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**Synapse Energy Economics, Inc.**  
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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, and risk analysis.

**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 50 regulatory proceedings in 2 Canadian provinces, 20 States, and before the Federal Energy Regulatory Commission.

Co-author of approximately 100 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, and the National Association of Regulatory Utility Commissioners.

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**

### **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**

Review of Consumers Power Company system operations during 1985 and economic evaluation of the Big Rock Point nuclear unit.

**Michigan Public Service Commission (U-8291) – April 1986**

Detroit Edison Company power supply costs, application of a multi-area dispatch model.

**Michigan Public Service Commission (U-8286) – February 1986**

Consumers Power Company power supply costs, application of a multi-area dispatch model.

**Maine Public Service Commission (85-132) – January 1986**

Standard and long term rates for cogeneration and small power production. Surrebuttal testimony in February.

**Arkansas Public Service Commission (84-249-U) – June 1985**

Impact of the Grand Gulf nuclear unit upon Arkansas Power and Light Company and Middle South Utilities electricity production costs.

**Kentucky Public Service Commission (8666) – February 1984**

Production costing modeling issues.

## REPORTS

***Stranded Nuclear Waste: Implications of Electric Industry Deregulation for Nuclear Plant Retirements and Funding for Decommissioning and Spent Fuel***, by Bruce Biewald and David White, January 15, 1999.

***New England Tracking System***, a report to the New England Governors' Conference, Inc., funded by a grant from the U.S. Environmental Protection Agency, prepared with Environmental Futures, Inc. and Tellus Institute, October 1998.

***The Role of Ozone Transport In Reaching Attainment in the Northeast: Opportunities, Equity and Economics***, a Synapse Energy Economics report for the Northeast States for Coordinated Air Use Management, by Tim Woolf, David White, Bruce Biewald, and William Moomaw, July 1998.

***Competition and Market Power in Northern Maine Electricity Market***, a Synapse Energy Economics report for the Maine Public Utilities Commission, by Tim Woolf, Bruce Biewald, and Duncan Glover, November 24, 1998.

***Grandfathering and Environmental Comparability: An Economic Analysis of Air Emission Regulations and Electricity Market Distortions***, a Synapse Energy Economics report for the National Association of Regulatory Utility Commissioners, by Bruce Biewald, David White, Tim Woolf, Frank Ackerman, and William Moomaw, June 11, 1998.

***Analysis of Market Power in the APS and Duquesne Service Territories***, prepared for the Maryland Office of People's Counsel, by Bruce Biewald and David White, February 9, 1998.

***Performance-Based Regulation in a Restructured Electric Industry***, a Synapse Energy Economics report for the National Association of Regulatory Utility Commissioners, by Bruce Biewald, Tim Woolf, Peter Bradford, Paul Chernick, Susan Geller, and Jerrold Oppenheim, November 8, 1997.

***Massachusetts Electric Utility Stranded Costs***, a Synapse Energy Economics report for MASSPIRG, Union of Concerned Scientists, Clean Water Action, Massachusetts Citizens for Safe Energy, and Public Citizen, by Bruce Biewald, Tim Woolf, and Marc Breslow, November 4, 1997.

***Horizontal Market Power in New England Electricity Markets: Simulation Results and a Review of NEPOOL's Analysis***, prepared for the New England Conference of Public Utility Commissioners, by Bruce Biewald, David E. White, and William Steinhurst, June 11, 1997 (a draft was published as Vermont DPS Technical Report No. 39 in March, 1997).

***Zero Carbon Electricity: The Essential Role of Efficiency and Renewables in New England's Electricity Mix***, a Tellus Institute report for the Boston Edison Company Settlement Board, by Bruce Biewald, Tim Woolf, Bill Dougherty, and Daljit Singh, April 30, 1997.

***Full Environmental Disclosure for Electricity: Tracking and Reporting Key Information***, a Regulatory Assistance Project report funded by the Pew Charitable Trusts, the Joyce-Mertz Gilmore Foundation, the U.S. EPA, and the U.S. DOE, by David Moskovitz, Tom Austin, Cheryl Harrington, Bruce Biewald, David E. White, and Robert Bigelow, March 1997.

***Restructuring the Electric Utilities of Maryland: Protecting and Advancing Consumer Interests***, for the Maryland People's Counsel, by Paul Chernick, Jonathan Wallach, Susan Geller, John Plunkett, Roger Colton, Peter Bradford, Bruce Biewald, and David Wise, February 20, 1997.

***Sustainable Electricity for New England: Developing Regulatory and Other Governmental Tools to Promote and Support Environmentally-Sustainable Technologies in the Context of Electric Industry Restructuring***, a report to the New England Governors' Conference, by Bruce Biewald, Max Duckworth, Gretchen McClain, David Nichols, Richard Rosen, and Steven Ferrey, Tellus No. 95-310, January 1997.

***Restructuring New Hampshire's Electric Power Industry: Stranded Costs and Market Power***, a report for the New Hampshire Office of Consumer Advocate, by Bruce Biewald, Paul Chernick, Jonathan Wallach, and Peter Bradford, Synapse Report No. 96-05, November 1996

***Comments of the New Hampshire Office of Consumer Advocate on Restructuring New Hampshire's Electric Utility Industry***, by Bruce Biewald, Paul Chernick, Jonathan Wallach, and Peter Bradford, Synapse Report No. 96-04, October 18, 1996.

***Can We Get There From Here?: The Challenge of Restructuring the Electricity Industry so that We Can All Benefit***, a White Paper for CalNeva, Consumer Action, Consumer Federation of California, Consumers First, Greenlining Coalition, Latino Issues Forum, Towards Utility Rate Normalization, and Utility Consumers' Action Network, by John Stutz, Bruce Biewald, Daljit Singh, Tim Woolf, George Edgar, and Wayne DeForrest, April 1996.

***A Study of the Impacts of EPA Phase II SO<sub>2</sub> and NO<sub>x</sub> Emissions Standards on Electrical Facilities in the ECAR Region***, for the Advisory Committee on Competition in Ontario's Electricity System, Ministry of Environment and Energy, by Stephen Bernow, Bruce Biewald, William Dougherty, Maxim Duckworth, and Daljit Singh, Tellus No. 96-069, April 15 1996.

***A Projection of Future Market-Based Prices for Air Emissions: Consequences for Renewable and Demand-Side Management Resources***, for the Massachusetts Division

of Energy Resources, by Maxim Duckworth and Bruce Biewald, Tellus Institute, March 29, 1996.

***Promoting Environmental Quality in a Restructured Electric Industry***, for the National Association of Regulatory Utility Commissioners, Tellus No. 95-056, December 1995.

***Systems Benefits Funding Options***, a report to Wisconsin Environmental Decade, Tellus No. 95-248, October 1995.

***Costing Energy Resource Options: An Avoided Cost Handbook for Electric Utilities***, prepared for the U.S. EPA, Tellus No. 93-251, September 1995.

***Electric Resource Planning for Sustainability***, a report to the Texas Sustainable Energy Development Council, Tellus No. 94-114, February 1995.

***New York State Environmental Externalities Cost Study Report; Report 3a: EXMOD User manual; Report 3b: EXMOD Reference manual; Report 4: Case Studies***, prepared for the Empire State Electric Energy Research Corporation and New York State Energy Research and Development Authority. ESEERCO Project EP91-50, December 1994.

***"Comments on the DOE's Proposed Rulemaking Regarding Energy Conservation Standards for Three types of Consumer Products: Including Fuel Cycle Environmental Impacts and Resource Depletion in a Societal Cost-Benefit Framework,"*** December 1994.

***Comments on the Northwest Power Planning Council's Issue Paper #94-50: "Accounting for Environmental Externalities in the Power Plan,"*** Tellus No. 94-284, December 1994.

***Comments on Incentive Regulation in Massachusetts***, DPU 94-158, November 1994.

***Valuation of Environmental and Human Health Risks Associated with Electric Power Generation: A Discussion of Methods and a Review of Greenhouse Gas Studies***, a report prepared for the Izaak Walton League of America, Minnesotans for an Energy Efficient Economy, American Wind Energy Association, Clean Water Action, American Lung Association, Minnesota Center for Environmental Advocacy, and Institute for Local Self Reliance, Tellus No. 94-202, November 1994.

***Resource and Compliance Planning: A Utility Case Study of Combined SO<sub>2</sub>/CO<sub>2</sub> Reduction***, Report Prepared in Cooperative Agreement with the U.S. EPA Acid Rain Division, Tellus No. 92-185, October 1994.

***Modelling Renewable Electric Resources: A Case Study of Wind***, a report to the U.S. Department of Energy, Tellus No. 91-187, October 1994.

***A Review of Methods and Models for Estimating the System Risk Reduction Value of DSM***, prepared for the Boston Edison Settlement Board, Tellus No. 93-174B, September 1994.

***Life Extension and Repowering for Fossil Plants: Guidelines for Evaluating Projects***, prepared for the Energy Foundation, Tellus No. 92-147A, August 1994.

***License Renewal for Nuclear Power Plants: Guidelines for Evaluating Continued Operation***, prepared for the Energy Foundation, Tellus No. 92-147B, August 1994.

***Greenhouse Gas Emissions: Targets and Control Costs***, for the British Columbia Energy Coalition, Tellus No. 94-195, August 1994.

***Non-Price Benefits of BECo Demand-Side Management Programs***, for the Boston Edison Settlement Board, Tellus No. 93-174A, July 1994.

***Development of Externality Values for Energy Resource Planning in Ontario: Air Pollutants***, prepared for the Ontario Externalities Collaborative, Tellus No. 94-016/2, June 1994.

***Development of Externality Values for Energy Resource Planning in Ontario: Air Toxics - Heavy Metals***, prepared for the Ontario Externalities Collaborative, Tellus No. 94-016/3, June 1994.

***Development of Externality Values for Energy Resource Planning in Ontario: Greenhouse Gases***, prepared for the Ontario Externalities Collaborative, Tellus No. 94-016/4, June 1994.

***Development of Externality Values for Energy Resource Planning in Ontario: Land and Water Impacts***, prepared for the Ontario Externalities Collaborative, Tellus No. 94-016/5, June 1994.

***Development of Externality Values for Energy Resource Planning in Ontario: Nuclear Fuel Cycle Externalities: Uranium Mining, Reactor Operations, Accidents, and Waste Disposal***, prepared for the Ontario Externalities Collaborative, Tellus No. 94-016/6, June 1994.

***Comments on the State of Wisconsin Draft Environmental Impact Statement - Point Beach Nuclear Power Plant Projects Proposed by Wisconsin Electric Power Company***, for the Wisconsin Citizens' Utility Board, Tellus No. 92-058, April 1994.

***Incorporating Environmental Externalities in Energy Decisions: A Guide for Energy Planners***, a report to the Swedish International Development Agency, Tellus No. 91-157, February 1994.

***Development of Externality Values for Energy Resource Planning in Ontario: Introductory Report***, prepared for the Ontario Externalities Collaborative, Tellus No. 94-016/1, January 1994.

***Cooling Towers for Hudson River Power Plants, Economic and Environmental Considerations***, for Scenic Hudson, Inc., Tellus No. 92-022, July 1993.

***Energy Efficiency for Massachusetts: A Strategy for Energy, Environment and the Economy***, a report to the Massachusetts Division of Energy Resources, Tellus No. 92-236D, April 1993.

***Renewable Energy for Massachusetts: A Strategy for Energy, Environment and the Economy***, a report to the Massachusetts Division of Energy Resources, Tellus No. 92-236H, April 1993.

***The Environmental Impacts of Demand-Side Management Measures***, a report for the Electric Power Research Institute, EPRI No. TR-101573, Research Project 3121-05, Tellus No. 92-089, December 1992.

***Incorporating Environmental Externalities in Electric System Planning***, a report to the Colorado Office of Energy Conservation, Tellus No. 91-203/SB, April 1992.

***Evaluation of the Application of Aquidneck Power Limited Partnership to Construct an Energy Facility in Portsmouth, Rhode Island***, a report to the Rhode Island Division of Public Utilities and Carriers, The Governor's Office of Housing, Energy and Intergovernmental Relations, and The Department of Administration/Division of Planning, Tellus No. 91-255, April 1992.

***Need for and Alternatives to Nuclear Plant License Renewal***, a report sponsored by the Vermont Department of Public Service, Tellus No. 91-248, March 1992.

***Preliminary Study on Integrated Resource Planning for the Consumers' Gas Company, Ltd.***, prepared for Consumers Gas Company, Ltd., Tellus No. 91-001, January 1992.

***America's Energy Choices: Investing in a Strong Economy and a Clean Environment***, in collaboration with the Union of Concerned Scientists, the American Council for an Energy Efficient Economy, the Natural Resources Defense Council, and the Alliance to Save Energy, Tellus No. 90-067, 1991.

***Valuation of Environmental Externalities: Sulfur Dioxide and Greenhouse Gases***, for the Massachusetts Division of Energy Resources, Tellus No. 91-085, December 1991.

***CASM: Coordinated Abatement Strategy Model***, Stockholm Environment Institute, Stockholm, Sweden, November 1991.

***Valuation of Environmental Externalities for Electric Utility Resource Planning in Wisconsin***, a report to Citizens for a Better Environment, Milwaukee, WI, Tellus No. 91-104, November 1991.

***The Environmental Costs and Benefits of DSM: A Framework for Analysis***, prepared for the Electric Power Research Institute, Tellus No. 90-177, January 1991.

***The Potential Impact of Environmental Externalities on New Resource Selection and Electric Rates***, for and with the Massachusetts Division of Energy Resources, Tellus No. 90-165, January 1991.

***Environmental Impacts of Long Island's Energy Choices: The Environmental Benefits of Demand-Side Management***, prepared for Long Island Power Authority, Tellus No. 90-028A, September 1990.

***Review of Southern Connecticut Gas Company's Conservation Impact Model***, prepared for the Conservation Collaborative Group (Southern Connecticut Gas Company, Connecticut Department of Public Utility Control (DPUC), Prosecutorial Division, DPUC, Office of Policy and Management/Energy Division, and Office of Consumer Counsel), Tellus No. 90-084, July 1990.

***Disposal Costs at Existing and Proposed Low-Level Radioactive Waste Disposal Facilities and the Implications for Vermont***, prepared for the Vermont Department of Public Service, Tellus No. 89-168, March 1990.

***Affidavit on Seabrook Decommissioning***, prepared for the Massachusetts Attorney General, ESRG Project No. 89-246, February 1990.

***The Economics of the Palisades Nuclear Plant: An Analysis of the Proposed Sale and Power Purchase Agreement***, a report to the Michigan Attorney General, ESRG No. 88-100C, April 1989.

***An Analysis of Physical Excess and Uneconomic Capacity Resulting from the Addition of Beaver Valley 2 and Perry 1 to the Centerior Generating System***, a report for the Ohio Office of Consumers' Counsel, ESRG No. 88-38B, October 1988.

***The Economics of Diablo Canyon: Analyses of the Proposed Settlement Agreement and the Continued Operation of the Plant***, a report for the Redwood Alliance, ESRG No. 88-050R, September 1988.

***The Fort St. Vrain Nuclear Plant: Economics and Related Issues***, a report to the Colorado Office of Consumer Council, ESRG No. 86-004, May 1987.

***Towards an Energy Transition on Long Island: Issues and Directions for Planning***, a report for Nassau and Suffolk Counties, New York, ESRG No. 87-05, April 1987.

***The Economics of Completing and Operating the Vogtle Nuclear Generating Facility***, prepared for the Georgia Office of Consumers' Utility Counsel, ESRG No. 85-098, April 1986.

***Audit-Related Issues in the WHIP Program***, a report to Technical Development Corporation, ESRG No. 85-41, January 1986.

***Two Issues in Georgia Power Company's Planning: The Economics of the Vogtle Plant - The Company's Load Forecasting***, ESRG No. 85-51A, December 1985.

***Cost-Benefit Analysis of the Cancellation of Commonwealth Edison's Braidwood Nuclear Generating Station***, ESRG No. 83-87, October 1984.

***The Economics of Seabrook 1 from the Perspective of the Three Maine Co-owners***, a report to the Maine Public Utilities Commission, ESRG No. 84-38, September 1984.

***Evaluation of the Massachusetts Energy Conservation Service***, ESRG No. 84-07, August 1984.

***Electric Rate Consequences of Cancellation of the Midland Nuclear Power Plant***, ESRG No. 83-81/1, May 1984.

***Power Planning in Kentucky: Assessing Issues and Choices, Technical Report III: Conservation as a Planning Option***, ESRG No. 83-51/TRIII, January 1984.

***Electric Rate Consequences of Retiring the Robinson 2 Nuclear Power Plant***, ESRG No. 83-10, January 1984.

***Power Planning in Kentucky: Assessing Issues and Choices, Technical Report I: Long Range Forecasts of Electricity Requirements for Kentucky and its Six Major Utilities***, ESRG No. 83-51/TRI, December 1983.

***Power Planning in Kentucky: Assessing Issues and Choices, Project Summary to the Public Service Commission***, ESRG No. 83-51, November 1983.

***Electricity and Gas Savings from Expanded Public Service Electric and Gas Company Conservation Programs***, a report to the New Jersey Division of Rate Counsel, ESRG No. 82-43/2, October 1983.

***Long Island Without the Shoreham Power Plant: Electricity Cost and System Planning Consequences***, ESRG No. 83-14/S, July 1983.

***A Technical Report to the Staff of the District of Columbia Public Service Commission on the Benefits to Ratepayers of the Electric Power Research Institute and Gas Research Institute Programs***, ESRG No. 83-11, February 1983.

***Customer Programs to Moderate Demand Growth on the Arizona Public Service Company System: Identifying Additional Cost-Effective Program Options***, ESRG No. 82-14, December 1982.

***The Economics of Alternative Space and Water Heating Systems in New Construction in the New Jersey Power and Light Service Area***, a report to the Public Advocate, ESRG No. 82-31, December 1982.

***Report on Electricity Conservation in the State of Vermont: Assessing the Potential and Developing Program Strategies***, a report to the Department of Public Service, ESRG No. 82-23, October 1982.

***Long-Range Forecast of Electric Loads in the State of Vermont***, ESRG No. 82-16, October 1982.

***The Economics of Closing the Indian Point Nuclear Power Plants***, ESRG No. 82-40, October 1982.

***Priority Residential Customer Programs to Conserve Electricity and Gas in the Public Service Electric and Gas Company Area***, a report to the Division of Rate Counsel for New Jersey Board of Public Utilities, ESRG No. 82-43, September 1982.

***The Impacts of Early Retirement of Nuclear Power Plant: The Case of Maine Yankee***, ESRG No. 82-91, August 1982.

***Long Range Forecast of Atlantic City Electric Company Electric Energy and Peak Demand***, a report to the New Jersey Board of Public Utilities, ESRG No. 82-17/1, July 1982.

***A Power Supply and Financial Analysis of the Seabrook Nuclear Station as a Generation Option for the Maine Public Service Company***, a report to the Staff of the Maine Public Utilities Commission, April 1982.

***Long Range Forecast of Detroit Edison Company Electric Energy Requirements and Peak Demands, a report to the Michigan Public Service Commission***, ESRG No. 81-60/2, April 1982.

***Long Range Forecast of Consumer's Power Company Electric Energy Requirements and Peak Demands***, a report to the Michigan Public Service Commission, ESRG No. 81-60, March 1982.

***A Conservation Case Forecast of Electric Energy Consumption and Peak Demand in the Sierra Power Company Service Area***, ESRG No. 81-42/2, February 1982.

***Maine Public Service Company's Electric Energy Requirements and Peak Demands***, a report to the Maine Public Utilities Commission, ESRG No. 81-61, January 1982.

***A Conservation Investment Scenario for the Northeast Utilities Connecticut Service Area***, ESRG No. 81-12/1, October 1981.

***The Conservation Investment Alternative for New York State***, ESRG No. 80-42, September 1981.

***A Conservation Investment Program for Alabama Power Company***, a report to the Alabama Public Service Commission, ESRG No. 80-62/2, July 1981.

***A Conservation Investment Strategy for Utah Power and Light Company: Cost-Benefit Analysis***, Public Service Commission of Utah, Case No. 80-035-17, ESRG No. 81-06, February 1981.

***The Conservation Alternative to the Power Plant at Shoreham, Long Island***, ESRG No. 80-31, November 1980.

## PAPERS

**Follow the Money: A Method for Tracking Electricity for Environmental Disclosure,**” Bruce Biewald, David White, and Tim Woolf, *The Electricity Journal*, May 1999.

**Book Review** of “U.S. Utility Mergers and the Restructuring of the New Global Power Industry,” in *Energy*, October 1998.

**“Implications of Premature Nuclear Plant Closures: Funding Shortfalls for Nuclear Plant Decommissioning and Spent Fuel Transportation and Storage,”** Bruce Biewald and David White, prepared for the United States Association for Energy Economics and International Association for Energy Economics, 19<sup>th</sup> Annual North American Conference, Albuquerque, NM, October 1998.

**“Efficiency, Renewables and Gas: Restructuring as if Climate Mattered,”** Tim Woolf and Bruce Biewald, *The Electricity Journal*, January/February 1998.

**“Green Electricity: Tracking Systems for Environmental Disclosure,”** B. Biewald and J.A. Ramey, proceedings of WINDPOWER '97, the American Wind Energy Association's annual conference in Austin, Texas, forthcoming.

**“Competition and Clean Air: The Operating Economics of Electricity Generation,”** *The Electricity Journal*, January/February 1997.

**“Electric Industry Restructuring and Environmental Sustainability,”** proceedings of the United States Association for Energy Economics and International Association for Energy Economics, 17<sup>th</sup> North American Conference on (De)regulation of Energy, Boston, October 1996.

**“Residential Real-Time Metering Technology for Electricity Restructuring,”** Daljit Singh and Bruce Biewald, presented at the National Training and Information Center conference, Chicago, September 1996.

**“Competition and Environmental Impacts in the U.S. Electric Sector: Must Market Forces be Tamed?,”** presented at the International Society of Ecological Economics conference, Boston, August 1996.

**“Stranded Risk: Nuclear Power Issues in Electricity Restructuring,”** for Energy Advocates meeting in Austin, Texas, May 1996.

**“Counting the Costs: Scientific Uncertainty and Valuation Perspective in EXMOD,”** Stephen Bernow, Bruce Biewald, William Dougherty, and David White, presented at technical meeting of the International Atomic Energy Agency, Vienna, Austria, December 4-8, 1995.

**"Environmentally Targeted Objectives for Reducing Acidification in Europe,"** *Energy Policy*, C.A. Gough, P.D. Bailey, B. Biewald, J.C.I. Kuylenstierna and M.J. Chadwick, December 1994.

**"Environmental Externalities: Highways and Byways,"** NRRI Quarterly Bulletin, Vol. 15 No. 4, Bruce Biewald, Paul Chernick and Bill Steinhurst, December 1994. Also presented at NARUC's 5th National Conference on Integrated Resource Planning, Kallispell, Montana, May 15-18, 1994.

**"From Social Costing to Sustainable Development: Beyond the Economic Paradigm,"** Stephen Bernow, Bruce Biewald, and Paul Raskin, in *Social Costs of Energy: Present Status and Future Trends*, Proceedings of an International Conference held at Racine, Wisconsin, September 8-11, 1992. Edited by Olav Hohmeyer and Richard Ottinger. Published by Springer-Verlag, September 1994.

**"Modelling Renewable Electric Resources: A Case Study of Wind,"** Stephen Bernow, Bruce Biewald, Daljit Singh, and Jeff Hall, proceedings of the Ninth NARUC Biennial Regulatory Information Conference, Columbus, OH, September 7-9, 1994.

**"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.

**"Modelling 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 CO<sub>2</sub>/SO<sub>2</sub> 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.

**"Modelling 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.

**"Modelling 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 Modelling 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, Volume 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.)

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.

**US Electric Utilities Sorted by  
Average Residential Revenue per kWh**

<u>Rank</u>	<u>Company</u>	<u>Cents/kWh</u>
1	Idaho Power Company	3.99
2	Kentucky Utilities Company	4.52
3	Avista Corp.	4.73
4	Avista Corp.	4.78
5	AEP (Kentucky Power Rate Area)	4.86
6	AEP (Kingsport Power Rate Area)	4.99
7	Old Dominion Power Company	4.99
8	Idaho Power Company	5.02
9	Idaho Power Company	5.18
10	PacifiCorp -- Washington	5.25
11	OG&E Electric Services	5.43
12	AEP (Appalachian Power Rate Area)	5.49
13	AEP (Appalachian Power Rate Area)	5.64
14	PacifiCorp -- Wyoming	5.73
15	Public Service Company of Oklahoma	5.88
16	Southwestern Public Service Company	5.89
17	Empire District Electric Company	5.90
18	South Beloit Water, Gas & Electric Company	5.94
19	Empire District Electric Company	5.98
20	Wisconsin Public Service Corporation	6.01
21	Puget Sound Power & Light Company	6.06
22	Northern States Power Company (Minnesota)	6.07
23	St. Joseph Light & Power Company	6.07
24	Portland General Electric Company	6.08
25	Otter Tail Power Company	6.09
26	Empire District Electric Company	6.14
27	PacifiCorp -- Oregon	6.15
28	Edison Sault Electric Company	6.16
29	Southwestern Electric Power Company	6.19
30	Southwestern Public Service Company	6.22
31	Gulf Power Company	6.22
32	Indianapolis Power & Light Company	6.23
33	Wisconsin Public Service Corporation	6.28
34	Southwestern Electric Power Company	6.29
35	Entergy Gulf States, Inc.	6.30
36	Otter Tail Power Company	6.30
37	KPL Company	6.30
38	Southwestern Public Service Company	6.33
39	Southwestern Electric Power Company	6.47
40	Southwestern Public Service Company	6.53

41 PSI Energy, Inc.	6.55
42 Otter Tail Power Company	6.56
43 Empire District Electric Company	6.57
44 Montana Power Company	6.58
45 PacifiCorp -- Idaho	6.59
46 Nevada Power Company	6.60
47 West Penn Power Company	6.60
48 AEP (Wheeling Power Rate Area)	6.65
49 AEP (Ohio Power Rate Area)	6.66
50 Potomac Edison Company	6.71
51 Monongahela Power Company	6.72
52 Wisconsin Power & Light Company	6.72
53 Interstate Power Company	6.77
54 Minnesota Power Company	6.77
55 CLECO Corporation	6.80
56 Union Light, Heat and Power	6.82
57 AEP - Indiana Michigan	6.86
58 PacifiCorp -- Utah	6.86*
59 OG&E Electric Services	6.87
60 Duke Power Company	6.90
61 PacifiCorp -- California	6.90
62 Montana-Dakota Utilities Company	6.90
63 Northern States Power Company (Wisconsin)	6.90
64 Potomac Edison Company	7.02
65 Entergy Louisiana, Inc.	7.06
66 AmerenUE	7.09
67 AmerenUE	7.09
68 Northern States Power Company (Wisconsin)	7.10
69 Savannah Electric & Power Company	7.10
70 Potomac Edison Company	7.16
71 Alabama Power Company	7.18
72 Black Hills Power & Light Company	7.22
73 Virginia Power	7.24
74 Montana-Dakota Utilities Company	7.29
75 Monongahela Power Company	7.34
76 Entergy Gulf States, Inc.	7.34
77 Duke Power Company	7.36
78 AEP (Indiana Michigan Power)	7.41
79 Kansas City Power & Light Company	7.41
80 Montana-Dakota Utilites Company	7.41
81 Kansas City Power & Light Company	7.44
82 Central Illinois Light Company	7.50
83 Nantahala Power & Light Company	7.61
84 Northwestern Wisconsin Electric Company	7.62
85 Georgia Power Company	7.63
86 Northern States Power Company (Minnesota)	7.66
87 Entergy Mississippi, Inc.	7.66
88 West Texas Utilities Company	7.68
89 Entergy New Orleans, Inc.	7.70

90 Cincinnati Gas & Electric Company	7.71
91 PacifiCorp - Wyoming West	7.72
92 AEP (Columbus Southern Power Rate Area)	7.76
93 TU Electric	7.77
94 Wisconsin Electric Power Company	7.79
95 Madison Gas & Electric Company	7.81
96 Carolina Power & Light Company	7.82
97 Black Hills Power & Light Company	7.84
98 Florida Power & Light Company	7.87
99 Northern States Power Company (Minnesota)	7.89
100 Carolina Power & Light Company	7.91
101 Tampa Electric Company	7.99
102 Central Power & Light Company	7.99
103 Potomac Electric Power Company	8.00
104 South Carolina Electric & Gas Company	8.01
105 Wisconsin Electric Power Company	8.04
106 USA Average	8.21
107 Black Hills Power & Light Company	8.28
108 Pennsylvania Power & Light Company	8.35
109 Houston Lighting & Power Company	8.47
110 Texas-New Mexico Power Company	8.48
111 Entergy Arkansas, Inc.	8.50
112 Consumers Energy	8.50
113 Potomac Electric Power Company	8.53
114 KG&E Company	8.53
115 Interstate Power Company	8.55
116 MidAmerican Energy	8.56
117 Interstate Power Company	8.62
118 Florida Power Corporation	8.62
119 IES Utilities, Inc.	8.73
120 Pennsylvania Electric Company	8.74
121 Sierra Pacific Power Company	8.76
122 UGI Utilities, Inc. (Electric Utilities Division)	8.76
123 Dayton Power & Light Company	8.77
124 Metropolitan Edison Company	8.88
125 MidAmerican Energy	8.88
126 Montana-Dakota Utilities Company	8.96
127 Upper Peninsula Power Company	9.07
128 Baltimore Gas & Electric Company	9.09
129 Detroit Edison Company	9.11
130 Pennsylvania Power Company	9.20
131 Arizona Public Service Company	9.22
132 Massachusetts Electric Company	9.33
133 Tucson Electric Power Company	9.35
134 PNM	9.35
135 Texas-New Mexico Power Company	9.71
136 Pike County Light & Power Company	9.81
137 Granite State Electric Company	9.95
138 San Diego Gas & Electric Company	10.14

139 Eastern Edison Company	10.19
140 Rockland Electric Company	10.33
141 Exeter & Hampton Electric Company	10.36
142 Cleveland Electric Illuminating Company	10.37
143 Ohio Edison Company	10.62
144 Blackstone Valley Electric Company	10.65
145 Commonwealth Edison Company	10.66
146 Concord Electric Company	10.69
147 El Paso Electric Company	10.73
148 Pacific Gas & Electric Company	10.77
149 Toledo Edison Company	10.80
150 Western Massachusetts Electric Company	10.83
151 El Paso Electric Company	10.92
152 Narragansett Electric Company	10.98
153 Central Hudson Gas & Electric Corporation	11.09
154 Southern California Edison	11.40
155 Green Mountain Power Company	11.56
156 Fitchburg Gas & Electric Light Company	11.56
157 GPU Energy	11.59
158 Connecticut Light & Power Company	11.69
159 Cambridge Electric Company	11.76
160 Newport Electric Corporation	11.90
161 Boston Edison Company	11.99
162 Central Vermont Public Service Corporation	12.45
163 Niagara Mohawk Power Corporation	12.46
164 Hawaiian Electric Company	12.56
165 Maine Public Service Company	12.63
166 Commonwealth Electric Company	12.74
167 Orange & Rockland Utilities, Inc.	12.79
168 PECO Energy	13.02
169 Central Maine Power Company	13.06
170 Bangor Hydro-Electric Company	13.66
171 United Illuminating Company	13.66
172 Maui Electric Company (Maui)	13.96
173 Public Service Company of New Hampshire	14.46
174 Consolidated Edison Company of New York	16.24
175 Maui Electric Company (Lanai)	17.97
176 Maui Electric Company (Molokai)	18.33
177 Hawaii Electric Light Company	18.62

Note: PacifiCorp's Utah rates were reduced by approximately 12 percent, effective early March 1999.

Source: Edison Electric Institute data for 1998.

**Annual Bills Charged to Typical Standard  
Domestic Tariff Customers in Great Britain  
(£/year in real (April 1997) prices)**

	<u>1993/4</u>	<u>1998/9</u>	<u>Percentage Reduction</u>
Eastern	290	230	21%
East Midlands	311	235	24%
London	315	237	25%
Manweb	329	256	22%
Midlands	298	232	22%
Northern	319	260	18%
Norweb	310	236	24%
Seeboard	313	230	27%
Southern	308	233	24%
South Wales	346	273	21%
South Western	336	251	25%
Yorkshire	<u>310</u>	<u>233</u>	<u>25%</u>
England & Wales Average	315	242	23%
Scottish Power	307	253	18%
Scottish Hydro	<u>301</u>	<u>255</u>	<u>15%</u>
Scottish Average	304	254	16%
Great Britain Average	314	244	22%

Source: Data provided by the Office of Electricity Regulation (Offer).