 7 percent above the ECAR average on-peak price. Off-peak, the prices in the eastern part of ECAR are very slightly below the ECAR average, but off-peak prices in general are quite flat in this region.

Q. Does the odd pattern of decreasing market prices in the eastern part of ECAR show up in prior analysis by Dr. Pifer in other cases?

A. I have examined Dr. Pifer's analysis of market prices using the GE-MAPS model filed in Pennsylvania Public Utility Commission Docket No. R-00973981, the West Penn Power restructuring proceeding. Dr. Pifer's Rebuttal Testimony in that case included an Exhibit HWP-15 that is analogous to his Exhibit HWP-23 in

this case. I have reproduced the two Exhibits here as Exhibit___(BEB-8) to allow easy comparison. It appears that the odd geographic pattern of market prices is something new in Dr. Pifer's application of the GE-MAPS model in this case. In the Pennsylvania case, Dr. Pifer's exhibit shows market prices that are higher in APS's area relative to AEP, PSI, and KUC. In the exhibit for this case in Maryland, the APS market price in Dr. Pifer's Exhibit is lower than those three areas.

Q. What is the significance of this pattern of market prices from the GE-MAPS model?

A. To the extent that prices in the eastern part of ECAR are artificially depressed in Dr. Pifer's GE-MAPS analysis of market prices, the value of Potomac Edison's plants will tend to be understated, and the Company's stranded cost claim will be correspondingly overstated. I believe this also raises questions about the overall validity of the GE-MAPS model in this case.

Q. What type of generating capacity does Dr. Pifer expect to be added in the Midwest?

A. Dr. Pifer expects a mix of combustion turbines (CT) and combined cycle generators (CC) to be added in the Midwest. For example, in the 2001 to 2003 period he has 2860 MW of new CT capacity and 3718 MW of new CC capacity (see Exhibit HWP-14). In the period after that, from 2004 through 2010, he has 26,180 MW of new CT capacity and 20,618 MW of new CC capacity. He

explains in his testimony (on page 34) that "Through several iterations of the GE MAPS model for each future year, I was able to determine the most profitable mix of these unit types for each of the regions in each of the modeled years after 1999."

Q. Are the combined cycle additions that Dr. Pifer projects economical?

A. In his Exhibit HWP-15 Dr. Pifer shows his projected costs and revenues for some CC additions in Virginia and Ohio. These are found to be economical, because they are located in areas in which the GE-MAPS model predicts market prices to be relatively high. Dr. Pifer finds that CC additions would not be economical in the APS area. I have estimated the costs of CC operation in the APS area using assumptions from Dr. Pifer's testimony in this case, and confirm that given his assumptions and results that the CC units would not earn revenues to cover their cost in the APS area. This analysis is summarized in Exhibit___(BEB-7). For example, even if the CC generator were to run at a fairly high capacity factor, say, 60 or 70 percent its total cost, given the Company's assumptions, works out to about 3 cents/kWh (in 1997 dollars). At the same time, Dr. Pifer's market prices in the year 2003, are in the neighborhood of 2 cents/kWh (e.g., 1.96 cents/kWh for all-hours average up to 2.14 cents/kWh for PE-generation-weighted averages in Dr. Pifer's "Base Case").

The result is that Dr. Pifer's analysis using GE-MAPS includes the construction of new CCs that depress the market price for energy in the APS area, while none of these CCs is actually built in the APS area. APS, situated at a key location in

the regional transmission system adjacent to higher priced markets to the east, is somehow never a economical location for new market entry. Rather, new construction in other locations including Ohio serves to keep market prices in the APS area perpetually below the level that would bring new generation into the market.

Q. What type of capacity is currently being planned for the ECAR region?

A. Most plans for capacity additions in the ECAR region are for CTs rather than CCs.

Q. If Dr. Pifer overstated the additions of CC units in the Midwest, what is the significance to this case?

A. To the extent that Dr. Pifer overstated the additions of CC units in his analysis, his estimates of the market prices for energy will be understated and the Company's stranded cost claim will be overstated.

Q. What did the Pennsylvania Commission conclude about Dr. Pifer's analysis of market prices?

A. On page 5 of Dr. Pifer's Direct Testimony in this case he points out that the market prices that he projects in this case in Maryland are "similar to those I filed on behalf of West Penn Power before the PaPUC." The Pennsylvania Public Utilities Commission was unimpressed with Dr. Pifer's GE-MAPS analysis of market prices. The Pennsylvania Commission found in its Order in that case that "The GEMAPS model used by West Penn witness Pifer also inappropriately

assumes bid price will be the incremental cost of changing unit operation rather than the average variable cost" (page 105 of the PUC Order in Docket R-00973981) and that "West Penn witness Pifer's valuation must be rejected as unreasonable" (page 104).

Q. Please summarize your testimony with regard to Dr. Pifer's analysis of market prices.

A. While I have not been able to fully review Dr. Pifer's analysis of market prices in detail due to confidentiality concerns, I can conclude that his analysis:

- Employs a model that is complex, is subject to claims of confidentiality, and has in a prior case been found to contain a fundamental error (while that particular error is not a concern in this case, the possibility of other unidentified errors is a concern);
- Understates market prices relative to recent actual market experience and current futures market prices;
- Reveals a counterintuitive pattern of regional variation that conflicts with actual market data, logical expectations, and with Dr. Pifer's results in a prior case; and
- Is similar to a prior analysis by Dr. Pifer using the same model and methodology that was flatly rejected for stranded cost valuation by regulators in a neighboring state.

Q. Does this conclude your testimony?

A. Yes.