

**Proposal to the Consumer Advocate Division
of the West Virginia Public Service Commission
to Provide Consulting and Expert Witness Services
for Case Number 12-1571-E-PC**

January 7, 2013

LEVITAN & ASSOCIATES, INC.

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January 7, 2013

Department of Administration, Purchasing Division
2019 Washington Street East
P.O. Box 50130
Charleston, WV 25305-0130

Re: Proposal for Consulting and Expert Testimony, Case No. 12-1571-E-PC

Dear Sir / Madam,

Levitan & Associates, Inc. (LAI) is pleased to provide the Consumer Advocate Division of the WV Public Service Commission (PSC) with this proposal to assist you in reviewing the Petition for two generation transactions filed by Monongahela Power (MP) and Potomac Edison (PE; collectively the Companies). We have reviewed their Petition of November 16th and the underlying 2012 Resource Plan of August 31st, and are confident that we can provide you with informed and focused expertise to uncover the key modeling assumptions and techniques upon which the Companies are relying. We are familiar with the Harrison and Pleasants plants, understand their role in the Western PJM market, and can evaluate their fair-market valuations. We can also suggest cost-effective demand side and supply-side alternatives that could provide WV ratepayers with considerable savings.

Founded in 1989, LAI is a Boston-based energy management consulting firm with major practice areas in power project analysis and due diligence, generation and transmission asset valuation, wholesale electric and fuel procurement, integrated resource planning, contracting, power market design, fuel transportation management, power systems engineering, and financial analysis. Our consultants possess in-depth knowledge of wholesale energy and capacity market rules, forecasting and optimization models, regulatory developments, environmental technology, and repowering options required to properly evaluate resource options and assess this proposed generation transaction.

LAI has worked closely with power generators, natural gas producers, pipelines, large end-users, and financial institutions throughout North America on diverse commercial matters related to complex energy transactions. We apply state-of-the-art mathematical and economic techniques to asset valuation, energy procurement strategies, wholesale market design, and financial transactions. We routinely evaluate demand-side and supply-side resource options in the context of short-term investment decisions and long-term resource planning. Our diversified consulting expertise provides a strong foundation for addressing difficult financing challenges and providing risk-adjusted asset valuations.

Since the mid-1990s, we have advised international investors on the purchase or sale of generation assets throughout the Northeast, mid-Atlantic, California, and Pacific Northwest. LAI has prepared locational market forecasts of fuel costs and market energy, capacity, and forward reserve prices in support of numerous generation acquisitions and

other transactions. We understand the PJM market, the economic factors driving coal plant retirements / retrofits and gas-fired additions, and the environmental regulations requiring coal plant capital expenditures.

In this matter we will work with the Consumer Advocate to focus our analysis on the key issues relating to the Companies' 2012 Resource Plan, including investigating whether all potential demand-side and supply side resources were fairly considered. We can also assist you with related business and financial issues, such as the proposed transaction mechanics, the terms of the MP / AE Supply Memo of Understanding, the capital structures of MP, PE, and AE Supply, the rate impacts of different ownership options, and the post-acquisition valuations of the Harrison and Pleasants Power Stations. In focusing on the August 31, 2012 Resource Plan, we will critically review the supply and demand-side options for meeting the projected electricity requirements. We will also review the Companies' rationale for their proposed April 15th decision deadline, since AE Supply's ownership should not prevent it from offering its Harrison capacity into the May 2013 RPM auction or from receiving profitable off-system sales next summer.

LAI is prepared to begin productive work immediately given our familiarity with these key issues and our corporate experience in similar matters. We will have Seth Parker, a Vice President and Principal with extensive expertise in generation transactions, fair market asset valuations, and power economics manage this assignment and author our expert report. He will be assisted by Dr. Richard Carlson, a Managing Consultant and resource planning expert who can submit additional expert testimony if required. Dr. Carlson led a major software development effort for resource planning models used for integrated resource planning and other assignments while in his previous position. They will be supported by other LAI staff who have first-hand knowledge of demand-side resource options, power plant performance, PJM market dynamics, power price forecasting, system operations, generation asset valuations, and other relevant functions. Mr. Parker and Dr. Carlson have testified many times before state commissions and Mr. Parker has participated in FERC proceedings as well. We will remain committed to meeting your evaluation objectives and supporting your regulatory efforts under the proposed schedule filed on December 17th.

We have no conflicts of interest that would impair our ability to meet your study goals and objectives through the term of this engagement. Please do not hesitate to contact me at (617) 531-2818 x26 or at sgp@levitan.com if you have any questions regarding our capabilities and study approach, or require additional information. We look forward to the privilege of this engagement. Thank you for considering LAI

Sincerely yours,



Seth G. Parker
Vice President & Principal

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Resumes

Seth Parker

Richard Carlson

Jack Elder

Phil Curlett

Boris Shapiro

1. QUALIFICATIONS

LAI has the expertise and experience to fulfill the requirements specified in Solicitation Number PSC13532. LAI will work with the Consumer Advocate on reviewing the Companies' 2012 Resource Plan, their testimony and supporting reports, developing additional discovery questions, evaluating their responses, responding to discovery questions, preparing expert testimony, and testifying before the WV PSC in this matter. We have extensive experience in assisting state commissions and participating in administrative hearings before them and, on occasion, FERC.

We will carefully and thoroughly review the assumptions and methodology embedded in the Companies' 2012 Resource Plan. LAI will specifically review the treatment of viable demand-side and supply-side resources in light of their treatment in the Resource Plan, *i.e.* "it stands to reason that the consumer...would eventually" install cost-effective energy efficiency measures "regardless...of any utility program" and "demand side resource options are not a viable solution capable of meeting Mon Power's obligations." We may propose updated cost and performance assumptions as warranted for those and other demand-side and supply-side options. We will pay particular attention to the recommended strategy of purchasing the remainder of Harrison in spite of the fact that coal plants are expected to provide a significant majority of the Companies' capacity (69%) and energy (85%) as of 2013 (per Figures 1 and 2) prior to the proposed transaction. With the Harrison purchase and the rest of the proposed transaction, coal plants will increase to 77% of the Companies' total capacity and 87% of their energy production in 2014 (Figures 3 and 4). We will also check the plant performance and operating cost assumptions in the 2012 Resource Plan, including Harrison's assumed capacity factors (averaged across the three units) of 65% - 85% (Figure 35) in light of its actual average capacity factors of 73% in 2010 and only 64% in 2011 (Figure 24).

We will review the Companies' resource planning methodology that compares the advantages of owned resources, which provide a financial hedge against uncertain market prices, against any disadvantages of being highly dependent upon coal resources and

locked into an inflexible asset base that will require capital expenditures to comply with MATS and other emission requirements. LAI will suggest reasonable corrections to any of their modeling assumptions if warranted, as well as demand-side and renewable energy, *i.e.* wind, options that the Companies may have overlooked. We will evaluate how the low growth and high growth scenarios influence the optimal resource selection, and may also review past Resource Plans along with critiques and recommendations from the associated PSC hearings to learn if questionable resource planning issues have previously been identified and if those issues have been addressed.

Seth Parker, a financial expert with significant transaction experience, will oversee this work and will be the principal testifying witness for the Project Team. Richard Carlson will focus on uncovering key resource planning assumptions and in confirming the integrity of the Companies' modeling. They will rely on other LAI staff with expertise in supply-side and demand-side resource options, PJM market dynamics, and other key functions.

We will develop and respond to discovery requests related to our testimony and will work closely with the Consumer Advocate and counsel. LAI assignments that demonstrate our ability to consider demand-side and supply-side options in the context of resource planning are as follows:

- **Connecticut Office of Consumer Counsel** – LAI was engaged to assess the integrated resource plans (IRPs) filed by the state's utilities and the CT Energy Advisory Board in the 2010 and 2012 DPUC proceedings. LAI focused on the procurement and policy recommendations offered by the parties regarding demand-side management and energy efficiency options, and also examined the full range of assumptions, conclusions, and recommendations regarding supply-side resources. In formulating our opinions, we assessed the reasonableness of the primary modeling assumptions by the different parties and their analytic results, and assessed the expected interaction effects between the new resource options and the wholesale market in New England.

- **Public Service Company of New Hampshire** – LAI developed a Monte Carlo real options valuation model in the course of preparing a continued unit operation report of an older dual fuel steam generating station for PSNH’s 2010 Least Cost IRP filing to the New Hampshire Public Utilities Commission. Dr. Carlson provided hearing support and joint rebuttal testimony. LAI is now commencing a study of various repowering, environmental retrofit, retirement, and divestiture options for two PSNH coal-fired units for another hearing.
- **Maryland PSC** – LAI developed and evaluated alternative energy futures for the Maryland PSC in response to a state legislative mandate that considered past deregulation actions and potential re-regulation of in-state generation assets. Central to our analysis of generation, transmission, and demand-side alternatives was our integrated suite of economic, mathematical, and dispatch simulation models to test the impact on wholesale and retail electricity prices. We evaluated various scenarios emphasizing energy efficiency, demand-side management, renewable energy, conventional generation technologies, and transmission expansion. Our primary objective was to provide reliable data and market intelligence to promote grid security and economic objectives, and to assist State policymakers in making rational policy choices to meet their long-term electricity requirements.
- **Long Island Power Authority** – LAI has prepared fuel and power price forecasts for LIPA in support of capital-intensive resource commitments, such as the 660 MW HVDA cable from PJM to Long Island, as well as long-term capacity and energy contracts in New York, PJM, and New England. We have conducted technical resource planning studies centered on the determination of avoided costs under alternate resource expansion scenarios. LAI has prepared short term and long term price forecasts of capacity, energy, and the underlying fuels for day-ahead market pricing, and continues to provide financial analysis support during contract negotiations and development.

- **Dominion Virginia Power** – LAI provided an expert report on resource options and economics on behalf of Shell Energy North America regarding Dominion Virginia Power’s 2009 IRP that addressed issues of need, resource availability, treatment of demand-side and supply-side resources, and Virginia’s status in the PJM market. Our consultant testified before the Virginia State Corporation Commission on behalf of Shell Energy NA.

LAI has worked closely with clients and their legal counsel on structured transactions on both the sell and buy sides. Many clients have relied on our financial expertise and valuation capabilities for acquisitions, divestitures, mergers, long-term contract restructurings, and buyouts. If directed by the Consumer Advocate, we can investigate the business and financial terms of the proposed transaction, including those in the Memo of Understanding, to ensure that ratepayers will be fairly treated. For example, we question the rationale of MP purchasing Harrison at the lower of market or book value, while AE Supply will purchase Pleasants at the higher of market value or book value. We note that this transaction will “lock in” a much higher \$1.33 billion valuation of Harrison (prior to any credits) compared to its net book value of \$500 million at the time of the First Energy – Allegheny Energy merger, with consequential ratepayer impacts.

We can also review the proposed Temporary Transaction Surcharge, the KPMG valuation report, and other supporting documents. Here we note that First Energy witness Wise expects residential customer rates will increase about 2% while commercial and industrial customer rates will decrease approximately 5% to 8%. To illustrate LAI’s qualifications in this area, some of our representative generation transaction projects are described below:

- **Vermont Public Service Department** – LAI provided financial, operational, and decommissioning funding advice to the VT Public Service Department regarding Entergy’s proposed generation transaction in which it would spin off its six merchant nuclear plants, including Vermont Yankee, into a separate entity that

would have its own financial structure and funding sources. LAI prepared information requests for the Department, submitted expert testimony, and testified before the VT Public Service Board.

- **Equity Fund** – LAI performed extensive market advisory and financial valuation services for an international equity infrastructure fund and its investment banker in its efforts to acquire the 2,480 MW KeySpan Ravenswood project in New York City.
- **Linden Power Plant** – LAI provided transaction advisory services to TransCanada for its potential acquisition of the 770 MW Linden generation facility and the related Variable Frequency Transformer (VFT) project. We prepared a project pro forma and an initial technical and commercial review of the VFT project that would allow an additional 300 MW to flow via an existing underwater cable connection into New York City. Prior to this transaction, LAI had advised the previous owner, Goldman Sachs, on similar issues that led to its successful acquisition of Linden.
- **Wind Generation Portfolio** – We advised a confidential investor on the potential purchase of 500+MW of wind resources in the northeastern US and the Canadian Maritimes. About one-half of these resources were in operation and the rest were in advanced stages of development. Our commercial analysis included the existing PPAs and energy swap contracts, as well as marking-to-market energy, capacity, and REC products.
- **Holyoke Gas & Electric Company** – LAI advised HG&E on its successful acquisition of the Holyoke hydroelectric power plant and on related commercial matters. LAI projected the project economics using our forecast of market fuel and power prices, evaluated the impact of rival financing options, estimated major capital expenditure requirements for environmental remediation and site maintenance, and assessed the short- and long-term impacts on retail customers. Our market study was an integral part of the debt financing documentation.

- **Connecticut Generation Procurement:** LAI served as an extension of Staff and as the “prosecutorial” arm of the Connecticut Department of Public Utility Control. We designed the solicitation process, administered the RFP, and conducted due diligence on proposed new peaking generation designed to provide ISO-NE with second contingency protection in the Locational Forward Reserve Market. Our work required extensive production cost simulations to compare the impacts of transmission improvements against new peaking generation on local reliability and on other portfolio benefits under cost of service regulation. We prepared a report recommending a portfolio of projects for approval and provided a wide range of support services, including defending our report in contested hearings, preparing and responding to discovery requests, and cross-examining project proponents.

2. STAFFING

This section presents summary biographies for the key individuals that identify each person's responsibility and highlight aspects of their experience that is relevant to this engagement. Resumes for each individual are included as attachments.

Seth Parker, *Vice President and Principal*, will manage this assignment, be the point of contact for the Consumer Advocate, and testify before the WV PSC. He is an economics and financial manager with experience in market design, price forecasts, and business transactions involving international power and fuel projects. Mr. Parker works with RTOs / ISOs, merchant plant developers, power purchasers, and utilities on a broad variety of commercial power topics. He has advised clients in New York and PJM on capacity market design and represented their interest before FERC. Mr. Parker has testified before the Virginia State Corporation on Dominion Virginia Power's 2009 Integrated Resource Plan. He has also submitted expert reports and testified before the Vermont DPS, Rhode Island PUC, and other bodies on renewable resource, financial, transaction, and electric market issues. Prior to joining LAI, he conducted due diligence for over \$6 billion of power and infrastructure financing in the US and overseas. Mr. Parker also prepared numerous financial forecasts that were the basis for power plant appraisals, and co-authored fair market valuations of generating assets.

Dr. Richard Carlson, *Managing Consultant*, has 34 years of experience as a consultant, software developer, and research economist on a wide range of energy and environmental economics topics, including integrated resource planning and portfolio optimization, asset and contract valuation, market structure and behavior, statistical volatility and risk analysis, emissions compliance, and rates setting. Previously, he was product manager of planning and risk software used for power plant and contract valuation, portfolio optimization, fuels and emissions allowance budgeting, risk management, and other planning applications by electric utilities and generating companies. He led the development of two advanced software simulation and optimization models related to

planning and portfolio management while at Ventyx. Dr. Carlson has performed independent market price analyses in support of power plant financings and the auction of purchased power agreements, and has testified in rate and IRP cases in Maine, New Hampshire, and Ontario.

John J. Elder, P.E., *Managing Consultant of LAI*, has 40 years of professional experience in the energy industry and supervises LAI's production simulation and transmission load flow modeling efforts. He will help evaluate the Companies' claimed costs and benefits of the proposed transaction and issues of PJM market policy and dynamics. As a leading authority on technical operating and performance issues, he has analyzed ISO / RTO regulations, transmission access reforms under FERC Order 888 initiatives, and competitive market structures. He and has provided utility clients, ISOs, and global investors with technical market assessments using chronological production simulation models. Mr. Elder has provided expert witness testimony before the Maryland Public Service Commission, the Connecticut Department of Public Utility Control, and the Massachusetts Department of Public Utilities.

Philip L. Curlett, P.E., is the *Manager of Energy Systems Analysis* and will focus on financial aspects of the proposed transaction. He has close to 40 years of experience in engineering, development, and financing of generation facilities and infrastructure projects. Mr. Curlett has conducted technical performance and project financial analyses for developers, lenders, and power purchasers, as well as for utilities and government agencies. He has also developed RFPs and managed bid evaluations for purchased power and EPC solicitations, and has been active in utility deregulation and privatization services in North America and several developing countries. Mr. Curlett is a leading expert in energy systems modeling and assessment, and has operated fluid flow models of natural gas pipeline systems for regional deliverability assessments and chronological power production simulation models for energy price forecasting.

Dr. Boris L. Shapiro, *Executive Consultant*, has 36 years of experience in the energy industry, including energy efficiency and demand-side programs, power plant design and performance, power system planning and operations, and market design. He has

international consulting and domestic regulatory experience providing technical and commercial advice to state utility regulatory commissions, electric power utilities, and system operators in the restructuring of the electric power industry, and the design and implementation of energy markets. He had primary responsibility for assessing the IRPs filed by the Connecticut utilities and by the Connecticut Energy Advisory Board in the 2010 IRP and 2012 IRP proceeding administered by CT PURA, in which he focused on energy efficiency and other demand-side options. Dr. Shapiro has provided expert witness testimony before FERC and state commissions on various matters related to system reliability, transmission projects, generation procurement, demand response and energy efficiency resources, and wholesale market issues.

3. RATES

The Project Team is pleased to provide the MPSC with the following hourly rates for this assignment. LAI ordinarily charges reasonable and necessary expenses as incurred. For this assignment we have increased our standard hourly rates slightly to include a limited amount of expected expenses, assuming a one-day meeting in Charleston prior to hearings, two days in Charleston for hearings on April 22-23, and other miscellaneous expenses.

LAI Consultant	Hourly Rate
R.L. Levitan	\$ 340
J.R. Bitler	\$ 290
S.G. Parker	\$ 290
E.G. Cool	\$ 290
R.L. Carlson	\$ 280
J.J. Elder	\$ 280
M.C. Lints	\$ 270
R.J. Bolbrock	\$ 270
P.L. Curlett	\$ 250
W.R. Luthern	\$ 230
T.M. Halleran	\$ 220
E.K. Tsikirayi	\$ 220
B.L. Shapiro	\$ 220
S. Wilmer	\$ 220
D.A. Rigos	\$ 220
M.J. DeCoursey	\$ 190
A.J. Mattfolk	\$ 130
Research Assistants	\$ 80

4. MISCELLANEOUS

LAI will be able to provide informed, neutral, and impartial services to the Consumer Advocate Division. We do not have any personal or commercial interests that would raise a conflict of interest concern.

LAI respectfully requests that Section 46 Indemnification of the General Terms and Conditions limit our indemnification to direct damages or loss, and that LAI would not be responsible for consequential damages. This is a common and customary limitation for consultants.

If necessary, LAI will be able to submit testimony by February 8th, and recognize that we will have until March 26th if the Revised Motion to establish Procedural Schedule is accepted.

We are submitting the forms required in the RFQ, including the Addendum Acknowledgement Form, PSC 13532 – Consulting Bid Form, Certification and Signature Page, and Purchasing Affidavit. PSC 13532 – Consulting Bid Form contains our estimated not-to-exceed price. Our price may be lower if we spend less time on this assignment. The consultants listed in PSC 13532 – Consulting Bid Form may be assisted by other LAI consultants, but we will not exceed this not-to-exceed price without written authorization.

FORMS

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: PSC13532

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:

(Check the box next to each addendum received)

<input checked="" type="checkbox"/> Addendum No. 1	<input type="checkbox"/> Addendum No. 6
<input type="checkbox"/> Addendum No. 2	<input type="checkbox"/> Addendum No. 7
<input type="checkbox"/> Addendum No. 3	<input type="checkbox"/> Addendum No. 8
<input type="checkbox"/> Addendum No. 4	<input type="checkbox"/> Addendum No. 9
<input type="checkbox"/> Addendum No. 5	<input type="checkbox"/> Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

LEVITAN & ASSOCIATES, INC
 Company

A. Blum
 Authorized Signature

JANUARY 7, 2013
 Date

PSC13532 - CONSULTING BID FORM			
Employee/Title	Not to Exceed Number of Hours*	Hourly Rate	Extended Price
S. G. PARKER	180	\$ 290	\$ 52,200
R. L. CARLSON	140	\$ 290	\$ 40,600
J. J. ELDER	60	\$ 280	\$ 16,800
P. L. CURLETT	60	\$ 250	\$ 15,000
B. L. SHAPIRO	60	\$ 220	\$ 13,200
A. J. MATTFOLK	160	\$ 130	\$ 20,800
		Total	\$ 158,600

Bidder / Vendor Information:

Name: LEVITAN & ASSOCIATES, INC

Address: 100 SUMMER STREET
SUITE 3200, BOSTON, MA 02110

Phone #: (617) 531-2818

Email Address: sgp@levitan.com

Contact Coordinator Information:

Name: SETH G. PARKER

Address: 100 SUMMER STREET
SUITE 3200, BOSTON, MA 02110

Phone #: (617) 531-2818 xt 26

Email Address: sgp@levitan.com

The Consultant will not be reimbursed for hours that exceed the total hours for each Employee/Title

CERTIFICATION AND SIGNATURE PAGE

By signing below, I certify that I have reviewed this Solicitation in its entirety; understand the requirements, terms and conditions, and other information contained herein; that I am submitting this bid or proposal for review and consideration; that I am authorized by the bidder to execute this bid or any documents related thereto on bidder's behalf; that I am authorized to bind the bidder in a contractual relationship; and that to the best of my knowledge, the bidder has properly registered with any State agency that may require registration.

LEVITAN & ASSOCIATES, INC
(Company)


(Authorized Signature)

SETH G. PARKER
(Representative Name, Title)

(617) 531-2818 x26 (617) 531-2826
(Phone Number) (Fax Number)

JANUARY 7, 2013
(Date)

RFQ No. _____

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

West Virginia Code §5A-3-10a states: No contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and the debt owed is an amount greater than one thousand dollars in the aggregate.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Debtor" means any individual, corporation, partnership, association, limited liability company or any other form or business association owing a debt to the state or any of its political subdivisions. "Political subdivision" means any county commission; municipality; county board of education; any instrumentality established by a county or municipality; any separate corporation or instrumentality established by one or more counties or municipalities, as permitted by law; or any public body charged by law with the performance of a government function or whose jurisdiction is coextensive with one or more counties or municipalities. "Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceeds five percent of the total contract amount.

EXCEPTION: The prohibition of this section does not apply where a vendor has contested any tax administered pursuant to chapter eleven of this code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

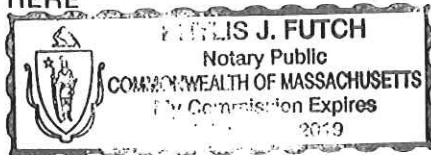
Under penalty of law for false swearing (*West Virginia Code §61-5-3*), it is hereby certified that the vendor affirms and acknowledges the information in this affidavit and is in compliance with the requirements as stated.

WITNESS THE FOLLOWING SIGNATURE

Vendor's Name: LEVITAN & ASSOCIATES, INC
 Authorized Signature: [Signature] Date: JANUARY 7, 2013
 State of MASSACHUSETTS
 County of SUFFOLK, to-wit:

Taken, subscribed, and sworn to before me this 7 day of January, 2013
 My Commission expires 2-1, 2019.

AFFIX SEAL HERE



NOTARY PUBLIC

[Signature]

SETH G. PARKER

SUMMARY

An economic and financial manager with an international background in competitive markets and power project development, evaluation, financing, and divestiture / privatization / acquisition. Key experience includes transaction support, risk management, credit / collateral provisions, modeling and analyses of conventional / wind / renewable power resources, inter-regional transmission projects, market design, and asset valuation.

PROFESSIONAL EXPERIENCE

- | | |
|-----------|--|
| 1998 - | Levitan & Associates, Inc.
Principal & Vice President
Managing Consultant |
| 1988-1998 | Stone & Webster Management Consultants (US and UK)
Vice President
Assistant Vice President
Executive Consultant
Senior Consultant |
| 1984-1988 | J. Makowski Associates, Inc.
Financial Manager - Ocean State Power |
| 1981-1983 | ThermoElectron Energy Systems
Senior Financial Analyst |
| 1978-1981 | Pacific Gas and Electric Co.
Project Financing Analyst |

CONSULTING ASSIGNMENTS

MARKET / POLICY ANALYSIS

Assisting the Vermont Department of Public Service (DPS) on power market and reliability matters in Docket 7862, Entergy's request to extend its Certificate of Public Good for the Vermont Yankee Station, before the Vermont Public Service Board.

Advised the Connecticut Public Utilities Regulatory Authority (PURA, previously the DPUC) on financial policy issues of pending Northeast Utilities / NStar merger.

Evaluated alternative resource options and the market price and socio-economic impacts associated with the potential retirement of the Vermont Yankee nuclear power station on behalf of the Vermont DPS.

Assessed the economic costs and benefits of a proposed HVAC transmission line versus generation and demand-side alternatives; utilized in filings to the Massachusetts Energy Facilities Siting Board on behalf of project sponsor NStar.

Advised the Virginia State Corporation Commission Staff on commercial and technical issues for the HVAC Potomac-Appalachian Transmission Highway (PATH) project, including need, cost, timing, market impacts, and alternative transmission solutions.

Advised three New York City (NYC) generators on the NYISO installed capacity demand curve reset process for 2011/12 – 2013/14 focusing on peaker proxy technology / cost, transmission deliverability, site requirements, and net energy and ancillary service revenue calculation.

Provided written testimony on resource options and economics on behalf of Shell Energy NA regarding Dominion Virginia Power's (DVP's) 2009 Integrated Resource Plan; testified before the Virginia State Corporation Commission.

Prepared expert report and testimony on the DVP 2007 Solicitation for 2011 Unit Capacity for Shell Energy NA that addressed capacity needs, bidder qualifications, best competitive procurement practices, and bid evaluation methodology.

Provided advice on financial, operational, decommissioning funding, and ratepayer risk issues to the Vermont DPS regarding Entergy's application to restructure the ownership of its merchant nuclear plants, including Vermont Yankee.

Prepared major deregulation study for the Maryland Public Service Commission that evaluated new generation, transmission, and demand-side options; evaluated divestiture's financial impact on generation fleet and to parent company; updated study for rate-base utility or power authority generation ownership.

Advised New York Power Authority (NYPA) on inter-market transactions, including power economics, interconnection requirements grid upgrades, reliability impacts, permit issues, and regulatory considerations; represented NYPA at PJM committee meetings.

Advised generator group on PJM's proposed Reliability Pricing Model (RPM) capacity valuation mechanism, including gas turbine capital & operating costs, net revenues, financing charges, etc.; represented group's interests at FERC.

Assessed market prices and congestion costs relative to competing generation and transmission project bids for Long Island Power Authority (LIPA); prepared ICAP forecasts across northeast markets and commercial analysis of HVDC cable proposals.

Evaluated market potential of PJM cable exports into NYC for potential purchaser of Linden simple / combined cycle project, including cable expansion issues.

Revised 2005/06 - 2007/08 capacity market demand curve parameters for NYISO based on levelized costs of gas turbine peaker capacity, including net energy revenues

from multi-regional simulation model with stochastic treatment of hourly loads; evaluated demand curve slope and zero-crossing point; achieved consensus with stakeholder group.

Advised counsel for Mirant Equity Committee regarding NYISO, ISO-NE, and PJM capacity markets and the demand curve mechanisms used to forecast ICAP prices.

Established feasibility of inter-pool wheeling into load pocket to reduce congestion costs; quantified maximum benefit and reliability / portfolio effects for LIPA.

Evaluated alternatives to the Indian Point Nuclear Power Station for Westchester County and its Public Utility Service Agency, including power and local economic implications of shut-down, repowering, replacement with transmission / conventional / renewable resources, continued operation, and license extension.

Estimated market value of incremental energy and capacity from the Bonanza coal plant owned by the Deseret Generation and Transmission Cooperative in Utah.

Prepared analysis of US power markets and merchant plant business structures for overseas investor; recommended target areas and distressed asset screening model.

Advised stakeholder group on technical, environmental, operational, and regulatory issues of power and gas infrastructure projects across Long Island Sound and in southwest Connecticut for the Institute for Sustainable Energy; facilitated revised guidelines for Connecticut Siting Council.

Prepared long-term market price forecasts by sub-regions in New England, New York, and PJM to capture congestion effects for PECO Energy's acquisition of Sithe assets.

Market analysis of conversion of Salem Harbor to gas for ISO-NE White Paper.

Assessed market potential for independent power producers throughout the US; identified competitive capabilities of utility and non-utility developers and of engineering firms.

ISO-NE cogeneration marketing and permitting assistance for Unitil gas utility.

Assessed state-by-state future demands for cogeneration systems based upon industrial activities, fuel costs, utility purchase and sales rates, and regulatory climates.

PROJECT DEVELOPMENT

Advised a confidential client on HVDC cable system operational issues, including performance risks, O&M issues, and voltage-source converter technology.

Assisted NRG with economic analysis, financing structure, debt and equity sources, finance rates, PPA terms, and credit issues for proposed offshore wind project.

Advised Maine Department of Transportation on proposed LNG terminal project, including feasibility, site, safety, comparative economics, and pipeline routing.

Provided commercial advice on 15 MW cogeneration upgrade for New York University, including economic feasibility, contract structure, and utility backup arrangements; advised on renewable wind project development / contractual support.

Advised The Stanley Works on business strategy / financing of 8MW hydro plant.

Completed pre-financing development work (permits, construction, and financing) for Ocean State Power Phase I, a 225 MW combined cycle plant in Rhode Island.

PROJECT AND DUE DILIGENCE EVALUATIONS

Conducted economic evaluation of the Deepwater Block Island offshore wind project for the Rhode Island Economic Development Corporation, including PPA pricing, risk allocation, price suppression benefits, regional economic impacts, and other issues.

Forecasted expected operating regime and changes in market power prices and regional air emissions for Bayonne 512 MW gas turbine peaker plant with HVAC underwater cable lead into NYC; report was used for Bayonne's Article VII Certificate application.

Prepared revenue and operating expense projections of PJM coal and combined cycle plants being sold by AES, including capacity revenues under alternative scenarios.

Conducted financial analysis of rival cogeneration projects at New York University, including operating cost savings, tax-exempt debt terms, and credit rating impacts; prepared project valuation and recommendation for Financial Committee.

Advised the New York State Housing Finance Agency as lender to a cogeneration project, including project review, contract negotiation, and financing terms.

Managed due diligence review, construction monitoring, and acceptance testing of cogeneration, combined cycle, fluidized bed, and industrial projects for commercial lenders, investment banks, and government, bilateral & multilateral agencies:

- Brooklyn Navy Yard, 220 MW cogeneration plant, New York
- Derwent Cogeneration Project, 210 MW cogeneration plant, England
- East Java Power, 500 MW combined cycle plant, Indonesia
- EES Coke Battery, 900,000 ton per year coke facility, Michigan
- Guna Power Project, 347 MW naphtha / gas combined cycle plant, India
- Hadley Falls, 43 MW hydroelectric plant, Massachusetts
- Hub Power, 1,200 MW, \$1.8 billion, World Bank-supported plant, Pakistan
- Indiana Harbor Coke Battery, 1.3 million ton per year facility, Indiana
- Kot Addu, 1,600 MW oil / gas combined cycle plant, Pakistan
- Midland Cogen Venture, 1,370 MW \$2.3 billion cogen plant, Michigan
- Niagara Falls Resource Recovery, 800,000 ton per year plant, New York

- Panther Creek, 80 MW fluidized bed power plant, Pennsylvania
- Warrior Run, 180 MW fluidized bed power plant, Maryland
- York Research, financing of four plants, Texas, New York, and Trinidad

Established the economic value and financing plan for existing 43 MW hydroelectric power plant in support of acquisition and financing by a Massachusetts municipal utility.

Evaluated operating characteristics and economics of cogeneration expansion plans for the Massachusetts Institute of Technology, and recommended phased-in scheduling.

Managed due diligence reviews of US coal and gas-fired power plants in support of Manweb (UK) equity investments; helped negotiate transaction modifications.

Recommended cogen plant design and financing plan for Turkish Industrial Zone.

Evaluated the feasibility of converting the Bataan nuclear power station in The Philippines to a gas-fired combined cycle plant for Shell Oil Company.

AUCTIONS & PROCUREMENT

Independent monitor on behalf of the California Public Utilities Commission for Southern California Edison's Fixed Price Request for Offers from non-gas fired Qualifying Facilities; authored Independent Evaluator Report for the Commission.

Agent for the New Jersey Board of Public Utilities to administer the Long-Term Capacity Agreement Pilot Program to develop 2,000 MW of new capacity; responsible for evaluating bidder financial strength / development expertise, contract drafting, and security (letters of credit and cash in escrow) provisions.

Retained by the Illinois Power Authority as Procurement Administrator for the 2008, 2009, 2010, and 2011 competitive procurements of energy, capacity, and RECs, the 2010 procurement of long-term renewable resources, and the 2012 Rate Stability energy and RECs procurement for the Ameren Illinois Utilities; responsible for benchmark pricing, finance, credit, security, performance, and related contract issues.

Advised the Connecticut PURA on economic costs / benefits, credit / collateral terms, and other contract conditions for long-term PPAs.

Conducted power and fuel price forecasts and financial analysis for a confidential equity investor in the auction of the 2,480 MW Ravenswood Facility in NYC.

Assisted Allegheny Electric Cooperative to identify power purchase and equity investment opportunities in PJM; evaluated economics and risk parameters of PPA, tolling, market purchases, and ownership options; reviewed ISDA and EEI agreements.

Part of the Procurement Monitor team for PURA to oversee Connecticut Light & Power and United Illuminating 2006-2012 supply procurements; responsible for credit issues and financial barrier options to protect against unanticipated price movements.

Advised LIPA on commercial and financial issues associated with multiple solicitations for on-island and off-island capacity and energy; refined contract terms on risk and credit.

Evaluated third party contracts, on-site generation alternatives for Visy Paper, NYC.

Evaluated design-build proposals for a CHP plant at Rochester Institute of Technology, including engineering / construction qualifications, O&M strategy, financial structure, utility interconnection issues, and lifecycle cost / ROI results.

Evaluated strategic electric and gas procurement strategy options for the Buffalo Fiscal Stability Authority; made procurement recommendations to BFSa and City officials.

Evaluated bidders for Indianapolis Power & Light's 1992 competitive power solicitation.

PROJECT FINANCING

Developed capital structure and cost of capital values for a MISO coal plant divestiture; evaluated depreciation assumptions and alternative (replacement cost less depreciation and comparable sale) valuations in support of state commission testimony.

Advised multiple clients on off-balance sheet financing structures, including tax-exempt operating leases and third-party ownership of CHP and cogen facilities.

Advised clients and conducted studies of merchant gas turbine and combined cycle financing assumptions filed at state commissions and FERC.

Structured non-recourse construction and permanent debt financing for Ocean State Power, the first domestic IPP; liaison between investors and financial advisor.

Developed off-balance sheet financing plans for ThermoElectron cogen projects.

Applied to the US Synthetic Fuels Corporation for price supports and loan guarantees.

Managed Pacific Gas and Electric's \$60 million pollution control Industrial Development Bond financing for Geysers dry steam geothermal power plants; structured financing terms with bond counsel, investment banks, and corporate staff.

Recommended financing and contract support structures for Pacific Gas and Electric subsidiaries & joint venture projects, including coal mine, power plants, gas production, and residential conservation.

PRIVATIZATION / DIVESTITURE

Prepared comprehensive descriptions of Southern California Edison thermal generation (12 plants, 10,000 MW) and Commonwealth Edison coal stations (6 plants, 6,000 MW) for Divestiture Offering Memorandum.

Technical and economic advisor to Maine Public Service, Fitchburg Gas and Electric, and Unitil Corp for hydro, thermal, and power purchase agreement divestiture.

Commercial and contract advice to Empresa Electrica de Guatemala, S.A. for power plant divestiture.

Commercial advice (including forward pricing) to a confidential bidder for the New England Electric System divestiture (2800 MW thermal & 1200 MW hydro).

Provided technical / environmental advice to the Government of Pakistan for the 1600 MW Kot Addu plant privatization; developed capacity / energy contract pricing structure adopted in final sales documents.

GAS AND FUEL PROJECTS

Developed integrated gas supply, storage, and forward haul transportation project for utilities in metropolitan New York / New Jersey to expand winter deliveries.

Evaluated equity return / risk profiles and prepared cash flow forecasts of interstate gas pipelines and storage projects for independent power plants in the Northeast.

Prepared testimony on risk, financing, and capital cost for the Endicott Pipeline Co.

Evaluated throughput and rate impacts on financial returns of competing gas pipeline proposals to support the development of Iroquois Gas Pipeline.

Commercial Advisor to the Pakistan Government for privatization of the Sui Northern Gas Pipeline Company (approx. 200 bcf annual sales with 24,000 km of pipe).

Determined distribution links between major domestic gas production basins and markets to allocate exploration and development funds of Sohio Petroleum.

World Bank advisor for Asia Pacific Ltd. oil storage & pipeline projects, Pakistan.

ENERGY / POWER PLANT OPTIMIZATION

Evaluated contract terms and conditions governing energy options for Nassau County Hub commercial district including cogeneration, spot market purchases, etc.

Assisted NYC industrial firm with cogeneration development; drafting steam purchase, power purchase option, site lease, and development contracts.

Developed cost-effective energy strategy with asset reconfiguration, contract restructuring, and permit modifications for Massachusetts Water Resources Authority.

Implemented direct gas service via Algonquin Gas Transmission and evaluated cogeneration options for Phelps Dodge copper plant in Connecticut.

Developed inside-the-fence cogeneration and fuel strategy for Arizona paper mill.

Identified optimal cogeneration plant configuration and fuel supply for City of Holyoke municipal utility.

FINANCIAL ANALYSIS / VALUATION

Financial and business evaluation of proposed electrical distribution / cogeneration system in Brooklyn NY using innovative non-synchronous interconnection technology.

Assessed gas turbine market dynamics, commercial issues, and financial damages for lawsuit regarding turbine inlet fogging systems for enhancing output and efficiency.

Evaluated intended financing plan and resulting credit strength of proposed new owner of Entergy's merchant nuclear plants, including Vermont Yankee, for the Vermont DPS; prepared information requests and rebuttal testimony.

Prepared cogen investment analysis for Massachusetts Institute of Technology.

Co-authored appraisals of five 22 MW GWF Bay Area fluidized bed coke-fired power projects and 209 MW Kalaeloa oil-fired cogeneration plant for financing transactions.

Advised lessor on buyout offer of wood-fired plant including future residual value.

Quantified the financial implications of purchasing an undivided equity interest in the River Bend nuclear plant in light of revised operating & maintenance expenses, revised administrative & general expenses, and changing market conditions for PECO Energy.

Evaluated pro forma assumptions and risk / returns of Malaysian power projects.

Reviewed financial feasibility of clean coal demonstration projects for DOE.

Managed steam purchase contract evaluation and internal cogeneration feasibility study for petrochemical producer in The Netherlands.

Proposed project financing options for Elektrenai plant modernization in Lithuania.

Power and fuel negotiation support for Cumbria Power, Ltd., the first English IPP.

Developed economic assumptions, financial pro formas, and equity return / risk profiles for numerous proposed power projects for ThermoElectron and clients.

Prepared long-term financial and rate forecasts of Pacific Gas & Electric for state commission filing.

GENERATION PLANNING / RESOURCE ECONOMICS

Audited Florida Power & Light's resource plan, including fuel, load, and generation.

Techno-economic cogeneration feasibility study for Algonquin Gas Transmission.

Valued existing generating plant based on alternative peaking capacity for Delmarva Power & Light.

Forecasted avoided energy / capacity costs for domestic third-party generators.

Supervised life cycle power plant economic analysis for a Fuel Use Act application.

Compared historic and projected electric use by manufacturing industry for EPRI.

LITIGATION SUPPORT AND EXPERT TESTIMONY

Submitted Direct Testimony on behalf of the Vermont DPS addressing the reliability, market price, socio-economic, and environmental impacts of Vermont Yankee's potential retirement to the Vermont Public Service Board (Docket No. 7862).

Provided expert report on the gas turbine power market and turbine inlet cooling competition in legal malpractice suit concerning gas turbine inlet fogging systems in the Ninth Judicial Court, Orange County, Florida (Case No. 2011-CA-004008-O).

Submitted expert report on alternative resource options, system reliability, market price, and socio-economic impacts of Vermont Yankee's potential retirement for the Vermont DPS in US District Court, District of Vermont (Civil Action No. 11-cv-99).

Submitted Affidavit to FERC on NYISO Demand Curve Reset parameters (excess capacity, system deliverability upgrades, and cost escalation rate) for Capability Years 2011/12 - 2013/14 on behalf of NYC generators (Docket ER11-2224-0000).

Provided Testimony on Deepwater Block Island offshore wind farm PPA price and electric impacts for the Rhode Island Economic Development Corporation, plus an Advisory Opinion on regional economic impacts, to the Rhode Island Public Utility Commission (Docket No. 4185).

Testified before the Virginia State Corporation Commission on behalf of Shell Energy NA regarding DVP's 2009 Integrated Resource Plan (Case No. PUE-2009-00096).

Submitted expert report and testified before the Virginia State Corporation Commission on behalf of Shell Energy NA regarding Dominion Virginia Power's 2007 Solicitation for 2011 Unit Capacity on RFP structure and bid evaluation issues (Case PUE-2008-00014).

Prepared information requests, submitted expert testimony, and testified before the Vermont Public Service Board on behalf of the Vermont DPS re: the proposed restructuring of Entergy's merchant nuclear generation assets (Docket No. 7404).

Submitted expert report on behalf of generator group; participated in FERC Technical Conference on proposed Reliability Pricing Model mechanism to set PJM market capacity prices (FERC Dockets Nos. EL05-148 and ER05-1410).

Prepared expert report on New York and New England capacity market mechanisms and plant valuation impacts for the Mirant Corporation Equity Committee in US Bankruptcy Court (Case No. 03-46590).

Submitted FERC affidavit regarding gas turbine engineering and economic parameters to reset locational ICAP demand curve; represented NYISO at FERC Technical Conference (FERC Docket No. ER05-428).

Expert witness regarding Salton Sea binary cycle geothermal EPC contract performance and consequential damages based on plant production and market power rates before the American Arbitration Association.

Expert witness testimony for the Bridgeport RESCO waste-to-energy facility at the Connecticut PURA re avoided cost pricing in the deregulated energy market (Docket 99-03-35REO3).

Tax valuation support for gas and electric assets for Yankee Gas Company and The Connecticut Light and Power Company in Connecticut Superior Court (Docket No. CV 95-0072561S).

Expert witness report supporting PECO Energy (Exelon) decision to cancel purchase of equity interest in the River Bend nuclear plant in US District Court for the Middle District of Louisiana (Adversary Proceeding No. 98-477-B-M3).

Expert witness report and testified regarding contractual benefits of major coal plant turbine upgrade for Mechanical Plant Services, Inc. based on future market power values in US District Court for the Middle District of Florida, Orlando Division, (Case No. 6:99-CV-76-ORL-22A); accepted as an expert in power project cost analysis and power price forecasting.

Expert witness regarding economic feasibility, financing, and profitability of Mid-Atlantic Energy's proposed cogeneration plant in West Virginia Circuit Court (Civil Action No. 95-C-214M).

Presented testimony on the relationship of independent power development fees to project capital costs before the American Arbitration Association.

PRESENTATIONS & PUBLICATIONS

Co-authored article “Working Jointly to Develop Offshore Wind” on socio-economic benefits and coordinating offshore wind development policies, published in North American Windpower, October 2012.

Speaker on cross-industry panel: Let's Talk Transmission: Unplugged! at the NARUC 2012 Summer Committee Meetings, July 2012.

Primary author of “Green Gridworks” lead article on transmission integration of renewable resources, Public Utilities Fortnightly, February 2012.

Panelist at the Northeast Offshore Wind Summit addressing renewable resource penetration and outlook in the ISO-NE electricity market, 2010.

Presentation to NYISO Installed Capacity Working Group on peaker proxy technology / cost / performance, deliverability, site requirements, availability, etc, 2010.

Moderated panel on ISO-NE's Forward Capacity Market mechanism at the Northeast Energy & Commerce Association's 2009 Power Markets Conference.

Gas and electric market interdependency panel moderator at Platt's 4th Annual Northeast Power Forum, 2009.

Sponsor for the Northeast Energy and Commerce and Association conference “Northeast Capacity Markets”; moderator for panel on generation entry / attrition outlook, 2007.

Conference organizer and moderator for “Capacity Markets – Impacts on Assets and Power Pricing” regarding generation and transmission investment in ISO-NE, NYISO, and PJM, 2007.

Conducted workshop, “Forecasting Capacity Prices in the Northeast” and panel moderator on generation financing at Infocast Northeast Power Supply Forum, 2006.

“Financing Projects with ICAP Revenues”, Infocast Power Financing conference, 2004.

Panel moderator on New England and Canadian LNG Projects, Infocast Atlantic Coast LNG Conference, 2004.

Speaker, “Power Sales Contract Restructuring Issues”, at Infocast Asset Optimization and Portfolio Management Conference, 2003.

Panelist on “Southwest Connecticut Congestion”, 10th Annual New England Energy Conference, 2003.

“Fuel and Power Contracting”, Int'l District Energy Association Conference, 2002.

“Contract Restructuring”, Infocast QF & IPP conference, 2001.

“Successful Valuation and Value-Creation of Transmission Assets”, Infocast Electric Asset & Portfolio Valuation conferences, 2001.

“Evaluation of Repowering the Cabot Street Steam Station” using gas turbine technology, International District Energy Association conference, 2001.

“Plant Repowering” at the Infocast Plant Acquisition conference, 2000.

“Equipment Performance Impacts”, Infocast Merchant Peaking Plant conference, 2000.

“The Pros and Cons of Repowering” in Competitive Utility, 2000.

“The First Wave” (initial divestiture results) 1998 and “Gas versus Coal” (techno-economic study) 1995, Independent Energy magazine.

“Evaluating Technical and Construction Risk” and “The Due Diligence Process”, classes and case studies on for the Infocast Project Finance Institute, 1996-1998.

Non-utility generation and project financing classes at Stone & Webster Utility Management Development Program, 1989-96; General Electric, 1991-94; IBM 1994.

"Self Generation under Competitive Bidding", 1989 Cogen & IPP Congress.

EDUCATION

Wharton Graduate School (Univ. of Pennsylvania)
MBA in Finance / Operation Research, 1978

Brown University
Sc.B. in Applied Mathematics / Economics, 1976

International Gas Turbine Institute course
Basic Gas Turbine Technology, 1996

Kennedy School (Harvard University) courses
International Geopolitics of Oil, 1982
International Political Economy, 1993

MISCELLANEOUS

Member of the Newton Solid Waste Commission, 2011-

Board of Directors, Northeast Energy and Commerce Association, 2007-2011.

President and volunteer, Watertown Recycling Center; served on Watertown Trash and Recycling Committee that initiated curbside pickup 1990-1996.

Adjunct faculty lecturer in finance, Golden Gate University, 1979-1980.

Optimum yield resource management, National Oceanic and Atmospheric Administration, 1977.

Member of Mayor's Waterfront Development Committee and Interface: Providence urban design team, 1974-1976.

RICHARD L. CARLSON, Ph.D.

SUMMARY

Economics consultant and model developer experienced in power and fuels portfolio risk-reward optimization; stochastic modeling of power and fuel commodity market prices, load, and hydro and wind energy; real options valuation analysis of generation resources; wholesale power and natural gas procurement methods and contracts evaluation; wholesale electric market performance and market power; 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

- 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 2012 Renewables RFO (on-going).

Prepared portion of State of Connecticut Power Procurement Plan for Standard Service for the CT Public Utilities Regulatory Agency.

Prepared statewide economic impact analysis for a confidential developer of a natural gas combined cycle project in response to the 2011 Maryland RFP for new resources.

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.

Independent evaluator to the California Public Utilities Commission for Southern California Edison's 2011 Non-Gas QF Fixed Price 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 REC price forecasts 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 and directed development, implementation, and training of a model 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

Advised the Connecticut Office of Consumer Council on negotiations of customer and state benefits in the proposed merger of Northeast Utilities and NSTAR, and cross-examined the utilities' chief financial officers.

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 Ventyx 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 Ventyx EnerPrise software system.

Directed Ventyx 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

University of Wisconsin

Ph.D., Resource Economics (Agricultural Economics), 1984

M.A., Resource Economics (Agricultural Economics), 1975

Washington State University

M.A., Natural Resource Economics (Agricultural Economics), 1973

B.S. with Distinction, Agricultural Economics, 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).

Federal Energy Regulatory Commission: Docket No. ER11-2224-000; Protest of the New York City Suppliers, Appendix B (December 21, 2010). Critique of the capacity demand curve reset econometric study performed for the New York ISO and presentation of the results of alternative econometric analysis.

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) and 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.

JOHN J. ELDER

SUMMARY

A registered professional engineer in mechanical engineering with expertise in market simulation analysis, transmission load flows, and thermodynamics. Supervises LAI's production simulation and transmission load flow modeling efforts. An authority on technical operating and performance issues, competitive power system regulations, transmission congestion, engineering economic evaluations, and technology assessments.

PROFESSIONAL EXPERIENCE

- 1995 - **Levitan & Associates, Inc.**
 Manager, Power Systems and Market Design
 Senior Consultant
- 1994 - 1995 **Hague International Corp.**
 Project Engineer
- 1970 - 1994 **Stone & Webster Engineering Corp.**
 Principal Mechanical Engineer - Heat Exchanger Specialist
 Mechanical Engineer

CONSULTING ASSIGNMENTS

MARKET ANALYSIS

Prepared analysis and report on the impact of proposed New York City peaking capacity on power market prices and air emissions in the NYISO and Eastern PJM markets.

Prepared analysis and report for the Maryland Public Service Commission on the impact of potential policy initiatives on Maryland electric consumer costs. Prepared load and resource forecasts to identify potential capacity shortfalls.

Testified at the Maryland Public Service Commission regarding the expected value of the output of the Warrior Run project as sold into the PJM market vs. a bilateral contract.

Prepared analysis and report on the impact of new peaking capacity in the NEMA/Boston area on emissions in New England.

Analyzed the distribution of non-energy market revenues (including ancillary services, uplift/BPCG/Operating Reserve Credit and ICAP/UCAP) among various market participants in support of project financial analysis for multiple clients, including utilities, energy investors and generators.

Prepared analysis and report on the market revenues expected for new peaking resources for presentation to the NYISO ICAP Working Group in support of its determination of ICAP Demand Curve parameters.

Advised ISO-NE, NYISO, and PJM Interconnection regarding the impacts of hurricane related damages to natural gas production, gathering and processing facilities in the Gulf of Mexico on fuel availability and grid reliability for the winter 2005/2006.

Analyzed the historical relationship between load, installed capacity and market energy prices in New England in support of financial analysis of proposed peaking market sales from an existing generator owned by the Massachusetts Water Resources Authority.

SIMULATION MODELING

Maintains a database of project development status, generation retirements, load forecasts, transmission constraints and other market data in support of production simulations and other market forecasts.

Performed production simulation modeling for New York State and adjoining areas (PJM, ISO-NE, and Canada) to prepare electric energy price forecasts under a congestion pricing framework covering all major consumption areas in New York State as well as plant specific operating costs and revenues for a variety of clients including Pure Energy, Abitas Capital, NYISO, New York Power Authority (NYPA), Long Island Power Authority (LIPA), All Capital, Cornell University, Westchester County Public Utility Service Agency, Consolidated Edison, the New York State University Construction Fund, the University of Rochester, the Rochester Institute of Technology, American National Power.

Performed production simulation modeling covering the NYISO and adjoining areas to develop electric generator gas consumption forecasts under transmission constraints for LIPA and Consolidated Edison.

Performed production simulation modeling for PJM and PJM West and adjoining areas to support analysis of policy initiatives for the Maryland Public Service Commission and to develop gas consumption forecasts under transmission constraints for the PJM Interconnection.

Performed production simulation modeling for New England and adjoining areas to prepare electric energy price forecasts under a congestion pricing framework covering all major consumption areas in New England as well as plant specific operating costs and revenues for multiple clients, including NStar, Connecticut Department of Public Utility Control, Abitas Capital, Consolidated Edison, PP&L Global, TransCanada Power, El Paso, and BW Energy.

Performed production simulation modeling for SERC and adjoining areas to prepare electric energy price forecasts in support of PowerGen on the acquisition of Louisville Gas & Electric.

Performed production simulation modeling for ERCOT and SPP to support financial analysis of the comparative economics of IGCC, pulverized coal, and natural gas-fired combined cycle generating plants.

Developed and/or reviewed production simulation model assumptions for use by the IMO, NYISO, and ISO-NE and reviewed their simulation results for gas reliability studies. Analyzed simulation results from MAPS (NYISO and IMO) and Prosym (ISO-NE) to prepare reports and inputs for gas pipeline modeling.

Reviewed production simulation by others (MAPS, Prosym, Promode, UPLAN, IREMM) regarding model assumptions and results in connection with congestion forecasting, energy contracting, contract restructuring and litigation support.

Prepared electric energy price forecasts for several proposed cogeneration evaluations for Cornell University, the University of Rochester, the State University of NY and the University of Massachusetts.

TRANSMISSION CONGESTION ANALYSIS

Analyzed transmission economic and reliability upgrades in PJM, NYISO and ISO-NE markets to identify regulated and merchant investment opportunities.

Analyzed transmission constraints and locational capacity and spinning reserve requirements affecting power plants proposed for New York City, Western NY, Rockland County, Long Island, Maine, Rhode Island, and Ontario.

Analyzed transmission congestion in northern NJ to support selection of points for analysis of Incremental Auction Revenue Rights resulting from the transmission upgrades proposed for the Neptune DC cable for LIPA.

Analyzed transmission congestion and reserves commitment in southeastern Massachusetts and Cape Cod to support expert testimony regarding the market and environmental impacts of NStar's proposed Carver to Cape Cod transmission project.

Analyzed transmission congestion in northern Maine to support expert testimony regarding the Maine Power Connection for the Connecticut DPUC.

Analyzed transmission congestion between JCP&L and the PJM CEI interface to support testimony in the NJ BPU hearings on the GPU First Energy merger.

TRANSMISSION INTERCONNECTION SUPPORT

Provided technical advisory services regarding interconnection options for a cogeneration facility at the Rochester Institute of Technology.

Provided technical advisory services regarding selection of the RTO to serve as operating authority and transmission system upgrades required for the Neptune DC cable from NJ for LIPA.

Provided technical advisory services regarding the development of the Green Path transmission project in southern California by Citizen's Energy.

Provided technical advisory services regarding transmission system upgrades required for interconnection of new generators for two projects in Maine, for Calpine and American National Power, a project in New York City for Visy Paper.

PROCUREMENT

Evaluated proposals for the sale of capacity and/or energy to NYPA and to LIPA.

Supported due diligence review of the Linden Cogeneration Plant's generation and transmission assets and the potential development of a VFT underwater HVDC cable link between PJM and NYISO for a confidential client.

Prepared analysis of "seams issues" to support evaluation of proposals for off-island capacity and/or energy received by LIPA. Issues included scheduling constraints resulting from proposal terms and the requirements of the NYISO and PJM or ISO-NE as well as the costs and risks associated with the PJM or ISO-NE transmission service required to execute the proposed transactions.

On behalf of the Connecticut Department of Public Utility Control, provided modeling to set proxy prices for energy and capacity for the procurement of Standard Service and Supplier of Last Resort Service for the state's two investor-owned utilities.

On behalf of the Connecticut Department of Public Utility Control, testified regarding the comparison of proposals for development of peaking power plants in Docket No. 08-01-01.

Advised the Ameren Illinois Utilities regarding the procurement process for the acquisition of a portfolio of energy products, including energy swaps, capacity and renewable energy credits, to meet the utilities' native load requirements for the period June 2008 through May 2009.

Provided advisory services regarding procurement of new base load capacity to Allegheny Electric Cooperative.

Analyzed the role of New England pumped storage facilities in the ancillary services markets for PP&L Global.

Supported due diligence review of Commonwealth Electric's generation assets including production simulation to support an energy price forecast, evaluation of development potential and site inspection of existing facilities for BW Energy.

Supported due diligence review of Boston Edison's generation assets including production simulation to support an energy price forecast, evaluation of development potential and site inspection of existing facilities for Consolidated Edison.

CONTRACT SUPPORT

Analyzed the distribution of non-energy market revenues (including ancillary services, uplift/BPCG/Operating Reserve Credit and ICAP/UCAP) among various market participants in support of contract financial analysis for multiple clients, including utilities, energy investors and generators.

Analyzed the impact of the terms of a dispatchable NUG contract on market prices to evaluate the total portfolio cost of purchased power for Consolidated Edison.

Reviewed term sheets and draft contracts with regarding interactions with applicable market rules for Consolidated Edison.

Evaluated proposed strategies to mitigate the effects of minimum generation events with respect to the limitations and constraints imposed by the operating characteristics of the plants operating within the PJM control area.

Facilitated Non-Utility Generation restructuring of Tenaska Ferndale contract on behalf of Puget Sound Energy.

Supported due diligence review of Central American generation assets including site inspection and evaluation of facilities for BankBoston.

LITIGATION SUPPORT

Prepared FERC affidavit regarding gas quality control on the Maritimes and Northeast system for Calpine Corporation.

Supported preparation of expert testimony regarding the Maine Power Connection for the Connecticut DPUC.

Prepared analysis of plant revenues in support of asset valuation in Mirant bankruptcy proceeding.

Provided litigation support to owners of a solid fuel, non-utility generator and a gas-fired cogenerator in PJM.

PLANT PERFORMANCE

Analyzed performance parameters and operating limits of several proposed cogeneration technologies for the Cornell University, University of Rochester, the State University of NY and the University of Massachusetts.

Prepared analysis and report on the effect of natural gas supply temperature on plant performance and availability for Florida Power & Light. Analyzed the impact on delivered gas temperature of various pipeline operating modes including the Joule Thomson effect and heat transfer through the pipe wall.

Prepared analysis and report on steam turbine operating limits for a Massachusetts Water Resources Authority cogeneration project that resulted in increased operating flexibility and reduced fuel costs.

Analyzed the performance and operating modes of solid fuel and gas fired combined cycle cogeneration facilities to develop strategies for contract restructuring for utilities in New York, Pennsylvania, West Virginia, and Washington.

Analyzed under-performance of Bay State Gas pipeline gas turbo expander energy project and predicted the maximum output that was realized after plant repairs.

Evaluated operating problems and proposed boiler and fuel handling upgrades for the Osceola and Okelanta Cogeneration projects.

Analyzed the performance and operating modes and operating costs of several gas fired combined cycle cogeneration facilities to develop strategies for contract restructuring for Puget Sound Energy.

PRIOR BACKGROUND

Prepared performance data for proposals for advanced combined cycle plants using a proprietary coal fired gas turbine combustion system.

Developed a procedure to prevent overheating a combustion turbine when operating with high levels of air extraction.

In support of the development of a high temperature gas to air heat exchanger, predicted the circumferential and axial temperature distribution in a ceramic tube exposed to convective and radiation heat transfer to predict the tube life and susceptibility to thermal cracking.

Developed a conceptual design for a closed loop cooling water system to transfer heat from the helium in a closed loop gas turbine power plant to the circulating water system for the Department of Energy. This effort included sizing the cooling water/circulating water heat exchanger, selecting the flow rates for the cooling and circulating water, and developing a conceptual arrangement.

Evaluated the feasibility and desirability of adding a Secondary Condensing System to ABB's System 80+ plant on behalf of the Korean Electric Power Company. Two design approaches were considered. The evaluation included sizing major equipment, equipment layout, interfaces with existing systems, and licensing impacts.

Reviewed the specification, bid evaluation, contract award, drawing review fabrication and testing for a high pressure and low-pressure feedwater heater for Electric Power Research Institute. Prepared a life cycle cost analysis for heaters using carbon steel, stainless steel and AL6XN tubing.

Participated in the Balance of Plant (BOP) design for a closed cycle helium gas turbine power plant using a helium-cooled reactor as a heat source. Prepared a plant cycle diagram and heat balance diagram. Determined the configuration and required sizes for BOP heat exchangers (recuperators, intercoolers, precooler and cooling tower).

Evaluated the impact of installing an oversized pump impeller for Sequoyah Nuclear Power Station - Tennessee Valley Authority. This analysis included consideration of consequences and repercussions to the system design of the containment spray system.

Developed procedures to ensure the technical accuracy and completeness of Design Basis Documents for North Anna - Virginia Power. Prepared Design Basis Documents for two nuclear power plant systems: the Auxiliary Feedwater and Component Cooling Water systems.

Coordinated engineering activities related to Duquesne Light Company application for a rate increase.

Coordinated and reviewed all Power Division activities related to Beaver Valley Unit 2 submitted to the NRC.

Prepared the Mechanical sections of the Description of Plant and the Plant Estimate for Patriot Power Station, Indianapolis Power & Light, and a 700 MW coal-fired steam power plant.

Supervised all Power Division engineers and designers as they prepared piping and diagrams for Boston Edison's Mystic Station wastewater treatment facility. Responsible for completion of the work on schedule and within budget.

Supervised work on the BOP for Sundesert Nuclear Power Plant. Oversaw activities related to flow diagrams, system descriptions, equipment specifications, and PSAR preparation, ensuring technical adequacy. Prepared BOP work package schedules and budgets.

Prepared and maintained flow diagrams and reviewed associated system diagrams and drawings prepared by other disciplines for Millstone Nuclear Power Station Unit 3. Prepared system descriptions, maintained equipment specifications reviewed vendor drawings and technical documents for compliance with the specifications, FSAR sections for the service water system and emergency diesel generators.

Calculated the thermal performance and fluid pressure drops for heat exchangers for many applications. Prepared calculations for equipment used to determine the heat exchanger configuration required to meet a specified thermal performance with constraints on pressure drop, overall length and/or diameter.

Prepared many engineering studies to evaluate the technical and economic feasibility of design concepts ranging in scope from individual mechanical components to integrated resource plans.

EDUCATION

Massachusetts Institute of Technology
M.S., Mechanical Engineering, 1967
B.S., Mechanical Engineering, 1967

PROFESSIONAL REGISTRATION

Commonwealth of Massachusetts Professional Engineer License #EN 27757-M

ASSOCIATIONS

ISO-NE Transmission Expansion Advisory Committee

American Society of Mechanical Engineers

New England Gas Association

Northeast Energy and Commerce Association

PUBLICATIONS

"Cost and Security of Backup Power Supplies," IDEA 13th College/University Conference Proceedings, February 2000.

"A Test Program for Predicting and Monitoring the Emergency Diesel Generator Heat Exchangers at Limerick Generating Station and Peach Bottom Atomic Power Station," Proceedings of the International Joint Power Generation Conference, October 1995.

PHILIP L. CURLETT

SUMMARY

A Managing Consultant and professional engineer with 40 years of experience in power engineering, project development, and financial analysis. Principal expertise includes technical and financial modeling of energy and industrial projects, risk analysis, gas pipeline and energy system simulation, decision support structures for procurement, and technology assessment.

PROFESSIONAL EXPERIENCE

- 2000 - **Levitan & Associates, Inc.**
 Manager – Energy Systems Analysis
 Executive Consultant
- 1990 – 1999 **Stone & Webster Development Corporation**
 Project Development Manager
- 1973 – 1990 **Stone & Webster Engineering Corporation**
 Consultant
 Supervisor
 Project Manager,
 Power Engineer
 Engineer

CONSULTING ASSIGNMENTS

GAS PIPELINE MODELING AND ANALYSIS

Prepared Exhibit G flow diagrams and supporting documents for a filing before FERC for the transfer of LNG and pipeline facilities to Public Service Resources Corporation.

Simulated performance of New England natural gas pipeline infrastructure for several days of the January 2004 cold snap to determine deliverability of gas to power plants as part of a study for ISO-NE. Confirmed historical deliveries and estimated deliveries under postulated contingencies.

Assessed deliverability of natural gas to Long Island over the Transco system to accommodate new gas fired capacity as part of the evaluation of proposals in response to a Long Island Power Authority RFP.

Developed detailed models of several interstate natural gas pipeline systems serving the Northeast US using WinFlow software as part of the *Multi-Regional Gas Study*, an assessment of the potential impact of gas deliverability on power supply reliability in PJM, ISO-NE, NYISO, and IMO control areas. (2002-2003)

GAS PIPELINE COST ALLOCATION AND RATE DESIGN

Developing cost allocation and rate design model to support testimony on behalf of a major shipper on Florida Gas Transmission in FERC rate case RP10-21-000.

Performed analysis of proposed cost allocation and rate design on behalf of a major shipper on El Paso Natural Gas pipeline in FERC rate case RP08-426-000.

EVALUATION OF SYSTEM PLANNING ALTERNATIVES

Assisted the Connecticut Office of Consumer Council (OCC) in its review of the state's Integrated Resource Plan (IRP), focusing on the direct and indirect costs and benefits of energy efficiency and demand response programs. (2010-2012)

Performed analyses on behalf of NStar to assess the relative benefits and costs of a proposed transmission line to reinforce deliverability of power to Southeastern Massachusetts and Cape Cod, in particular, against alternatives of reliance on aging generating units or new generation. (2011)

Analyzed the direct and indirect cost effects of both transmission and generation alternatives available to the New York Power Authority (NYPA) to serve customer loads in New York City. (2007-2008) Options evaluated included a 660 MW controllable transmission link between New Jersey and New York City, a cross-Hudson generator lead to convert a New Jersey generation plant into an in-City asset, and various in-City generation projects. Analysis included estimating effects of each alternative on market energy and capacity prices and city-wide cost of load, as well as direct contract costs.

PROCUREMENT AND BID EVALUATION SYSTEMS

Developed RFP and bid evaluation process for long-term contracts for energy and Renewable Energy Certificates as part of the standard service supply portfolio for an Illinois utility on behalf of the Illinois Power Agency. Previously developed procedures for processing and evaluating bids for energy, capacity, and REC products to serve standard service load in Illinois. (2008-2012) Oversaw REC bid evaluation process based on on-line bid submissions, ranking of bids under various categories, and processing rules for preferences and limits by category. Prepared analysis comparing and contrasting standard service auction structures and product mixes in Illinois and Ohio.

As part of LAI's supervision of the 2006 through 2012 Connecticut Standard Service and Supplier of Last Resort solicitations on behalf of the state's Public Utility Regulatory Authority (PURA, previously known as Department of Public Utility Control), developed and implemented a mixed-integer linear programming application to quickly find an optimum combination of bids covering multiple delivery periods and subject to a wide range of contingency constraints. Also defined a structure for calculating "proxy" prices used to set hurdles for acceptance of bids beyond the

targeted quantity and for the rejection of bids where deferral of a tranche to a later solicitation might yield a more favorable result.

On behalf of the Prosecutorial team for the Connecticut DPUC, performed economic analysis of plans for peaking generation offered by various sponsors in response to legislation seeking cost-of-service generation. (2008) Analysis included assessment of impact of each portfolio of possible projects on markets for locational forward reserves, capacity, and energy, as well as the direct costs and benefits of contracts for differences tied to regulated cost-of-service principals. Also, developed a pricing structure for peaking generation contracts for differences (CfDs) s. The new peaking facilities will receive cost-of-service revenues, subject to performance guarantees, in exchange for the market value of energy, capacity, and ancillary services produced.

Developed evaluation process and participated in drafting of Standard Offer Capacity Agreement (SOCA) form for a fast-track procurement process for capacity contracts-for-differences for the New Jersey Board of Public Utilities under the Long-Term Capacity Agreement Pilot Program (LCAPP) (2011). Performed economic evaluation of proposals and consolidated all evaluation results for presentation to the Board.

Performed a detailed financial comparison of proposals to provide off-Island generation capacity and energy to Long Island Power Authority (LIPA) over its HVDC cables connecting Long Island to New England and New Jersey. (2005-2006) Modeling incorporated capacity and energy market rules and reliability criteria in each region.

Performed a multi-phase analysis of proposals for on-island generation, off-Island transmission (sub-marine cables), and off-Island generation for LIPA (2004-2005). Early phases compared bids on a total cost per kW of equivalent capacity, allowing for screening. Subsequent phases involved chronological modeling of New York and surrounding control areas to establish hourly impacts of each proposal and reasonable combination of proposals over a 22-year planning horizon to allow calculation of the present value of the cost of serving load. Financial modeling included a probabilistic simulation using @Risk under various scenarios of fuel costs and other variables to assess risk factors. Defined electric market simulation runs in MarketSym and processed results to extract utilization and energy pricing data.

Developed Requests for Proposals and performed bid analyses for two rounds of all-source power solicitations by Seminole Electric Cooperative, Inc.

Developed bid evaluation procedures for selection of preferred bidder for lump sum turnkey construction contract of a large coal fired power plant for Indianapolis Power & Light Co.

Developed bid evaluation procedures for selection of preferred bidder for a build-own-operate-transfer power plant for the Public Power Corporation of Greece.

MARKET STRUCTURE DEVELOPMENT AND ANALYSIS

Performed economic and financial analyses as part of a study for the Maryland Public Service Commission considering alternative strategies to secure timely new entry of high merit generation in the Maryland load area. (2007-2008) Strategies included long term contracts for differences based on new nuclear, wind, and gas-fired generation in the State. In an extension of the study, evaluated financial impact of a partial return to rate-base regulation through the repurchase of previously divested generation by the electric distribution companies or a state power authority.

Developed model for incorporation of projected net energy revenues into the calculation of the reference point capacity revenue requirement for New York Independent System Operator (NYISO) UCAP demand curve mechanism. (2003-2004). Defined simulation runs in MarketSym and developed procedures for extracting revenue data for use in financial model.

SYSTEM OPERATIONS AND OPTIMIZATION

Developed a cost-to-load optimization model to provide LIPA with 2-day ahead recommendations for hourly energy flow level settings on the Cross Sound Cable (Connecticut to Long Island) and the Netpune Cable (New Jersey to Long Island). (2007-2008) The model uses the RiskSolver add-in to Excel to optimize 48 independent variables, given stochastic forecasts of relevant nodal energy prices and daily updates to fuel prices, hourly loads, and generation unit availability.

COGENERATION PROJECT FEASIBILITY

Performed a discounted cash flow economic evaluation of various options for steam and electric supply, including cogeneration, for Newport News Shipbuilding. (2011)

Evaluated proposals to Rochester Institute of Technology for development of a central heating and cooling plant with cogeneration based on either reciprocating engines or gas turbines. (2006) A detailed load model was developed to allow simulation of each proposal over a realistic range of campus requirements and market price conditions for fuel and electric energy.

Evaluated alternative short term and long term central heating plant capacity expansion options for Cornell University. (2004-2006) Options included the continued use of coal, gas/oil fired boilers, gas turbine-based cogeneration, and biomass combustion. Several procurement and delivery strategies for natural gas were considered. The alternatives were modeled probabilistically under various scenarios of campus load growth, fuel and electric prices, and variables affecting the use of coal to quantify financial merit and risk measures.

Evaluated alternative strategies for electric and thermal energy supply for University of Rochester. (2003-2005) Performed risk analysis on a proposed biomass-fueled boiler plant, including reliability and economics of dedicated short rotation woody crops and

wood waste as possible fuels. Modeled both gas-fired and biomass projects to establish economic merit relative to the *status quo*.

Evaluated fuel, electricity and steam energy alternatives for a large recycle paper mill in New York City. (2003) Alternatives included cogeneration, use of landfill gas, rejects combustion, and hosting of a merchant power plant. Analysis included location value due to transmission constraints.

Assessed alternative cogeneration plant configurations for Massachusetts Institute of Technology and for the Massachusetts Water Resources Authority.

Evaluated alternative energy production strategies for the State University of New York campuses as part of a university system-wide review of energy procurement including locational consideration relative to electric transmission and gas pipelines.

Evaluated alternative energy management, production and procurement strategies for Abitibi-Consolidated's Snowflake linerboard mill.

Managed cogeneration feasibility studies for Boston College and University of Pennsylvania.

ASSET VALUATION / FINANCIAL DUE DILIGENCE

Performed a discounted cash flow (DCF) valuation of a minority interest in a mid-western coal-fired generating unit in support of testimony before the Michigan Public Service Commission on behalf of WE Energies. (2011)

Analyzed benefits to Public Service Company of New Hampshire ratepayers of continued operation of the Newington generating station under a wide range of possible fuel and energy market conditions using a stochastic modeling approach. (2010)

Developed a Capitalized Income-based appraisal of the Indian Point nuclear power plant for the County of Westchester, New York. (2004-2005) The appraisal model used energy revenue estimates based on chronological modeling of the New York and surrounding power markets. Capacity revenues were based on the New York Independent System Operator (NYISO) Demand Curve mechanism. The effort included an assessment of the value of extending the current operating license for the two units against the costs of securing the extension. The impact on local electric rates of a closure of Indian Point was also assessed. Defined MarketSym runs to develop energy pricing profiles under various retirement scenarios.

Analyzed value of deregulated generation assets in a proposed merger of two large energy companies using chronological simulation modeling to capture the value of unique resources such as pumped energy storage.

Performed due-diligence review in support of a successful tax-exempt bond financing of an acquisition of hydroelectric assets by a municipal utility department. Analyzed

value of expected output from the facilities against the wholesale marketplace. Developed comprehensive financial model of department encompassing electric, gas, steam, and telecommunications activities.

Performed due-diligence evaluation for Inter-American Development Bank on coal-fired Termoeléctrica del Golfo power project in Mexico.

Performed asset valuation study for lenders supporting a bid to acquire Connecticut Light & Power generating assets.

Performed due-diligence evaluation for lenders in re-financing of Southern California Edison and San Diego Gas & Electric generating assets acquired by NRG.

Performed due-diligence financial modeling evaluation for Chemical Bank in its financing of a Solvay, NY, linerboard plant.

CONTRACT RESTRUCTURING

Developed a detailed model to analyze the effects of proposed changes to a power purchase agreement for a large electric utility. The model considers the probabilistic interactions of volatile market energy prices and the dispatch of a large cogeneration facility under different contractual constraints. Used MarketSym to establish energy price regime under various dispatch structures.

Analyzed gas supply contract restructuring strategies for a large independent power facility in New England, taking into consideration the changes in gas and power market structures since the contract was originally executed. Client sought to retain the value of certain favorable provisions while adapting the pricing mechanism to the current market.

Analyzed non-utility generator contract reformation initiatives for Potomac Electric Power Co.

Provided support for non-utility generator contract arbitration for Allegheny Energy.

PROJECT DEVELOPMENT / PROJECT FINANCE

Performed financial and process modeling to support development from inception through financing, construction, and initial operation of the Auburn VPS recycle pulp project.

Developed technical and economic performance models for the Tampa Bay Water seawater desalination project developed by Poseidon Resources and Stone & Webster. Created bid pricing structure to allocate electric pricing, volume, and other risks between developer/owner and the regional water authority.

Performed technical, economic and financial modeling of the Pedricktown Cogeneration Limited Partnership 110 MW combined cycle project for owner and CS First Boston.

PRIVATIZATION PROGRAMS

Managed a series of studies and consulting assignments over several years for the U. S. Army Corps of Engineers, involving all aspects of competitive energy and utility services procurement for military installations in the U. S. and Europe. Projects included the energy plant at Fort Drum, NY, a waste water treatment plant at Fort Sill, OK, and cogeneration feasibility studies at the Pentagon, Fort Meade, Fort Irwin, and the Presidio.

POWER PLANT ENGINEERING

Developed project screening and prioritization procedures for multiple-plant upgrade and/or life-extension programs for the World Bank (Pakistan and the Dominican Republic), Omaha Public Power District, Consolidated Edison, and Northeast Utilities.

Co-developed software to analyze the impact of different coals on power plant design, capital costs, and operating costs. Managed a study for Consolidation Coal Company to assess valuation differentials for various coal resources based on long-term contract customer value.

Performed heat rejection system optimization studies to match performance parameters of cooling towers and condensers to site ambient conditions, turbine performance characteristics, and client economic criteria for several major nuclear, coal-fired, and gas-fired power plant projects.

EDUCATION

Babson College, Wellesley Hills, MA
MBA, 1981

Bucknell University, Lewisburg, PA
M.S., Mechanical Engineering, 1973
A.B., Economics and B. S., Mechanical Engineering, 1972

PRESENTATIONS & PUBLICATIONS

"Cornell University Energy Master Plan and Economic Analysis" (with T. Peer), IDEA Campus Energy Conference, Albuquerque, NM, February 2006.

"Evaluating Capacity Bids: The Seminole Solicitations," NRECA Competitive Bidding Conference, Washington, DC, July 1992.

"Economic Decision Making for Condenser Life Extension," (with Y. G. Mussalli). EPRI Condenser Technology Symposium, Providence, RI, September 1987.

"Economic Evaluation of Plant Improvement Projects Which Mitigate Forced Outage Risks". Proceedings of the American Power Conference, Vol. 49, 1987.

"Selecting Initial Steam Conditions for Industrial Power Plants," (with C. J. Haynes). Power Engineering, Vol. 89, No. 3, March 1985.

"Economic Decision Making for Life Extension Programs," Stone & Webster Life Extension Seminar, Bedford, MA, September 1984.

"Determining the Value of Availability" (with C. S. Nowiszewski). Proceedings of the American Power Conference, Vol. 46, 1984.

"An Economic Evaluation of Nuclear Service Water Pump Options," (with G. T. Kan). 1983 Joint Power Generation Conference, Indianapolis, IN.

"Evaluating the Effects of Coal Quality on New Power Plant Capital and Operating Costs", (with B. C. Kreppinni). Proceeding of the American Power Conference, Vol. 45, 1983.

"The Impact of Condenser Tube Fouling in Power Plant Design and Economics", (with A. M. Impagliazzo). Fouling in Heat Exchange Equipment, ASME, HTD - Vol. 17, 1981.

REGISTRATIONS

Registered Professional Engineer, Massachusetts, #30597 (Mechanical)

BORIS L. SHAPIRO

SUMMARY

An electric power engineer, market design consultant, and project manager with an international background in power plants, system design, transmission planning, and operations. Extensive state regulatory experience and participation in the regional stakeholder processes includes system technical and operational analysis, market efficiency, reliability, and resource adequacy determination.

PROFESSIONAL EXPERIENCE

2007-	Levitan & Associates, Inc. Executive Consultant Senior Consultant
2002-07, 1991-96	Massachusetts Department of Public Utilities Senior Utility Engineer Utility Performance Engineer
1996-2001	PA Consulting Group Program Director Deputy Chief of Party Senior Consultant
1976-1990	Russian Electric Power Research Institute Senior Researcher Junior Researcher Testing Engineer

CONSULTING ASSIGNMENTS

SYSTEM PLANNING AND RELIABILITY ASSESSMENT

On behalf of CT Public Utilities Regulatory Authority (PURA), prepared reliability benefit analysis portion of a joint affidavit to the FERC on proposed transmission project interconnecting a remote wind generating facility in Northern Maine with the bulk transmission system of New England.

On behalf of NSTAR Electric Company, analyzed the economic impact and reliability benefits of a proposed 345 kV transmission line from Carver, MA to Cape Cod. Analyzed feasibility and economic efficiency of the active DR alternative addressing the reliability need; testified at the MA Energy Facilities Siting Board hearings.

Investigated the Unitil's subsidiary Fitchburg Gas and Electric Light Company's response to a December 2008 ice storm in Massachusetts and assisted in preparation of

an updated emergency restoration plan. Reviewed the company's emergency preparedness and service restoration plans, interviewed company's managers and engineers, prepared the company's self-assessment report, and recommend enhancements. Analyzed the company's emergency preparedness, response, and service restoration plans against good practices in other states, provided a detailed critique of existing plan, and developed recommendations that were adopted. Extensive analysis was presented to the MA Department of Public Utilities (DPU).

Reviewed and evaluated annual reliability filings at MA DPU submitted by jurisdictional electric utilities and participated in the annual meetings with the utilities' technical staff for review of their reliability reports, quality of service, and summer preparedness activities.

Participated in the Regional System Planning process as a member of the New England regional Planning Advisory Committee. Analyzed proposed reliability transmission upgrades in NEMA, North Shore, lower SEMA, and SWCT areas. Provided recommendations to MA DPU on feasibility studies, system impact studies, engineering solutions, cost estimates, and cost allocation proposals.

Represented MA DPU in the regional Scenario Analysis working group. Provided regular updates to the Commission on the working group progress and major issues discussed during the meetings.

Represented MA DPU in the Massachusetts State Working Group investigating the blackout of August 14, 2003.

Conducted investigation of the stray voltage and dislodged manhole covers events in the Greater Boston area.

Monitored the NERC process for developing mandatory reliability standards, including vegetation management standards, identified issues, drafted comments, and made recommendations to the MA DPU.

RESOURCE ADEQUACY / PROCUREMENT

Provided oversight of the Long Term Capacity Agreement Pilot Program (LCAPP) on behalf of the New Jersey Board of Public Utilities. In the role of LCAPP Agent, LAI had the responsibility for establishing the LCAPP process, pre-qualifying eligible generators, managing communications, evaluating project economics, completeness, and risks, and submitting recommendations for the Board's consideration. Prepared responses to questions from the participants and was responsible for analyzing BRA rules, including MOPR revision process at PJM, in preparing our report.

On behalf of the Illinois Power Authority (IPA) and in the context of the IPA 2013 Procurement Plan developed methodology for determination of the scalar factor for the benchmark standard offer price of small distributed generation (photovoltaics) based on the average procurement cost of larger PV installations.

On behalf of the CT Office of Consumer Counsel (OCC), reviewed and assessed the integrated resource plans (IRPs) filed by CL&P and UI, and by the Connecticut Energy Advisory Board in the 2010 IRP and 2012 IRP proceeding administered by CT PURA. Focused on the procurement and policy recommendations offered by the parties regarding EE and active DR options.

As a consultant to the CT PURA, developed a methodology for determining the optimal amount of local operating reserves, designed criteria for selecting new peaking generation projects, developed model terms and conditions for a Contract for Differences, evaluated costs and benefits to ratepayers of competing proposals over a 30-year contract term, recommended projects for selection, and provided written and verbal testimony during the contested phase of the proceeding.

Provided analytical support in economic evaluation of continual operation of a power plant on behalf of NH Public Service Company in the course of the IRP proceeding at NH PUC.

On behalf of a confidential client, provided analytical support to the need assessment in the course of the IRP proceeding at MD PSC in 2011, and focused on the DR and EE forecast.

On behalf of a confidential client, assessed management and performance risks of ownership transfer of an HVDC cable.

Evaluated contract terms and conditions governing energy options for Nassau County Hub commercial district including cogeneration, spot market purchases, etc.

On behalf of the MD PSC, evaluated alternative strategies for meeting the state's growing power demands through new generation, transmission expansion, and demand-side options. Developed a methodology evaluating costs and benefits associated with the "15 by 15" demand side and energy efficiency scenario. Analyzed market and reliability impact of the backbone transmission projects.

On behalf of PowerOptions, advised the non-profit corporation regarding the development of a program to install solar photovoltaic facilities on member institutions' sites across Massachusetts under PPA arrangements.

Provided technical support in preparing expert report on the Dominion Virginia Power's 2007 Solicitation for 2011 Unit Capacity for Shell Energy North America that addressed capacity needs, bidder qualifications, competitive procurement best practices, and bid evaluation methodology.

MARKET / POLICY ANALYSIS

On behalf of CT OCC, analyzed merger proposal by NU and NSTAR, focusing on the cost savings.

On behalf of CT PURA, participated in the Forward Capacity Market (FCM) regional stakeholder working group established by ISO-NE to review existing mechanism, assess deficiencies in market rules, and develop recommendations for rule changes.

Conducted extensive evaluation and prepared expert testimony on behalf of CT PURA supporting a complaint filed at FERC regarding capacity payments made from 2006 to 2009 by New England customers to external Northern New York capacity resources.

Participated in the New England regional stakeholder process; advised the MA DPU on the state regulatory policy with regards to establishing the FCM mechanism in the context of the FERC negotiated Settlement Agreement.

Analyzed ratepayers' potential exposure under the proposed Locational Forward Reserve Market (ASM Phase II); provided technical and policy advice to the MA DPU regarding the design, development, and modification to the Locational Forward Reserve Market.

Participated in the regional working stakeholder groups involved in the revision of the Installed Capacity Requirements determination methodology; provided recommendations to the MA DPU on the implications for the state's electricity consumers.

Identified deficiencies in the compensation mechanisms for providing reactive power and voltage support in the New England region; proposed revisions to the FERC OATT Schedule 2. Represented MA DPU in the regional stakeholder work group charged with making recommendations for the Schedule 2 modifications.

Analyzed New England market inefficiencies, market power issues, and associated second contingency and VAR uplift costs for the MA DPU; proposed mitigating measures.

Provided analytical support to NJ BPU in the FERC proceeding regarding MOPR mechanism in the PJM RPM capacity market.

Reviewed the Reliability-Must-Run proposals for the cost of service agreements, followed the related FERC proceedings, and made recommendations to the Commission.

Monitored the FERC rule-making processes developing the generation interconnection standards, including interconnection standards for the intermittent (large wind) resources.

Provided consulting services to the new Energy Regulatory Commissions, Ministries of Energy, and utility companies of Newly Independent States (Russia, Ukraine, Armenia, and Georgia) in restructuring their electric power sectors.

Contributed to drafting and editing of the Electricity Law in Georgia and in Armenia; drafted licensing regulations and licenses for the market members in Georgia, Armenia, and Ukraine.

Developed distribution company service quality standards in Ukraine; assisted the Ukrainian state regulatory commissioners in determining their policy on demand-side management programs; proposed and developed a pricing methodology for ancillary services.

Designed methodology for transition from a one-part tariff (energy only) to a two-part tariff (both energy and capacity) in Russia; directed a USAID-funded Winter Heating Assistance Project in Georgia under a humanitarian assistance program to subsidize electricity rates with a total budget close to \$7 million.

Participated in the development of the competitive wholesale markets of electric power in the individual nations and in the entire Caucasus region; evaluated power flows and transactions between Russia, Georgia, Armenia, Azerbaijan, and Turkey; developed and drafted the grid codes, market rules, and model bilateral contracts.

Developed programs and coordinated study tours for foreign regulators and governmental officials to Washington, DC (FERC), Kansas and Missouri (PUCs). As a resident advisor in Russia, worked in a capacity of Administrative Deputy to the COP, responsible for office operations and local staff work supervision; conducted training sessions and made presentations at the conferences.

PRIVATIZATION/DIVESTITURE

Responsible for Seabrook nuclear power plant divestiture case at the MA DPU; conducted discovery, cross-examined witnesses, and made recommendations.

Conducted discovery and cross-examined NSTAR witnesses in the proceedings for termination of the multiple power purchase agreements with IPPs; provided recommendations to the MA DPU.

Recommended organizational reform of the vertically integrated state-owned utility companies in Russia.

POWER PLANT DESIGN AND EFFICIENCY

In the context of the MA DPU administered fuel charge proceedings, set performance goals, conducted prudence reviews, and evaluated actual performance of nuclear electric power plants including Pilgrim, Vermont Yankee, Millstone, Maine Yankee, Connecticut Yankee, and Seabrook. Estimated replacement power costs associated with nuclear plants' extended planned and unplanned outages.

Coordinated a project in Russia for power plant efficiency evaluation for introduction and implementation of the economic dispatch in the electric power system.

Designed an advanced doubly fed 220 MW electrical generator, excitation system, and automatic voltage controller for the Russian EPRI, supervised its manufacture, and implemented as a retrofit at a coal-fired power plant in Burshtin, Ukraine.

Prepared and conducted field operational tests of commercial power plants for troubleshooting, efficiency, or reliability improvement purposes.

PRESENTATIONS, PUBLICATIONS & PATENTS

“Gas / Electric Interdependencies: Near Term Strategic Considerations,” Presentation at ISO-NE, September 2012.

“Green Gridworks”, Public Utilities Fortnightly, February 2012

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

“The Doubly Fed Generators as Source of the VAR Support,” Presentation at the NEPOOL Transmission Committee’s VAR Working Group, July 20, 2005.

“Desynchronized Synchronous Turbogenerators: Could They Benefit the New England Electric Power System?” Presentation at the NEPOOL Reliability Committee Meeting, Oct 5, 2004.

Development and Investigation of Desynchronized Turbogenerators, Their Application in Power Systems. Presentation at the International Conference on the Evolution and Modern Aspects of Synchronous Machines (SM100), Zurich, Switzerland, Aug 1991.

Review of a Textbook “Design of Turbogenerators” by A. Abramov, V. Izvekov, N. Serikhin. Moscow, 1990.

Dynamic stability of a doubly fed turbogenerator under the emergency load drop. Presentation at the National Scientific Conference, Moscow, MPEI, 1989.

Research of the performance characteristics of the turbogenerator ASTG 200-2U3 in asynchronous mode without excitation and voltage control. Elektricheskie Stantsii, Issue 7, 1988.

Device for reversible control of excitation for an electrical machine with two-axis field windings. Russian Patent #1688368, 1988.

Analytical method of the approximated estimation of the dynamic stability limitations of the doubly fed electrical generators, Presentation at the National Scientific Conference, Kaunas, Lithuania, 1988.

Utilizing physical modeling techniques for testing abnormal operation of doubly fed generators under the contingencies in the excitation system. Transactions of the Russian Electric Power Research Institute, Moscow, 1988.

Transients in the doubly fed turbogenerators during accidental loss of their excitation and voltage control. Institute of Electro Dynamics Akademii Nauk of Ukraine, Preprint 491, Kiev, 1987.

Automatic Voltage Controller for doubly fed electrical machine, Russian Patent #1314429, 1987.

Dynamic stability of the doubly fed electrical generator equipped with excitation systems of various structures, Izvestiya Akademii Nauk, Energetika i Transport, 1986, Issue 3, pp. 3-11.

Device for controlling doubly fed electrical machine, Russian Patent #1288885, 1986.

Post-contingency transients during restoration of the excitation system of a doubly fed electrical generator, Elektricheskie Stantsii, 1985, Issue 10, pp.38-40.

Transients in the doubly fed electrical generators under various contingencies in their excitation systems, Presentation at the Russian National Scientific Conference, Dneprodzerzhinsk, 1985, Part I, cc. 151-152.

Dynamic stability of the electrical generators with the two-axis excitation system, Presentation at the Ukrainian Scientific Conference, Kiev, 1985, pp. 53-54.

Device for the two-axis excitation of electrical machines, Russian Patent #1156234, 1985.

Transients in the doubly fed electrical generator during malfunctions in the exciter, Elektricheskie Stantsii, 1984, Issue 11, pp. 51-53.

Transients in the doubly fed electrical generator under full excitation loss, Elektricheskie Stantsii, 1983, Issue 10, pp. 46-49.

Analysis of potentials for improving the power factor of a doubly fed electric drive by alteration of the geometrical parameters of the conventional electric motor. Transaction of the Russian Electric Power Research Institute, Moscow, 1982.

EDUCATION

Russian Electric Power Research Institute
Ph. D. in Electric Power, 1987

Moscow Power Engineering Institute
M.S. in Electrical and Mechanical Engineering, 1976

University of Michigan
Annual Regulatory Study Course, 1991

MISCELLANEOUS

Evening classes lecturer and lab instructor in Theory and Operation of Electrical Motors and Generators, Russian Correspondence Polytechnic Institute, 1980-86.

Translator from English into Russian of Foreign Patents and Scientific Papers on Electrical Motors and Generators, and their application in the Electric Power Systems, Russian State Institute of Scientific and Technical Information (VINITI), 1977-82.