BEFORE THE

NOVA SCOTIA UTILITY AND REVIEW BOARD

IN THE MATTER OF The *Public Utilities Act*, R.S.N.S., 1989, c. 380, as amended

— and —

IN THE MATTER OF an Application of Nova Scotia Power Incorporated for approval of certain revisions to its Rates, Charges, and Regulations

EVIDENCE FILED BY BRUCE BIEWALD

On behalf of:

The Utility and Review Board Staff

August 7, 2008

Synapse Energy Economics
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1. INTRODUCTION, QUALIFICATIONS, AND CONCLUSIONS

Q. What is your name, position and business address?

A. My name is Bruce Edward Biewald. I am the President of Synapse Energy Economics, Inc., a consulting firm located at 22 Pearl Street in Cambridge, Massachusetts, 02139.

Q. Please describe Synapse Energy Economics.

A. Synapse Energy Economics ("Synapse") is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, market power, electricity market prices, 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. A complete description of Synapse is available at our website, www.synapse-energy.com.

Q. Please describe your background and qualifications.

A. I am founder and President of Synapse Energy Economics. Since 1980, I have analyzed the electricity industry and have advised state agencies, consumer and environmental advocates, utilities, and others on issues related to the production and consumption of energy. I have testified in more than one hundred cases including utility regulatory proceedings in twenty-five states, the Federal Energy Regulatory Commission, the Nuclear Regulatory Commission's Atomic Safety and Licensing Board, two Canadian provinces, and in State and Federal Courts.

I have co-authored more than one hundred reports, including studies for the Electric Power Research Institute, the U.S. Department of Energy, the U.S. Environmental Protection Agency, the U.S. Department of Justice, the Office of Technology Assessment, the Interfaith Center on Corporate Responsibility, the New England Governors' Conference, the New England Conference of Public Utility Commissioners, the National Association of Regulatory Utility

Commissioners, and the United Nations Framework Convention on Climate Change. My papers have been published in the Electricity Journal, Energy Journal, Energy Policy, Public Utilities Fortnightly, and numerous conference proceedings.

Prior to founding Synapse, I was with Energy Systems Research Group (later Tellus Institute) where I consulted on a wide range of electric system regulatory and economic issues (from 1980 to 1996). I studied architecture and building technology at MIT.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of the Nova Scotia Utility and Review Board Staff.

Q. What has your role been with regard to system planning and demand-side management in Nova Scotia?

A. My work for the UARB staff in the last couple of years includes consulting on NSPI's integrated resource plan, demand side management, and Tufts Cove waste heat recovery project.

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

A. My focus is on escalating costs associated with the construction of power plants, depreciation schedules and load forecasting.

Q. What are your key conclusions and recommendations with regard to power plant costs and depreciation?

A. Power plant construction costs have increased dramatically in the last few years. Correspondingly, the value of existing utility assets has also increased. Other key variables such as fossil fuel prices have also changed dramatically since 2003.

Given the many changes, I recommend that depreciation rates be revisited and examined in a consistent and up-to-date manner.

Q. What are your key conclusions and recommendations with regard to the load forecast?

A. NSPI's overall methodology for load forecasting is problematic, since it uses an econometric approach that amounts to statistical trending. I recommend that the Company be required to prepare and present a forecast that relies on an end-use approach to the maximum extent possible and practical.

2. TESTIMONY ON CONSTRUCTION COSTS AND DEPRECIATION

Q. Are existing fossil fuel power plants in North America likely to retire in significant numbers in the foreseeable future?

A. No, as existing plants age, few plants actually retire. The US Department of Energy's Energy Information Agency's Annual Energy Outlook 2008 has a forecast of generating capacity retirements in the US, totaling a cumulative amount of 44.8 GW by 2030. This is out of an existing power plant fleet in the US of approximately 1000 GW.[1]

Q. Have power plant construction costs been reasonably stable in recent years?

A. Absolutely not. Power plant construction costs have been escalating very rapidly. Recent research reports and indices published by the Brattle Group, Synapse Energy Economics, and others document the trends, and suggest that that the escalation in power plant construction that has occurred in the last four years may continue. These trends have been driven in part by the rise in raw material costs (steel and cement). Furthermore, the changes in the cost inputs that have been driving the construction cost trends do not appear to be abating.

[1] See page 133, Table A9, of the United States Department of Energy, Energy Information Agency. "Annual Energy Outlook 2008."

Q. Would recent research reports support your findings concerning escalating construction costs?

A. Recently, Synapse published a paper on construction cost for coal fired power plants.[2] This analysis documented escalation of coal fired plant construction costs from recent examples. Escalations in these four examples ranged from 15% (over six months) to 40% (over a period of eighteen months). The Synapse analysis also found that cost estimates for coal fired power plants have reached over $3,500 per kilowatt (kW). Moreover, these power plant construction costs have dramatically increased since 2004.

Q. Would other research reports support your findings about construction costs?

A. A recent research study published by the Brattle Group also documents escalating construction costs associated with utility infrastructure projects that include generation, transmission, and infrastructure projects.[3] The Brattle Group documents "dramatically increased raw material prices" and increasing labor costs as some of the drivers of the escalating costs seen in the generation sector.

The report also documents that the full impact of the rise of raw materials has not been seen in infrastructure projects, since "construction or materials acquisition preceded the most recent price increases."[4] As a result, proposed infrastructure projects will reflect recent price increases more dramatically than current projects.

Q. Are power plant construction costs increasing in Nova Scotia?

A. Yes, costs are increasing in Nova Scotia as they are elsewhere. For example, NSPI's September 2007 application to the Nova Scotia Utility and Review Board titled "Tufts Cove 6 Waste Heat Recovery Project" specified a cost of $66 million for the conversion of two combustion turbines to a combined cycle plant with

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[2] Schissel, D., Smith, A., Wilson, R. "Coal Fired Power Plant Construction Costs." dated July 30, 2008. Available at http://www.synapse-energy.com/Downloads/SynapsePaper.2008-07.0.Coal-Plant-Construction-Costs.A0021.pdf

[3] Chupka, M., Basheda, G., "Rising Utility Construction Cost: Sources and Impacts." The Brattle Group, prepared for the Edison Foundation, September 2007.

[4] *Ibid.* page *3*.

duct firing, for an additional 50MW of capacity.[5] In its revised filing on May 28, 2008, NSPI stated that the cost estimate had increased to a project total of $84 million. This 27% increase in estimated construction costs is documented in filings dated less than a year apart.

Q. What are your key conclusions and recommendations with regard to costs and depreciation?

A. Power plant construction costs have increased dramatically in the last few years. Correspondingly, the value of existing utility assets has also increased. Other key variables such as fossil fuel prices have also changed dramatically since 2003. Given the many changes, I recommend that depreciation rates be revisited and examined in a consistent and up-to-date manner.

3. TESTIMONY ON LOAD FORECAST

Q. What are your conclusions and recommendations with regard to NSPI's load forecast?

A. Synapse reviewed the load forecast presented by NSPI in this case. We find that the overall methodology is problematic, since it uses an econometric approach that amounts to statistical trending, rather than an end-use approach that would provide a stronger basis for planning and for future developments that may differ from the past trends, and that may to some extent be within the control of the Company and the Province and its businesses and citizens. I recommend that the Company be required to prepare and present a forecast that relies on an end-use approach to the maximum extent possible and practical.

Q. What is the Company's load forecasting methodology?

A. NSPI's 2008 Load Forecast uses the same econometric methodology and nearly the same models as those used for the 2006 Load Forecast. We have observed

[5] Nova Scotia Power. "Tufts Cove 6 Waste Heat Recovery Project" filed to the Nova Scotia Utility and Review Board, September 2007.

previously that this approach amounts to statistical trending, and that it does not provide a solid basis for planning and decision-making.

Q. **If one accepts the NSPI forecast on its own terms, as an econometric forecast, does it appear to be reasonable?**

A. Generally, yes. It appears to be reasonable in broad terms.

NSPI's forecast includes some items that I think are incorrect or would disagree with. For example, the "RCGOODS" model variable (representing customer spending on goods) should have been converted to constant dollars for use in the forecasting analysis. However, I do not expect that correcting this would have a large impact on the result.

Q. Are there ways in which NSPI's forecast allows the results to differ from past trends?

A. Yes. The EFFIDX variable[6] is, in my view, a particularly important example of this. It represents the "Appliance Efficiency Index" which is developed by NSPI using a methodology and data that are not provided in the Company's evidence and were not provided in response to our information requests (see NSPI responses to IR-10 and IR-26). This one important and derived variable is intended to account for changes in residential appliance efficiency, but there is no way to know if it is reasonable, or to know what programmatic assumptions drive it. For example, National or provincial appliance efficiency standards and/or demand-side management programs could be key drivers of the "EFFIDX," but there is no way to know what was assumed, or whether there is "double counting" with the projected DSM program impacts.

[6] The "EFFDIX" variable is sometimes referred to by NSPI as the "AIDX." We believe that this is interchangeable terminology referring to the same thing.

Q. What are the advantages of an end-use forecasting methodology?

A. First, an end-use forecasting methodology would recognize changes in the penetration and utilization of devices of different efficiency levels. For example, as new efficient refrigerators are purchased and older equipment is retired there is a general trend toward decreased electricity use for this end use. On the other hand some end uses (e.g., computer equipment and internet-related devices) are typically increasing in number, sometimes rapidly, and so electricity for these end uses is likely increasing as well. In an environment where the mix of devices is changing and/or the energy use per device is changing, an end use forecasting methodology can offer more accurate results.

In addition, end-use forecasting would provide a basis for planning. For example, the demand-side management programs that will be offered in Nova Scotia, should be designed and evaluated with the benefit of an end-use forecast. This is true whether the utility implements the DSM programs or not. Regardless of the entity that delivers the programs, they can be designed and evaluated better in the context of an end-use forecast. For example, the data and analysis that goes into the end-use forecast can help to identify the opportunities for DSM savings, and can help to prioritize the targeting of the effort to places where the potential savings (or lost opportunities) are greatest. Also, assumptions about free-ridership and spillover can be made in a more rational, informed, and consistent manner with the benefit of an end-use forecast.

With the Company's econometric forecast methodology, there will inherently be questions and concerns about whether the estimated DSM savings are reasonable and consistent with the underlying forecast.

Q. Does this conclude your testimony?

A. Yes, it does.

Exhibit BB-1: Resume of Bruce Biewald

Bruce Edward Biewald

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA. President, 1996 to present. Consulting on issues of energy economics, environmental impacts, and utility regulatory policy, including electric industry restructuring, electric power system planning, performance-based regulation, stranded costs, system benefits, market power, mergers and acquisitions, generation asset valuation and divestiture, nuclear and fossil power plant costs and performance, renewable resources, power supply contracts and performance standards, green marketing of electricity, environmental disclosure, nuclear plant decommissioning and radioactive waste issues, climate change policy, environmental externalities valuation, energy conservation and demand-side management, electric power system reliability, avoided costs, fuel prices, purchased power availability and cost, dispatch modeling, economic analysis of power plants and resource plans, portfolio management, risk analysis and risk management.

Tellus Institute, Boston, MA. Senior Scientist and Manager of the Electricity Program, 1989 to 1996. Responsible for research and consulting on all aspects of electric system planning, regulation, and restructuring.
Research Associate, later Associate Scientist, 1980 to 1988.

EDUCATION

Massachusetts Institute of Technology,
BS 1981, Architecture, Building Technology, Energy Use in Buildings.
Harvard University Extension School,
1989/90, Graduate courses in micro and macroeconomics.

SUMMARY OF TESTIMONY, PUBLICATIONS, AND PRESENTATIONS

Expert testimony on energy, economic, and environmental issues in more than eighty utility regulatory proceedings in twenty six states and two Canadian provinces, in cases in State and Federal Courts, and in proceedings of the Nuclear Regulatory Commission's Atomic Safety and Licensing Board.

Co-author of more than one hundred reports, including studies for the Electric Power Research Institute, the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Office of Technology Assessment, the New England Governors' Conference, the National Association of Regulatory Utility Commissioners, and the United Nations Framework Convention on Climate Change.

Papers published in the Electricity Journal, the Energy Journal, Energy Policy, Public Utilities Fortnightly, and numerous conference proceedings.

Invited to speak by American Society of Mechanical Engineers, International Atomic Energy Agency, National Association of Regulatory Utility Commissioners, National Association of State Utility Consumer Advocates, National Consumer Law Center, the Latin American Energy Association (OLADE), the Swedish Environmental Protection Agency (SNV), the U.S. Environmental Protection Agency, and others.

TESTIMONY

New Jersey Board of Public Utilities (Docket No. EM05020106) – November and December 2005 and March 2006
Joint Testimony with Bob Fagan and David Schlissel on the market power implications of the proposed merger between Exelon Corp. and Public Service Enterprise Group.

Indiana Utility Regulatory Commission (Cause Nos. 42861) – October 2005
Vectren (SIGECO) environmental compliance planning, including climate change policy and carbon price forecasting, energy efficiency and renewables as compliance options, and cost recovery issues.

United States District Court for the Eastern District of Kentucky, Lexington Division (Civil Action No.04-34-KSF, United States v. East Kentucky Power Cooperative – September 2005
Expert report on state regulation of electric utilities, use of computer models for system planning, capital investment planning and economic analysis, and projections of generating unit operations.

United States District Court for the Southern District of Indiana (Civil Action No.IP99-1693 C-M/S, United States v. Cinergy – May 2005
Expert report on state regulation of electric utilities, forecasting sales and resource requirements, use of computer models for system planning, capital investment planning and economic analysis, projections of generating unit operations, and the relationship between generator availability and output. Also, rebuttal report in September.

Federal Energy Regulatory Commission (Docket No. EC05-43-000) – April 2005
Market power analysis of the proposed merger of Exelon Corporation and Public Service Enterprise Group Incorporated. (Joint affidavit with David Schlissel.)

Nuclear Regulatory Commission Atomic Safety and Licensing Board (Docket No. 52-007-ESP and ASLBP No. 04-821-01-ESP) – April 2005
Affidavit on the environmental impacts and economic costs of a proposed new nuclear power project and alternatives.

Indiana Utility Regulatory Commission (Cause Nos. 42622 and 42718) – March 2005
Public Service Company of Indiana environmental compliance planning, including cost estimates for emission control technologies, climate change policy and carbon price forecasting, energy efficiency and renewables as compliance options, power plant retirement economics, and cost recovery issues.

National Research Council, Division on Engineering and Physical Sciences, Board on Energy and Environmental Systems (Project No. BEES-J-03-03-A) – March 2005
Alternatives for replacing the generation of the Indian Point Energy Center nuclear facility.

Georgia Public Service Commission (Docket No. 18300-U) – October 2004
Georgia Power Company's cost of service study, treatment of electrical distribution equipment, and proposed rates for the Metropolitan Atlanta Rapid Transit Authority.

Texas Public Utility Commission (Docket No. 29526) – June 2004
Issues in CenterPoint Energy Houston Electric LLC's true up filing, including environmental cleanup costs, excess mitigation credits, and construction work in progress. Also rebuttal testimony on June 14.

Texas Public Utility Commission (Docket No. 28818) – April 2004
The Independent Transmission Operator proposal of Energy Gulf States Utilities, Inc. (prefiled testimony adopted by Paul Peterson).

Indiana Utility Regulatory Commission (Cause No. 42359) – August 2003
Public Service Company of Indiana rate making issues including the impact of trackers on risks to shareholders and customers, costs of environmental compliance, treatment of merchant plant investment and risk, and joint dispatch issues.

Nevada Public Utilities Commission (Docket No. 03-1014) – April 2003
Review of Sierra Pacific Power Company's risk management and procurement of electric power in the wholesale markets.

Nevada Public Utilities Commission (Docket No. 02-11021) – March 2003
Review of Nevada Power Company's risk management and procurement of electric power in the wholesale markets.

United States District Court for the Southern District of Illinois (Civil Action No. 99-833-MJR, United States v. Illinois Power Company and Dynegy Midwest Generation, Inc.) – August 2003
Testimony at trial on analysis and opinions in rebuttal report dated October 2002 on use of computer models for system planning, projections of generating unit operations, and the relationship between generator availability and output.

State of Vermont, Windham Superior Court (Appeal of USGen New England, Inc. from 2001 Property Valuation by the Town of Rockingham) – September 2002
Electricity market prices and economic valuation of hydroelectric generating plant.

United States District Court for the Middle District of North Carolina (Civil Action No. 1:00 CV 1262, United States v. Duke Energy Corporation) – August 2002
Expert report on use of computer models for system planning, projections of generating unit operations, and the relationship between generator availability and output. (Joint report with Phil Hayet.)

Indiana Utility Regulatory Commission (Cause No. 41746) – July 2002
Reply testimony on a rate case settlement agreement, dealing with issues including NiSource's financial condition, service quality, environmental commitment, and electric rate impacts.

Connecticut Department of Public Utility Control (Docket No. 00-12-13RE01) – July 2002
The proposed sale of Seabrook Nuclear Station to FPL Energy Seabrook, LLC. Market power issues and market modeling.

United States District Court for the Southern District of Indiana (Civil Action No. IP99-1692-C-M/S, United States v. Southern Indiana Gas and Electric Company) – June 2002
Declaration on confidential business information and competitive harm.

Nevada Public Utilities Commission (Docket No. 02-2002) – April 2002
Review of Sierra Pacific Power Company's risk management and procurement of electric power in the wholesale markets.

Vermont Public Service Board (Docket No. 6596) – March 2002
Used and useful policy issues, electricity market prices, and above market costs of the purchase from Hydro Quebec.

Nevada Public Utilities Commission (Docket No. 01-11029) – February 2002
Review of Nevada Power Company's risk management and procurement of electric power in the wholesale markets.

Vermont Public Service Board (Docket No. 6545) – January 2002
Economic analysis of the proposed sale of Vermont Yankee nuclear plant and an associated Purchased Power Agreement.

New Jersey Board of Public Utilities (Docket No. EM01050308) – September 2001
Analysis of the proposed merger between Conectiv and PEPCo. Also, surrebuttal testimony in November. (Joint testimony with David Schlissel.)

Indiana Utility Regulatory Commission (Cause No. 41954) – June 2001
System planning and joint operation in a partially deregulated context.

State of Vermont, Windham Superior Court (Dockets S 362-9-99 and S372-9-99) – May 2001
Deposition on electricity market prices and economic valuation of hydroelectric generating plant.

Federal Energy Regulatory Commission (Docket No. ER01-200-001) – April 2001
Termination of the Cinergy Operating Agreement, treatment of merger savings, and affiliate relationships. Also cross-answering testimony in April.

New Jersey Board of Public Utilities (Docket No. EM00110870) – April 2001
Analysis of the proposed merger between FirstEnergy and GPU. Also, supplemental testimony in April. (Joint testimony with David Schlissel.)

Vermont Public Service Board (Dockets Nos. 6120 and 6460 – March 2001
Used and useful policy issues, electricity market prices, and above market costs of the purchase from Hydro Quebec. Also, surrebuttal testimony in April.

United States District Court for the Northern District of New York (Civil Action No. 00-CV-1738) – January 2001
Affidavit on the issuance and trading of SO_2 emission allowances under the Title IV of the Clean Air Act, in Clean Air Markets Group v. George E. Pataki et al.

Department of Energy (Docket No. EE-RM-500) – December 2000
Oral testimony on proposed rules for central air conditioner and heat pump energy conservation standards.

Illinois Commerce Commission (Docket No. 00-0361) – July 2000
Review of ComEd's funding for nuclear power plant decommissioning.

California Public Utilities Commission (Rulemaking 99-10-025) – July 2000
Distributed generation and related rate design issues. Also, rebuttal testimony in August.

Massachusetts Department of Environmental Protection – July 2000
Comments on reliability implications of proposed emission standards for power plants.

Arkansas Public Service Commission (Docket No. 00-048-R) – June 2000
Requirements for electricity market power analyses.

United States District Court for the Middle District of North Carolina (1:99CV00033) – March 2000
Expert report on replacement power costs in Carolina Power & Light Company vs. Yuasa Exide, Inc.

Illinois Commerce Commission (Docket No. 99-0115) – September 1999
Review of ComEd's nuclear power plant decommissioning cost estimates.

West Virginia Public Service Commission (Case No. 98-0452-E-GI) – August 1999
AEP and Allegheny Power restructuring, market power, divestiture of generation, electric system market price modeling, statistical analysis of comparable sales, and responsibility for stranded costs and gains.

Mississippi Public Service Commission (Docket No. 96-UA-389) – August 1999
Review of Entergy Mississippi, Inc. and Mississippi Power Company stranded cost filings, divestiture of generation, statistical analysis of comparable sales, responsibility for stranded costs and gains.

Connecticut Department of Public Utility Control (Docket No. 99-03-36) – July 1999
Connecticut Light and Power Company standard offer service, market prices for electricity and the influence of market power, simulation analysis of the New England electricity market.

Connecticut Department of Public Utility Control (Docket No. 99-03-35) – July 1999
United Illuminating Company standard offer service, market prices for electricity and the influence of market power, simulation analysis of the New England electricity market.

Utah Public Service Commission (Docket No. 98-2035-04) – June 1999
Cost savings expectations for the proposed merger of PacifiCorp and Scottish Power.

Washington Utilities and Transportation Commission (Docket No. UE-981627) – June 1999
Cost savings expectations for the proposed merger of PacifiCorp and Scottish Power and assessment of whether the merger is in the public interest.

Federal Energy Regulatory Commission (Docket Nos. EC98-40-00, et al.) – April 1999
Horizontal market power and barriers to entry in consideration of the proposed merger of American Electric Power Company and Central and South West Corporation.

Connecticut Department of Public Utility Control (Docket No. 99-03-04) – April 1999
Market power, market prices, and simulation modeling as related to the application of United Illuminating Company for recovery of stranded costs.

Connecticut Department of Public Utility Control (Docket No. 99-02-05) – April 1999
Market power, market prices, and simulation modeling as related to the application of Connecticut Light & Power Company for recovery of stranded costs.

Maryland Public Service Commission (Case No. 8797) – January 1999
Simulation analysis of the ECAR market and projected market prices for electricity for estimation of Potomac Electric Company's stranded generation costs and unbundled rates.

Maryland Public Service Commission (Case No. 8795) – December 1998
Simulation analysis of the PJM market and projected market prices for electricity for estimation of Delmarva Power and Light Company's stranded generation costs and unbundled rates.

Maryland Public Service Commission (Cases Nos. 8794 and 8804) – December 1998
Simulation analysis of the PJM market and projected market prices for electricity for estimation of Baltimore Gas and Electric Company's stranded generation costs and unbundled rates.

Vermont Public Service Board (Docket No. 6107) – September 1998
Excess capacity, used & useful, and the economics of Green Mountain Power's purchase from Hydro Quebec.

Mississippi Public Service Commission (Docket No. 96-UA-389) – September 1998
Analyses of market concentration and market power, behavior of affiliated companies, need for an independent system operator.

California Public Utilities Commission (Application No. 97-12-020) – July 1998
Nuclear power plant decommissioning and radioactive waste disposal. Also, rebuttal testimony in August.

Federal Energy Regulatory Commission (Docket No. EC97-46-000) – June 1998
Affidavit on market power implications of the proposed merger between Allegheny Power System and Duquesne Light Company.

New Jersey Board of Public Utilities (Docket Nos. EX4120585Y, EO97070460, and EO97070463) – March 1998
Economic and environmental benefits of energy efficiency, including estimation of marginal air emissions from the PJM System. (Joint testimony with Nathanael Greene, Edward Smeloff, and Thomas Bourgeois.)

Vermont Public Service Board (Docket No. 6018) – February 1998
Excess capacity and the economics of Central Vermont Public Service Company's purchase from Hydro Quebec.

Public Service Commission of Maryland (Case No. 8774) – February 1998
Market power implications of the APS-DQE merger.

Federal Energy Regulatory Commission (Docket Nos. OA97-237-000 and ER97-1079-000) – January 1998
Market power in New England electricity markets.

British Columbia Utilities Commission – November 1997
British Columbia Hydro and Power Authority Wholesale Transmission Services Application.

Pennsylvania Public Utility Commission (Docket R-00973981) – November 1997
West Penn Power Company Restructuring Plan. Environmental disclosure, consumer education, and allocation of default customers.

Pennsylvania Public Utility Commission (Docket R-00974104) – November 1997
Duquesne Light Company Restructuring Plan. Environmental disclosure, consumer education, nuclear decommissioning, and allocation of default customers. Also surrebuttal testimony in December 1997.

Mississippi Public Service Commission (Docket No. 97-UA-496) – November 1997
Petition of Mississippi Power Company for a Certificate of Public Convenience and Necessity Authorizing Construction of a Generating Plant in Jackson County.

Pennsylvania Public Utility Commission (Docket Nos. R-00973953 and P-00971265) – November 1997
Application of PECO Energy Company for approval of its restructuring plan and petition on Enron Energy Services Power, Inc. for approval of an electric competition and customer choice plan. Allocation of default customers.

Vermont Public Service Board (Docket No. 5983) – October 1997
Excess capacity and the economics of Green Mountain Power Company's purchase from Hydro Quebec. Also rebuttal testimony in December 1997 and supplemental rebuttal testimony in January 1998.

Pennsylvania Public Utility Commission (Docket No. R-00973953) – September 1997
Joint petition for partial settlement of PECO Energy Company's proposed restructuring plan and application for a qualified rate order. Environmental disclosure, nuclear decommissioning and spent fuel.

Pennsylvania Public Utility Commission (Docket No. R-00974009) – September 1997
Pennsylvania Electric Company's Restructuring Plan. Environmental disclosure, customer education, and nuclear issues.

Pennsylvania Public Utility Commission (Docket No. R-00974008) – September 1997
Metropolitan Edison Company's Restructuring Plan. Environmental disclosure, customer education, and nuclear issues.

Indiana Legislature, Regulatory Flexibility Committee -- September 23, 1997.
Testimony on "Electric Industry Restructuring To Benefit Consumers and the Environment: Stranded Costs, Nuclear Issues, and Air Emissions."

Pennsylvania Public Utility Commission (Docket No. R-00973954) – June 1997
Pennsylvania Power & Light Company's Restructuring Plan. Environmental disclosure, customer education, PJM market structure, nuclear decommissioning and spent fuel, rate design for stranded cost recovery. Also, surrebuttal testimony in August.

Pennsylvania Public Utility Commission (Docket No. R-00973953) – June 1997
PECO Energy Company's Restructuring Plan. Environmental disclosure, PJM market structure, nuclear decommissioning and spent fuel.

New York Public Service Commission (Case 96-E-0897) -- April 1997
Consolidated Edison Company's Plans for Electric Rate Restructuring. Analysis of market power in the New York City load pocket.

Pennsylvania Public Utility Commission (Docket No. R-00973877) -- February 1997
Application of PECO Energy Company for Issuance of a Qualified Rate Order. Nuclear power plant decommissioning costs, stranded cost recovery, and securitization.

New Hampshire Public Utilities Commission (DR 96-150) -- November 1996
Electric industry restructuring, including stranded costs, industry structure, market power, and nuclear issues.

Massachusetts Department of Public Utilities (96-100) -- July 1996
Nuclear plant stranded costs and decommissioning.

Vermont Public Service Board (5854) – July 1996
Electric industry restructuring, including stranded costs, industry structure, and environmental protection.

Ontario Energy Board (H.R. 23) -- June 1995
Electricity rate options (joint evidence with John Stutz).

Pennsylvania Public Utility Commission (R-00943271) -- April 1995
Discount rates and system benefits charge.

Colorado Public Utilities Commission (94A-516A) – January 1995
Construction of new generating resources.

Public Service Commission of Nevada (94-9002) – November 1994
Environmental and health impacts of a proposed power plant.

Nuclear Decommissioning Finance Committee of New Hampshire (93-001) – September 1994
Seabrook decommissioning cost, spent fuel storage, and cost collection methodology (joint testimony with William Dougherty).

Public Service Commission of Wisconsin (6630-CE-197 and 6630-CE-209) – September 1994
Point Beach externalities, economics, spent fuel storage, and aging (joint testimony with William Dougherty).

British Columbia Utilities Commission – August 1994
Greenhouse gas emissions and environmental externalities policy

Public Service Commission of Wisconsin (05-EI-14) – February 1994
Cost of decommissioning Point Beach and Kewaunee nuclear power plants. Also, rebuttal and surrebuttal testimony in February.

Delaware Public Service Commission (91-39) – September 1992
Nuclear and fossil power plant performance targets.

Massachusetts Department of Public Utilities (91-131) – December 1991
Internalization of environmental externalities, greenhouse gas valuation and policy.

Massachusetts Department of Public Utilities (91-131) – October 1991
Environmental externalities valuation, emissions effects and global warming.

Massachusetts Department of Public Utilities ((89-141, 90-73, 90-141, 90-194 and 90-270) – December 1990
The incorporation of environmental externalities in specific utility RFPs.

Massachusetts Department of Public Utilities (90-55) – June 1990
Costs and benefits of high-efficiency gas heating equipment.

Massachusetts Department of Public Utilities (86-36-G and 89-239) – March 1990
Environmental externalities of electric resources.

Florida Public Service Commission (890973-E1) – January 1990
Integrated energy planning, power plant emissions, and nuclear plant performance.

Pennsylvania Public Utilities Commission (R-891364) – October 1989
Generating capacity requirements of the Philadelphia Electric Company and the Pennsylvania-New Jersey-Maryland Interconnection.

Maryland Public Service Commission (8199) – October 1989
Performance standards for coal, oil, and nuclear power plants.

Michigan Public Service Commission (U-9172) – April 1989
Economic analysis of the Palisades Power Purchase Agreement. Ratepayer impacts, incentives, and implications for plant operation and decommissioning.

Pennsylvania Public Utility Commission (P-870216, P-880283, P-880284, and P-880286) – March 1989
Allegheny Power System planning and avoided costs.

Michigan Public Service Commission (U-8880) – February 1988
Detroit Edison Company power supply costs, economics of Fermi "buy-back" purchase, nuclear fuel expense, oil costs, and power transactions.

Michigan Public Service Commission (U-8866) – December 1987
Consumers Power Company power supply costs, including projections of oil prices and purchased power costs.

Pennsylvania Public Utility Commission (R-850220) – September 1987
Economic analysis of West Penn Power Company's participation in the Bath County Pumped Storage Project, and Allegheny Power System capacity reserve requirements. Also, surrebuttal testimony in October.

Arizona Corporation Commission (U-1345-85-367) – February 1987
Palo Verde decommissioning cost.

Michigan Public Service Commission (U-8545) – December 1986
Consumers Power Company power costs, projected cost of oil and purchased power, economic evaluation of the Big Rock Point nuclear unit.

Public Service Commission of Indiana (38045) – November 1986
Northern Indiana Public Service Company system reliability and excess capacity.

California Public Utility Commission (84-06-014 and 85-08-025) – July 1986
Diablo Canyon decommissioning cost and collection issues.

Michigan Public Service Commission (U-8042R) – June 1986
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"Alternative Closed Cycle Cooling Systems for Power Plants: A Framework of Evaluation in Integrated Resource Planning," Daljit Singh and Bruce Biewald, in the proceedings of the Ninth NARUC Biennial Regulatory Information Conference, Columbus, OH. September 7-9, 1994.

"Misconceptions, Mistakes and Misnomers in DSM Cost-Effectiveness Analysis, Or What Do You Really Mean By T.R.C.?," Mark Fulmer and Bruce Biewald, ACEEE 1994 Summer Study, Pacific Grove, CA. August 28 - Sept. 2, 1994.

"Modeling Renewable Electric Resources: A Case Study of Wind Power," Stephen Bernow, Bruce Biewald, and Daljit Singh, presented at WINDPOWER 1994, Sponsored by American Wind Energy Association, Minneapolis, Minnesota, May 9-13, 1994.

"National Climate Change Policy and Clean Air Act Compliance: A Case Study of Combined CO2/SO2 Reduction," Stephen Bernow, Bruce Biewald, Mark Fulmer, Tim Woolf, Kristen Wulfsberg, and Barry Solomon, in the proceedings of NARUC's 5th National Conference on Integrated Resource Planning, Kallispell, Montana, May 15-18, 1994.

"Modeling Renewable Electric Resources: A Case Study of Wind Reliability," Stephen Bernow, Bruce Biewald, and Daljit Singh, presented at the NARUC-DOE National Regulatory Conference on Renewable Energy, Savannah, Georgia, October 3-6, 1993.

"Environmental Sustainability as a Goal in Resource Planning and Policy," Stephen Bernow and Bruce Biewald, Office of Technology Assessment workshop, Washington, DC. April 1993.

"Climate Change and the U.S. Electric Sector," Bruce Biewald and Stephen Bernow, presented at NARUC's 4th National Conference on Integrated Resource Planning, Burlington, Vermont, September 1992.

"Coordinating Clean Air Act Compliance with Integrated Resource Planning: The Role of Externalities," Stephen Bernow, Bruce Biewald, and Kristin Wulfsberg, the Eighth NARUC Biennial Regulatory Information Conference, Ohio State University, Columbus, Ohio. September 9-11, 1992.

"Direct Environmental Impacts of Demand-Side Management," Stephen Bernow, Frank Ackerman, Bruce Biewald, Mark Fulmer, Karen Shapiro, and Kristin Wulfsberg, American Council for an Energy Efficient Economy (ACEEE) 1992 Summer Study, September 1992.

"Modeling Fuel Cycle and Site-Dependent Environmental Impacts in Electric Resource Planning," Stephen Bernow and Bruce Biewald, invited paper at OECD-IEA Expert Workshop on Life-Cycle Analysis of Energy Systems, Paris, France, May 18 and 19, 1992. Proceedings published OECD/IEA Paris, 1993.

"Computer Model Use in Energy Conservation Planning," presented at the Latin American Energy Organization (OLADE) Seminar on Power Systems Computer Modeling in Quito, Ecuador, September 23-25, 1991.

"Environmental Externalities Measurement: Quantification, Valuation and Monetization," Bernow, Biewald and Marron, in External Environmental Costs of Electric Power, proceedings of a German-American workshop, Ladenburg, FRG, October 23-25, 1991. Edited by Olav Hohmeyer and Richard Ottinger, published by Springer-Verlag (Berlin, Heidelberg, New York).

"Some Microcomputer Tools for Least Cost Integrated Energy Planning: ECO, LEAP and EDB," Bruce Biewald and Harvey Salgo, presented at workshop on Energy Pricing and Planning, Bratislava, Czechoslovakia, May 21-22, 1991.

"**Confronting Uncertainty: Contingency Planning for Decommissioning,"** Bruce Biewald and Stephen Bernow, Chapter 18 of "Nuclear Decommissioning Economics," a special issue of *The Energy Journal* of the International Association for Energy Economics, Vol.12, March 1991.

"Avoided Emissions and Environmental Dispatch," Stephen Bernow and Bruce Biewald, presented at the Conference on "Demand-Side Management and the Global Environment," Arlington, Virginia, April 22-23, 1991.

"Environmental Benefits of DSM in New York: Long Island Case Study," Bruce Biewald and Stephen Bernow, presented at the Conference on "Demand-Side Management and the Global Environment," Arlington, Virginia, April 22-23, 1991.

"Full Cost Dispatch: Incorporating Environmental Externalities in Electric System Operation," Stephen Bernow, Bruce Biewald and Donald Marron, the *Electricity Journal*, March 1991.

"EDB: A Flexible Database System for Energy-Environmental Analysis," Bruce Biewald, Michael Lazarus, and David Von Hippel, presented at International Atomic Energy Agency (IAEA) Technical Committee Meeting on "Development of a Database for Comparative Health and Environmental Impacts of Various Energy Systems," in Vienna, Austria, October 15-19, 1990.

"Full Cost Economic Dispatch: Recognizing Environmental Externalities in Electric Utility System Operation," Stephen Bernow, Bruce Biewald, and Donald Marron, presented at NARUC Conference on Externalities, Jackson Hole, Wyoming, October 1990.

"An Assessment of Demand-Side Management Models and Their Use and Applicability in Canadian Utilities," Martin Adelaar and Bruce Biewald, in the proceedings of the Canadian Electrical Association Demand-Side Management Conference, Halifax, Nova Scotia, September 1990.

"**Avoided Cost Contracts Can Undermine Least Cost Planning,"** Stephen Bernow, Bruce Biewald, and Donald Marron, Energy Policy, September 1990.

"Environmental Externalities Measurement: Quantification, Valuation, and Monetization," Stephen Bernow, Bruce Biewald, and Donald Marron, in the proceedings of the Seventh NARUC Biennial Regulatory Information Conference, September 1990.

"Do We Really Need Nuclear Generating Companies?," Public Utilities Fortnightly, June 7, 1990.

"Nuclear Power Economics: Construction, Operation and Disposal," Bruce Biewald and Donald Marron, March 1989.

"Electric Utility System Reliability Analysis: Determining the Need for Generating Capacity," Stephen Bernow and Bruce Biewald, in the proceedings of the Sixth NARUC Biennial Regulatory Information Conference, September 1988.

"Nuclear Power Plant Decommissioning: Cost Estimation for Power Planning and Ratemaking," Stephen Bernow and Bruce Biewald, Public Utilities Fortnightly, October 29, 1987.

"Cost and Performance of Boiling Water Reactors," Stephen Bernow, Bruce Biewald and Tim Woolf, Public Utilities Fortnightly, August 1987.

PRESENTATIONS

(Note: Presentations that were accompanied by a written paper are listed in the section for "papers," above.)

"Portfolio Management: Tools and Practices for Regulators," presentation at the NARUC 2006 Summer Meeting in San Francisco, California, and for the Annual Convention in Miami, Florida, prepared for the National Association of Regulatory Utility Commissioners, July 2006 and November 2006.

"Electricity Price Increases: Causes, Effects, and Solutions," presentation at the Restructuring Roundtable, May 19, 2006.

"Forecasting and Using Carbon Prices in a World of Uncertainty," presentation to Electric Utilities Environmental Conference in Tucson, Arizona on January 22, 2006.

"Energy Efficiency in the Northeast," presentation at ACEEE National Conference on Energy Efficiency as a Resource, Berkeley, CA, September 27, 2005.

"The Shape of Things to Come: Incorporating Unproven Reserves of Efficiency Savings into Energy Models," presentation to the East Coast Energy Group, Washington, DC, November 10, 2004.

"Displaced Emissions from Renewables and Efficiency in the Northeast United States," presentation at a workshop convened by the Commission for Environmental Cooperation, the US Environmental Protection Agency, and the World Resources Institute, Washington DC, November 4, 2004.

"Electric Transmission Technical and Policy Issues," presentation at National Association of State Utility Consumer Advocates conference in Austin, Texas, June 14, 2004.

"Incorporating Renewable Generation into a Risk Management Strategy," presentation at the New England Conference of Public Utility Commissioners Symposium, Brewster, Massachusetts, May 25, 2004.

"Electricity Portfolio Management," presentation at Illinois State University Institute for Regulatory Policy Studies Conference on "Beyond 2006," Springfield, Illinois, May 20, 2004.

"Electricity Risk Management: Diversified Resource Portfolios," presentation at Electric Power Supply Association Meeting, Washington, D.C., May 6, 2004.

"Quantifying Emission Reductions from Local Government Actions," presentation to Metropolitan Washington Council of Governments Energy and Air Quality Conference, Washington DC, April 5, 2004.

"Electricity Portfolio Management," presentation to National Association of Regulatory Utility Commissioners' conference in Washington, D.C., March 9, 2004.

"Portfolio Management for Electricity," presentation at the Regulatory Assistance Project's workshop on portfolio management, Chicago, September 18, 2003.

"Issues in Estimating Electric System Displaced Emissions," presentation at the Commission for Environmental Cooperation Technical Meeting on Approaches to Estimating Environmental Benefits of Renewable Energy and Energy Efficiency, Washington, DC, July 27, 2003.

"Best Practices in Market Monitoring and Mitigation," presented at the National Association of State Utility Consumer Advocates Mid-Year Meeting in Austin, Texas, June 16, 2002.

"Regulation of Waste Management at Large Electric Utilities: Modeling Industry Impacts," US Environmental Protection Agency, August 7, 2001.

"Quality of Service in Performance-Based Regulation: US Experiences," presented at the Seminar on Regulation of Electricity Supply Quality, Milan, Italy, June 8, 2001.

"Demand Response in Electricity Markets," presented at the National Association of State Utility Consumer Advocates Mid-Year Meeting in Santa Fe, New Mexico, June 18, 2001.

Presentation on "Repowering the Midwest: The Clean Energy Development Plan for the Heartland," at the National Wind Coordinating Committee Upper Midwest Transmission Workshop, Minneapolis, Minnesota, May 1, 2001.

"Observations on New England's Electricity Markets," National Regulatory Research Institute Market Power Conference, Columbus, Ohio, April 10, 2001.

Presentation on "Derailing Coal: The Economics of Coal-Fired Electricity Generation in the U.S.," Tax Shift Strategy Meeting, Washington, D.C., December 2, 2000.

Presentation on "Repowering the Midwest: A Clean Energy Development Plan for the Heartland," presentation with Howard Learner at the National Association of Regulatory Utility Commissioners Annual Meeting, San Diego, California, November 14, 2000.

Presentation on "Electricity in New England: Market Imperfections of Failure?" at National Association of State Utility Consumer Advocates Annual Meeting, San Diego, California, November 13, 2000.

Presentation on "How Green is Green? Verifying Energy Advertising Claims," at the New England Conference of Public Utility Commissioners Symposium, Bretton Woods, New Hampshire, May 25, 1999.

Presentation on "Consumer Perspectives on Market Power – Case Studies from New England, New York, PJM, and Mississippi," IBC Conference on Market Power, Washington DC, May 24, 1999.

Presentation on "Grandfathering and Environmental Comparability," at the National Association of Regulatory Utility Commissioners 1998 Summer Committee Meetings, Seattle, July 26, 1998.

Presentation on "Tracking Electricity in the New England Market," at the National Association of Regulatory Utility Commissioners 1998 Summer Committee Meetings, Seattle, July 26, 1998.

Presentation on "Tracking Electricity in the New England Electricity Market," at the National Council on Competition and the Electricity Industry National Executive Dialogue on Customers' Right to Know, Chicago, May 13, 1998.

Presentation on "Comparable Environmental Regulations in a Restructured Electricity Industry: The Grandfathering Effect," National Association of Regulatory Utility Commissioners meeting in Washington, D.C., March 1, 1998.

Presentation on "Market Power in Electricity Generation," National Consumer Law Center Conference, Washington, D.C., February 9, 1998.

Presentation on "Electricity Market Power in New England," Massachusetts Electric Industry Restructuring Roundtable, Boston, December 15, 1997.

Presentation on wind power development and air quality, National Wind Coordinating Committee New England Wind Issues Forum, Boston, November 7, 1997.

Invited speaker on market power, National Association of State Utility Consumer Advocates meeting in Boston, November 12, 1997.

Presentation on "Distortions to Future and Current Competitive Electric Energy Markets Due to Grandfathering Environmental Regulations of Electric Power Plants," National Association of Regulatory Utility Commissioners meeting in Boston, November 9, 1997.

Presentation on "Electric Industry Restructuring as if the Environment Mattered," Boston Area Solar Energy Association, October 9, 1997.

Invited speaker on "Modeling Market Power in Electricity Generation," National Association of Regulatory Utility Commissioners meeting in San Francisco, July 22, 1997.

Presentation on "Performance-Based Regulation in a Restructured Electric Industry," National Association of Regulatory Utility Commissioners meeting in San Francisco, July 20, 1997.

Presentation on "State Initiatives and Regional Issues," New England Governors' Conference Workshop on Restructuring and Environmentally Sustainable Technologies, Warwick, Rhode Island, March 25, 1997.

Invited speaker on stranded costs, National Association of State Utility Consumer Advocates meeting in San Francisco, November 1996.

Presentation on “Nuclear Power Plant Decommissioning Costs and Electricity Restructuring,” Nuclear Decommissioning Trusts conference, New York City, November 18, 1996.

Invited speaker on stranded costs, Indiana Utilities Regulatory Commission Forum, Indianapolis, November 1, 1996.

Presentation on “Electric Industry Restructuring and the Environment,” at the Indiana Energy Conference, Indianapolis, Indiana, October 10, 1996.

Presentation on "Small Customers in a Restructured Electricity Industry: Transaction Costs, Advanced Metering Technologies and Aggregation Options" to the Consumers' Energy Conference, South Portland, Maine, July 1996.

Presentation on "Electric Generation Market Power in New England" to New England Conference of Public Utility Commissioners, Manchester Village, Vermont, May 1996.

Presentation on "Advanced Metering for Residential Customers on Electricity Restructuring" to National Consumer Law Center's 10th Annual Conference in Washington, DC, February 1996.

Presentations on "Market Power," "Environmental Aspects of Restructuring" and "Market Access for Small Customers" to Vermont Public Service Board workshops on electricity restructuring, January and February 1996.

Presentation on "Environmental Impacts of Energy: Sustainability and Social Costing" to British Columbia Utilities Commission Workshop, Vancouver, BC, March 1995.

Presentation on "Competition and Economic Efficiency" to the National Council on Competition and the Electric Industry, December 1995.

Presentation on "Compliance Planning Under Regulatory Uncertainty," to EPA "Opportunities Conference: Energy Efficiency and Renewable Energy," Washington, DC, June 1993.

Presentation on "Energy and Sustainability" to Hydro-Quebec Conference, Hampshire College, Amherst, Massachusetts, April 1993.

Invited Speaker on environmental externalities, ASME "ECO World" conference in Washington, DC, June 1992.

Invited Speaker, Association of Energy Engineers, Boston, Massachusetts, February 1992.

Presentation of Acid Rain Abatement Optimization Model to the Swedish Environmental Protection Agency, Solna, Sweden, November 1991.

Presentation on Integrated Resource Planning to Boston Gas Company, July 1990.

Training on Methods for Calculating Electric System Avoided Costs, provided to energy planners and policy makers from five Southeast Asian countries sponsored by U.S. Agency for International Development and administered by the Institute of International Education, May 1990.

Invited Speaker, National Association of State Utility Consumer Advocates (NASUCA) Mid-Year Meeting, Annapolis, Maryland, and June 1988.

Invited Speaker, Conference on New Developments in Nuclear Decommissioning Costs and Funding Methods, sponsored by the Northeast Center for Professional Education, Washington, DC, April 1988.

Resume dated May 2007.

Exhibit BB-2: Schlissel, D., Smith, A., Wilson, R. "Coal-Fired Power Plant Construction Costs." dated July 30, 2008.

Introduction

Construction cost estimates for new coal-fired power plants are very uncertain and have increased significantly in recent years. The industry is using terms like "soaring," "skyrocketing," and "staggering" to describe the cost increases being experienced by coal plant construction projects. In fact, the estimated costs of building new coal plants have reached $3,500 per kW, without financing costs, and are still expected to increase further. This would mean a cost of well over $2 billion for a new 600 MW coal plant when financing costs are included. These cost increases have been driven by a worldwide competition for power plant design and construction resources, commodities, equipment and manufacturing capacity. Moreover, there is little reason to expect that this worldwide competition will end anytime in the foreseeable future.

Cost Estimates for Proposed Coal-Fired Power Plants

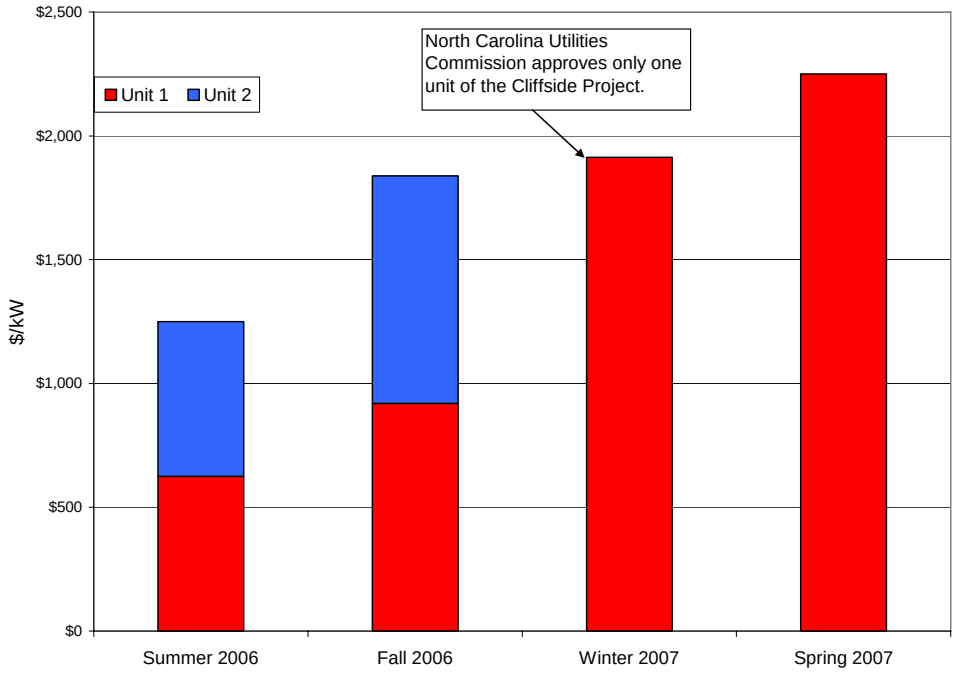
As recently as 2005, companies were saying that proposed coal-fired power plants would cost as little as $1,500/kW to $1,800/kW. However, the estimated construction costs of new coal plants have risen significantly since then.

The following examples illustrate the cost increases that proposed projects experienced in the past two or three years:

- Duke Energy Carolinas' summer 2006 cost estimate for the two unit Cliffside Project was approximately $2 billion. In the fall of 2006, Duke announced that the cost of the project had increased by approximately 47 percent ($1 billion). After the project had been downsized because the North Carolina Utilities Commission refused to grant a permit for two units, Duke announced that the cost of the remaining single unit would be about $1.53 billion, not including financing costs. In late May 2007, Duke announced that the cost of building the single Cliffside unit had increased by yet another 20 percent. As a result, the estimate cost of the one unit that Duke is building at Cliffside is now $1.8 billion exclusive of financing costs. Thus, the single Cliffside unit is now expected to cost almost as much as Duke estimated for a two unit plant only two years ago in the summer of 2006.

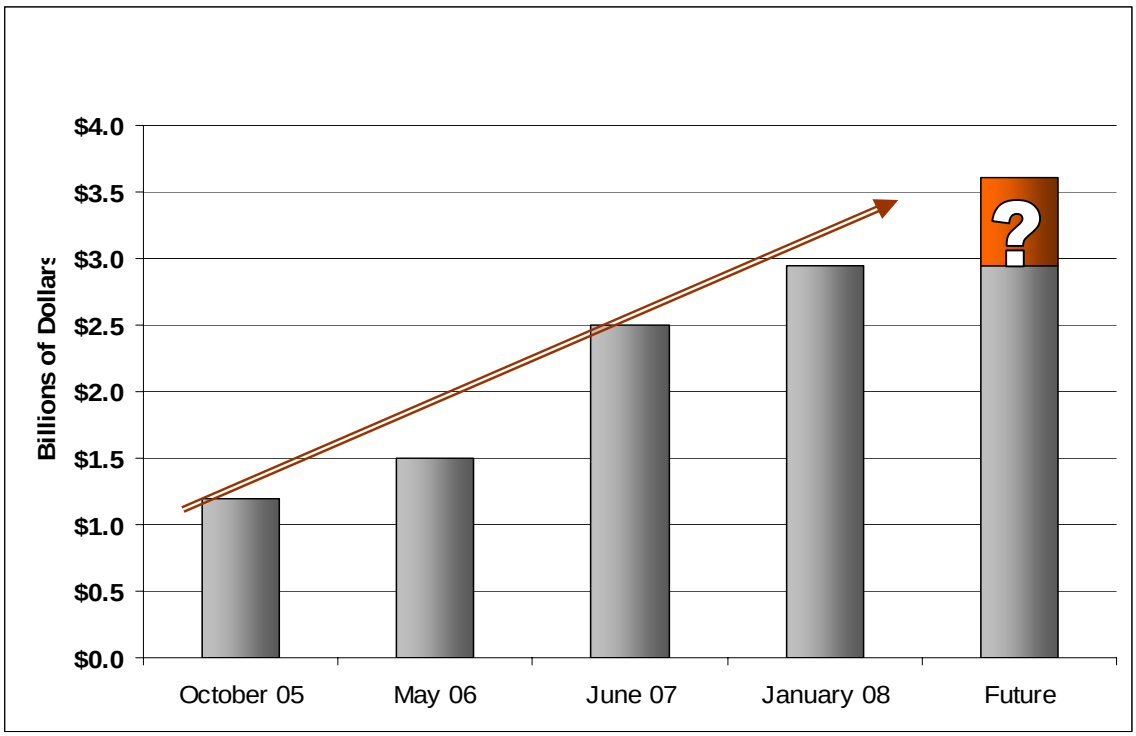
The increases in the estimated cost of the Cliffside Project are presented in Figure 1 below.

Figure 1: Duke Energy Carolinas Cliffside Project Cost Increases 2006-2007 ($/kW)



- As shown in Figure 2 below, the estimated cost of AMP-Ohio's proposed 960 MW coal-fired power plant project nearly doubled between May 2006 and January 2008. The estimated cost increased by 15 percent in just the six months between June 2007 and January 2008. The estimated cost of the 960 MW plant is currently estimated at nearly $3 billion, without any financing costs. This represents a construction cost of more than $3,100 per kW. And the available evidence suggests that plant costs will continue to rise.

Figure 2: AMP-Ohio AMPGS Cost Increases 2005-2008 ($)



- In mid-June 2008, Wisconsin Power & Light ("WPL") announced a nearly 40 percent increase in the estimated cost of its proposed 300 MW Nelson Dewey 3 coal-fired power plant. The previous estimate had been prepared in late 2006. The estimated cost for this Circulating Fluid Bed plant is above $3,500/kW, in early 2008 dollars. The company has similarly estimated that the cost of building a new supercritical coal plant also would exceed $3,500/kW. In support of its new cost estimates, WPL presented testimony that noted that "EPC [Engineering, Procurement and Construction] pricing for other non-IGCC, primarily coal-fired generating projects under construction or in the planning stages have similarly increased with many projects falling in the $2,500 to $3,800/kW range, without AFUDC or uncommon owner's costs (e.g., major railway additions.)."[7]

- In April 2008, Duke Energy Indiana announced an 18 percent increase in the estimated cost of its proposed Edwardsport coal plant just since the spring of 2007. Duke said that "the increase in the cost estimate is driven by factors outside the Company's control, including unprecedented global competition for commodities, engineered equipment and materials, and increased labor costs."[8] Duke noted in its Petition to the Indiana Utility Regulatory Commission that this

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7 Direct Testimony of Charles J. Hookham on behalf on Wisconsin Power & Light Company in Public Service Commission of Wisconsin Docket No. 6680-CE-170, June 2008, at page 21.

8 Verified Petition in Indiana Utility Regulatory Commission Cause No. 43114 IGCC-1, filed on May 1, 2008, at pages 3-4

projected increase in cost "is consistent with other recent power plant project cost increases across the country."[9]

Nor are coal-fired power plants that are under construction immune to further cost increases. For example, Kansas City Power & Light just announced a 15 percent price increase for the Iatan 2 power plant that has been under construction for several years and is scheduled to be completed by 2010. This shows that one cannot assume that the cost of a plant will be fixed when construction begins.

Indeed, in the past utilities were able to secure fixed-price contracts for their power plant construction projects. However, it is not possible to obtain fixed-price contracts for new power plant projects in the present environment. The reasons for this change in circumstances has been explained as follows by a witness for the Appalachian Power Company, a subsidiary of American Electric Power in testimony before the West Virginia Public Service Commission:

> Company witness Renchek discusses in his testimony the rapid escalation of key commodity prices in the [Engineering, Procurement and Construction] industry. In such a situation, no contractor is willing to assume this risk for a multi-year project. Even if a contractor was willing to do so, its estimated price for the project would reflect this risk and the resulting price estimate would be much higher.[10] [Emphasis added.]

A fall 2007 assessment of AMP-Ohio's proposed coal-fired power plant similarly noted that the reviewing engineers from Burns and Roe Enterprises:

> agree that the fixed price turnkey EPC contract is a reasonable approach to executing the project. However, the viability of obtaining a contract of this type is not certain. The high cost of the EPC contract, in excess of $2 billion, significantly reduces the number of potential contractors even when teaming of engineers, constructors and equipment suppliers is taken into account. Recent experience on large U.S. coal projects indicates that the major EPC Contractors are not willing to fix price the entire project cost. This is the result of volatile

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9 Id, at page 7.

10 Ibid, at page 16, lines 16-20.

> costs for materials (alloy pipe, steel, copper, concrete) as well as a very tight construction labor market. When asked to fix the price, several EPC Contractors have commented that they are willing to do so, but the amount of money to be added to cover potential risks of a cost overrun would make the project uneconomical.[11]

In fact, rising commodity prices and increasing construction cost risks have been responsible, at least in part, for the cancellation or delay of more than fifty proposed coal-fired power plants since mid-2006. The following examples are illustrative of the factors and risks which have contributed to these cancellations and delays:

- Tenaska Energy cancelled plans to build a coal-fired power plant in Oklahoma in 2007 because of rising steel and construction prices. According to the Company's general manager of business development:

> ".. coal prices have gone up "dramatically" since Tenaska started planning the project more than a year ago.
>
> And coal plants are largely built with steel, so there's the cost of the unit that we would build has gone up a lot… At one point in our development, we had some of the steel and equipment at some very attractive prices and that equipment all of a sudden was not available.
>
> We went immediately trying to buy additional equipment and the pricing was so high, we looked at the price of the power that would be produced because of those higher prices and equipment and it just wouldn't be a prudent business decision to build it."[12]

- Westar Energy announced in December 2006 that it was deferring site selection for a new 600 MW coal-fired power plant due to significant increases in the facility's estimated capital cost of 20 to 40 percent, over just 18 months. This prompted Westar's Chief Executive to warn: "When equipment and construction cost estimates grow by $200 million to $400 million in 18 months, it's necessary to proceed with caution."[13] As a result, Westar Energy has suspended site selection for the coal-plant and is considering other options, including building a

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11 *Consulting Engineer's Report for the American Municipal Power Generating Station located in Meigs County, Ohio*, for the Division of Cleveland Public Power, Burns and Roe Enterprises, Inc., October 16, 2007, at page 11-1.

12 Available at www.swtimes.com/articles/2007/07/09/news/news02.prt.

13 Available at http://www.westarenergy.com/corp_com/corpcomm.nsf/F6BE1277A768F0E4862572690055581C/$file/122806%20coal%20plant%20final2.pdf.

natural gas plant, to meet growing electricity demand. The company also explained that:

> most major engineering firms and equipment manufacturers of coal-fueled power plant equipment are at full production capacity and yet are not indicating any plans to significantly increase their production capability. As a result, fewer manufacturers and suppliers are bidding on new projects and equipment prices have escalated and become unpredictable.[14]

The increases in construction costs being experienced by proposed coal-fired power plants are due, in large part, to a significant increase in the worldwide demand for power plant design and construction resources, commodities and equipment. This worldwide competition is driven mainly by huge demands for power plants in China and India, by a rapidly increasing demand for power plants and power plant pollution control modifications in the United States required to meet SO_2 and NO_x emissions standards, and by the competition for resources from the petroleum refining industry.

The limited capacity of EPC firms and equipment manufacturers also has contributed to rising power plant construction costs. This has meant fewer bidders for work, higher prices, earlier payment schedules and longer delivery times. The demand for and cost of both on-site construction labor and skilled manufacturing labor also have escalated significantly in recent years.

In addition, the planned construction of new nuclear power plants is expected to compete for limited power plant design and construction resources, manufacturing capacity and commodities.

It is reasonable to expect that the factors that have led to skyrocketing power plant construction costs in recent years will lead to further increases in costs and construction delays in the five or more years before the projects are scheduled to be completed. For example, a May 15, 2008 story in the Wall Street Journal noted that "escalating steel prices are halting and slowing major construction projects worldwide and limiting shipbuilding and oil and gas exploration." The same article noted that "Steel prices are up 40 percent to 50 percent since December, and industry executives say they have not

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[14] Id.

reached a peak" and "raw materials prices have surged in the past year, fueled in part because of the rapid industrialization of China, India and other developing nations."

Indeed, there is no reason to expect that the worldwide competition for resources or the existing supply constraints and bottlenecks affecting coal-fired plant construction costs will clear anytime in the foreseeable future.

The Virginia State Corporation Commission denied the request of Appalachian Power Company to build a coal-fired power plant in West Virginia. The Commission found that the proposal was neither "reasonable" nor "prudent." In its order denying the request to build the new coal-fired power plant, the Virginia Commission also found that the Company's cost estimate for the project was not credible and that the Company had not updated its cost estimate since November 2006. The Commission further noted that the Company ("APCo") will not obtain actual or firm prices for components of the project until after receiving regulatory approval.[15] The Virginia Commission Final Order included the following language concerning risk: "Indeed APCo has no fixed price contract for any appreciable portion of the total construction costs; there are no meaningful price or performance guarantees or controls for this project at this time. This represents an extraordinary risk that we cannot allow the ratepayers of Virginia in [Appalachian Power Company's] service territory to assume." This is the very same "extraordinary" risk that the customers and ratepayers of investor-owned companies and publicly-owned utilities building new coal-fired power plants are being asked to assume because there are no fixed prices or contracts for the projects.

Finally, there is no currently commercially available technology for post-combustion capture of carbon dioxide from pulverized coal power plants. Moreover, it is estimated that such technology may not be commercially available until 2020 or 2030, if then. However, it is expected that the addition of carbon capture and sequestration technology will greatly increase the cost of generating power at coal-fired power. In fact, a number of independent sources agree, as illustrated in Table 1 below, that adding and

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15 April 14, 2008 Final Order of the Virginia State Corporation Commission in Case No. PUE-2007-00068, at page 5.

operating CCS equipment will raise the cost of generating electricity at new coal-fired power plants by perhaps as much as 60% to 80%.

Table 1: **Projected Increase in the Cost of Generating Power Due to Carbon Capture and Sequestration**

Source	Projected Increase in Cost of Electricity from Addition of CCS
Duke Energy Indiana[16]	68%
MIT Future of Coal Report[17]	61%
Edison Electric Institute[18]	75%
National Energy Technology Laboratory[19]	81%

16 Testimony of James E. Rogers in Indiana Utility Regulatory Commission Cause No. 43114, Joint Petitioners' Exhibit No. 1, at page 13, lines 6-11.

17 *The Future of Coal*, *Options for a Carbon-Constrained World*, Massachusetts Institute of Technology, 2007, at page 19.

18 Letter to Hon. Edward J. Markey, Chairman, Select Committee on Energy Independence and Global Warming, from Thomas R. Kuhn, Edison Electric Institute, September 21, 2007, at page 4.

19 *Cost and Performance Baseline for Fossil Energy Plants*, *Revised August 2007,* DOE/NETL – 2007/1281, at page 17.