

ROGER SCHIFFMAN

SUMMARY OF QUALIFICATIONS

Mr. Schiffman has 25 years of energy industry experience covering utility resource planning, electricity market evaluation, market assessment and simulation modeling; regulatory policy development; economic and financial analysis, and contract evaluation. Mr. Schiffman has worked with public and private utility companies on resource planning decisions, power plant retirement decisions, avoided cost determinations, and on power supply procurement activity. Mr. Schiffman has worked extensively with electric utility staff, power plant developers, regulatory personnel, investment bankers and other industry participants in both consulting and regulatory environments. Mr. Schiffman possesses extensive financial analysis skills, supported by thorough knowledge of financial, economic and accounting principles. He has a strong technical understanding of the electric utility industry and excellent analytical problem-solving skills, including quantitative analysis and computer modeling techniques.

EXPERIENCE

Managing Director, Power Markets Research Group, Davis, CA, October, 2015 - Present

- Providing avoided cost analysis, projections and testimony for wind energy projects under development in Montana and South Dakota. These projects have involved review and assessment of avoided cost methodology and projections developed by investor-owned utility operating in that region, and development of independent estimates of avoided cost.
- Completed transmission planning engagement evaluating proposed transmission line under development in the Pacific Northwest, by Puget Sound Energy. As part of this engagement, reviewed studies PSE had sponsored to advance its high voltage transmission project. Completed independent power flow and reliability analysis of the Puget Sound and Pacific Northwest market area, and developed analysis of whether the proposed line is needed to maintain power system reliability.

Principal, Black and Veatch Corporation, Inc., Sacramento, CA, November, 2008 to October, 2015

- Initiated Integrated Resource Plan for the Virgin Islands Water & Power Authority. This project is a multi-faceted IRP, where detailed planning and potential siting impacts must be considered in the overall planning, due to geographic and topology limitations on the islands. Mr. Schiffman directed the analysis and playing the lead analytic role in assessing resource needs. This included directing the data gathering efforts, taking technical lead in completing production cost and financial modeling, and managing Black & Veatch's team of technical experts. Mr. Schiffman also developed a stakeholder process and gave multiple presentations before stakeholder and customer groups.
- Completed nodal market simulation and congestion study for a concentrating solar plant in Northern Nevada. This engagement includes a review of transmission system impact studies, power flow data and development of a PROMOD nodal simulation database to assess congestion likelihood for the project.
- Completed economic assessment of a large pumped storage project in Southern California, including development of energy market arbitrage, capacity market and ancillary services market

revenue forecasts. Developed pro forma financial statements examining economics of project under different ownership and off-take agreement structures.

- Completed Integrated Resource Plan for Azusa Light & Water, a municipal utility in southern California. This project involved using Black & Veatch's EMP database and price forecast, specifying thermal and renewable resource options, and completing detailed market simulation and financial modeling to determine a preferred power supply plan for Azusa. A key focus of the study is to identify resource options to replace output from the San Juan 3 coal plant, which is scheduled to retire.
- Completed Integrated Resource Plan for Pasadena Water & Power, a municipal utility in southern California. This project involved using Black & Veatch's EMP database and price forecast, specifying thermal and renewable resource options, and completing detailed market simulation and financial modeling to determine a preferred power supply plan for Pasadena. The project also included reflection of key stakeholder input, and testing stakeholder driven policy proposals for advancing renewable resource procurement beyond state-mandated RPS levels. A key focus of the study is to identify resource options to replace output from the Intermountain coal plant, which is scheduled to retire.
- Completed generation reliability study for the Brownsville Public Utility Board. This study included directing the completion of detailed reliability modeling using GE-MARS, and evaluating loss-of-load probabilities for BPUB based on its existing system and based on the addition of a 200 MW ownership share in the combined cycle power plant being developed in Brownsville by Tenaska. The study also included detailed pro forma modeling of partial ownership of the combined cycle plant, and a financial and risk assessment presented to BPUB's Board of Directors, and also used to address rating agency questions about credit impacts of the new power plant. On behalf of Southern California Edison, completed nodal power price forecast and assessment of high voltage transmission upgrades and additions in Southern California. This project included an assessment of congestion, locational marginal pricing, transmission system losses, and economic impacts of adding new transmission facilities in WECC, with particular focus on Southern California. PROMOD IV was used to complete the nodal market analysis, and PROMOD simulation results were translated into GE-PSLF for more detailed transmission system modeling of power flow cases under a variety of supply and demand conditions throughout the year.
- Completed four projects focused on nodal market modeling in California, Arizona and Southern Nevada. These studies were used to assess congestion risk faced by solar and wind generation projects at the sites where each is being developed. Completed PROMOD IV dispatch and nodal analyses for each project, and developed risk assessments for generation curtailment risk. Also developed analyses of transmission system congestion along delivery paths for each project, and on key economic transmission paths in Northern and Southern California, transmission import paths into Southern California, and transmission paths in Southern Nevada.
- Completed resource and power supply planning/procurement project for confidential SPP energy supplier. Completed a competitiveness assessment of major electricity supplier in Nebraska, examining cost structure, net resource position, generation asset characteristics, transmission access and delivery options, and overall competitive positioning of SPP, MISO and MRO entities that have potential to provide wholesale electricity service in Nebraska. Worked collaboratively with client and a wholesale customer task force
- Completed due diligence analysis of portfolio of power supply assets to support bid development. The generators being sold were located in SPP, WECC, and the Northeast. The

WECC asset is a qualifying facility, which required detailed representation and modeling of the California PUC Short-Run Avoided Cost tariff and pricing formula. One of the SPP assets is also a qualifying facility, which required detailed analysis of the steam load and interaction between joint power and steam production. Completed modeling analysis and risk assessment of power supply agreements, developed revenue forecasts for each power plant, and completed merchant plant analysis of plant operations after PPA expiration.

- On behalf of a municipal utility client, developed database of renewable energy resource bids solicited through an RFP process, developed assessment of delivery terms and transmission tariffs associated with power delivery from distant resources, and completed bid screening analysis of 240 separate bids/pricing options.
- Completed detailed review of California ISO ancillary services markets, and opportunity for renewable energy and energy storage markets to participate in those markets. Analysis included assessment of day-ahead, hour-ahead, and real-time market operation.
- Completed dispatch modeling and power supply planning study examining construction of a pumped storage hydro project in Hawaii. The evaluation included assessments of project revenue in energy, ancillary services, and capacity markets in Hawaii, expected dispatch and operation of the pumped storage project, and comparison of long-term power supply plans with and without addition of the pumped storage project.
- Completed deliverability and congestion analysis of wind energy resources being located in California. Developed nodal market simulations, and examined locational marginal price differences, congestion components, and transmission line loadings of facilities impacted by the wind assets being studied.
- Completed detailed financial and dispatch modeling (deterministic and stochastic) of energy storage project being developed in Southern California, to create dispatch profile and estimated long-term project value of the facility. The evaluation included assessments of project revenue in energy, ancillary services, and capacity markets in Southern California.
- Completed dispatch analysis and financial modeling of pumped storage hydro project in Colorado, for use in regulatory proceedings. The evaluation included assessments of project revenue in energy, ancillary services, and capacity markets in Colorado.
- Completed nodal power price forecast and assessment of high voltage transmission upgrades and additions in Southern California. This project included an assessment of congestion, locational marginal pricing, transmission system losses, and economic impacts of adding new transmission facilities in WECC, with particular focus on Southern California. PROMOD IV was used to complete the nodal market analysis, and PROMOD simulation results were translated into GE-PSLF for more detailed transmission system modeling of power flow cases under a variety of supply and demand conditions throughout the year.
- Completed PROMOD IV dispatch and economic analysis of Lodi Energy Center, with focus upon expected dispatch of the project, and its fit into the overall power supply portfolio of a Southern California Municipal Utility.
- Completed PROMOD IV market price forecasts and detailed analyses of power markets in all North American regions, including hourly energy price forecasts, annual capacity price forecasts, and detailed assessment of supply/demand conditions and generator dispatch. The assessments included forecasts of renewable energy development in each region/submarket, forecast greenhouse gas regulation, and economic assessment of fossil and renewable energy technologies.

Vice President, Ventyx, Inc., Sacramento, CA, June 2007 to November 2008

- Managed project and led analysis for consortium of upper Midwest utilities focused on developing plans for long-term transmission expansion to ensure reliability in the region and to accommodate economic transfer of large-scale wind-based electricity generation. This project examined congestion, reliability and economic benefits associated with large-scale wind generation expansion in the upper Midwest, and accompanying needs for transmission system expansion. Evaluation was completed on both nodal and zonal basis.
- Developed projections of expected dispatch, revenue, and operating costs for new combined-cycle power plant under development in Southern California. Prepared financial projections under merchant plant and other likely economic scenarios. Completed evaluation of tolling agreement terms and conditions.
- Assisted Southern California energy supplier in completing due diligence analysis for investment and development of 300-500 MW wind generation project located in Central/Southern California. Reviewed due diligence documents and completed economic evaluation of expected revenue, operating costs and investment cash flows for the project at a range of capacities varying from 100 MW to 500 MW.

Director, Navigant Consulting, Inc., Sacramento, CA, April, 2000 to June, 2007

- Responsible for managing the price forecasting subpractice within Navigant Consulting's Energy Market Assessment group. Responsibilities included a wide variety of engagements focused on evaluating wholesale power market conditions. Completed market assessment and simulation studies of all North American regional power markets, including Canada and Mexico.
- Created and Developed NCI's PROSYM market simulation practice and capabilities in modeling WECC and Eastern Interconnected markets. Completed numerous market simulation and assessment engagements throughout the U.S. covering all North American market regions.
- With a team of consultants, assisting the California Energy Commission in defining and evaluating scenarios for its 2007 Integrated Energy Plan. Reviewing market simulation results from each of the scenarios and completing analysis of industry and consumer risks likely to be faced in California over the next decade (ongoing).
- Directed NCI's market simulation efforts as independent consultant to the State of California Department of Water Resources, leading to the successful underwriting of \$11 billion in bond financing and supporting the execution of power supply agreements aggregating to over 13,000 MW.
- Developed projections of lost revenue and operating profits due to construction delays at a large combined-cycle project in the Desert Southwest. Prepared evaluation of WECC power market conditions during the construction period for this project, and completed power market simulations used to measure likely dispatch, revenue and operating profits of the project during the construction delay period. Successfully presented and defended those estimates before an Arbitration Panel, resulting in a significant financial award for our client.
- Developed and maintained power market simulations to evaluate likely dispatch, costs, and spot market purchases and sales associated with the California Department of Water Resources purchased power contract portfolio. Results from these simulations have been used in each of the last five years to support CDWR's annual revenue requirement filing before the California

Public Utilities Commission. Provide ongoing regulatory support to CDWR, including consultation and limited training of CPUC staff in power market modeling.

- Directed a number of nationwide market simulation and valuation engagements examining current market value of power plant portfolios owned by Calpine, Mirant, NRG and other independent power producers. Worked with bond investors to develop refined valuation estimates for subsets of each portfolio.
- Served on WECC's Power Simulation Task Force which was formed to assess available options for the WECC to procure, maintain and use a power market simulation database and model in its generation and transmission planning efforts. Participated in task force meetings where criteria were developed for selecting a simulation database and model, and assisted in evaluating proposals submitted to the WECC task force
- Assisted a California investor-owned utility in conducting RFP and in evaluating bids received for short-term and medium-term power supply contracts. Developed cost rankings, economic screening, risk assessment and preferred bid evaluations, and assisted the utility's planning and bid evaluation staff in presenting results to the company's senior management.
- Developed WECC market simulations and assessment of investment conditions for numerous clients used in feasibility analysis and financing support of new generation projects being developed in WECC markets. These analyses included separate evaluation of power market conditions in California, Mexico (Baja), Arizona, Colorado, Nevada, Oregon, Washington, British Columbia, and Alberta.

Senior Consultant, Henwood Energy Services, Inc., Sacramento, CA, 1998 to 2000

- Prepared numerous forecasts of wholesale market electricity prices using Henwood's proprietary market simulation tools. Drafted reports presenting price forecasts to consulting clients. Worked closely with clients and sponsors of new merchant power plants to provide customized market price forecasts and to serve individual client needs. Presented study results to clients and their constituents.
- Directed project evaluation and revenue forecast for major merchant power plant in Texas. Presented revenue forecast to investment bankers, and to several potential equity investors. Advised and worked with project developer to successfully obtain debt and equity financing for the project, which is currently under construction.
- Advised and worked with PricewaterhouseCoopers to perform economic evaluation and market simulations of proposed Purchase Power Arrangements under development in Alberta, Canada. The Power Purchase Arrangements are to be sold at auction in coming months. Prepared economic study of market power held by incumbent electricity suppliers in Alberta.
- Developed software and modeling tools to estimate investment cash flows and pro forma financial results for new merchant power plants. Developed Henwood approach for evaluating profitability of new market entrants and incorporating equilibrium amounts of new entry in its market studies.

Senior Financial Analyst, Public Service Commission of Wisconsin, Madison, WI, 1990 to 1998

- Developed policy proposals for restructuring wholesale and retail electricity markets. Evaluated competing policy proposals for impacts upon consumers and upon electrical system operation. Drafted formal electricity industry restructuring policy adopted by the Wisconsin Commission.

- Developed policies for addressing wholesale and retail market power in Primergy and Interstate Energy Corporation merger cases. Evaluated feasibility and corporate finance implications of asset divestiture and spin-off options for mitigating market power.
- Presented evaluation of proposed electric utility merger legislation to subcommittee of Wisconsin legislature. Advised individual legislators on merger policy.
- Developed policy proposal and draft legislation for reforming power plant siting law and for allowing development of new merchant power plants in Wisconsin.
- Directed industry-wide efforts to revise the PSCW generation competitive bidding procedures. Conducted workshops on proposed revisions for utility and other industry participants. Drafted policy reforms adopted by the Wisconsin Commission.

Research Assistant, University of Wisconsin, Madison, WI, 1989-1990

- Co-authored and provided research support for study of consolidation and mergers in the electric utility industry.

EDUCATION

University of Wisconsin-Madison

- Graduate Studies toward MS-Finance, September 1988 - May 1990.
- Bachelor of Business Administration, Finance, Investment and Banking, May 1988.
- Curriculum concentrated heavily upon financial economics, with additional emphasis upon economics, mathematics, and accounting.

PUBLICATIONS

Electric Utility Mergers and Regulatory Policy, Ray, Stevenson, Schiffman, Thompson. National Regulatory Research Institute, 1992.

The Future of Wisconsin's Electric Power Industry: Environmental Impact Statement, co-author, Public Service Commission of Wisconsin, October 1995, Docket 05-EI-114.

Report to the Governor on Electric Reliability, co-author, Public Service Commission of Wisconsin, Summer 1997.

TESTIMONY

Public Service Commission of Wisconsin, Docket 6630-UR-104, Wisconsin Electric Power Company Rate Case, 1990, "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Docket 6690-UR-106, Wisconsin Public Service Corporation Rate Case, 1991, "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Docket 4220-UR-105, Northern States Power Company (Wisconsin) Rate Case, 1991, "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Rate of Return on Equity, Cost of Capital and Financial Condition, Wisconsin Electric Power Company, Docket 6630-UR-105, Public Service Commission of Wisconsin, 1991

Public Service Commission of Wisconsin, Docket 05-EP-6, Advance Plan 6, 1992, "Alignment of Managerial Interests and Incentives with Integrated Resource Planning Goals" (with Paul Newman).

Public Service Commission of Wisconsin, Docket 6680-UR-107, Wisconsin Power & Light Company Rate Case, 1992, "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Docket 4220-UR-106, Northern States Power Company (Wisconsin) Rate Case, 1992, "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Docket 6630-UR-106, Wisconsin Electric Power Company Rate Case, 1992, "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Docket 05-EI-112, Investigation on the Commission's Own Motion Into Barriers to Contracts Between Electric Utilities and Non-Utility Cogenerators and Certain Related Policy Issues, 1992, "Contract Risk in Long-Term Purchase Power Arrangements."

Public Service Commission of Wisconsin, Docket 3270-UR-106, Madison Gas and Electric Company Rate Case, 1993, "Rate of Return on Equity, Cost of Capital and Financial Condition."

TESTIMONY (CONTINUED)

Public Service Commission of Wisconsin, Docket 6630-CE-187, Wisconsin Electric Power Company, 1993, "Memorandum to Commission Presenting Economic Analysis of Competitively Bid Proposals for New Power Plants" (co-authored).

Public Service Commission of Wisconsin, Docket 6680-UR-108, Wisconsin Power & Light Company Rate Case, 1993, "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Docket 4220-UR-107, Northern States Power Company (Wisconsin) Rate Case, 1993, "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Docket 6630-CE-202, Wisconsin Electric Power Company Auburn to Butternut Transmission Line Case, 1994, "Economic Cost Comparison of Transmission Upgrade and Distributed Generation Wind Turbine Project."

Public Service Commission of Wisconsin, Docket 3270-UR-107, Madison Gas and Electric Company, 1994 "Rate of Return on Equity, Cost of Capital and Financial Condition."

Public Service Commission of Wisconsin, Docket 6690-CE-156, Application of Wisconsin Public Service Corporation for Authority to Increase Electric Generating Capacity (Stage One Competition Among Alternative Suppliers), 1994 & 1995, "Economic Analysis of Competitively Bid Power Plant Proposals" (with Paul Newman), "Contract Risk in Purchased Power Arrangements," "Accounting Treatment for Long-Term Purchased Power Contracts," "Contract Risk and Analysis of True-Up Mechanisms and Balancing Accounts."

Public Service Commission of Wisconsin, Docket 6630-UM-100/4220-UM-101, Wisconsin Electric Power Company/Northern States Power Company Merger Case, 1996, "Market Power Remedies; State/Federal Jurisdictional Issues."

Public Service Commission of Wisconsin, Docket 05-EP-7, Advance Plan 7, 1996, "Risk-Adjusted Discount Rates."

Public Service Commission of Wisconsin, Docket 6680-UM-100, WPL Holdings/IES Industries/Interstate Power Merger Case, 1997, "Market Power Remedies; State/Federal Jurisdictional Issues."

TESTIMONY (CONTINUED)

Public Service Commission of Wisconsin, Docket 6630-UR-110, Wisconsin Electric Power Company Rate Case, 1997, “Rate of Return on Equity, Cost of Capital and Financial Condition.”

Public Service Commission of Wisconsin, Docket 05-EP-8, Advance Plan 8, 1997, “Purchased Power Costs, Supply Planning Risks and Supply Planning Parameters.”

North Dakota Public Service Commission, Docket No. PU-399-01-186, Montana-Dakota Utilities Co., 2000 Electric Operations Annual Report (Commission Investigation of Excess Earnings), February, 2002, “Wholesale power market conditions in the upper midwest, and the impact on the level and profitability of off-system sales for Montana-Dakota Utilities Co.”

California Public Utilities Commission, Rulemaking 02-01-011 Implementation of the Suspension of Direct Access Pursuant to Assembly Bill 1X and Decision 01-09-0. June, 2002. “Rebuttal Testimony of Roger Schiffman on behalf of the California Department of Water Resources: Market modeling issues.”

Washington DC Arbitration Panel, “Estimate of lost energy sales and lost revenue due to construction delay” for two new combined cycle projects that were built in Michigan and Arizona markets, January-February, 2006.