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RICHARD L. LEVITAN

SUMMARY

A management consultant experienced in electricity and natural gas procurement, competition, power and gas contracts, transmission pricing, transportation management, and market simulation analysis. Analytic expertise includes financial and economic analysis of conventional and renewable energy projects, pipeline transportation management, wholesale electric and gas procurement, generation and transmission asset valuation, and pipeline and storage due diligence.

PROFESSIONAL EXPERIENCE

- 1989 - **Levitan & Associates, Inc.**
 President
- 1980 - 1989 **Stone & Webster Management Consultants, Inc.**
 Vice President and Managing Officer (Boston)
 Vice President
 Executive Consultant
 Senior Consultant
 Consultant
- 1978 - 1980 **Pacific Gas & Electric Company**
 Economist

CONSULTING ASSIGNMENTS

AUCTIONS & PROCUREMENT

Advised the New Jersey Board of Public Utilities (BPU) on the Long-Term Capacity Agreement Pilot Program (LCAPP). In Agent capacity on behalf of the BPU, facilitated the implementation of the LCAPP Law, including development of Standard Offer Capacity Agreements culminating in the selection of 1,947 MW of new combined cycle plants under CfDs.

Responsible for Standard and Last Resort Service procurements for the Connecticut Department (Department) of Public Utility Control regarding Connecticut Light & Power Co's and United Illuminating's standard solicitations. Procurement oversight has been provided for 26 rounds since 2006.

Served as Independent Evaluator on behalf of the California Public Utilities Commission regarding Southern California Edison's Non-Gas QF Request for Offers (RFO), Gas RFO, and All Source RFO, including renewable energy proposals.

Provided testimony before the Department regarding the hedge benefits of long term contracts within the utilities' portfolios as well as other procurement options.

Served as "Prosecutorial" arm of the Department to support the selection of 540 MW of new peaking generation in Connecticut under long term cost of service contracts.

Prepared procurement paradigm and contract to support four Maryland electric distribution companies' (EDCs) long term resource requirements for the Maryland Public Service Commission.

Represented NSTAR on proposed 345 kV AC transmission project from Carver to Cape Cod to provide reliability benefits in Lower SEMA.

Provided technical support to four Massachusetts EDCs regarding long term renewable energy solicitation.

Responsible for due diligence to support the New York Power Authority's RFP#5. Provided transmission and regulatory assistance in PJM in relation to NYPA's selection of the Hudson Transmission HVDC project.

Managed project team's market advisory and quantitative assessment of generation, fuel deliverability, and DC transmission options for Long Island Power Authority's (LIPA's) 2007 RFP. Identified primary risk factors associated with competing long term strategic alternatives. Submitted expert reports to the Governor's Office to support long term transmission contract.

Managed project team's due diligence for LIPA regarding the election of Unforced Capacity Deliverability Rights (UDRs) on Neptune and Cross Sound Cable. Technical assessment covered transmission withdrawal rights, auction revenue rights, firm v. non-firm point-to-point transmission rights, and scheduling of internal bilateral transactions.

Advised LIPA on various procurement matters pertaining to Standard Market Design and fuel deliverability issues.

Evaluated wholesale procurement options for Arizona Public Service.

Evaluated wholesale procurement options for Salt River Project.

Evaluated wholesale procurement options for Phelps Dodge Corporation.

Evaluated retail procurement options for the Massachusetts Water Resources Authority.

Evaluated retail purchasing options for Abitibi Consolidated in Ontario and Quebec.

Evaluated retail purchasing options for Visy Paper in New York.

Represented Potomac Electric Power Co. in the transference of long term energy purchase contracts to Mirant.

TRANSACTION SUPPORT

Advised global investors on the acquisition of a wind portfolio in New York, New England, and PJM.

Represented AllCapital on the acquisition of power plants located in New York City.

Represented TransCanada on the acquisition of power plants in the Northeast.

Represented Con Edison in the acquisition of a major New England utility, including risk management review of wholesale power, oil, and natural gas trading operations throughout New England, New York, and PJM.

Represented Goldman Sachs in the acquisition of the 730 MW Linden generation asset in New Jersey.

Represented National Grid (Power Gen) on the acquisition of LG&E.

Provided market support for Public Service Resources Corporation on storage asset lease dispute under FERC jurisdiction.

Restructured long term power purchase agreements for Con Edison, including technical simulation analyses of replacement energy under Standard Market Design and NYSRC reliability procedures.

Restructured long term power purchase contracts for Puget Sound Energy, Potomac Electric Power Co., Commonwealth Electric, Public Service Electric & Gas, and Bonneville Power Administration.

Represented GPU Energy on retail services in New Jersey.

Advised various U.S. and international investors groups regarding the purchase of generation assets divested by the New England Electric System, Boston Edison,

Commonwealth Electric, Eastern Utilities Associates, Northeast Utilities, Pacific Gas & Electric Co., among others.

Represented Con Edison on the consensual termination of nine long term PPAs resulting in over \$1.5 billion in ratepayer savings, including transactional support before the NYPSC. Advised Con Edison on the securitization values of its QF portfolio, including all ancillary contracts covering gas supply, transportation, and steam.

Represented Puget Sound Energy, Commonwealth Electric, JCP&L, Bonneville Power Administration, Orange & Rockland Utilities, and PEPCO on the consensual termination of many long term PPAs.

Advised Associated Industries of Massachusetts on electric utility restructuring initiatives in New England.

Represented the Association Québécoise des Consommateurs Industriels d'Electricité (pulp and paper companies and aluminum smelters) on the potential restructuring of Hydro Québec.

Represented Bay State Gas Co. on the sale of a cogeneration and small power production facility.

Submitted expert testimony regarding competitive effects, market power effects, and opportunity costs attributable to NEES' transfer of non-nuclear assets to USGenNE.

LITIGATION SUPPORT

Served as project manager for Puget Sound Energy, Portland General Electric, Avista, Cascade Natural Gas, and Northwest Natural Gas Company on Gas Transmission Northwest rate case before FERC.

Served as expert witness for Southwest Gas Corporation on pipeline transportation matters before FERC.

Served as expert witness on behalf of NSTAR regarding its proposed 345 kV AC project submittal before the Massachusetts Facilities Siting Board.

Served as expert witness to eCORP on financial damages associated with AIG Highstar and West LB's administration of project loan covenants.

Provided litigation support to Con Edison regarding the merger with Northeast Utilities.

Provided support to Con Edison counsel on contract matters pertaining to cogeneration facilities in New York State and New Jersey.

Served as expert witness for Puget Sound Energy and Bonneville Power on diverse matters pertaining to Tenaska Ferndale, Tenaska Frederickson, Encogen and March Point.

Represented a financial estate on the matter of MMWEC's lawsuit arising from delays completing Seabrook.

Performed net income analysis of fossil generation facilities owned by Northeast Utilities and Public Service Co. of New Hampshire for property tax valuations.

Represented Salt River Project, Arizona Public Service Co., Phelps Dodge, Magma Copper, Asarco and Cyprus before FERC on multiple FERC dockets related to transportation management, cost of service and certificate proceedings. Represented same shipper group on FERC unbundling and compliance filings under open access.

Represented Wheelabrator-Frackville in its contract disputes with Pennsylvania Power & Light on min-gen emergencies and economic dispatch.

Evaluated pipeline alternative cost allocation methods, capacity release mechanisms, buy/sells, and other general rate case issues for the Arizona Directs. Assessed San Juan and East End certificate applications on gas deliverability and fuel sourcing decisions.

Provided expert testimony and litigation support on behalf of Pan Alberta Gas-U.S. on the matter of rolled-in rates on Pacific Gas Transmission.

Represented Northern Municipal Distributors Group and Midwest Region Gas Task Force Association, a group of gas utilities in eight states served by Northern Natural Gas Co., on Order 636 restructuring. Profiled member utilities' individual gas usage data for cooperative balancing and sourcing arrangements.

Represented New England Cogeneration Association before FERC regarding Northeast Utilities' merger with Public Service of New Hampshire. Conducted technical transmission interface analysis and market power concentration ratios.

Represented Industrial Gas Users group in Northern Nevada before FERC in Southwest Gas Co.'s spin-off of transmission properties to Paiute Pipeline Co.

Directed project team's assessment of El Paso Natural Gas Co.'s proposed off-peak firm transportation service on behalf of inland southwest gas and electric utilities. Analysis included system impacts on deliverability East of California, rate/revenue effects, and transportation service quality assessment.

Conducted fuel supply and transportation analysis on CNG and Columbia including expert testimony on behalf of Doswell Energy Ltd. Partnership in its civil litigation with Virginia Power.

Led project team's assessment of financial risk for major offshore Arctic pipeline (Endicott) owned by British Petroleum, Exxon, Amoco and UNOCAL. Performed analysis of Endicott risks for ratemaking capital structure and return under FERC's trended original cost methodology prescribed in Order Nos. 154-B and C (Williams).

Determined appropriate ratemaking capital structure and rates of return for the Cochin Pipeline under Williams methodology.

Assisted in the prudence determination of South Jersey Gas Co.'s Distrigas LNG take-or-pay commitments in light of FERC order No. 380 and merchant service options on Transco.

PROJECT FINANCIAL ANALYSIS (OTHER THAN DIVESTITURE RELATED)

Conducted real options valuation of the Newington Station for Public Service Company of New Hampshire.

Evaluated onshore and offshore wind project economics for NRG BluewaterWind, including financial assessment of loan guarantees and production tax credits.

Provided enterprise valuation of eCORP's Stagecoach ownership interest under option value measures.

Represented Westchester County on the potential decommissioning of the Indian Point nuclear power plants, including enterprise valuation analysis under Fair Market Value.

Represented Cornell University on the master energy plan for expansion of generation assets. Conducted real option value (ROV) analysis pertaining to solid fuel and natural gas based energy infrastructure improvements.

Represented University of Rochester on the selection and optimization of a cogeneration facility to meet UR's long term energy requirements.

Represented Rochester Institute of Technology on the selection and optimization of a cogeneration facility to meet RIT's long term energy requirements.

Represented The State University of New York on the development of combined heat and power facilities on 26 campuses.

Represented Great Bay Power Corporation's equity investors in the purchase of a minority share of the Seabrook station.

Evaluated financial merit of power technology options for the Massachusetts Water Resources Authority on Deer Island, including NStar's distribution rate unbundling proposal. Advised MWRA on modifications to operating procedures related to combustion turbine generators and gas economics through Duke Energy HubLine project.

Evaluated the competitive economic merits of rival steam and power production technology options to serve the UMass at Amherst's energy plant requirements.

Performed fuel-related contract restructuring services for various gas-fired generators throughout New England.

Served as financial advisor to the various pension funds holding Osceola and Okeelanta bonds resulting from Florida Power & Light's *de facto* termination of the PPAs.

Evaluated NUG profitability levels for various developers under alternative project financing arrangements for competitive solicitations.

Evaluated QF power purchase contracts using decision risk analysis for leverage lease transactions and non-recourse debt financing for thermal and hydro projects in various stages of development.

Evaluated the financial and business risks surrounding the proposed Champlain Pipeline Co. Supervised the market need assessment conducted by Stone & Webster to support Champlain's certificate application at FERC. Conducted cost of service study. Estimated third party gas requirements for electricity supply in New England.

Conducted gas valuation condemnation study for City of Mesa, AZ; determined economic value of Mesa's gas properties; advised City Council on strategic options with Southwest Gas.

Evaluated impact of the National Energy Board's proposed market-oriented price regime on TransCanada's transportation toll methodology.

Revised internal accounting procedures for capital budgeting techniques for Union Gas, CentraGas, and Gaz Metro in Ontario and Quebec.

Structured loan guarantees and price supports for Synthetic Fuels Corporation filing on behalf of New England Energy Park coal gasification facility.

Conducted comprehensive review of financial modeling capability of Energy, Mines and Resources (EMR), Canada for a national distribution system expansion program. Derived real cost of capital for EMR.

Performed financial analysis for the Territorial governments of Yukon and the Northwest Territories in regard to local gas distribution systems, small-scale LNG, and methanol.

RESOURCE ASSESSMENT

Represented the Connecticut Office of Consumer Counsel on the state's two EDCs' 2010 Integrated Resource Plan, including technical assessment of demand side initiatives, renewables, and natural gas infrastructure. Provided testimony before the Department regarding procurement recommendations over a 10-year horizon.

Represented NRG, TransCanada Power, and USPowerGen on NYISO Demand Curve Reset procedure, including the derivation of the Cost of New Entry and econometric determination of net energy profits.

Provided NSTAR with economic analysis and resource planning support regarding the reliability and economic benefits associated with a proposed high voltage transmission project in Southeast Massachusetts relative to continued reliance on existing generation.

Conducted engineering economic analysis of conventional generation and renewable technology options to meet Maryland's long term resource options for the Maryland Public Service Commission. Evaluated the impact of backbone transmission projects on congestion in SWMAAC. Evaluated onshore and offshore wind options. Assessed the economic merit of the return to rate base regulation in Maryland using stochastic modeling technique.

Conducted multiple studies on off-shore and onshore wind potential in New England for ISO-NE.

Represented Southwest Gas Co. on pipeline transportation options on El Paso before FERC.

Represented Avista, Portland General Electric, Puget Sound Energy, and Northwest Natural Gas on pipeline transportation service options and pricing on Gas Transmission Northwest, formerly Pacific Gas Transmission.

Conducted short and long term fuel price forecasts for ISO-NE.

Assessed fuel adequacy assessment for PJM, NYISO, and ISO-NE following hurricanes Katrina and Rita. Recommended risk mitigation measures for winter of 2005/2006.

Conducted due diligence on proposed off-shore LNG import terminals for the Massachusetts Department of Energy Resources.

Conducted due diligence on the proposed Broadwater Floating Storage Regasification Unit for LIPA, including homeland security, environmental, and economic impacts.

Provided support to ISO-NE Market Monitor regarding pipeline delivery conditions and market participant behavior during the cold snap of January 2004.

Advised PJM, Independent Electricity Operator of Ontario (formerly IMO), NY-ISO, ISO-NE, and NERC on pipeline and natural gas adequacy issues affecting bulk power security over four Northeast control areas. Managed project team's efforts for the ISOs and NERC to construct multi-region steady-state hydraulic models of pipeline deliverability.

Advised ISO-NE and NEPOOL System Restoration Working Group on restart procedures governing natural gas plants in New England following a black out. Responsible for steady-state and transient flow simulation analysis of New England's pipeline and storage infrastructure, including gas and electric contingencies.

Advised ISO-NE on fuel diversity issues associated with the potential retirement or conversion of the Salem Harbor generation station.

Assessed transportation deliverability constraints in the transient state on El Paso Natural Gas Co.'s pipeline network across metropolitan Phoenix for Salt River Project.

Advised Florida Power Light Energy on pipeline infrastructure adequacy on Tennessee Gas Pipeline.

Advised TransCanada on bulk power transmission limitations affecting market options in the Northeast.

Represented major Canadian pipeline company regarding the competitive impacts among merchant generators associated with rival commodity gas pricing arrangements.

Evaluated pipeline decontracting initiatives associated with consensual termination of a large QF's gas supply, transportation and energy purchase contracts for El Paso Merchant Energy.

Conducted market forecasts of merchant income streams for major merchant power producers in New England, New York, and PJM.

Evaluated the feasibility of inside-the-fence cogeneration for Phelps Dodge at primary rod mill production plant.

Evaluated the feasibility of inside-the-fence cogeneration for a large paper mill in the inland southwest.

Evaluated the feasibility of inside-the-fence cogeneration for the MWRA.

Assessed competitive economics and merchant risk of a proposed 1,500 MW pumped storage facility in Ohio for Consolidated Hydro. Negotiated long-term preliminary arrangements for pumping power with Commonwealth Edison.

Evaluated post-restructuring transportation and natural gas supply procurement options for conversion of Canal Unit #2. Conducted assessment of interruptible transportation quality and capacity release options on pipelines serving New England.

Evaluated power pricing and contract options for Enron Power's Milford project.

Advised HYDRA-CO Enterprise's "ChIEF" facility at the Domtar Mill in Cornwall, Ontario in response to Vermont Department of Public Service RFP.

Prepared Gas Company of Hawaii's Integrated Resource Plan, including demand side management. Analysis included formulation of DSM strategy and alternative propane supply acquisition strategies.

Conducted market analysis of New England utilities' long-term resource requirements for Texaco's integrated gasified combined cycle plant (IGCC).

Conducted inter-fuel substitution analyses for KeySpan.

Evaluated pipeline deliverability impacts attributable to El Paso's proposed San Juan Triangle and Northern Mainline expansions, and East End Manifold proposal for the Arizona Directs. Assessed pipeline interconnection arrangements on Northern Natural and Natural Gas Pipeline of America.

Assessed rival NO_x and SO₂ pollution control strategies, emission effects, and compliance costs for Clark Public Utility District, WA.

Responsible for audit of West Ohio Gas Co.'s gas purchase and transportation policies. Conducted management audit of West Ohio Gas purchasing practices under state mandated least cost planning standards.

Responsible for Stone & Webster's audit of Florida Power & Light Co.'s 1988 Resource Plan, including transmission effects and third party project development

potential. Assessed impact of Florida Gas Transmission Co.'s expansion on third-party gas use. Advised CEO on investment strategies and investor relations.

Project manager on engineering economic and financial assessment of Texaco's coal gasification technology; examined IGCC merits under various ownership structures; conducted preliminary market study of IGCC suitability in Florida and California.

Acted as project manager for economic/financial analysis of proposed IGCC for Florida Progress Corporation utilizing decision risk-evaluation techniques.

Determined market and resource/economic strategy for the proposed 1500 MW IGCC at New England Energy Park.

Served as project manager for technical/economic assessment of natural gas/liquid fuel substitution prospects in the province of Newfoundland/Labrador, and the Yukon and Northwest Territories.

Evaluated monetary / financial issues related to a natural gas optimization study for the Government of Argentina, Energy Ministry. Activities included derivation of shadow prices for tradable petroleum products and recommended gas rate tariffs at shadow prices.

Determined the economic feasibility of a proposed oil to coal conversion project for General Electric's Pittsfield Plant.

RETAIL & WHOLESALE CHOICE

Formulated risk management option programs for University of Rochester, Cornell University, Phelps Dodge, and Visy Paper.

Negotiated gas supply and transportation contracts for Texas Instruments. Profiled and aggregated gas and oil usage data from various plant facilities for purposes of energy procurement package.

Designed contract options for natural gas, oil and electricity for CareGroup, a network of Harvard hospitals in Massachusetts and Rhode Island.

Designed RFP and negotiated contracts for natural gas, oil and energy tolling for a Massachusetts municipal electric utility.

Represented L'Association des Industries Forestières du Québec (Quebec's association of pulp and paper manufacturers) in the matter of design and implementation of unbundled electricity rates under a new regulatory framework in Quebec.

Renegotiated intermediate term retail electricity contracts for Holoyke Industrials, a large group of energy users in Central Massachusetts.

Negotiated contracts for fuel and/or transportation services for various electric utilities in Arizona.

Valued Northern Natural Gas Co.'s Canadian gas supply and transportation contracts for Northern Illinois Gas Co. in the pipelines Order 636 reverse auction.

Renegotiated Paramount Resources gas supply agreement with Selkirk Cogeneration Ltd.

Negotiated preliminary Canadian gas supply contract for major proposed cogeneration venture in Eastern Ontario.

Obtained gas supply from major producer for South Jersey Cogeneration project.

Negotiated gas and transportation contracts with British Gas on behalf of Lakeland Energy (the first commercial IPP in U.K.). Also led consortium negotiations for power sales agreement with the North Western Electricity Board.

Negotiated power sales agreements for first planned coal gasification facility in New England with Boston Edison, EUA, and MMWEC.

Assisted in the formulation of transportation contracts between New England utilities and Champlain Pipeline Co.

Negotiated power sales agreements for various hydro small power producers with Southern Company affiliates, and various California and New England utilities.

Conducted analysis of power contract pricing terms and conditions, including wheeling provisions, for various cogeneration projects.

Formulated tipping fees and steam power values for proposed Puerto Rican biomass facility. Negotiated letters of intent with cities of San Juan and Guaynabo.

Designed terms and conditions for interruptible and curtailable contract rates for Barbados Light & Power Co.

DUE DILIGENCE

Evaluated transmission requirements and economic impacts associated with firm transmission withdrawal rights to support NYPA's proposed merchant connection to the PJM.

Derived generation asset portfolio value of existing gas assets in New England for Exelon.

Advised Goldman Sachs on the acquisition of a large gas-fired power plant in New Jersey.

Responsible for project financial valuations underlying generation asset valuations for international investors acquiring generation assets in New England, New York, and PJM.

Evaluated LG&E's market exposure in SERC for PowerGen.

Conducted due diligence on behalf of BankBoston regarding Constellation Power's acquisition of EDE Noreste in Panama.

Evaluated short list respondents' fuel supply plans for Clark Public Utilities District.

Provided senior lenders with technical opinions regarding the (re)financing of power plants in New York State.

Analyzed California border and burner-tip gas prices affecting contract avoided costs in loan covenants for Deutsche Morgan Grenfell.

Responsible for Stone & Webster's engineering and financial / economic assessment of Reading Culm circulating fluidized bed facility, including fuel and power purchase contracts with Pennsylvania Power & Light Co. for The Deerpath Group.

Responsible for Stone & Webster's economic, financial, and regulatory risk analysis for The Deerpath Group, the lessor of the 1370 MW Midland Cogeneration Venture.

RATE DESIGN

Evaluated transmission tariff options in PJM, New York and New England for import / export from New York State.

Evaluated Noreste's distribution rates in Panama under alternative performance based ratemaking methods.

Evaluated commercial implications of various utility unbundling mechanisms for purposes of installing inside-the-fence cogeneration or third-party energy procurement.

Derived transportation rates and competitive impacts under roll-in versus incremental tolling proposals for shippers on Northwest Pipeline, Pacific Gas Transmission, El Paso Natural Gas, Iroquois, and others.

Performed technical rate calculations for LDCs and electric utilities. Conducted or assisted in the preparation of marginal costs studies for electric and gas utilities throughout the U.S., Canada and Barbados.

Assessed the refunctionalization of El Paso's and Northwest's transportation rates under FERC Policy Statement and Orders 637/636/500.

Formulated rates for firm/non-firm cogeneration purchases for various utilities. Applied various revenue reconciliation methods for marginal cost-based rates.

Evaluated Bonneville Power Administration's trigger price rate proposal for Intalco Aluminum Co., an aluminum manufacturer in the Pacific Northwest.

Determined promotional off-peak power rates for Barbados Light & Power; measured avoided capacity and energy costs for both utilities and prospective QFs throughout U.S.

PRIOR BACKGROUND

UTILITY EXPERIENCE

Conducted production simulation analysis to support long term cogeneration rates for standardized contracts for Pacific Gas & Electric Co. Assisted in cost of service studies and rate cases (1978-1980).

OTHER INDUSTRY

Evaluated the impact of airline deregulation on the major U.S. trunk carriers as a Research Assistant at the Harvard Business School (1977-1978).

EXPERT TESTIMONY (ADMINISTRATIVE ONLY)

Federal Energy Regulatory Commission

- Pan Alberta Gas (Pacific Gas Transmission)
- Con Edison Co. (Decertification)
- Con Edison and Central Hudson Gas & Electric (Information Disclosure)
- Arizona Directs (El Paso Natural Gas Co., multiple dockets)
- Northern Municipal Distributors Group (Northern Natural Gas Co.)
- New England Cogeneration Association (Northeast Utilities)
- Northern Nevada Industrial Gas Users (Paiute Pipeline Co.)
- East-of-California Customer Group (Mojave Pipeline Co.)
- Dome Petroleum Ltd. (Cochin Pipeline Co.)
- Endicott Pipeline Co. (British Petroleum, Exxon, UNOCAL, Amoco)

Connecticut Department of Public Utility Control

- United Illuminating Company (thirteen rounds)
- Connecticut Light & Power Company (thirteen rounds)
- Peaking Docket (Prosecutorial Arm)
- Office of Consumer Counsel (IRP docket)

New York Public Service Commission

- Consolidated Edison Co. (nine dockets)
- Orange & Rockland (three dockets)

New Jersey Board of Public Utilities

- Orange & Rockland (three dockets)
- GPU Energy

Hawaii Public Utility Commission

- The Gas Company of Hawaii

Maryland Public Service Commission

- Eastalco Aluminum Company

Massachusetts Department of Telecommunications and Energy

- Enron Capital & Trade

Massachusetts Department of Telecommunications and Energy

- NStar

New Hampshire Department of Public Utilities

- Enron Energy Services

Rhode Island Public Utilities Commission

- Enron Energy Services

Public Service Commission of Ohio

- West Ohio Gas Co.

Bonneville Power Administration

- Intalco Aluminum Co.

California Public Utilities Commission

- Pacific Gas and Electric Co.

Indiana Public Service commission

- Southern Indiana Gas and Electric Co. (multiple dockets)

Régie De L'Énergie du Québec

- L'Association des Industries Forestières du Québec

EXPERT TESTIMONY (JUDICIAL – AVAILABLE UPON REQUEST)

EDUCATION

Cornell University, B.A., Liberal Arts, 1975 (Phi Beta Kappa).

Harvard University, Masters, with specialization in Energy Economics, 1978.

Stanford University, Post-graduate Industrial Organizational Management Program, Department of Electrical Engineering, 1979.

INDUSTRY PRESENTATIONS & PUBLICATIONS

“Leaning on Line Pack,” Public Utilities Fortnightly,” January 2011.

“Growth Prospects for Appalachian Gas: Good Access Trumps Market Fundamentals,” Platts 3rd Appalachian Gas Conference, October 2010.

“Future of Natural Gas in New England and Interaction with Electricity Markets,” New England Roundtable, April 2010.

“Managing Inter-Dependencies Across Gas and Electricity,” Carnegie Mellon University, Department of Electrical Engineering, December 2008.

“Capacity Price Frameworks in the Greater Northeast: Can you take them to the bank?” Infocast, Washington, D.C., June 2007.

“North American Gas Demand: How Gas & Power Markets are Reacting to Higher Prices and Weather Effects,” Zeus Development Forum, Houston, December 2006.

“Does the Northeast Energy Market Grade an ‘A,’ ‘F’ or Something in Between?” LNG Express, Boston, September, 2006.

“Functionality of Northeast Capacity Markets Under RPM, the Demand Curve and LICAP,” Northeastern Power Supply Forum, Infocast, Philadelphia, June 2006.

“How Much Gas is Enough? Finding Incentives to Lessen the Gas Overbuild,” Platts Northeast Power Markets Forum, Washington, D.C., March 2006.

“How LNG fits into the Regional Market,” New England Roundtable, Boston, February, 2006.

“Outlook on Natural Gas and LNG in New England,” New England Roundtable, November, 2004.

“Market Dynamics Driving LNG Growth Prospects,” INFOCAST, Boston, October 2004.

“An Outlook on Gas Commodity Prices and Market Fundamentals in The Northeast,” before The Energy Committee of The New York Bar Association, New York, April 2003.

“Value Drivers Affecting Pipeline & Storage Entitlements,” INFOCAST, Houston, September 2002.

“The Big Picture on Power Market Dynamics and Storage,” INFOCAST, Houston, June 2002.

“2002 Outlook on Gas Supply and Deliverability,” INFOCAST, Boston, January, 2002.

“Technical Assessment of New England’s Natural Gas Pipeline Adequacy,” on behalf of Independent System Operator- New England, before New England Association of Energy Engineers, April, 2001; U.S. Department of Energy, Wye Workshop on Strategic Initiatives for Coal and Power, March, 2001; Northeast Energy and Commerce Association, March, 2001; Boston Bar Association, February, 2001; Massachusetts Roundtable, February, 2001; NEPOOL Reliability Committee, January, 2001; and, NEPOOL Participants Committee, January, 2001.

“Forecasting Equity Returns for Merchant Power,” INFOCAST, Atlanta, GA, September, 2000.

“Maximizing the Value of QFs and IPPs in a Restructured Environment,” INFOCAST, Santa Monica, CA, July 2000.

“Valuing Transmission and Distribution Assets,” INFOCAST, Orlando, FL, January, 2000.

“Build v. Buy: New Commercial Benchmarks,” International District Energy Association, Boston, MA, June, 1999

“Monetizing Key Value Drivers,” INFOCAST, Buying & Selling Utilities’ Generation Assets, Boston, MA, November, 1998.

“A Business Perspective on the Competitive Transition of the Electric Utility Industry,” American Bankruptcy Institute’s Fifth Annual Northeast Bankruptcy Conference, Falmouth, MA, July 1998.

“Uncertain ESCO Margins in New England’s Transitional Energy Markets,” Con Edison Energy conference on Supplying New Retail Markets, New York City, June 1998.

“PPA Buyouts and Restructurings: War Stories from the Trenches,” Exnet conference on Industry Restructuring, Washington, D.C., 1997.

“Monetizing NUG Opportunity Costs,” Sloan School of Management, Massachusetts Institute of Technology, August 1996.

“Natural Gas Procurement Options for Power Generators in New England,” presented to New England Cogeneration Association’s New England Gas Markets Conference, May, 1995.

“The Emerging Secondary Market for Idled Transportation Capacity in the Northeast,” presented to Executive Enterprise’s Northeast Gas Markets Industry Conference, April, 1994.

“Outlook for Gas-Fired Electric Power Generation in the Northeast through 2000,” presented to Executive Enterprise’s Northeast Gas Markets in the Post 636 Environment, November, 1993.

“Gas Supply and Transportation Contract Issues: Implications for Cogeneration Project Financing,” presented to annual symposium on Energy Planning sponsored by Niagara Mohawk Power Corporation, May, 1993.

“A Post-Merger Outlook on Wheeling in New England: FERC Precedent Cloaked in a Merger,” presented to Executive Enterprise's Second Annual Northeast Power Market Conference, May, 1992.

“Transmission of Non-Utility Generation in New England,” presented to Executive Enterprise's Third Annual Industrial & Utilities Conference, Chicago, IL, October 1990.

“Capital Structure and Rate of Return for Regulated Entities: the State Perspective v. FERC's View, Accounting Association of Oil Pipelines,” Houston, Texas, February, 1986.

“Demand-Side Management (DSM) Technologies for Island Utilities,” St. Lucia West Indies, September, 1985.

“Alternative Marginal Cost Methodologies since PURPA,” Center for Professional Advancement, New Brunswick, NJ, May, 1983.

“Utility Resource Selection-Decisions and New Challenges,” Department of Electrical Engineering, Tufts University, April, 1982.

Participated in biannual Stone & Webster Utility Management Development Program on gas price and Federal regulatory developments, cogeneration and marginal costs, 1982-1989.

ASSOCIATIONS (Current and Past)

American Gas Association

International District Energy Association

Northeast Gas Association

Northeast Energy and Commerce Association (prior Board Member)

RICHARD L. CARLSON, Ph.D.

SUMMARY

Economics consultant and model developer experienced in wholesale power and natural gas procurement methods and contracts evaluation; wholesale electric market performance and market power; real options valuation analysis of thermal, wind, biomass, and hydro resources; stochastic modeling of commodity market prices, load, and hydro and wind energy; power and fuels portfolio risk-reward optimization; emissions compliance; integrated resource planning; due diligence of power and natural gas issues; socio-economic cost-benefit analysis; regional economic impacts analysis; econometric and optimization modeling techniques; and energy software product management.

PROFESSIONAL EXPERIENCE

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|-------------|---|
| 2008 - | Levitan & Associates, Inc.
Managing Consultant |
| 1998 - 2008 | Ventyx, Inc. (previously Global Energy Decisions, LLC and Henwood Energy Services, Inc.)
Vice President of New Solutions, Software
Assistant Vice President of Research, Software
Director of Planning and Risk Analytics, Software
Product Manager, Software
Senior Project Manager, Consulting
Project Manager, Consulting |
| 1992 - 1998 | The Goodman Group, Ltd.
Senior Economist
Economist |
| 1986 – 1991 | Economics Plus, Inc.
Principal |
| 1981 – 1985 | Queens College, City University of New York
Assistant Professor
Instructor |
| 1981 – 1986 | Center for the Biology of Natural Systems, Queens College
Research Associate |
| 1978 – 1981 | Center for the Biology of Natural Systems, Washington University (St. Louis)
Research Associate |

CONSULTING ASSIGNMENTS

Procurement and Asset Valuation

Independent evaluator to the California Public Utilities Commission for Southern California Edison's 2011 All Source RFO.

Independent evaluator to the California Public Utilities Commission for Southern California Edison's Summer 2011 Gas RFO.

Prepared portions of the New Jersey Board of Public Utilities 2011 Long-Term Capacity Agreement Pilot Program (LCAPP) RFO for procurement of 2,000 MW of new non-peaking capacity, and performed regional economic impact analysis, due diligence and financial evaluation of proposals that resulted in selection of three new combined cycle plants under capacity contracts-for-differences.

Advised an offshore wind developer in preparation of the pricing, PPA terms, and project socioeconomic benefits of a 350 MW proposal response to an RFP.

Developed a Monte Carlo real options valuation model of a dual fuel generating station and prepared a continued unit operation report for Public Service Company of New Hampshire for its 2010 Least Cost Integrated Resource Plan filing to the New Hampshire Public Utilities Commission.

Developed a REC price forecast for four Massachusetts LSEs.

Advised a New England LSE in developing an RFP for procuring energy and RECs under long-term contracts, and developing methods for evaluation of bids from wind farms and wood biomass plants.

Prepared an energy, REC, and capacity market valuation and risk analysis report for an investment bank interested in the purchase of existing and planned wind farms in New England and New York.

Developed a REC price forecast benchmark procedure for Illinois REC auction procurement by the Illinois Power Agency on behalf of Ameren Illinois.

Developed a statistical optimization model framework to aid two New England LSEs in determining the number of bids to accept in standard service power procurement auctions while maintaining laddering diversification.

Developed a credit risk model of potential future exposure for a New England LSE to apply in setting collateral rules for power contracts.

Prepared a market simulation and risk analysis report for an investment bank interested in the purchase of three existing coal plants in PJM.

Directed independent valuation assessments for several power plant structured financings and presented conclusions to prospective investors as advisor to asset owners and their investment banks.

Forecasted electric energy and ancillary services prices for generation asset valuation studies for numerous utility and generating company clients.

Integrated Resource Planning and Renewable Energy

Led implementation and training engagements on the use of the System Optimizer software for integrated resource planning, emissions compliance planning, and hydro storage optimization for PacifiCorp, TVA, and BC Hydro, and trained the trainers for many other client software implementations.

Designed, directed development, and implemented a software tool that uses historical simulation of wind energy for a European utility company.

Designed, directed coding, and directed implementation and training of a tool for a large hydro utility that uses historical simulation of hydro inflows and statistically adjusts Monte Carlo simulation of power prices and loads, accounting for their partial correlations.

Coauthored a client report analyzing the need for large hydroelectric projects in Quebec.

Portfolio Risk Management

Presented workshops to U.S. and European electric utility and generation companies on portfolio risk management concepts and strategies, stochastic modeling, and real options analysis.

Directed development and implementation of a stochastic portfolio simulation and financial hedging optimization modeling system for an electric utility company.

Energy and Commodity Market Analysis

Developed hybrid simulation models of hourly energy prices and monthly hydro energy that combine historical simulation and stochastic process simulation techniques.

Developed econometric models for ancillary services price forecasting and multi-product bidding strategies for generation company clients, and prepared client reports on DAM-RTM bidding strategies.

Prepared analysis of avoided costs for an association of small hydro producers in North Carolina.

Prepared a client report on surface coal mining costs in the Southwest.

Led a team that prepared a client report on pulp and paper industry economics.

Developed a national market model and report of joint food and energy production from U.S. agriculture; developed regional market models for U.S. DOE and the Ford Foundation.

Compared alternative municipal solid waste disposal methods using cost and risk modeling with grants from the Veatch Foundation, the J.M. Kaplan Fund, and the New York State Assembly Commission on Solid Waste Management.

Led studies funded by the U.S. Dept. of Energy and the Ford Foundation re the economic potential for fuel ethanol production. Testified before the U.S. Congress Joint Economic Committee Energy Subcommittee, spoke to the U.S. Departments of Energy and Agriculture, and interviewed by National Public Radio on the study results.

Regulation

Performed an economic cost-benefit analysis of the Exelon and Constellation merger for the Staff of the Maryland Public Utilities Commission.

Performed due diligence for a group of generating companies regarding the NYISO 2010 ICAP Demand Curve Reset evaluation and presented results of alternative econometric models to the NYISO ICAP Working Group and to FERC.

Developed Monte Carlo risk simulation framework for fuel, REC, and GHG prices, forecasts of REC prices and regional wind farm capacity expansion, and energy bid-cost markup model for a potential generation re-regulation study for the Maryland Public Service Commission.

Prepared the economic analysis portion of a joint affidavit to FERC re the need for a risk adder for the rate of return on a transmission project in Maine for remote wind farm development.

Developed and applied a Cournot pivotal player model of market power for the Alberta Independent Assessment Team's evaluation of alternative PPA auction rules for the deregulation of electricity generation via virtual divestiture of thermal generation units.

Developed econometric models for the California ISO for ancillary services price forecasting and monitoring of potential market power.

Coauthored a client report on alternative incentive regulation systems.

Prepared reports to the Maine Public Utilities Commission staff and testimony to the Ontario Energy Board re the need for special discount rates for large industrial customers.

Prepared a client report on industrial cogeneration economics and the issue of "cross-hauling."

Prepared testimony to FERC on behalf of interveners re the market power analysis submitted by H.Q. Energy Services (U.S.) Inc. in its application for market-based rates.

Prepared testimony to FERC on behalf of interveners re the market power analysis submitted by NEPOOL in its application for market-based rates.

Litigation Support

Prepared portion of testimony to FERC on natural gas transportation rates for a western gas company.

Preparing portion of testimony on the reasonableness of excluding a merchant power plant from bidding in an RFP for a PPA.

Prepared testimony on the accuracy of contract payments for a PURPA project owner.

INDUSTRY EXPERIENCE

Managed software product development of the Ventyx EnerPrise software System Optimizer, Planning and Risk, and Market Data Warehouse modules. Prepared market requirements documents, marketing documents and presentations, functional specifications documents, technical documents, and user guides. Supervised quality control and support issues, managed new version software implementations, trained programming, implementation, and support staff and clients in the uses of the software, and provided technical support to sales executives and clients.

Advised energy trading and risk management (ETRM) product managers on risk analytic methods to include in the product.

Directed programming teams in migrating statistical analysis and risk-reward optimization modules, the System Optimizer product, and the Planning and Risk product from independent applications into modules integrated within the SQL Server-based enterprise software system.

Directed software implementation and training staff on numerous client projects involving initial or upgrade implementation of the System Optimizer product, the Planning and Risk product, and the Market Data Warehouse product.

Led a cross business unit team in charge of packaging and marketing of integrated (data, software, consulting) emissions management solutions.

Assessed the market for providing web-based electricity market analytics and portfolio simulation software to financial firms (investment banks and energy hedge funds).

Presented webinars and seminars to North American, European, and Pacific Rim software and advisory clients on planning, portfolio optimization, stochastic modeling, real options analysis, and risk management topics.

Prepared custom implementation solutions for European, U.S., and Canadian software clients, involving a mix of software development and application consulting.

Designed, coded, and documented capacity expansion, emissions compliance, and hydro storage optimization components of the System Optimizer module, and the mean reversion Monte Carlo simulation, statistical estimation, and risk-reward optimization components of the Planning and Risk module.

Developed the Energy, Economic, and Environmental Analysis System (E³AS), a software program and database system funded by U.S. EPA for use by state government agencies in regional inter-industry input-output analysis of employment and air emissions impacts of state-wide energy supply and demand-side management programs.

Developed the Second Opinion software product for economic and financial analysis of investments in solid waste management systems, for use by state and local government agencies.

EDUCATION

Ph.D., Natural and Human Resource Economics (Agricultural and Applied Economics),
University of Wisconsin – Madison, 1984

M.A., Natural and Human Resource Economics (Agricultural and Applied Economics),
University of Wisconsin – Madison, 1975

M.A., Natural Resource Economics (Agricultural and Applied Economics), Washington
State University, 1973

B.S. with Distinction, Agricultural and Applied Economics, Washington State University,
1973

EXPERT WITNESS / REGULATORY EXPERIENCE

Maine Public Utilities Commission: Docket 92-331; Airco industrial Gases Request for Interruptible Load Retention Service Rate with Central Maine Power Company; for Maine Public Utilities Commission Staff (July 9, 1993); Supplemental Testimony (August 10, 1993). Development of criteria for special discount rates and analysis of need for special discount rate in instant case (with I. Goodman and R. McCullough).

Maine Public Utilities Commission: Docket 93-147; Central Maine Power Company Petition for a Certificate of Public Convenience and Necessity to Erect a Transmission Line Carrying 100 Kilovolts or More in York County; for Maine Public Utilities Commission Staff (September 21, 1993). Review of need and alternative routes (with I. Goodman and W. Scott).

Ontario Energy Board: E.B.L.O. 246 Amended; 1994/95 Trafalgar Facilities Expansion Program of Union Gas Ltd.; for Pollution Probe Foundation (April 4, 1994); Supplemental Oral Direct Testimony (April 22, 1994). Review of need for gas transmission system expansion (with I. Goodman).

Ontario Energy Board: H.R. 22; Ontario Hydro 1995 Rates Proceeding; for The Green Energy Coalition (June 2, 1994). "Economic Implications of Ontario Hydro Special Industrial Rates" (with I. Goodman).

Ontario Energy Board: H.R. 22; Ontario Hydro 1995 Rates Proceeding; for Nishnawbe Aski Nation and Grand Council Treaty #3 (June 2, 1994). Development and equity concerns of rates proposal on Native American communities (with I. Goodman).

Maine Public Utilities Commission: Docket 92-345, Phase II; Central Maine Power Company's Proposed Increase in Rates; for the Office of the Maine Public Advocate (June 15, 1994). Assessment of DSM impacts of adopting proposed Alternative Rate Plan (with I. Goodman).

Maine Public Utilities Commission: Docket 93-320; Central Maine Power Company and Keyes Fibre Company, Joint Request for Investigation of Special Contract Tariff; Maine Public Utilities Commission Staff (August 1994). "Staff Report and Recommendation Re: Keyes Fibre-CMP Special Rate Contract" (with D. Sipe).

Ontario Energy Board: E.B.R.O. 486; Union Gas Ltd. 1995 Rates Hearing; for Pollution Probe Foundation (December 5, 1994). "Review of Avoided Cost Methodology and Results" (with I. Goodman).

Ontario Energy Board: E.B.L.O. 251; 1995/96 Trafalgar Facilities Expansion Program of Union Gas Ltd.; for Pollution Probe Foundation (May 5, 1995). Review of need for gas transmission system expansion (with I. Goodman).

Ontario Energy Board: H.R. 23; Ontario Hydro 1996 Rates Proceeding; for The Green Energy Coalition (June 16, 1995). "Economic Implications of Ontario Hydro Special Industrial Rates" (with I. Goodman).

Ontario Energy Board: E.B.L.O. 251 (Updated); 1996/97 Trafalgar Facilities Expansion Program of Union Gas Ltd., for Pollution Probe Foundation (February 8, 1996). Review of need for gas transmission system expansion (with I. Goodman).

Ontario Energy Board: H.R. 24; Ontario Hydro 1997 Rates Proceeding; for The Green Energy Coalition (June 11, 1996). “Economic Implications of Ontario Hydro’s Proposed 1997 Optional Rates” (with I. Goodman).

Ontario Energy Board: E.B.R.O. 493/494; Union Gas Ltd./Centra Gas Ontario, Inc. 1997 Rates Hearing; for Pollution Probe Foundation (September 6, 1996). “Review of Avoided Cost Methodology and Results” (with I. Goodman).

Federal Energy Regulatory Commission: Docket Nos. ER97-1079-000, OA97-237-000; Applications for Market-Based Rates by NEPOOL; for The Grand Council of the Crees (of Quebec) and The New England Coalition for Energy Efficiency and the Environment (July 1, 1997). Review of NEPOOL’s “Market Power Analysis” and “Market Power Mitigation Procedure” submissions (with I. Goodman).

Federal Energy Regulatory Commission: Docket No. ER97-851-000; Application by H.Q. Energy Services (U.S.) Inc. for Market-Based Rates; for The Grand Council of the Crees (of Québec) and The New England Coalition for Energy Efficiency and the Environment (August 19, 1997); Supplemental affidavit (September 25, 1997). Review of HQUS’ market power analysis (with I. Goodman).

Federal Energy Regulatory Commission: Docket No. EL08-77-000; Petition for Declaratory Order Authorizing Incentive Rates for Central Maine Power Company and Maine Public Service Company for the Maine Power Connection Project; Joint Affidavit for the Connecticut Department of Public Utility Control (August 29, 2008). Review of the costs and benefits of the transmission project related to proposed wind farm development (with B. Shapiro).

Maryland Public Service Commission: Case No. 9271; Merger of Constellation Energy Group, Inc. and Exelon Corporation; for the Staff of the Maryland Public Service Commission; Prepared Panel Direct Testimony (September 16, 2011). Cost-benefit analysis of the economic benefits of the merger for BGE and Maryland.

Maryland Public Service Commission: Case No. 9271; Merger of Constellation Energy Group, Inc. and Exelon Corporation; for the Staff of the Maryland Public Service Commission; Prepared Panel Surrebuttal Testimony (October 26, 2011). Cost-benefit analysis of the economic benefits of the merger for BGE and Maryland.

PUBLICATIONS AND SELECTED TECHNICAL DOCUMENTS

System Optimizer 2.1 User Guide, Global Energy Decisions, 2007.

Capacity Expansion 1.3 User Guide, Global Energy Decisions, 2006.

The Seven Deadly Sins of Planning and Risk Management for Power Companies, Global Energy Decisions, Briefing Report, 2005.

Theo User Guide, Global Energy Decisions, 2004.

Theo Models Documentation, Global Energy Decisions, 2004.

Forward to Spot Price Model Stochastic Parameter Calibration, Henwood Energy Services, Inc., Technical Report, April 2004 (with Wei Liu).

Documentation for Henwood Stochastic Model Parameter Estimation, Henwood Energy Services, Inc., Technical Report, Feb. 2003.

“Risk Analytics,” *Energy Markets*, February 2002, p. 68.

“Simulations of Alternative PPA Holding Restrictions”, Prepared for the Alberta Independent Assessment Team, Sept. 28, 1999 (with G. Given and R. Schiffman).

Energy, Economic, and Environmental Analysis System (E3AS) User’s Guide – Version 2, Prepared for the U.S. Environmental Protection Agency, The Goodman Group, Ltd., July 1998 (with B. Krier and I. Goodman).

Employment, earnings, and Environmental Impacts of Regional Improvements in Energy Efficiency, Prepared for the Southern States Energy Board, Dec. 1996 (with B. Krier and I. Goodman).

North Carolina State Energy Supply Plan for Use with E3AS, Prepared for the North Carolina Dept. of Commerce Energy Division, Nov. 27, 1996 (with I. Goodman).

Energy, Economic, and Environmental Analysis System (E3AS) User’s Guide, Prepared for the Southern States Energy Board, The Goodman Group, Ltd., May 1996 (with B. Krier and I. Goodman).

“Guidelines for Granting Industrial ‘Distress’ Rate Discounts,” *Public Utilities Fortnightly*, January 15, 1995 (with D. Sipe).

The Potential for Cogeneration in the Quebec Pulp and Paper Industry, Prepared for The Grand Council of the Crees of Québec. The Goodman Group, Ltd., December 1993 (with I. Goodman, E. Titus, G. Breton and L. Vanasse).

Economic Analysis of Black Mesa Mine Profitability, Prepared for the Alternative Coal Transport Study, Economic Analysis for the Hopi Tribe, The Goodman Group, Ltd., September 1993.

Economic Evaluation of Ontario Hydro’s Proposed Moose River Basin Hydroelectric Projects, Prepared for the Moose River/James Bay Coalition in the Ontario Hydro Demand/Supply Plan Hearing, The Goodman Group, Ltd., and McCullough Research, December 1992 (with I. Goodman, R. McCullough and W. Huddleston).

Incentive Regulation Theory and Practice, Prepared for the Public Interest Advocacy Centre, Ottawa, Canada, The Goodman Group, Ltd. and Econanalysis Consulting Services Inc., November 1992 (with B. Alexander, I. Goodman and J. Todd).

Second Opinion: Municipal Solid Waste Disposal Model User’s Guide, Economics Plus, Inc., 1989.

“The Impact of Materials Recycling Programs on Energy Recovery Facility Economics,” *Journal of Resource Management and Technology* 15, March 1986, pp. 28-36.

Environmental and Economic Analysis of Alternative Municipal Solid Waste Resource Recovery Technologies, Report to the Veatch Foundation, New York: Center for the Biology of Natural Systems, Queens College, July 1985 (with T. Webster, B. Commoner, and M. McNamara).

“Alcohol,” in J. Ridgeway, ed., *Powering Civilization: The Complete Energy Reader* (New York: Pantheon Books, 1982) (with D. Freedman, N. Jacobstein, J. Kendell, R. Schneider, and H. Winger).

The New York Metropolitan Area Produce Market: A New Opportunity to Preserve Long Island Farmland, Report to the J. M. Kaplan Fund, New York: Center for the Biology of Natural Systems, Queens College, July 1982 (with L. Herman, T. Goldfarb and B. Commoner).

Economic Evaluation and Conceptual Design of Optimal Agricultural Systems for Production of Food and Energy, Final Report to the U.S. Department of Energy (Washington: US GPO, March 1982) (with D. Freedman, N. Jacobstein, R. Schneider, H. Winger and B. Commoner).

“The Technical Potential for Alcohol Fuels from Biomass,” *Farm and Forest Produced Alcohol: The Key to Liquid Fuel Independence*, Paper submitted to the Subcommittee on Energy, Joint Economic Committee, U.S. Congress, 22 August 1980 (Washington: US GPO, 1990) (with D. Freedman, N. Jacobstein, J. Kendell, R. Schneider, and H. Winger).

“Integrated Food-Energy Production Analysis,” *Alcohol Fuels Policy: Part I Energy Self Sufficiency for Rural America*, Hearings before the Subcommittee on Energy, Joint Economic Committee, U.S. Congress, 17 March 1980 (Washington: US GPO, 1980).

A Critique of ‘The Report of the Alcohol Fuels Policy Review’, Report to the U.S. Department of Energy, Center for the Biology of Natural Systems, Washington University, September 1979 (with B. Commoner and D. Freedman).

Ethanol’s Role in the Current Gasoline Crisis, Report to the Gasohol Caucus, U.S. Congress, 25 June 1979, Center for the Biology of Natural Systems, Washington University, 1979 (with B. Commoner, R. Scott and D. Freedman).

The Economic Potential of On-farm Energy Production Systems, Report to the Ford Foundation, Center for the Biology of Natural System, Washington University, January 1979 (with B. Commoner, D. Freeman and R. Scott).

“The Effects of Property Taxes and Local Public Services upon Residential Property Values in Small Wisconsin Cities,” *American Journal of Agricultural Economics* 59 February 1977, pp. 81-87 (with M. McMillan).

CONFERENCE PRESENTATIONS

“Procurement of Resources via Auctions”, EUCI “Resource and Supply Planning” Conference, Arlington, VA, March 24, 2010.

“Portfolio Optimisation and Risk Management: Practical Applications”, EMART Energy, Pre-Conference Seminar, Amsterdam, Nov. 20, 2007.

“Risk Analysis for an Asset-Centric Portfolio”, EUCI “Risk Management 101” Conference, New York, June 20, 2007.

“Managing Risks of Asset-Centric Portfolios”, EUCI “Risk Management 101” Post-Conference Workshop, New York, June 21, 2007 (with J. Teofilo).

“An Integrated Approach to Portfolio Optimization for a Power Company”, EUCI “Managing Physical and Financial Uncertainty in the Power Industry” Conference Dinner Workshop, New York, August 2, 2006.

“Portfolio Optimization Theory and Practice for Electric Generators and Load-serving Entities”, EUCI Conference, “Portfolio Optimization for Electric Utilities” New York, June 26, 2003.

“Estimating and Modeling Electricity and Fuel Price Volatility: A Comparison of Approaches,” Infocast Conference, “Market Price Volatility,” Houston, May 2, 2002.

“New Methods of Evaluating Assets in the Electric Industry”, UTILICON 2001 Conference, Melbourne, July 25, 2001.

“Portfolio Optimization in Volatile Wholesale Energy Markets”, EUCI Conference, “Portfolio Valuation and Optimization”, Denver, March 9, 2001.

“Estimating and Modeling Electricity and Gas Price Volatility in the MAIN NERC Region,” Infocast Conference, “Market Price Volatility,” Houston, March 5, 2001.

“Estimating and Modeling Gas and Electric Price Volatility in the Mid-American Interconnected Network (MAIN) NERC Region,” Infocast Conference, “Market Price Volatility,” Chicago, May 10, 2000.

“The Runaway World of Merchant Power,” GasMart/Power 2000 Conference, Denver, April 11, 2000.

“Market Power in Alberta,” Canadian Institute Conference, “Deregulation of Power Generation in Alberta,” Calgary, April 10, 2000.

“The Rapid Evolution of Plant Valuation: From Guaranteed Returns to Portfolio Analysis,” Infocast Conference, “Energy Asset and Corporate Valuation,” Orlando, January 26, 2000. With M. Griffith and K. Woodruff.

“Ancillary Services Price Forecasting: Key Drivers of A/S Prices in the California Market,” Infocast “Market Price Forecasting” Post-Conference Workshop, Chicago, May 21, 1999.

Public Service Company of New
Hampshire
Docket No. DE 10-261

Data Request OCA-02

Dated: 04/29/2011
Q-OCA-039
Page 1 of 2

Witness: Richard L. Levitan
Request from: Office of Consumer Advocate

Question:

The annual Emissions Allowance expenses shown in the revised Exhibit G.12 on Bates page 227 range from \$300-500,000 annually. Exhibit G.1, Bates page 196, which wasn't revised, shows the annual Emission Allowance expenses in 2008-2009, in the range of \$2 million. Why has the annual forecasted level declined so much from prior actual expense levels?

Response:

Annual emission allowance expenses are the product of emission allowance prices and the number of emission allowances used. In turn, the number of emission allowances used is a function of energy generation and the natural gas versus oil shares of fuel consumption. RFO emits SO₂ while natural gas does not, and RFO emits nearly twice as much NO_x and about 50% more CO₂ as natural gas.

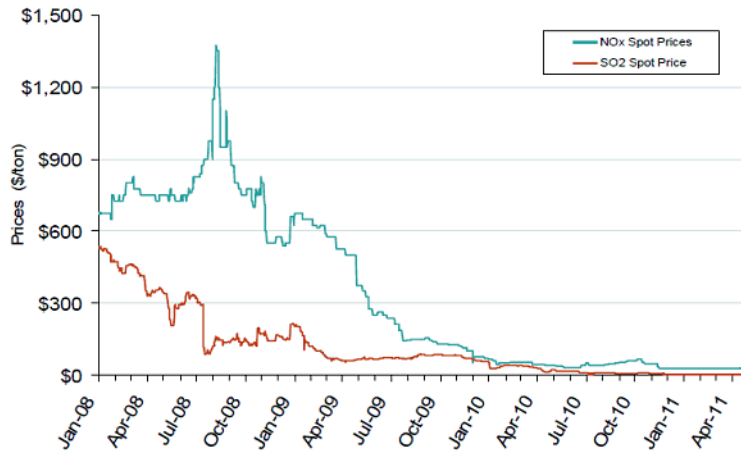
In 2008, the natural gas share of fuel use was 4.7% in 2008 and 22.4% in 2009. Due to forward market natural gas prices per MMBtu much lower than RFO prices in the 2011-2020 period, lower-emitting natural gas was simulated to be 99% of the fuel mix in 2011 and very high shares in all following years.

Emission allowance prices, particularly for SO₂ and NO_x, have fallen dramatically since 2008 as the following chart from FERC based on Bloomberg data shows. The study used forward market SO₂ allowances prices of \$7/ton in 2011 falling to \$2.70/ton in 2020, and NO_x allowance prices of \$34/ton for in all years, 2011 to 2020 (see the response to Staff-01, Q-Staff-079, Attachment 5). Annual emission allowance cost in 2008 and 2009 reflect the actual inventory cost of allowances expensed for compliance.

Emissions Market: Emission Allowance Prices

Federal Energy Regulatory Commission • Market Oversight • www.ferc.gov/oversight

SO₂ Allowance Spot Prices and NO_x Seasonal Allowance Spot Prices



Source: Derived from Bloomberg data.

Updated May 6, 2011

RGGI CO₂ allowance expenses began in 2009. The average price of current period allowances in auctions 1-6, held from 9/25/2008 to 12/2/2009, was \$2.91/ton, and the average price in auctions 7-10, held from 3/10/2010 to 12/1/2010, was \$1.92/ton. The clearing price of the 11th auction, held 3/9/2011, was \$1.89/ton, similar to the forward price LAI used for 2011 of \$1.92/ton (see the response to Staff-01, Q-Staff-079, Attachment 5).

The substantial declines in SO₂ and NO_x allowance prices from 2008 to 2011 and the decline in CO₂ allowance prices from 2009 to 2011 and the projected very high share of natural gas usage explain the reduction in annual emission expenses, despite an increase in generation expected during the forecast period.

Public Service Company of New Hampshire
Least Cost Integrated Resource Plan

Docket No. DE 10-261

Staff Responses to Second Set of PSNH Data Requests to Staff

Date Received: September 12, 2011

Date of Response: September 26, 2011

Request: PSNH 2-5

Witness: George McCluskey

REQUEST:

Referring to Staff response to PSNH-1-25(c):

- a. Please respond to the request to provide the cost for Staff's Gas Daily subscription.
- b. Does Staff's subscription to Gas Daily go back to 2003 or earlier? If not, when did it begin?

RESPONSE:

- a. Staff objects to this data request on the grounds that it is irrelevant.
- b. No. The first issue received by the Commission is dated June 18, 2004.

**Public Service Company of New Hampshire
Least Cost Integrated Resource Plan**

Docket No. DE 10-261

Staff Responses to First Set of PSNH Data Requests to Staff

Date Received: August 15, 2011

Date of Response: August 29, 2011

Request: PSNH 1-14

Witness: George McCluskey

REQUEST:

Referencing page 11, lines 1-9. Does Staff or Jacobs Consultancy have access to WTI crude oil price data and RFO and 2FO prices? If so, what is Staff's reasoning that these prices could not be used to verify model accuracy?

RESPONSE:

Staff does not have access to historical oil prices, but Jacobs does. See, however, Staff response to PSNH 1-9(a).

**Public Service Company of New Hampshire
Least Cost Integrated Resource Plan**

Docket No. DE 10-261

Staff Responses to First Set of PSNH Data Requests to Staff

Date Received: August 15, 2011

Date of Response: December 29, 2011

Request: PSNH 1-9

Witness: George McCluskey

REQUEST:

Referencing page 9, line 18 to page 10, line 3, regarding LAI's inability to disclose the historical daily fuel price data LAI licenses from Bloomberg LP,

- a. Do Staff and Jacobs acknowledge that Jacobs could have procured the same, or essentially the same, historical fuel price data from a provider (e.g., Platts) that will sell individual data time-series in order to verify LAI's calculations? If not, please explain.
- b. Do Staff and/or Jacobs believe it is reasonable to expect the release of proprietary data from a third-party under a licensing obligation? If so, explain.
- c. Do Staff and Jacobs believe there is a legal distinction between a request to provide data protected by a third-party data service license and a third-party software tool (e.g., Excel, MATLAB, or Stata) similarly protected by a software service license? If so, explain.

RESPONSE:

- a. PSNH, not Staff, bears the burden of showing that the CUO Study conducted on its behalf by LAI uses reasonable methods and reasonable input data and that the study results are also reasonable. PSNH cannot shift that burden to Staff and its consultant by requiring it to obtain the same or essentially the same data from other providers, at their own cost.
- b. Staff believes that PSNH erred in allowing its consultant to conduct the study on the basis of methods and data that could not be shared with Staff and its consultant, even under confidential treatment per Commission rules. Without full access to such methods and data Staff cannot fulfill its obligation to evaluate the reasonableness of the study.
- c. Staff objects to this question on the ground that it calls for a legal opinion.

Public Service Company of New Hampshire
Least Cost Integrated Resource Plan

Docket No. DE 10-261

Staff Responses to First Set of PSNH Data Requests to Staff

Date Received: August 15, 2011

Date of Response: August 29, 2011

Request: PSNH 1-8

Witness: George McCluskey

REQUEST:

Referencing page 9, lines 15-17, "Neither Staff nor Jacobs was given access to LAI's Newington Station asset valuation model. As a consequence, Jacobs could not perform in-depth testing of the actual sub-models," and footnote 3, "Instead, Jacobs' review was limited to: (a) reading LAI's description of the model structure in summary reports; (b) reviewing LAI's responses to questions issued on those reports; and (c) analyzing the results of model re-runs, made at the request of Staff and Jacobs, based on different inputs,"

- a. Please define what constitutes "given access to LAI's Newington Station asset valuation model."
- b. Do Staff and Jacobs acknowledge that LAI answered all data requests for detailed equations and calculation steps of the sub-models? If your answer is not unequivocally yes, please identify each data request or sub-part of a data request that was not answered to Staff and/or Jacobs' satisfaction with respect to the equation or calculation steps.
- c. Do Staff and Jacobs acknowledge that LAI responded to three rounds of Staff general data requests?
- d. Do Staff and Jacobs acknowledge that LAI responded to an additional round of model-related data requests?
- e. Do Staff and Jacobs acknowledge that there were two technical sessions held at the Commission's office in New Hampshire as well as two additional visits to LAI's offices in Boston that were designed to answer Staff's and Jacobs' questions about model functionality, assumptions, and results?
- f. Do Staff and Jacobs acknowledge that neither Staff nor Jacobs requested any model runs which would have yielded test results of the functionality of sub-models during the three rounds of general data requests, the additional round of model-related data requests, and the two visits to LAI's offices? If not, please explain the basis for your position.
- g. Do Staff and Jacobs acknowledge that LAI agreed to Staff's request to visit LAI's offices for up to five days initially for an in-depth examination and discussion of the LAI modeling system? If not, explain.

- h. Do Staff and Jacobs acknowledge that they visited LAI's offices on two one-day visits and that there was a conference call among the parties between the two visits? If not, explain.
- i. Do Staff and Jacobs acknowledge that neither Staff nor Jacobs requested a formula or code review of any model component during either of the two visits to LAI's offices? If not, explain.
- j. Do Staff and Jacobs acknowledge that LAI provided a voluminous amount of intermediate output from the modeling system, including (i) statistical volatility and correlation calculations, (ii) statistical estimates of the market heat rate elasticities, (iii) daily fuel and energy prices by scenario, and (iv) monthly operating performance by scenario, which is useful for diagnosing the price simulation and dispatch sub-models? If not, please explain.
- k. To support Jacobs Consultancy practice in the oil and gas industry, does Jacobs utilize any commercial providers of oil and natural gas historic price data? If yes, please name the provider firm(s).
- l. Over the last three years, please identify all regulatory matters before a state regulatory commission or FERC where Jacobs has released a proprietary model to a consulting or engineering firm without a non-disclosure agreement in place. In the event that Jacobs has indeed released a proprietary model to a consulting or engineering firm, please identify the matter and docket number, counterparty, and a brief description of the nature of the model.
- m. If Staff and Jacobs had additional concerns regarding LAI's Newington valuation model, why did Staff and Jacobs not continue its in-depth examination of the LAI modeling system for all or a portion of the additional days set aside to accommodate Staff's and Jacobs' concerns?

RESPONSE:

- a. This refers to direct personal access to the LAI models. Direct personal access means either: (1) being given all the model programs and pertinent input data in a form that would have allowed Edward Arnold of Jacobs Consultancy to run the models and perform Jacobs' own direct testing and evaluation of the models in Jacobs Consultancy's offices, or (2) being given access to the model(s) and pertinent input data on a computer in LAI's or a third party's office in a form that would have allowed Mr. Arnold to run the models and perform his own direct testing and evaluation of the models. The term "direct" means that Jacobs Consultancy would have full control of the model and inputs and outputs, in terms of handling all inputs and outputs without interaction of LAI personnel. Note that Jacobs Consultancy was not asking for software, but rather the LAI models that would run in licensed software packages.
- b. No. LAI declined to provide the full regression equations used to calculate the stochastic parameters for natural gas, RFO and 2FO in the Fuels Monthly Forwards Pricing sub-model. In addition, LAI declined to provide all of the calculations relating to the calculation of: the Newington node DA energy prices, the Dracut natural gas prices, and the Newington node RT energy prices.

- c. Staff acknowledges that LAI provided answers to three rounds of general data requests. Note, however, that not all of the answers were satisfactory or informative.
- d. Staff acknowledges that LAI provided answers to one additional round of model-related data requests. Note, however, that not all of the answers were satisfactory or informative.
- e. Yes.
- f. Jacobs Consultancy did not request these types of model runs. Model runs performed by a third party will not prove functionality of sub-models, as Jacobs Consultancy would not have command and control of the data in, the data out and the way the model is set-up (in terms of model run variables). Thus this request was not made. Direct personal access is required to check on and verify claimed functionality of models.
- g. Staff recalls that it proposed four days of meetings at LAI's offices but LAI responded that Richard Levitan would not be available on two of those days and that Richard Carlson's availability may only be spotty on those same two days. Staff also recalls that LAI claimed that its models are proprietary.
- h. Yes.
- i. Jacobs Consultancy did not request formula or code review, as there is no guarantee that such code would have been used in the model that was used to generate the data in the LAI Report. In addition, a code review approach to model validation is – typically - extremely time consuming and was beyond the scope of the contract between Jacobs Consultancy and the NHPUC.
- j. While Jacobs Consultancy did receive considerable amounts of intermediate output from the LAI model system, it believes that intermediate data is not enough to generate absolute and distinctive characterization of a model in terms of saying that it can or cannot do x, y and z. Again, absolute validation of a model cannot be made without significant direct personal access.
- k. Yes, Jacobs Consultancy uses commercial providers of data. Examples of some of the providers are Platts, Argus, OPIS, and ICIS. In addition, Jacobs Consultancy uses public domain data.
- l. Mr. Arnold cannot comment on Jacobs Consultancy as a whole, as Jacobs comprises dozens of offices and he is not aware of the engagements and clients of each office. Jacobs Consultancy's Chicago Office has not previously been directly involved with a state regulatory commission or FERC. However, Jacobs Consultancy sometimes provides proprietary models to clients under strict terms and conditions.
- m. Mr. Arnold contends that only direct personal access to the models would have answered Jacobs' remaining questions.

Exhibit LAI-8
Newington Station Continued Operation Analysis

Year beginning June	2011	2012	2013	2014	Total
FCA Price (prorated \$/kW-mo)	3.12	2.54	2.52	2.86	
Newington Capacity Obligation (MW)	400.2	400.2	400.2	400.2	
Newington Capacity Revenue (\$M)*	\$15.0	\$12.2	\$12.1	\$13.7	\$38.0
Reconfiguration Auction Price (\$/kW-mo)	1.00	1.00	1.00	1.00	
Newington Capacity Obligation, Shedding 2012 (MW)	400.2	0	0	0	
Newington Retirement Revenue (\$M)	NA	\$7.4	\$7.3	\$8.9	\$23.6
Newington Net Retirement Benefit (\$M)	NA	(\$4.8)	(\$4.8)	(\$4.8)	(\$14.4)

(*) Without peak energy rent (PER) adjustment.

PUC Docket No. DE 10-261
TransCanada Responses to
PSNH Data Requests

Date of Request: August 15, 2011

Date of Response: August 29, 2011

Q-PSNH-18 Referencing page 9, line 206 to page 10, line 210:

- a. Please explain how the excess of capacity may exist after the floor is removed.
- b. Please provide the regional FCA supply curve that would be consistent with this assumption and with the FCA clearing at \$1/kW-month with the surplus.
- c. Please provide historical FCA supply curves from the initial 5 annual capacity auctions (FCA-1 to FCA-5).

Witness: Michael E. Hachey

Response:

- a) Whether excess capacity exists in New England is independent of whether “the floor is removed”.
- b) Details of supply are provided in Exhibit MEH-2.
- c) Mr. Hachey does not possess such supply curves.

**Public Service Company of New Hampshire
Least Cost Integrated Resource Plan**

Docket No. DE 10-261

Staff Responses to First Set of PSNH Data Requests to Staff

Date Received: August 15, 2011

Date of Response: August 29, 2011

Request: PSNH 1-22

Witness: George McCluskey

REQUEST:

Referencing page 19, lines 14-17, "the model continued to over-estimate actual 2010 energy net revenues by about \$1.2 million or 45%. An error of this magnitude is too great, in our opinion, to inspire confidence in the ability of the model to reasonably predict future performance,"

- a. Please explain whether the judgment that the model error was "too great" was based only on the metric of energy net revenue, or also on other performance measures, such as price prediction, capacity factor, etc.
- b. In light of the skewed distribution of power plant energy net revenue, please discuss whether it is better to compare actual performance for one year against expected energy net revenue or a quartile measure (for example, the median or the interquartile range).
- c. Does Staff and/or Jacobs believe that 2010 economic conditions for peaking plants in New Hampshire were above the median of the probability distribution? If no, how was this assessment factored into the judgment that the model error was "too great"?
- d. Please provide all workpapers, including statistical calculations, used to reach the assessment that the model error was "too great."

RESPONSE:

- a. The judgment was based on the energy net revenue metric. Staff considers this to be the main metric because it is a key determinant of customer benefits from plant operations.
- b. Jacobs Consultancy often works with skewed input and output distributions. Based on our experience, given the nature of this skewed distribution we believe that comparison of the median of the output distribution with the result of the

- backcast analysis is adequate. Ideally, we would have liked to see a comparison of output histograms (from simulation runs).
- c. Jacobs Consultancy expected that the LAI model of the Newington peaking plant would – ideally – have been formulated to be able to approximately simulate the plant’s 2010 results. If the model was not built to be able to do so (because 2010 was considered to be an unusual or “outlier” year) we would have expected an explanation as to why it was not able to do so. When Jacobs Consultancy builds stochastic models that attempt to simulate the future it typically will build them such that they can approximately simulate the past in terms of median and full value probability range results (as illustrated by a value versus probability of occurrence histogram). We do this so we can tell clients that the underlying model – to the best of our abilities – was an accurate tool for predicting asset (and asset management) behavior by approximately predicting past performance in a pseudo forecast (backcast) mode. Jacobs Consultancy realizes that this approach is not always used for building stochastic models and certainly not in cases where asset performance and management behavior is expected to be different in the immediate future. However, in cases where there is not an expectation of a significant difference in asset performance or asset management behavior in the immediate future, we prefer this approach because it gives clients confidence in the relative accuracy of our underlying model that drive the stochastic simulation, in terms of being able to reasonably predict asset and management response to highly uncertain future events in the future.
 - d. The assessment that a 45% difference is too great to inspire confidence in the ability of the model to reasonably predict future performance is based on experience and judgment. Jacobs Consultancy generally likes to see backcast results within a range of +/- 30%. The 30% limit is based on experience with Backcast model ability. Most of our models are built to backcast within 30%. While 45% is close to 30%, it is not within our standard range. 45% may be adequate for many investors.

**Public Service Company of New Hampshire
Least Cost Integrated Resource Plan**

Docket No. DE 10-261

Staff Responses to First Set of PSNH Data Requests to Staff

Date Received: August 15, 2011

Date of Response: August 29, 2011

Request: PSNH 1-27

Witness: George McCluskey

REQUEST:

Referencing page 21, line 15 to page 22, line 4, regarding Staff or Jacobs assumptions on oil to gas price ratios:

- a. Please specify the hub location for the referenced RFO price.
- b. Please specify the hub location for the referenced natural gas price.
- c. Please provide the spreadsheet data, with formulas intact, and all workpapers for the calculations that support the RFO/gas price ratio that "now stands at about 4.4:1."
- d. Please state the year that the 4.4:1 ratio represents and the date of the analysis.
- e. If the RFO/Dracut ratio is currently higher than what LAI had used, please explain why it is appropriate for the Staff-requested model run to only increase oil prices rather than, at least in part, decrease natural gas prices.

RESPONSE:

- a. Mr. Arnold used both USGC and NYH posted prices.
- b. Mr. Arnold used Henry Hub.
- c. The ratio recommended by Jacobs Consultancy to the NHPUC was 4.0:1 not 4.4:1. Mr. Arnold will provide support for this ratio in due course.
- d. The ratio recommended by Jacobs Consultancy to the NHPUC was 4.0:1 not 4.4:1. This ratio represents the ratio between 1% S RFO and natural gas on a \$/MM BTU basis. Mr. Arnold will provide the date of the analysis in due course.
- e. Jacobs current conservative expectation is that both prices will increase, but that RFO will increase more.

Public Service Company of New
Hampshire
Docket No. DE 10-261

Data Request TC-02

Dated: 04/29/2011
Q-TC-007
Page 1 of 1

Witness: Richard L. Levitan
Request from: TransCanada

Question:

Relative to Levitan Exhibit G.17, for each selected probability level please provide annual values for:

- a. Hub on peak average LBMP
- b. Hub off peak average LBMP
- c. Hub all hour average LBMP
- d. Average delivered gas price

Response:

Exhibit G.17 reports annual operational performance measures for Newington Station with respect to the expected value (average over all scenarios) and the P50 and P25 level of energy net revenues based on separate annual rankings. Given 250 scenarios, the P50 and P25 fuel and energy price results provided here are based on a weighted averages of the two scenarios closest to the target percentile level. Keep in mind that the specific scenarios at the P50 and P25 levels of energy net revenues do not necessarily correspond to the P50 and P25 levels, respectively, of fuel prices and energy prices. Also keep in mind that two scenarios with nearly the same level of energy net revenues may have very different fuel and energy price levels, so the fuel and energy price results provided here are only indicative since they are not robust. For example, relatively low gas prices and energy prices in one scenario may result in about the same spark spread and profitability as relatively high gas prices and energy prices in another scenario. Hence, caution must be used in interpreting the indicative results for the P50 and P25 scenarios reported here.

Although the energy price simulation method started with monthly forward prices at the Mass Hub, the energy prices saved during the simulation run were at the Newington node, which has slightly lower prices on average. Rather than very difficult back-calculations to provide Hub LBMPs, the responses to parts a-c provide the forecasts of Newington node LBMPs. Likewise, the fuel price simulation method used natural gas prices at Dracut and deterministic seasonal delivery costs were added later. To provide the requested delivered gas prices, the assumed winter and summer season transportation adders are included in the prices reported here.

The attachment containing the data is under development and will be filed as a supplemental response as soon as it is available.

Public Service Company of New Hampshire
Least Cost Integrated Resource Plan

DE 10-261
OCA Responses to
PSNH's Data Requests – Set 1

Date Received: August 15, 2011
Request No.: PSNH to OCA 1-35

Date of Response: August 25, 2010
Witness: Kenneth E. Traum

35. Referencing page 28, line 14 to page 29, line 3, please state your understanding of whether the average gas cost at Newington includes or excludes certain overhead or fixed costs allocated across all PSNH fossil stations.

- a. Did you include an adjustment for fixed costs allocated to the cost of fuel for Newington Station in your analysis?
- b. Aside from fixed costs accounting allocation issues and Dracut to Newington basis, please explain your understanding of any reasons why average annual delivered natural gas cost for Newington Station may not be directly comparable to the CUO study Exhibit G.3 average natural gas spot price at Dracut.

RESPONSE: Objection. This data request is overbroad and unduly burdensome, and not reasonably calculated to lead to the discovery of information that would be admissible in this proceeding. Subject to and without waiving this objection, the OCA responds as follows:

- a. I assumed that the columns labeled “Newington Average Natural Gas Cost (\$MMbtu)” and “Average Natural Gas Spot Price, Dracut (\$MMbtu)” in Exhibit G.3 were comparing apples to apples. Note 2 states: “Average spot fuel prices are from NYMEX”, so I did not make an adjustment for fixed costs.
- b. Some additional reasons may relate to the location of the plant, the natural gas pipeline serving it, and general supply and demand issues.

**Public Service Company of New Hampshire
Least Cost Integrated Resource Plan**

Docket No. DE 10-261

Staff Responses to First Set of PSNH Data Requests to Staff

Date Received: August 15, 2011

Date of Response: August 29, 2011

Request: PSNH 1-37

Witness: George McCluskey

REQUEST:

Referencing page 26, line 10 through page 27, line 11, regarding two possible new environmental compliance rules that may necessitate capital expenditures, please explain the extent to which Staff believes that it is appropriate to use the real options valuation decision approach of "wait-and-see" to handle the option to defer an investment or retirement decision until there is better information.

RESPONSE:

If the results of the continued unit operation study indicate a positive net benefit absent the compliance costs associated with the new environmental rules, Staff believes it would be appropriate to adopt a wait-and-see approach to retirement. If, however, the results indicate a negative net benefit absent inclusion of compliance costs, Staff believes it would be inappropriate to adopt a wait-and-see approach. Under this latter scenario, the new environmental rules simply add to the risk of uneconomic operation. These comments notwithstanding, it is instructive to note that LAI itself chose to neglect the "wait-and-see" approach when evaluating the economics of continued operation for Newington. Specifically, when developing its forecast of FCM prices LAI elected to assume that 2,000 MW of fossil-fired generating unit capacity would be retired due to concerns over the cost of complying with the proposed new rules even though those rules have yet to be finalized and the owners of the 2,000 MW of generating capacity have yet to make public their intentions. The effect of LAI's decision was to improve the economics of continued unit operation.