

ATTACHMENTS

October 15, 2002

ATTACHMENT A

Bruce Edward Biewald

President

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, 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 eighty regulatory proceedings in two Canadian provinces, twenty five States, and before the Federal Energy Regulatory Commission.

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, 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

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.

State of Vermont, Windham Superior Court (Appeal of USGen New England, Inc. from 2001 Property Valuation by the Town of Rockingham) – May 2002

Deposition on electricity market prices and economic valuation of hydroelectric generating plant.

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 2002

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.

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 State 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

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

Predicting Avoided Emissions from Policies that Encourage Energy Efficiency and Clean Power, a Synapse Energy Economics, Inc. report prepared for the Ozone Transport Commission, by Geoff Keith and Bruce Biewald, June 24, 2002.

Survey of Clean Power and Energy Efficiency Programs, a Synapse Energy Economics report prepared for the Ozone Transport Commission, by Lucy Johnston, Geoff Keith, Tim Woolf, Bruce Biewald, and Etienne Gonin, January 14, 2002.

Updated Avoided Energy-Supply Costs for Demand-Side Management Screening in Massachusetts, a Resource Insight report for the AESC Study Group, by Paul Chernick, Susan Geller, Bruce Biewald, and David White, December 5, 2001.

Best Practices in Market Monitoring: A Survey of Current ISO Activities and Recommendations for Effective Market Monitoring and Mitigation in Wholesale Electricity Markets, a Synapse Energy Economics report for the Maryland Office of People's Counsel, the Pennsylvania Office of Consumer Advocate, the Delaware Division of the Public Advocate, the New Jersey Division of the Ratepayer Advocate, and the Office of the People's Counsel of the District of Columbia, by Paul Peterson, Bruce Biewald, Lucy Johnston, Etienne Gonin, and Jonathan Wallach, November 9, 2001.

Electricity Market Analysis of Coal Waste Regulations: An Illustrative Midwest Case Study, a Synapse Energy Economics report prepared for US Environmental Protection Agency by Bruce Biewald, David White, and Montserrat Ramiro, October 31, 2001.

The Other Side of Competitive Markets: Developing Effective Load Response in New England's Electricity Market, a Synapse Energy Economics report prepared for the Maine Department of Attorney General and the Maine Office of the Public Advocate, June 13, 2001.

Room to Breathe: Why the Massachusetts Department of Environmental Protection's Proposed Air Regulations Are Compatible With Electric System Reliability, a Synapse Energy Economics report prepared for MASSPIRG and Clean Water Fund, March 2001

Repowering the Midwest: A Plan for Cleaning Up the Electricity Industry in America's Heartland, prepared for the Environmental Law and Policy Center and a coalition of Midwest environmental organizations, February, 2001.

Generator Outage Increases: A Preliminary Analysis of Outage Trends in the New England Electricity Market, a Synapse Energy Economics report prepared for the Union of Concerned Scientists, by Daniel Allen, Bruce Biewald, and David Schlissel, January 7, 2001.

Marginal Price Assumptions for Estimating Customer Benefits of Air Conditioner Efficiency Standards: Comments on the Department of Energy's Proposed Rules for Central Air Conditioners and Heat Pump Energy Conservation Standards, a Synapse Energy Economics report prepared for the Appliance Standards Awareness Project, by Tim Woolf, Bruce Biewald, and Daniel Allen, December 4, 2000.

Transmitting Windpower from the Dakotas to Chicago: A Preliminary Analysis of a Hydrogen Transmission Scenario, a Synapse Energy Economics report prepared for the Environmental Law and Policy Center, with funding from the Leighty Foundation, by Barclay Gibbs and Bruce Biewald, September 8, 2000.

Valuation of Hydroelectric Generating Facilities on the Connecticut and Deerfield Rivers in Vermont, a Synapse Energy Economics report for the Vermont Department of Taxes, by Bruce Biewald, Daniel Allen, David White, Neil Talbot, Paul Kirshen, Lawrence Martin, Paul Chernick, and Rachel Brailove, April 1, 2000.

Use of Selective Catalytic Reduction For Control of NOx Emissions From Power Plants in the U.S., a Synapse Energy Economics report for the OntAIRio Campaign, February, 2000.

Electricity Market Distortions Associated With Inconsistent Air Quality Regulations, by Tim Woolf, Bruce Biewald, and David White for the Project for Sustainable FERC Energy Policy, November 18, 1999.

Avoided Energy-Supply Costs for Demand-Side Management Screening in Massachusetts, a Resource Insight report for the AESC Study Group, by Rachel Brailove, Paul Chernick, Susan Geller, Bruce Biewald, and David White, July 7, 1999.

Comments on the Scope of Issues for FERC Staff's Environmental Assessment of the Proposed Rule on RTOs by the Project for Sustainable FERC Energy Policy on behalf of Multiple Parties, prepared by Terry Black and Bruce Biewald, June 14, 1999.

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 Moskowitz, 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 SO₂ and NO_x 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 SO₂/CO₂ 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.

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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.

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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.

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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.

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

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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.

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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.

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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.

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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

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Grandfathering and coal plant emissions: the cost of cleaning up the Clean Air Act, Frank Ackerman, Bruce Biewald, David White, Tim Woolf, William Moomaw, *Energy Policy*, Volume 27, Number 15, December 1999.

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, 19th 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, 17th 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 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.

“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.)

“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.

ATTACHMENT B

Attachment B - Documents Considered

1. For a list of PROMOD runs considered, see attachment D.
2. Expert Report of Michael King, on behalf of Illinois Power Company and Dynegy Midwest Generation, Inc.; Civil Action No. 99-833-MJR, July 3, 2002.
3. Expert Report of Dr. Gary L. Liberson, on behalf of Illinois Power Company and Dynegy Midwest Generation, Inc.; Civil Action No. 99-833-MJR, July 3, 2002.
4. Deposition of Gary L. Liberson (USA v. Illinois Power Company) September 9, 2002
5. Participation in the Deposition of Michael King, October 3 and 4, 2002.
6. Expert Report of Alan Michael Hekking, Analysis of 7 Projects Baldwin Power Station, Illinois Power, March 2002.
7. Environmental Protection Agency Regulations, Section 52.21 Prevention of Significant Deterioration of Air Quality.
8. Federal Register; Requirements for Preparation, Adoption and Submittal of Implementation Plans; Approval and Promulgation of Implementation Plans; Standards of Performance for New Stationary Sources. Vol. 57, No. 140, Tuesday July 21, 1992
9. North American Electric Reliability Council; GADS Event and Performance Data for Baldwin 1-3 provided by Illinois Power Company.
10. North American Electric Reliability Council; GADS Data Reporting Instructions. October 2001.
11. The Public Utilities Act for the State of Illinois, updated as of September 4, 2002.
12. *Steam, Its Generation and Use*, edited by S.C. Stultz and J.B. Kitto. Babcock & Wilcox, 40th Edition, 1992
13. "Prior Approval – Work Order 24619 – Baldwin Power Station Unit 2 Boiler floor Replacement", from J.S. Spencer to P.J. Themig (IPPRO 0162268). February 5, 1990.
14. "Baldwin Unit # 2 Floor", from J.M. Yagen to P.J. Themig (IPPRO-0162263 to IPPRO-0162264). February 20, 1990.

15. "Baldwin 2 Boiler Floor Replacement – Economic Analysis – Mini-Scope" (IPPRO-0162258 to IPPRP 0162259). February 21, 1990.
16. "Baldwin Unit 2 Boiler Floor Replacement Economic Analysis", from E.F. Stoneburg to J.S. Spencer (IPPRO-0162239 to 0162240). March 1, 1990.
17. "1990 ICC Rider P Filing" (IPPRO-0158681 to 0158695), from EF Stoneburg to Ms. B. A. Deed. June 6, 1990.
18. IPC's Response to ICC Staff data request No. POS 1.01 to 1.10, ICC Docket No. 91-0335 (IPPRO-0158476 to IPPRO-0158670).
19. "1990 ICC Rider P Filing", Attachments, (IPPRO-0158681 to IPPRO-0158695) from E.F. Stoneburg to Ms. B.A. Dees. June 6, 1990.
20. "Capacity Factor Projections" (IPPRO-0003689), from Robert Reynolds. March 27, 1990.
21. "Capacity Factor Projections" (IPPRO-0003690 to IPPRO-0003697), E. F. Stoneburg. March 19, 1990.
22. "Electric Resource Plan for 1991-1995 Financial Forecast" (IPPRO-0158469 to IPPRO-0158475), from E.F. Stoneburg.
23. "Baldwin Power Station Unit 1 Lower Furnace Repairs" (IPPRO-0070067), from J.M. Yagen, July 19, 1989.
24. "Summary of Projected Equivalent Availability" (IPPRO-014554-014555), September 29, 1993.
25. Page 401 of FERC forms 1 for IPC for the following years:
 - 1981: IPPRO-0107790
 - 1982: IPPRO-0107792
 - 1983: IPPRO-0107794
 - 1984: IPPRO-0107796
 - 1985: IPPRO-0107798
 - 1986: IPPRO-0107800
 - 1987: IPPRO-0107802
 - 1988: IPPRO-0107804
 - 1989: IPPRO-0107806
 - 1990: IPPRO-0107808
 - 1991: IPPRO-0107810
 - 1992: IPPRO-0107812
 - 1993: IPPRO-0107814
 - 1994: IPPRO-0107816
 - 1995: IPPRO-0107818

- 1996: IPPRO-0107820
- 1997: IPPRO-0107822
- 1998: IPPRO-0107824 and IPPRO-0107825
- 1999: IPPRO-0107827 and IPPRO-0107828

26. Pratt, J.W., and Gibbons, J.D.; *Concepts of Nonparametric Theory*, Springer-Verlag, 1981.

24. Bhattacharyaa G.K., and Johnson, R.A.; *Statistical Concepts and Methods*, John Wiley and Sons, 1977.

25. Bradley, J.V.; *Distribution-Free Statistical Tests*. Prentice-Hall, Inc., 1968.

26. Conover, W.J.; *Practical Nonparametric Statistics*, Third Edition, John Wiley and Sons, Inc., 1999.

27. Hahn, G.J., and Meeker, W.Q.; *Statistical Intervals: A Guide for Practitioners*, John Wiley and Sons, Inc., 1991.

28. Sprent, P., and Smeeton, N.C.; *Applied Nonparametric Statistical Methods*, Third Edition, Chapman & Hall/CRC, 2001.

ATTACHMENT C

Attachment C - List of the Modifications

(1) Baldwin 1 - 1985

Replacing air heater tubes at Unit 1

(2) Baldwin 1 - 1990

Replacing air heater tubes at Unit 1

(3) Baldwin 1 – 1992

Replacing 14 cyclones and front and rear furnace walls, among other things at Unit 1

(4) Baldwin 2 – 1988

Replacing air heater tubes at Unit 2

(5) Baldwin 2 – 1991

Replacing air heater tubes at Unit 2

(6) Baldwin 2 – 1991

Replacing the entire boiler floor at Unit 2, including the inlet headers, floor tubing, and the lower 3 feet of the front and rear walls

(7) Baldwin 3 – 1982

Performing a complete change-out of the economizer at Unit 3

(8) Baldwin 3 – 1994

Replacing the Unit 3 Reheater

(9) Baldwin 3 – 1994

Adding 20,000 square feet of secondary superheater surface area at Unit 3

ATTACHMENT D

Attachment D - List of PROMOD Model Runs and Bates Numbers

IPC Code	Date of the run	Bates Number	Indication in title	Indication in name of tape	Support Document	Remark	Status	Status in Mr. King's Report
8701	March 1987	IPPRO 0144646 - IPPRO0144672				No Unit-specific data		Considered
8707	18 March 88 - Reported in April 1988 Summary Report	Summary results in IPPRO-0165157 to IPPRO0165162 ; Report: IPPRO-0144614 to 0144645.			Summary Report "PROMOD III Electric Production Cost Base Case 8707" April 1988		Base Case	Considered
8802	Reported in April 1989 Summary Report	Various Printouts of the report: IPPRO-0144673 to 0144755			Summary Report "PROMOD III Electric Production Base Case 8802" April 1989		Base Case	Considered
8903	08/11/1989	Mr. King's response to Subpoena – Mentioned in Mr. King's report Page B3 (List of Documents considered)	"Base Case 8903 – Oct 1988 – 1995 Marginal Cost Run"	"Posicc03"			Base Case	Considered
PROMOD for PROVIEW	11/15/1989	Outputs Only: IPPRO 0173368-173469	"Promod Case For Proview Data-Multi Area"	"Prmbase5 - Base Case"			Base Case	Not Considered

9001	2/27/ 1990 (2 versions)	Outputs Only: IPPRO- 0162274- 0162357	"Promod 15 Bld 2 Boilr Flr [NOT] Replaced PDEF COL24"	TestV20Y FCST=FRP L PDEF Col 66 For Inv		See Analysis in Section 3.3	One- Off Case	Not Considered
	5/11/ 1990	Inputs Only: IPPRO- 0141560 to 0141725	"Base Case 9001 – Jan 1990 - 1994	FPK9001P. BaseVr02		Inputs Only		Considered
9002	9/26/ 1990	Outputs: IPPRO0141345 - 1530	Base Case 9002 – Jan 1990-1995	Fpk9002P. BaseVr01			Base Case	Considered
	11/29/ 1990	Inputs and Outputs: Inputs: IPPRO0141560 -1721	Base Case 9002 – Jan 1990-1995	Fpk9002P. BaseVr02	Part of a larger IPC report		Base Case	Relied Upon
	1/4/1991	Outputs: IPPRO0141726 -1845	Base Case 9002 – Jan 1990-2010	Fpk9002P. BaseVr09			Base Case	Considered
	2/5/1991 and 2/6/1991	Inputs and Outputs: IPPRO0159524 - 160128	Base Case 9002 – Jan 1990-1995	FPJ Bal03 Outage 01 and FPJ Bal03 Outage 02		Only 1991 Data (Apparently Baldwin 3 outage Analysis, see IPPRO015 9524)	One- Off case (Comp arison of two cases for 1991)	Not Considered
	2/11/ 1991	IPMicro 00015 to 00025	"Mrg. Cost - Reg Emrg Prc - New Soy"	FPJ9002N. Stall01				Not Considered
	4/5/1991	Inputs Only: IPMicro 00234 to 00373 and IPMicro 00521 to 00535	Base Case 9002 – Jan 1990 - 1995	Fpk9002P. BaseVr02		Inputs Only (Several Printouts)		Not Considered
	5/3/1991	Inputs-Outputs: IPPRO0160309 - 0620	"Base Case 9002 1990-2010 New Soy Land"	Fpj 9002N.Bas eVr01	Part of a Longer IPC report – Apparently a response to the ICC staff (see IPPRO 0160311)	Only 2 years (1997 and 2002) of outputs available		Not Considered

	6/4/1991	Outputs Only (Short report): IPPRO0160208 - 0244	Base Case 9002 Jan 1990-2010	RoIVr90B				Not Considered
	6/4/1991	IPMicro 00467 to 520	Base Case 9002 1990-2010 "New Soy land"	Prmd11YR				Not Considered
	9/5/1991	IP Micro 00374 to 00393	Base Case 9002 1990-2010 Detailed DSM	FPF9002N. NomDac7D				Not Considered
9101	7/3/1991	Outputs Only: IPPRO0145446 - 5683	Base Case 9101 1991-2010	FPA9002N BaseVr03			Base Case	Considered
	8/22/1991 (2 cases)	Outputs Only: IPPRO0166699 - 7088	Base Case 9101 1991-2010 Coal FCST Not Final	FPR0101I. DS80MWA 2 and FPR0101I. DS80MWB 2		Un-determined Purpose	One-off Case	Not Considered
	9/25/1991	Outputs Only: 0158614 to 0158638	Base Case 9101 1991-2010 Coal FCST Not Final	FPA9101M .RTDS MAR2	Response to ICC Staff Data requests			Not Considered
	10/4/1991	IPPRO0161461 to IPPRO0161467 (Fuel Inventory Reports Only)	Base Case 9101 1991-2010 Coal FCST Not Final	FPA9102V. ESFLBRN S	October 4, 1991 letter to Ms. K. Johnson			Not Considered
	12/11/1991	Inputs Only: 0158490 to 0158613	Base Case 9101 1991-2010 Coal FCST Not Final	FPA9101M .RTDSNM R3	Response to ICC Staff Data requests			Not Considered
	9102	11/22/1991	Inputs - Outputs: IPPRO0139628 - 0170	Base Case 9102 - Jan 1991-Dec 1996	FPA9102.B 00M06	Part of a larger IPC report		Base Case
12/16/1991		Outputs Only: IPPRO-0144756 to 0144871 -	Base Case 9102 - Jan 1991-Dec 1996	FPA9102L. LCSTT5		Possibly Test for a Least Cost Plan		Considered

2/24/1992	Only "Weekday Thermal Dispatch Energy Balance" IPPRO0160655 to 0160875	Base Case 9102 – Jan 1991-Dec 1996	FPA9102.B00M06				Not Considered
3/26/1992 (2 versions)	Outputs Only: IPPRO0145685 to 0145798, IPPRO0145806 to 0145861	Base Case 9102 – Jan 1991-Dec 2013	FPA9202.T estLC8 and FPA9202.T est2		Un-determined Purpose	One-off Case	Considered
4/10/1992	Outputs Only: IPPRO0170075 to 0170345 (PROMOD outputs starting on IPPRO-0170220)	Base case 9102 – Jan 1991-Dec 2013	FPA9202.L CSTR03	Part of a July 1992 Least Cost Plan Output Reports – 1992 LCP Resource Book 2	The run is described as a "Benchmark Run" (IPPRO-0170076)	Base Case	Not Considered
4/22/1992	Inputs and Outputs: IPPRO0148999 to 00149565 (Outputs to this run starts on IPPRO-0149350)	Base Case 9102 – Jan 1991-Dec 1996	FPA9201.B00M00	April 29 1992 Memo on Increased Capacity Options Screening	Run apparently used as benchmark for this Increased Capacity Options study (IPPRO-0166494)	Base Case	Relied Upon
5/7/1992	Only Fuel - Related data: IPPRO0139233 - 9331	Base case 9102 – Jan 1991-Dec 2013	Fpa9202-Basr04				Not Considered
6/1/1992 (2 versions)	Outputs Only: IPPRO0162394 – 2498	Base Case 9102 – Jan 1991-Dec 1996	FPA9201D elayBse and FPA9201D elay5Yr		Un-determined Purpose	One-off Case	Not Considered

	6/11/1992 (2 versions)	Outputs Only: IPMicro 00442 to 00453 and IPMicro 00536 to 00554	Base Case 9203 – Jan 1991 – Dec 2013	FPJ9203.R iderp20 and RiderPPFC		Possibly Test for a potential 9203 Base Case	One-off Case	Not Considered
	11/10/1992	1992 Annual Outputs: IPPRO-0149300 to 0149347	Base Case 9102 – Jan 1991-Dec 1996	FPA9201.B 00M00		Only one year available (Monthly and Yearly)		Not Considered
9301	11/5/1992	Inputs and Outputs Only: IPPRO0143747 to 0144612	Base Case 9301B00 Jan 1992-Dec 1997	FPJ9301.B 00M00	Introduction on Assumptions: IPPRO-0143747 to 0143757		Base Case	Considered
	11/10/1992	Inputs and Outputs: IPPRO0143747 to 0144612	Base Case 9301B00 Jan 1992-Dec 1997	FPJ9301.B 00M00		Monthly version of Nov 5, 92 run		Not Considered
	12/21/1992	Outputs Only: IPPRO0161325 to 0161433	Base Case 9301B00 Jan 1992-Dec 2013	FPJ9301.B .MinPvrr2				Considered
	12/22/1992	Outputs Only: IPPRO0161217 to 0161324	Base Case 9301B00 Jan 1992-Dec 1997	FPJ9302.M inRisk2B				Not Considered
	1/8/1993	Outputs Only: IPPRO0161014 to 0161119	Base Case 9301B00 Jan 1992-Dec 1997	MinRisk1D				Not Considered
	1/15/1993	Outputs Only: IPPRO0161120 - 0161169	Base Case 9301B00 Jan 1992-Dec 1997	FPJ9301M. MinRisk1E				Not Considered
	1/27/1993	Extracts of Outputs IPPRO0162179 to 0162187	Base Case 9301B00 Jan 1992-Dec 1997	FPJ9303M. MrgWoint		August 1995 Results only		Not Considered
	1/29/1993	Extracts of Outputs IPPRO0162170 to 0162178: Unit Segment and System Probability Only IPPRO0162188 - 2198	Base Case 9301B00 Jan 1992-Dec 1997	FPJ9303M. MrgWhsc		August 1995 Results only		Not Considered

9302	1/5/1993	Only Fuel - Related data: IPPRO0161480 to 0161487	Base Case 9302B00 Jan 1992- Dec 1997	FPJ9302.B00.M00		Possibly Test for 1/22/93 Base Case		Not Considered
	1/22/1993	Inputs - Outputs: IPPRO0148520 to 148998	Base Case 9302B00 Jan 1992- Dec 1997	FPJ9302.B00.M00	Memo from D. Robinson, February 1, 1993, "New PROMOD Case" (IPPRO-0148518)		Base Case	Considered
	6/14/1993 and 6/15/1993 (5 versions)	Outputs Only: IPPRO0159003 to 01599460	Base Case 9302B00 Jan 1992- Dec 1997	FpjBurn1-RgjcB1a, B4, B6, B7, B8,		1993 Monthly Outputs Only		Not Considered
	6/18/1993	Outputs Only: IPPRO0158952 to 0158999	Base Case 9302B00 Jan 1992- Dec 1997	FpjBurn1-RgjcB20		1993 Monthly Outputs Only For Fiscal Year June 93 to September 93		Not Considered
	6/21/1993	Outputs Only: IPPRO0159461 to 0159508	Base Case 9302B00 Jan 1992- Dec 1997	FpjBurn1-RgjcB23		1993 Monthly Outputs Only For Fiscal Year June 93 to September 93		Not Considered
9303	1/12/1993	Outputs Only: IPPRO0161489 to 0161539	Base Case 9303 B00 Jan 1992 – Dec 1997	FPA9303.Fuelbrn1		2 years only (1997 and 1998)		Not Considered
	1/18/1993	Outputs only: IPPRO0162002 to 0162079	Base Case 9303 B00 Jan 1992 – Dec 1997	FPA9303.PreFpln1		3 years only (1997 and 1998)		Not Considered
	2/9/1993	Output: IPPRO0162080 to 0162169	Base Case 9303 B00 Jan 1993 – Dec 1999	FPA9303B.PBDYSCN 1				Not Considered

9304	3/22/ 1993	Inputs: IPPRO-0142763 to 0143069, Outputs: IPPRO-0143097 to 0143718	Base Case 9304B00 – Jan 1993- Dec1997	FPA9304B.B00M00	March 18, 1993 Memo from B. Anselmo (IPPRO-0142764) and “PROMOD Audit” March 29, 1993 Document (IPPRO-0143719 to 0143727)		Base Case	Considered
	5/5/1993	Outputs Only: IPPRO014935 - 0148018	Base Case 9304B00 – Jan 1993- Dec 1997	FPA9305.P RVW01		Possibly a Test for PROVIEW		Not Considered
9304	10/6/ 1993	Outputs Only: IPPRO0147323 - 0147414	Base Case 9304B00 – Jan 1993- Dec 1997	FPA9305.P RVW02		Possibly a Test for PROVIEW		Not Considered
9401	11/8/ 1993	Inputs and Outputs: IPPRO0140586 to 0141001; Similar Outputs (Repeated): IPPRO0141016 to 0141331	Base Case 9401B00 – Jan 1994 – Dec 1998	FPA9401.B00M00			Probably Not a Base Case (see Discussion in Section 4.1 of the report)	Relied Upon

Note: For Runs Done in 1995 or later (i.e. after the last modification analyzed in this report), I have not attempted to determine base cases or one-off cases

9503	6/28/ 1995 (2 versions)	Output: IPPRO01608 92 to 0160931, IPPRO01609 36 - 0160975	Base Case 9503B00 – Jan 1995 – Jan 1999	1995 DPC Case - Original to determine fixed Dispatch and 1995 DPC Case - New Basecase
9601	11/22/ 1995 (Inputs and Outputs) and 11/27/ 1995 (Outputs)	Inputs and Outputs: IPPRO01495 66 to 0150834	Base Case 9601B2 – Jan 1995 to Dec 2000	9601 Case - 1996 Financial Forecast

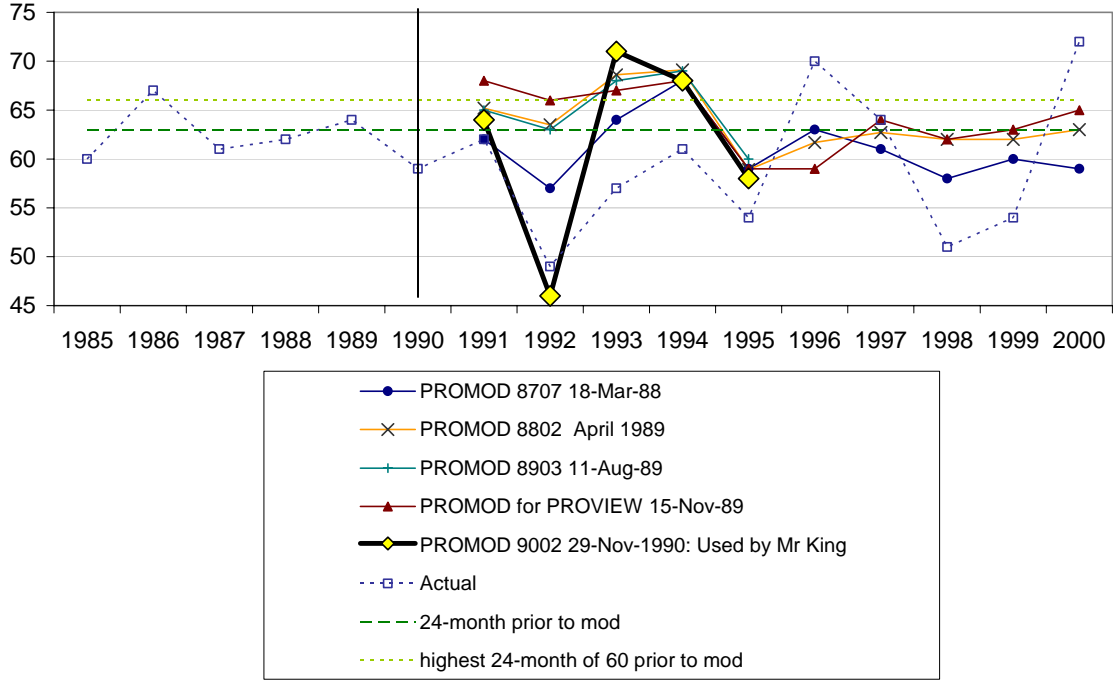
	3/7/1996	Outputs: IPPRO01380 76 - 0138347	Base Case 9602B0 – Jan 1996 – Dec 2000	9602 Case – 1996 Financial Forecast Rollover
9603	11/14/ 1995 and 11/15/ 1995	Inputs and Outputs: IPPRO 0146031 to IPPRO 0147217	Base Case\960 1B00 – Jan 1995 – Dec 2000	9601 case – 1996 Financial Forecast
9701	1/9/1998	Outputs Only: IPPRO01508 35 to 0150879	Base Case P980185 —Jan 1997 – Dec 2002	9801 Case – 1998 Financial Forecast
9901	12/30/ 1998 (2 versions)	Outputs Only: IPPRO01508 80 to 0150916	Base Case P9901B0	9901 Case CPS 7/1/99 Restart Scenario w/ sale in 1999 and 9901 Case CPS 4/3
	3/23/ 1999	Outputs Only: IPPRO01509 17 to 0150921	Base Case P9901B1	9901 Case – CPS Sale 4/3 – Repurchase Amergen – New Soy PCA

ATTACHMENT E

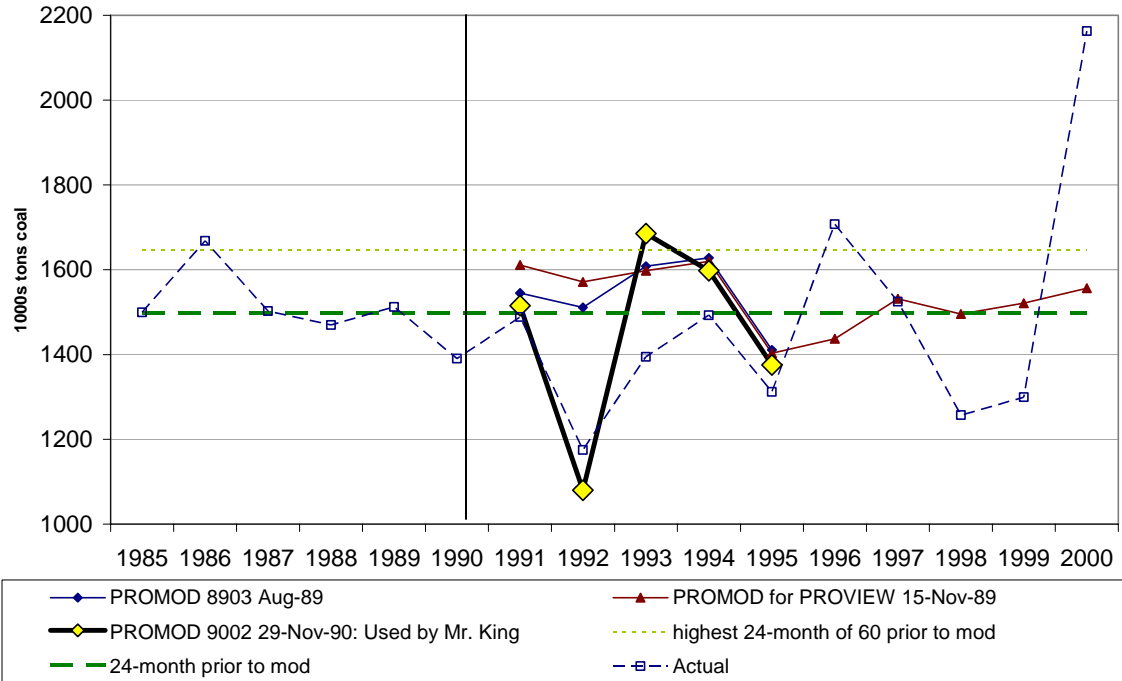
Attachment E - Summary Charts of IPC's projections of unit operation

Modification at Baldwin Unit 1 – Second Phase 1990 Replacing the cold-end air heater section at Unit 1

Compared capacity factors - Various Runs



Coal Use Baldwin 1 - Actual and Projections



Capacity Factors Data

	PROMOD 8707	PROMOD 8802	PROMOD 8903	PROMOD for PROVIEW	PROMOD 9002	Actual
	18-Mar- 88	April 1989	11-Aug-89	15-Nov-89	29-Nov- 1990	
1985						60
1986						67
1987						61
1988						62
1989			65			64
1990			56			59
1991	62	65	65	68	64	62
1992	57	64	63	66	46	49
1993	64	69	68	67	71	57
1994	68	69	69	68	68	61
1995	59	59	60	59	58	54
1996	63	62		59		70
1997	61	63		64		64
1998	58	62		62		51
1999	60	62		63		54
2000	59	63		65		72

Averages – Capacity Factors

24-month prior to mod	highest 24-month of 60 prior to mod
63	66

Coal Use (in thousand of tons)

	PROMOD 8707	PROMOD 8802	PROMOD 8903	PROMOD for PROVIEW	PROMOD 9002	Actual
	18-Mar-88	April 1989	Aug-89	15-Nov-89	29-Nov-90	
1985						1,500
1986						1,668
1987						1,502
1988						1,470
1989						1,513
1990						1,390
1991	NA	NA	1,545	1,611	1,515	1,488
1992	NA	NA	1,511	1,571	1,080	1,175
1993	NA	NA	1,608	1,598	1,685	1,394
1994	NA	NA	1,628	1,620	1,598	1,493
1995	NA	NA	1,411	1,403	1,376	1,312
1996	NA	NA		1,437		1,707
1997	NA	NA		1,532		1,525
1998	NA	NA		1,496		1,257
1999	NA	NA		1,521		1,300
2000	NA	NA		1,557		2,163

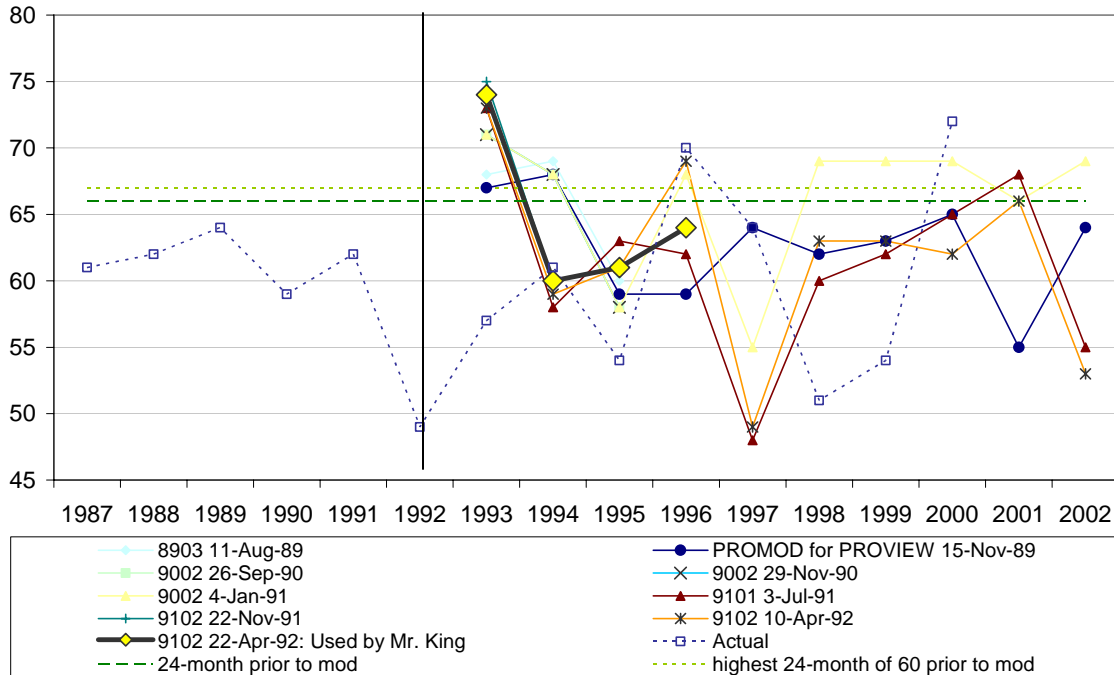
Averages – Coal Use

24-month prior to mod	highest 24-month of 60 prior to mod
1,497	1,645

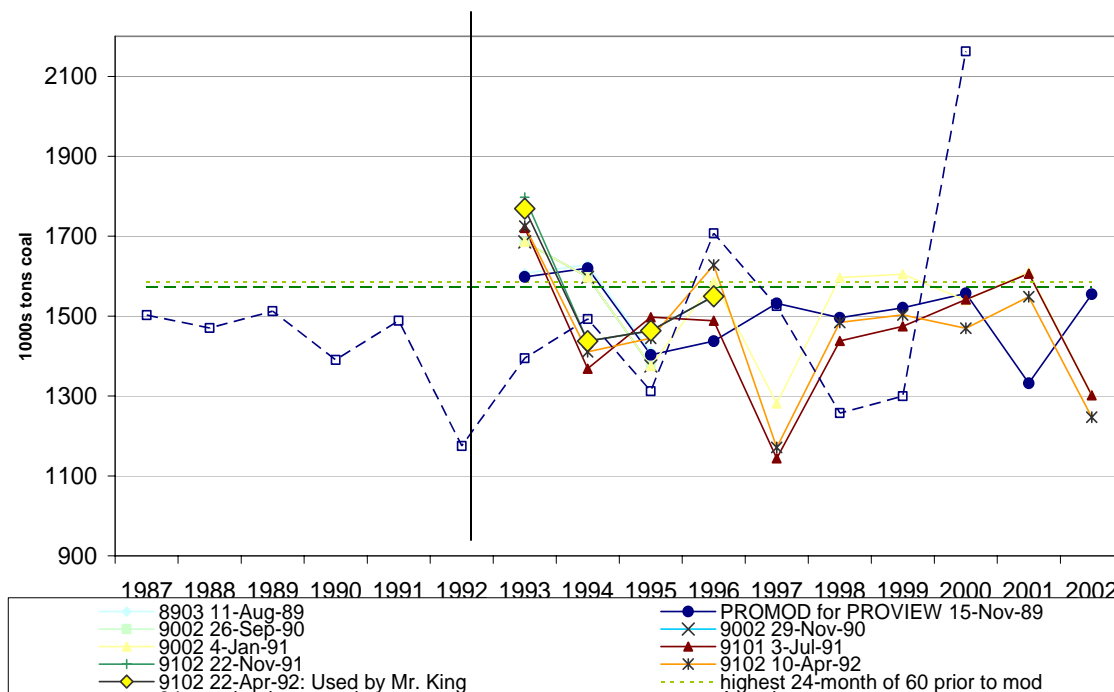
Modification at Baldwin Unit 1 – 1992

Replacing 14 cyclones and front and rear furnace walls, among other things at Unit 1

Compared capacity factors - Various Runs



Coal Use at Baldwin 1 - Actual and Projections



Capacity Factors Data

	8903	PROMOD for PROVIEW	9002	9002	9002	9101	9102	9102	9102	Actual
	11- Aug- 89	15-Nov-89	26- Sep- 90	29- Nov- 90	4- Jan- 91	3-Jul- 91	22- Nov- 91	10- Apr- 92	22- Apr- 92	
1987										61
1988										62
1989										64
1990										59
1991										62
1992										49
1993	68	67	71	71	71	73	75	73	74	57
1994	69	68	68	68	68	58	60	59	60	61
1995	60	59	58	58	58	63	61	61	61	54
1996		59			68	62	64	69	64	70
1997		64			55	48		49		64
1998		62			69	60		63		51
1999		63			69	62		63		54
2000		65			69	65		62		72
2001		55			66	68		66		
2002		64			69	55		53		

Averages – Capacity Factors

24-month prior to mod	highest 24-month of 60 prior to mod
66	67

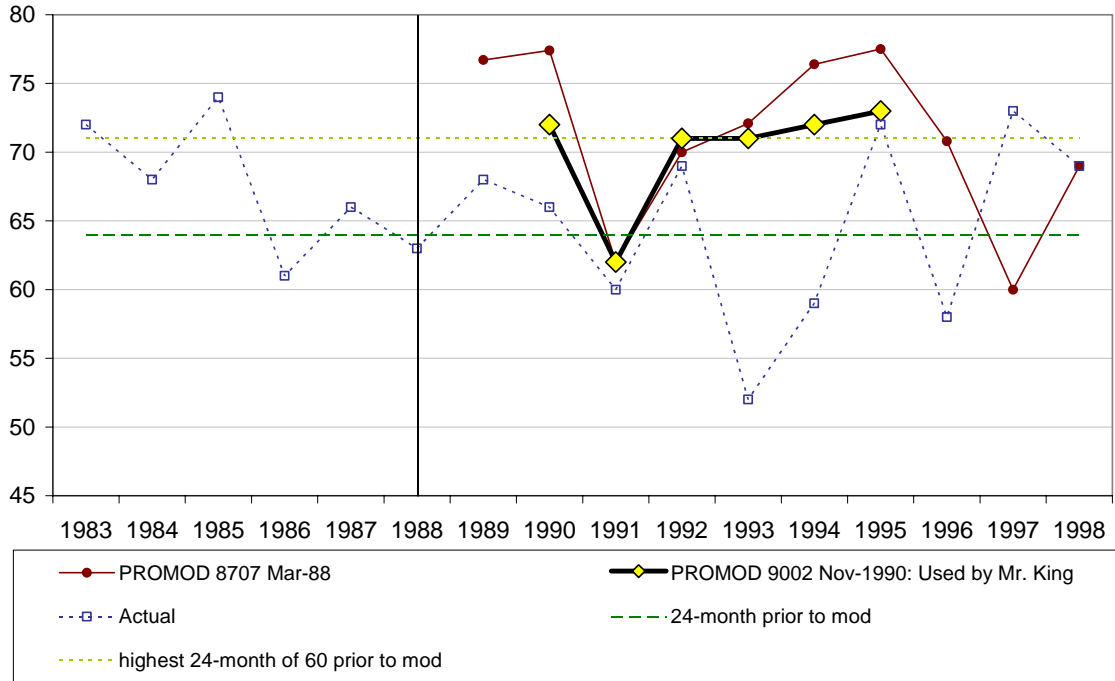
Coal Use (in thousand of tons)

	8903	PROMOD for PROVIEW	9002	9002	9002	9101	9102	9102	9102	Actual
	11-Aug-89	15-Nov-89	26- Sep- 90	29- Nov- 90	4- Jan- 91	3-Jul- 91	22- Nov- 91	10- Apr- 92	22- Apr- 92	
1987										1,502
1988										1,470
1989										1,513
1990										1,390
1991										1,488
1992										1,175
1993	1,608	1,598	1,685	1,685	1,685	1,721	1,798	1,725	1,769	1,394
1994	1,628	1,620	1,598	1,598	1,598	1,369	1,437	1,411	1,437	1,493
1995	1,411	1,403	1,376	1,376	1,376	1,498	1,463	1,445	1,463	1,312
1996		1,437			1,586	1,488	1,550	1,628	1,550	1,707
1997		1,532			1,281	1,144		1,172		1,525
1998		1,496			1,597	1,438		1,484		1,257
1999		1,521			1,605	1,474		1,503		1,300
2000		1,557			1,540	1,542		1,470		2,163
2001		1,332			1,611	1,606		1,548		

2002		1,555			1,303	1,302		1,247		
<i>Averages – Coal Use</i>										
24-month prior to mod					highest 24-month of 60 prior to mod					
1,572					1,586					

Modification at Baldwin Unit 2 – First Phase 1988 Replacing the cold-end air heater section at Unit 2

Compared capacity factors - Various Runs



Capacity Factors Data

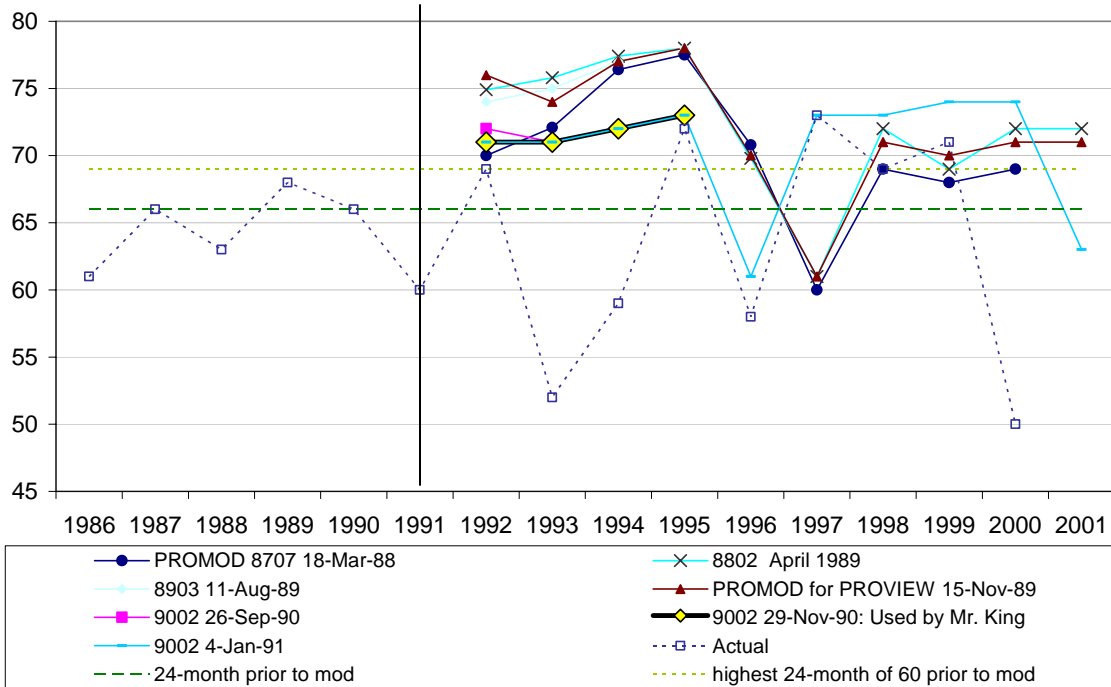
	PROMOD 8707 Mar-88	PROMOD 9002 Nov-90	Actual
1983			72
1984			68
1985			74
1986			61
1987			66
1988			63
1989	77		68
1990	77	72	66
1991	62	62	60
1992	70	71	69
1993	72	71	52
1994	76	72	59
1995	78	73	72
1996	71		58
1997	60		73
1998	69		69

Averages – Capacity Factors

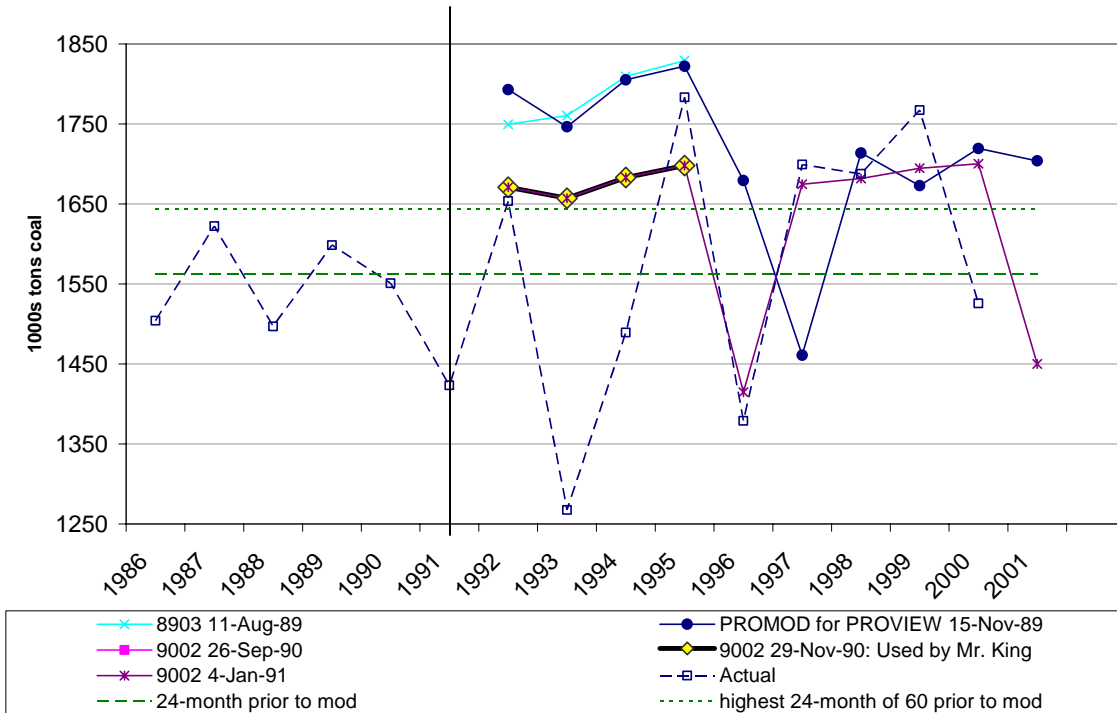
24-month prior to mod	highest 24-month of 60 prior to mod
64	71

Modification at Baldwin Unit 2 – Second Phase 1991 Replacing the cold-end air heater section at Unit 2

Compared capacity factors - Various Runs

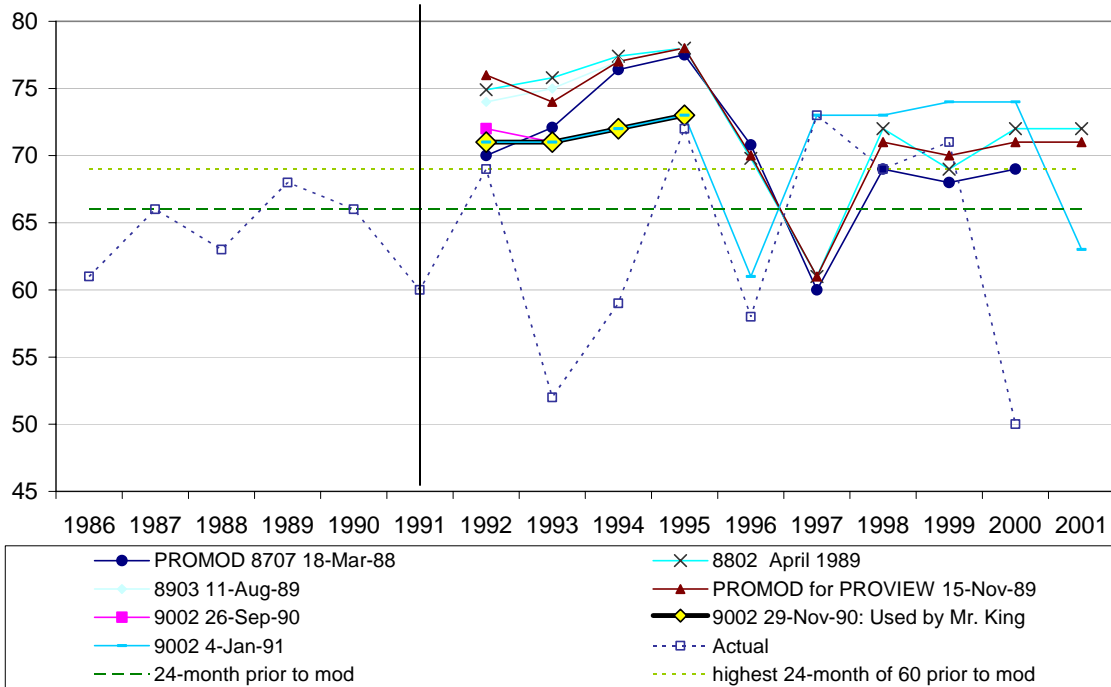


Coal Use Baldwin 2 - Actual and Projections

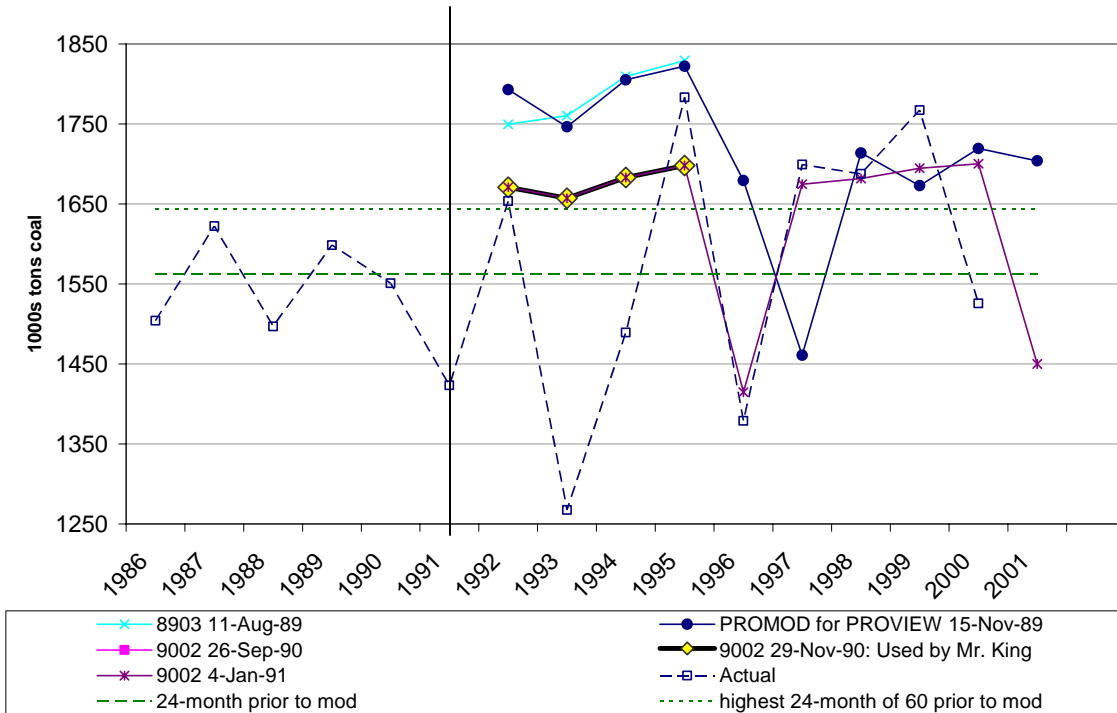


Modification at Baldwin Unit 2 – 1991 Replacing the entire boiler floor at Unit 2

Compared capacity factors - Various Runs



Coal Use Baldwin 2 - Actual and Projections



Capacity Factors Data

	8707	8802	8903	PROMOD for PROVIEW	9002	9002	9002
	18-Mar-88	April 1989	11-Aug-89	15-Nov-89	26-Sep-90	29-Nov-90	4-Jan-91
1986							
1987							
1988							
1989							
1990							
1991							
1992	70	75	74	76	72	71	71
1993	72	76	75	74	71	71	71
1994	76	77	77	77	72	72	72
1995	78	78	78	78	73	73	73
1996	71	70		70			61
1997	60	61		61			73
1998	69	72		71			73
1999	68	69		70			74
2000	69	72		71			74
2001		72		71			63

Averages – Capacity Factors

24-month prior to mod	highest 24-month of 60 prior to mod
66	69

Coal Use (in thousand of tons)

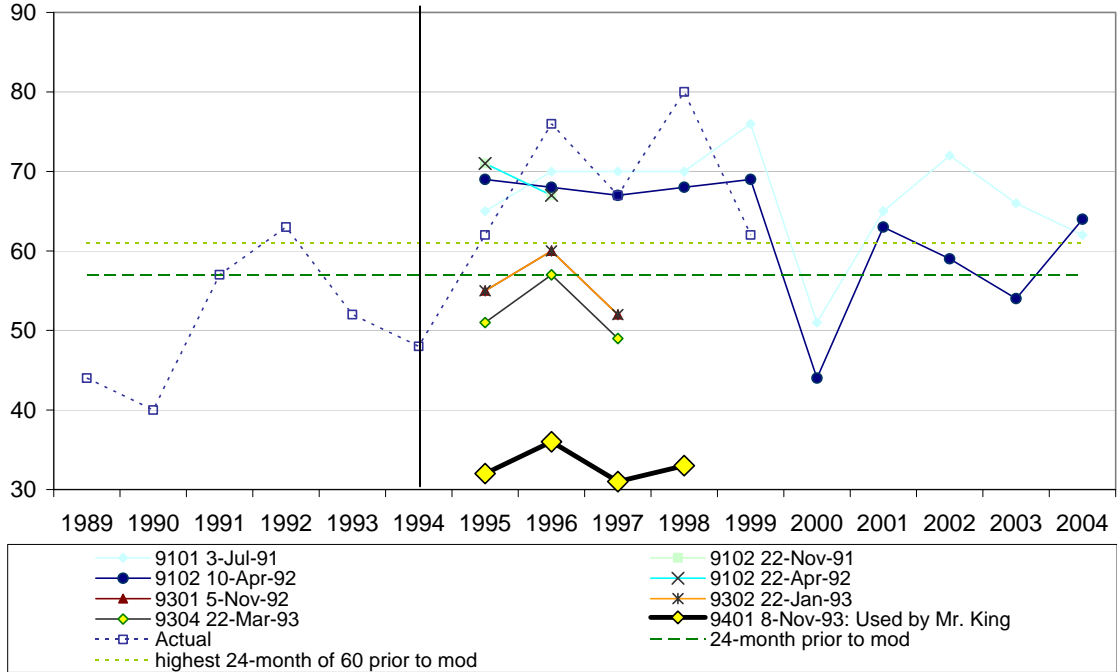
	8707	8802	8903	PROMOD for PROVIEW	9002	9002	9002	
	18-Mar-88	April 1989	11-Aug-89	15-Nov-89	26-Sep-90	29-Nov-90	4-Jan-91	Actual
1986								1,504
1987								1,622
1988								1,497
1989								1,598
1990								1,551
1991								1,423
1992	NA	NA	1,749	1,793	1,671	1,671	1,671	1,654
1993	NA	NA	1,760	1,747	1,657	1,657	1,657	1,267
1994	NA	NA	1,809	1,805	1,683	1,683	1,683	1,489
1995	NA	NA	1,829	1,822	1,698	1,698	1,698	1,783
1996	NA	NA		1,679			1,415	1,379
1997	NA	NA		1,461			1,675	1,699
1998	NA	NA		1,714			1,682	1,688
1999	NA	NA		1,673			1,695	1,767
2000	NA	NA		1,719			1,700	1,526
2001	NA	NA		1,704			1,450	

Averages – Coal Use

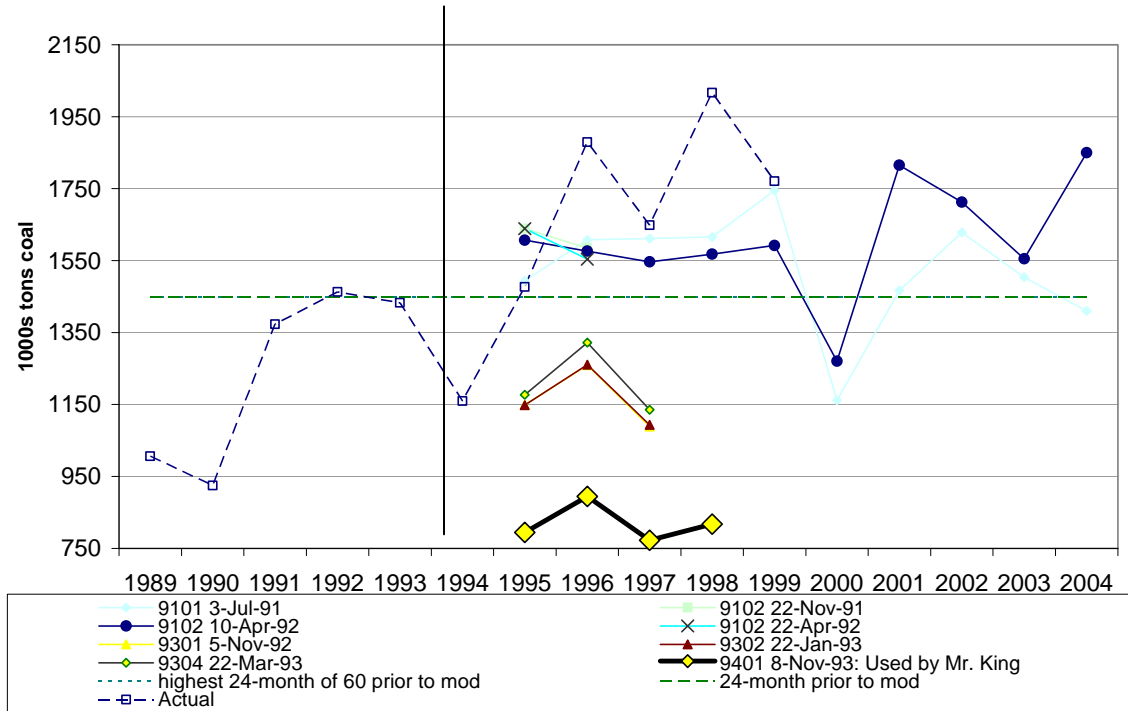
24-month prior to mod	highest 24-month of 60 prior to mod
1,562	1,644

Modification at Baldwin Unit 3 – 1994 Replacing the Unit 3 Reheater

Compared capacity factors - Various Runs



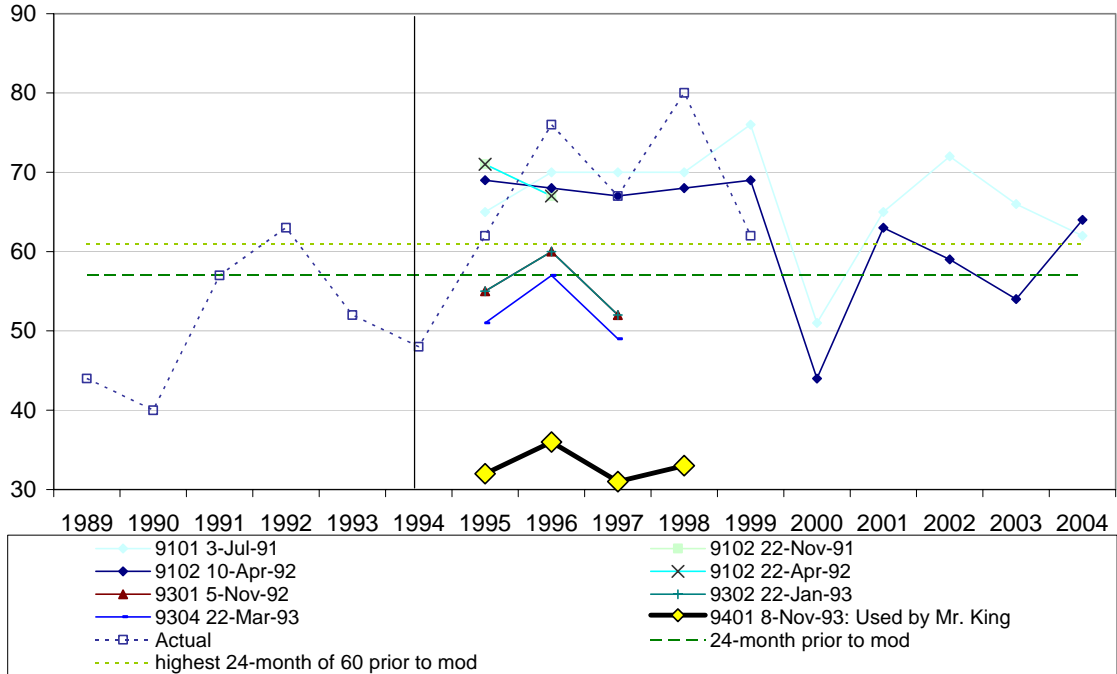
Coal Use Baldwin 3 - Actual and Projected



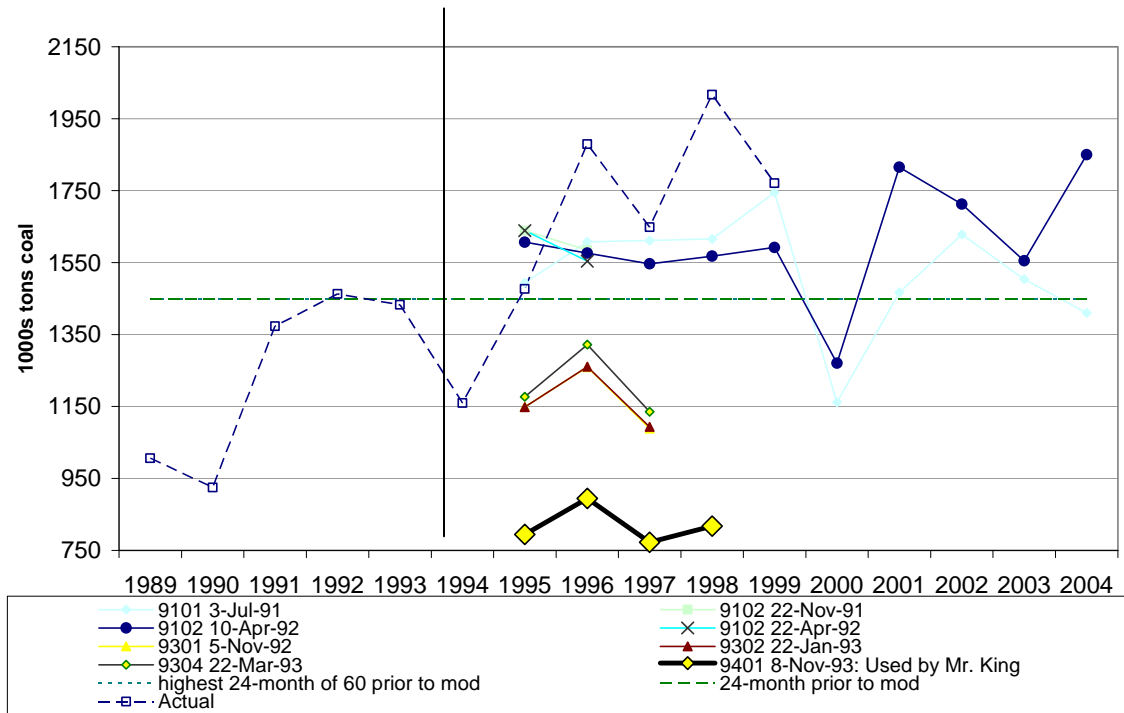
Modification at Baldwin Unit 3 – 1994

Adding 20,000 sq. feet of secondary superheater surface area at Unit 3

Compared capacity factors - Various Runs



Coal Use Baldwin 3 - Actual and Projected



Modifications at Baldwin Unit 3 – 1994

Capacity Factors Data

	9101	9102	9102	9102	9301	9302	9304	9401	Actual
	3-Jul-91	22-Nov-91	10-Apr-92	22-Apr-92	5-Nov-92	22-Jan-93	22-Mar-93	8-Nov-93	
1989									44
1990									40
1991									57
1992									63
1993									52
1994									48
1995	65	71	69	71	55	55	51	32	62
1996	70	67	68	67	60	60	57	36	76
1997	70		67		52	52	49	31	67
1998	70		68					33	80
1999	76		69						62
2000	51		44						
2001	65		63						
2002	72		59						
2003	66		54						
2004	62		64						

Averages – Capacity Factors

24-month prior to mod	highest 24-month of 60 prior to mod
57	61

Coal Use (in thousand of tons)

Coal Use (1000s tons)	9101	9102	9102	9102	9301	9302	9304	9401	Actual
	3-Jul-91	22-Nov-91	10-Apr-92	22-Apr-92	5-Nov-92	22-Jan-93	22-Mar-93	8-Nov-93	
1989									1,006
1990									925
1991									1,373
1992									1,463
1993									1,433
1994									1,160
1995	1,494	1,639	1,607	1,639	1,149	1,149	1,177	794	1,477
1996	1,608	1,585	1,576	1,554	1,259	1,261	1,322	894	1,879
1997	1,611		1,547		1,089	1,093	1,135	772	1,648
1998	1,616		1,568					818	2,017
1999	1,745		1,592						1,771
2000	1,162		1,271						
2001	1,467		1,815						
2002	1,628		1,713						
2003	1,504		1,555						
2004	1,410		1,850						

Averages – Coal Use

24-month prior to mod	highest 24-month of 60 prior to mod
1,448	1,449

ATTACHMENT F

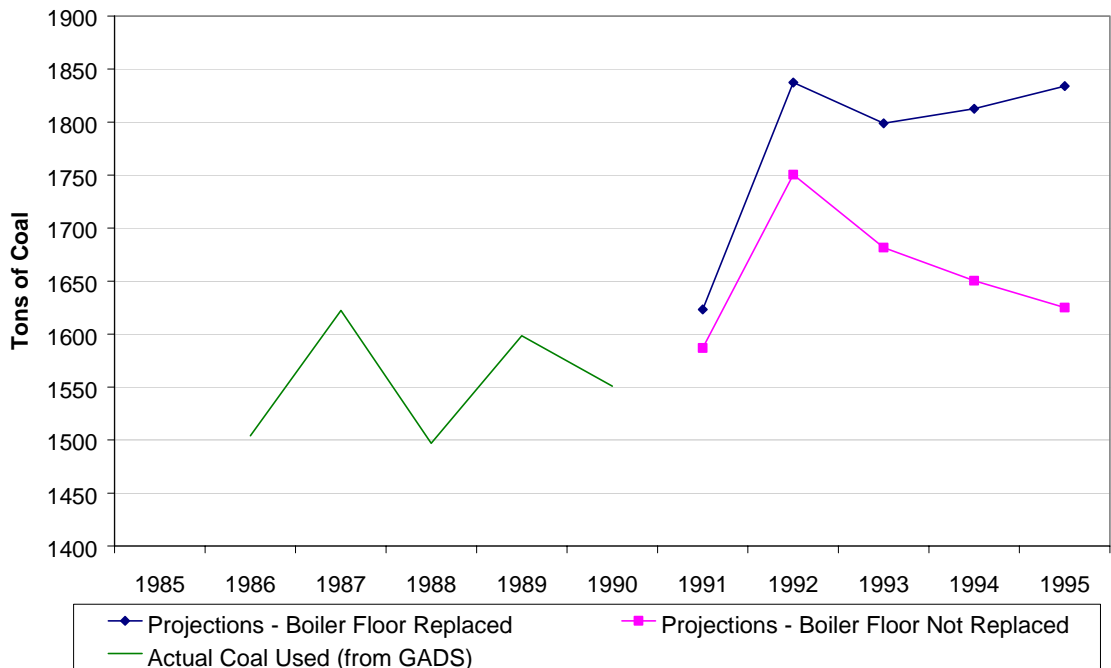
Attachment F - Summary Charts for IPC's analysis of the 1991 Baldwin 2 replacement of the boiler heater floor.

Note: Projections in these 2 graphs are drawn from the two 02/27/1990 PROMOD runs.

Baldwin 2 Capacity Factors - One-time study Boiler Floor Replacement



Baldwin 2 Coal Use - One-time study Boiler Floor Replacement



Summary of data used for the graphs

Source of data: February 27, 1990 PROMOD runs for projections, GADS data for actual

	Capacity Factors			Coal Use (thousand tons)		
	Projections - Boiler Floor Replaced	Projections - Boiler Floor Not Replaced	Actual Capacity Factors (from GADS)	Projections - Boiler Floor Replaced	Projections - Boiler Floor Not Replaced	Actual Coal Used (from GADS)
1985						
1986			61			1,504
1987			66			1,622
1988			63			1,497
1989			68			1,598
1990			66			1,551
1991	67	66		1,623	1,587	
1992	76	72		1,837	1,750	
1993	75	70		1,799	1,682	
1994	75	68		1,813	1,650	
1995	76	67		1,834	1,625	

ATTACHMENT G

Attachment G - Impact of Outage Rate Changes on Capacity Factors and Emissions

Synapse Energy Economics conducted simulation analysis of the IPC system in order to illustrate the relationships between outage rates and plant operation. The results of our analysis show a clear and nearly linear relationship between the availability of a generating unit as measured by Equivalent Forced Outage Rate (EFOR) or Equivalent Availability Factor (EAF) and the output of the unit (as measured by generation in MWH or capacity factor). The relationships between these variables and fuel consumption (MMBTU or tons of coal) and air emissions are also roughly linear on an expected basis.

For this analysis we used the PROSYM model and the data set Mr. King used for his base run called "alec_9102_b" which is based on IPC's April 22, 1992 version of the 9102 PROMOD run. PROSYM is the model used by Mr. King in his July 3, 2002 report for IPC (see page 31).

The projections of generation and emissions presented in Attachment D and discussed in Section 3 of the Biewald Expert Report were developed by IPC based upon a large set of input data and the model algorithms. In the PROMOD and PROSYM models, as in the actual operation of the IPC system, plant availability will have a direct impact upon plant generation. Specifically, the basic flow of causation from a modification that improves the forced outage rate of a generating unit is as follows:

A decrease in forced outage rate (which can also be expressed as an increase in plant availability or "equivalent availability factor") results in increased generation from the plant (which can also be expressed in terms of increased "capacity factor"). The relationship between EAF and CF tends to be a simple linear one, with CF increasing in direct proportion to EAF improvements, if all other variables are held constant. The increase in generation will typically be associated with a nearly proportional increase in coal use, and – if there are no changes in the type of coal burned or the emission controls on the plant – a very nearly proportional increase in air emissions.

We have illustrated these relationships for IPC's Baldwin 1 unit. In this analysis, we begin with the input data set that Mr. King used for his PROSYM analysis. This data set is based on the data set IPC used in its 9102 PROMOD runs and was provided to us by Mr. King. Using the input data set that Mr. King used in his PROSYM model run, I was able to replicate his results, and then to run additional cases. My additional cases hold all variables constant, except for the forced outage rate input for Baldwin unit 1. In Mr. King's analysis, he did an alternative PROSYM case in which he isolated the effect of demand growth by holding all of the input data constant between two PROSYM runs except for the loads.

Mr. King's input data for Baldwin 1 for 1994 has an Equivalent Forced Outage Rate or (EFOR) of 10.31%. With a scheduled outage rate (SOR) of 24.11% input for Baldwin 1 in this year for this case, the Equivalent Availability Factor for the unit amounts to 68.07%, calculated as follows:

$$EAF = (1 - EFOR) (1 - SOR) = (1 - 0.1031) (1 - 0.2411) = 0.6807$$

Thus far in this example, we are discussing *inputs* to the model. The greater the Equivalent Availability Factor, the higher the probability that the unit is available to be dispatched within the model. Based upon these unit availability inputs, and hundreds of other input data items, the simulation model will project the amount of generation from the unit. In this case, the model simulation predicted that Baldwin 1 would generate 2919 GWh on an annual basis, amounting to a 59.8% capacity factor for this 557 MW unit¹.

This amount of generation is estimated in the model to require the consumption of 30,445 GBtu of coal. The coal consumption is related to the amount of electricity generation by two factors: the heat rate of the unit and the heat content of the coal. Applying a fuel heat content value to the heat equivalent of fuel burned, the amount of coal in tons can be calculated². SO₂ emissions can be calculated from by multiplying the tons of coal burned by an emission rate. Using Mr. King's methodology and SO₂ emission rate, this amount of generation is estimated to produce roughly 79,571 tons of SO₂ emissions, which is only 0.5% less than Mr. King's projected figure for 1994. The predicted generation for 1994 for this PROSYM run is within about 1.5% of the generation in IPC's April 22, 1992 version of the 9102 PROMOD run, while coal use is within about 0.5%. These values from my PROSYM run match Mr. King's PROSYM run precisely.

With this case as the departure point, we then set out to determine the effects of increasing the forced outage rate for Baldwin 1. We set up a PROSYM run with an outage rate that is 6 percentage points lower than in the reference case run. This means that the EAF is 72.62%, which is 6.7 percent higher than the 68.07% EAF in the reference case run. The results of this simulation of the operation of IPC's entire system with the modified availability factor input for Baldwin 1 show a capacity factor for 1994 of 63.9%, an increase from the reference case of 6.7 percent. In the same run, the SO₂ emissions from Baldwin 1 are 84,908 tons, an increase of 5337 tons, or 6.7 percent, from the reference case run with the higher outage rate input.

These results are listed in the Table G-1 and displayed graphically in Figures G-1 through G-4 below. They are remarkably proportional. That is, the percentage decrease in the

¹ PROSYM calculates capacity factor based on derated capacity. However, in order to maintain consistency with our other analyses as well as PROMOD outputs, capacity factor here is calculated based on maximum capacity. Baldwin 1 has an actual maximum capacity of 584 MW in 1994 according to the GADS data for this unit, but the input data sets for both Mr. King's PROSYM runs and IPC's 9102 PROMOD runs list Baldwin 1 with a maximum capacity of 557 MW (diurnal and seasonal deratings are applied to this figure). In the calculations and tables in this section, I have used this 557 MW capacity figure for consistency.

² A heat content of 21.3 Mbtu/ton of coal was used for this calculation. This figure is from the heat content input used in IPC's 9102 PROMOD runs.

input EFOR and the resultant increase in the input EAF is matched very closely by the percentage increase in generation (as measured by capacity factor), the percentage increase in coal consumption and the percentage increase in SO2 emissions.

Table G-1. Summary Results from Synapse PROSYM Runs of IPC System for 1994

Run ID	Equivalent Forced Outage Rate	Equivalent Availability Factor	Capacity Factor	SO2 Emissions (tons/year)
BALD1UP6_100402	4.31%	72.62%	63.9%	84,908
BALD1UP3_100402	7.31%	70.34%	62.0%	82,388
SYN_9102_B (Reference case)	10.31%	68.07%	59.8%	79,571
BALD1DN3_100402	13.31%	65.79%	57.7%	76,771
BALD1DN6_100402	16.31%	63.51%	55.9%	74,361
BALD1DN9_100402	19.31%	61.24%	54.1%	71,884
BALD1DN12_100402	22.31%	58.96%	52.1%	69,269

Figure G-1.

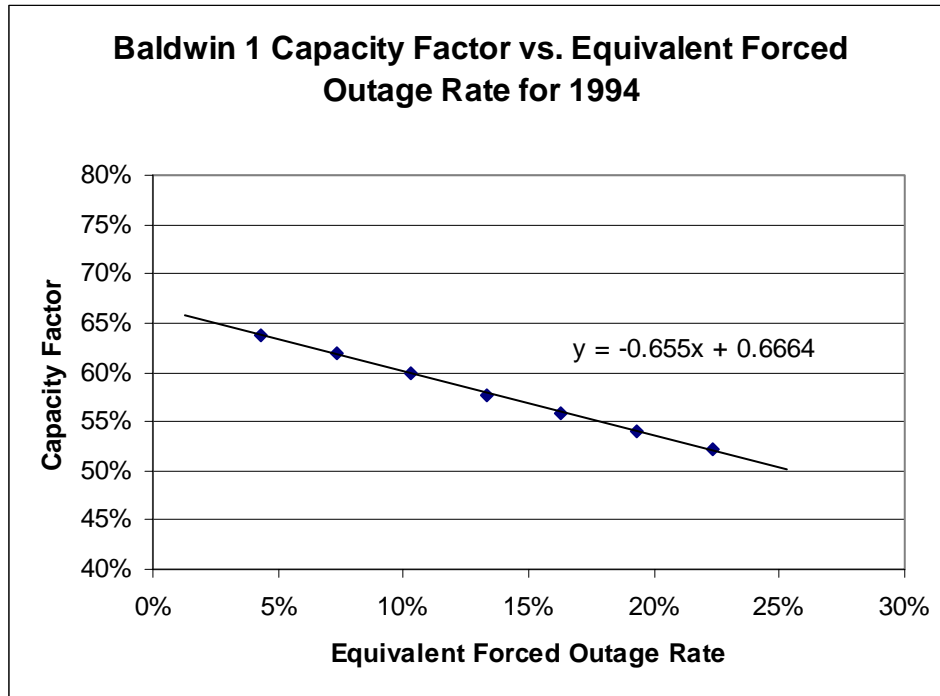


Figure G-2.

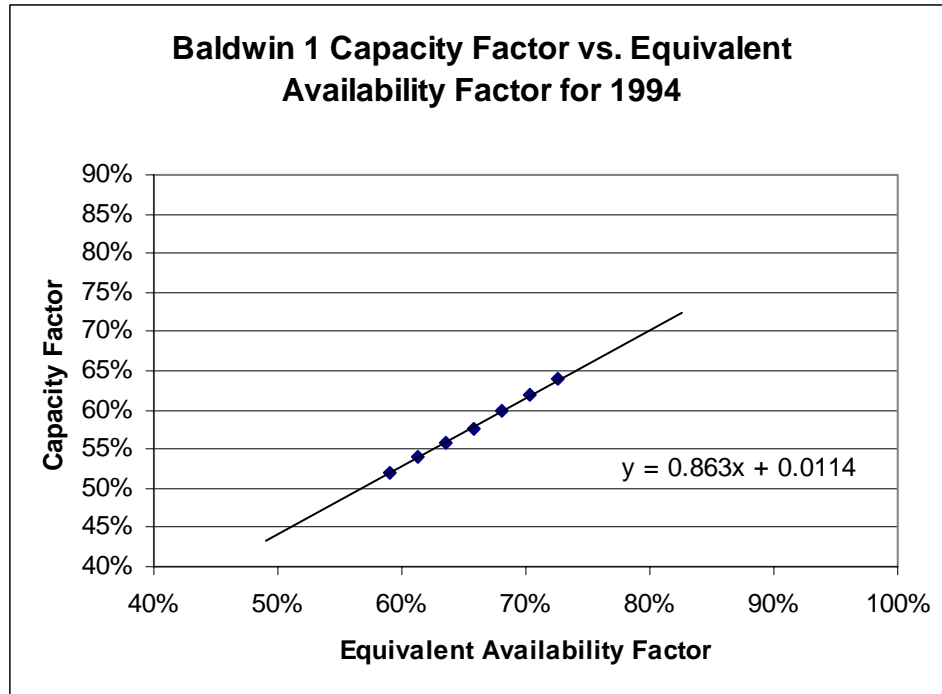


Figure G-3.

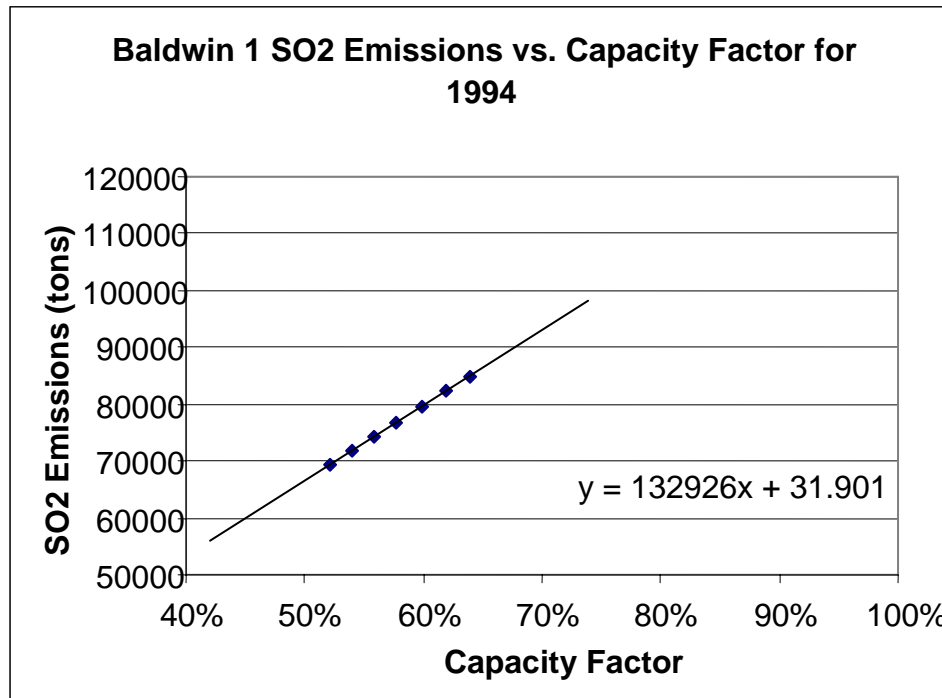
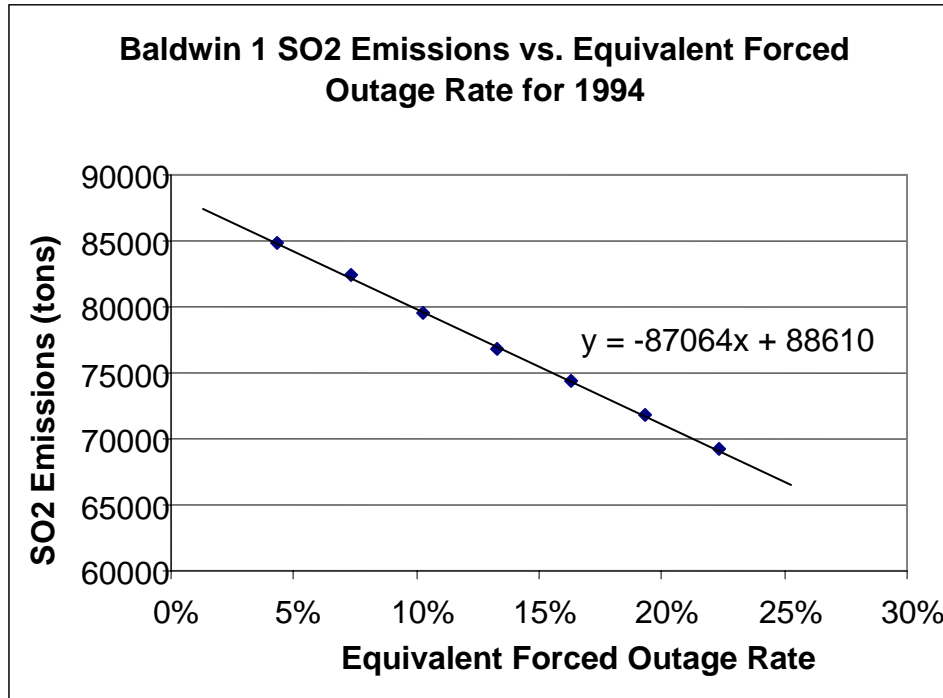


Figure G-4.



We also show results for cases with equivalent forced outage rates in each 3 percentage point increment from a low of 4.31% up to 22.31%. These continue the simple linear trend. Indeed, with all seven cases plotted on Figure 2 above, the capacity factor is shown to be linearly related to the equivalent availability factor. The graph of SO2 emissions (Figure G-3) shows that the SO2 emissions in turn are linearly related to capacity factor.

The relationships between these parameters (EFOR, EAF, CF, and SO2 emissions) are such that we can describe the relationships (for this unit for this year) with the slopes of the lines (shown on each graph). For example, in Figure G-2 (CF v. EAF) we see that the change in capacity factor is 0.863 percentage points for every one percentage point change in equivalent availability factor. Similarly, from the Figure G-3 (SO2 emissions v. CF) we see that the change in annual SO2 emissions is 1329 tons for every one percentage point change in CF. We can also state this in terms of the forced outage rate impact upon SO2 emissions as 871 tons of SO2 emissions increase for every one percentage point decrease in the equivalent forced outage rate (Figure G-4).

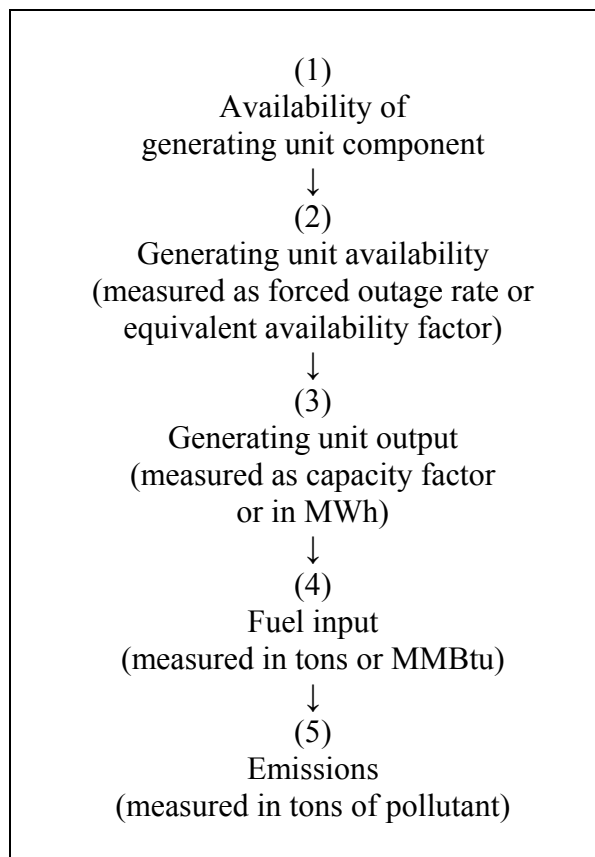
The numerical relationships will vary for other generating units and for other years. The general structure of the relationships, however, will be universally applicable. That is, holding all other parameters constant, one can expect the amount of generation from a unit to be higher if its availability rate is higher. One can also expect that this relationship will be roughly linear over a wide range for a reasonably large power system such as IPC's. Of course, changes such as the addition of emission control equipment or

fuel switching will alter the emission rates and, hence, the relationships of emissions to the other variables.

The high correlation is not surprising, of course, given the underlying principles that govern the operation of the system. That is, for any particular unit in any particular electric system, one can calculate the fraction of the time that the unit is actually operated out of the total time that the unit is available to operate. If the outages are decreased, then the unit will be available more of the time, but of that time it will only actually be operated for a portion. That portion will generally be similar to the overall utilization for the unit, since the additional hours are, by definition, distributed throughout the time period.

The logical progression of the relationships involved in translating a change in component availability to a change in emissions is as follows:

Figure G-5 Schematic of the Impact of Availability Upon Output



My PROSYM analysis shows a clear, direct, and nearly linear relationship between item 2, generating unit availability, and item 5, emissions. The connection between item 1, component availability and item 2, unit availability, is not something that is addressed by production costing models such as PROMOD and PROSYM. That relationship is

addressed in engineering calculations done to develop the inputs to the production costing model. For example, IP produced a table dated September 29, 1993 with "projected equivalent availability" for each of its generating units (IPPRO-0140554). That table has a note for the Baldwin unit 1 projection, indicating "[p]rojected equivalent availability improvement of 4.11% in 1994, 1995, 1996, 1997, and 1998 with the replacement of Baldwin 1 cyclones during the Fall 1992 outage." The change in unit EAF (in this case 4.11%) would be the result of a unit-specific analysis, that would then be an input to the production costing model. The model would then predict the impact of this change in unit availability upon generation and fuel use, which can then be used to estimate emissions. Based upon the PROSYM runs for 1994 discussed above, I estimate that a 4.11 percentage point increase in EAF at Baldwin 1 would have the following effects:

- Increase in capacity factor of 3.55 percentage points.
- Increase in generation of 173 GWh
- Increase in SO₂ emissions of 4,715 tons.