Samuel Newell

PRINCIPAL

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Dr. Newell leads Brattle's Electricity Group of over 50 consultants addressing the most challenging economic questions facing an industry transforming to clean energy.

His expertise centers on electricity wholesale markets, market design, generation asset valuation, integrated resource planning, and transmission planning. He frequently provides testimony and expert reports to Independent System Operators (ISOs), the Federal Energy Regulatory Commission (FERC), state regulatory commissions, and the American Arbitration Association.

AREAS OF EXPERTISE

- Electricity Wholesale Markets & Planning
- Electricity Litigation & Regulatory Disputes

EDUCATION

- **Massachusetts Institute of Technology**
  PhD in Technology Management and Policy
- **Stanford University**
  MS in Materials Science and Engineering
- **Harvard University**
  AB in Chemistry and Physics

PROFESSIONAL EXPERIENCE

- **The Brattle Group (2004–Present)**
  Principal
- **Cambridge Energy Research Associates (2003–2004)**
  Director
- **Kearney (1998–2002)**
  Manager

SELECTED CONSULTING EXPERIENCE

CAPACITY MARKET DESIGN (ORGANIZED BY JURISDICTION)

- **PJM's Capacity Market Reviews and Parameters**. For PJM, conducted all five official reviews of its Reliability Pricing Model (2008, 2011, 2014, 2018, and 2022). Analyzed capacity auctions and interviewed stakeholders. Evaluated the demand curve shape, the Cost of New Entry (CONE) parameter, and the methodology for estimating net energy and ancillary services revenues. Recommended improvements to support participation and competition, to avoid excessive price volatility, and to safeguard future reliability performance. Relatedly, have also provided Avoidable Cost Rates for existing resources and Net CONE for new energy efficiency resources, for use in the Minimum Offer Price Rule. Submitted testimonies before FERC.
- **Seasonal Capacity in PJM.** On behalf of the Natural Resources Defense Council, analyzed the ability of PJM's capacity market to efficiently accommodate seasonal capacity resources and meet seasonal resource adequacy needs. Co-authored a whitepaper proposing a co-optimized two-season auction and estimating the efficiency benefits. Filed and presented report at FERC.
- **Buyer Market Power Mitigation in PJM**. On Behalf of the "Competitive Markets Coalition" group of generating companies, helped develop and evaluate proposals for improving PJM's Minimum Offer Price Rule so that it more effectively protects the capacity market from manipulation by buyers while reducing interference with non-manipulative activity. Participated in discussions with other stakeholders. Submitted testimony to FERC supporting tariff revisions that PJM filed.
- **Resource Accreditation**. Co-authored two whitepapers in 2022 for the Massachusetts Attorney General's Office on resource accreditation methodologies, including "ELCC" and empirical methods; evaluated reform options for New England.
- **ISO-NE Capacity Demand Curve Design.** For ISO New England (ISO-NE), developed a demand curve for its Forward Capacity Market. Solicited staff and stakeholder input, then established market design objectives. Provided a range of candidate curves and evaluated them against objectives, showing tradeoffs between reliability uncertainty and price volatility (using a probabilistic locational capacity market simulation model we developed). Worked with Sargent & Lundy to estimate the Net Cost of New Entry to which the demand curve prices are indexed. Submitted testimonies before FERC, which accepted the proposed curve.
- **Offer Review Trigger Prices in ISO-NE**. For the Internal Market Monitor in ISO-NE, developed benchmark prices for screening for uncompetitively low offers in the Forward Capacity Market. Worked with Sargent & Lundy to conduct bottom-up analyses of the costs of constructing and operating gas-fired generation technologies and onshore wind; also estimated the costs of energy efficiency and demand response. For each technology, estimated capacity payments needed to make the resource economically viable, given

their costs and expected non-capacity revenues. Recommendations were filed with and accepted by the FERC.

- **ISO-NE Forward Capacity Market (FCM) Performance.** With ISO-NE's internal market monitor, reviewed the performance of the first two forward auctions. Evaluated key design elements regarding demand response participation, capacity zone definition and price formation, an alternative pricing rule for mitigating the effects of buyer market power, the use of the Cost of New Entry in auction parameters, and whether to have an auction price ceiling and floor.
- **Evaluation of Tie-Benefits**. For ISO-NE, analyzed the implications of different levels of tie-benefits (i.e., assistance from neighbors, reducing installed capacity requirements) for capacity costs and prices, emergency procurement costs, and energy prices. Whitepaper submitted by ISO-NE to the FERC.
- **New York State Resource Adequacy Constructs**. For NYSERDA, evaluated the customer cost impacts of several alternative constructs that differ in whether FERC or the state sets the rules and how buyer-side mitigation is implemented.
- **Evaluation of Moving to a Forward Capacity Market in NYISO.** For NYISO, conducted a benefit-cost analysis of replacing its prompt capacity market with a 4-year forward capacity market. Evaluated options based on stakeholder interviews and the experience of PJM and ISO-NE. Addressed risks to buyers and suppliers, market power mitigation, implementation costs, and long-run costs. Recommendations were used by NYISO and stakeholders to help decide whether to pursue a forward capacity market.
- **MISO Resource Adequacy Framework for a Transforming Fleet**. Currently advising MISO in its Resource Availability and Need initiative (2020-present) to reform its resource adequacy framework to address year-round shortage risks as the fleet transforms. Presenting to stakeholders on resource accreditation, determination of LSE requirements, modifications to the Planning Reserve Auction, and interactions with outage scheduling and with energy and ancillary services markets.
- **MISO Competitive Retail Choice Solution.** For MISO, evaluated design alternatives for accommodating the differing needs of states relying on competitive retail choice and integrated resource planning. Conducted probabilistic simulations of likely market results under alternative market designs and demand curves. Provided expert support in stakeholder forums and submitted expert testimony before FERC.
- **MISO's Resource Adequacy Construct and Market Design Elements.** For MISO, conducted the first major assessment of its resource adequacy construct. Identified several successes and recommended improvements in load forecasting, locational resource adequacy, and the determination of reliability targets. Incorporated stakeholder input and review. Continued to consult with MISO in its work with the Supply Adequacy Working Group on design improvements, including market design elements for its annual locational capacity auctions.

- **Singapore Capacity Market Development**. For the Energy Market Authority (EMA) in Singapore, developed a complete forward capacity market design in 2018-2021. Worked with EMA in collaboration with other government entities and stakeholders. Published high-level design documents and presented to stakeholders. Currently assisting with detailed design and implementation.
- **Western Australia Capacity Market Design**. For the Public Utilities Office (PUO) of Western Australia, led a Brattle team to advise on the design and implementation of a new forward capacity market. Reviewed the high-level forward capacity market design proposed by the PUO; evaluated options for auction parameters such as the demand curve; recommended supplier-side and buyer-side market power mitigation measures; helped define administrative processes needed to conduct the auction and the governance of such processes.
- **Western Australia Reserve Capacity Mechanism**. For EnerNOC, evaluated Western Australia's administrative Reserve Capacity Mechanism in comparison with international capacity markets, and made recommendations for improvements to meet reliability objectives more cost effectively. Evaluated whether to develop an auction-based capacity market compared or an energy-only market design. Submitted report and presented recommendations to the Electricity Market Review Steering Committee and other senior government officials.

ENERGY & ANCILLARY SERVICES (AND OTHER) MARKET DESIGN (ORGANIZED BY JURISDICTION)

- **ERCOT Post-Uri Market Reform**. Advised ERCOT and the Public Utility Commission of Texas regarding market design for reliability. Interviewed Commissioners, ERCOT, and stakeholders. Helped frame the problem as primarily resource adequacy and secondarily as operational reliability; evaluated market design proposals to support resource adequacy; evaluated refinements to the Operating Reserve Demand Curve and to Ancillary Services markets; presented recommendations and commented on stakeholder proposals at numerous PUCT workshops. Later invited by the State Energy Plan Advisory Committee to testify.
- **ERCOT's Proposed Future Ancillary Services Design**. For the Electric Reliability Council of Texas (ERCOT), evaluated the benefits of its proposal to unbundle ancillary services, enable broader participation by load resources and new technologies, and tune its procurement amounts to system conditions. Worked with ERCOT staff to assess each ancillary service and how generation, load resources, and new technologies could participate. Directed their simulation of the market using PLEXOS, and evaluated other benefits outside of the model.
- **Investment Incentives in ERCOT**. For ERCOT, led a Brattle team to: (1) interview stakeholders and characterize the factors influencing generation investment decisions; (2) analyze the energy market's ability to support investment and resource adequacy; and (3) evaluate options to enhance resource adequacy while maintaining market efficiency. Worked with ERCOT staff to understand their operations and market data. Performed probabilistic simulation analyses of prices, investment costs, and reliability.

Conclusions informed a PUCT proceeding in which I filed comments and presented at several workshops.

- **Operating Reserve Demand Curve (ORDC) in ERCOT**. For ERCOT, evaluated several alternative ORDCs' effects on real-time price formation and investment incentives. Conducted backcast analyses using interval-level data provided by ERCOT and assuming generators rationally modify their commitment and dispatch in response to higher prices under the ORDC. Analysis was used by ERCOT and the PUCT to inform selection of final ORDC parameters.
- **Economically Optimal Reserve Margins in ERCOT**. For ERCOT, co-led studies (2014 and 2018) estimating the economically-optimal reserve margin, and the market equilibrium reserve margins in its energy-only market. Collaborated with ERCOT staff and Astrape Consulting to construct Monte Carlo economic and reliability simulations. Accounted for uncertainty and correlations in weather-driven load, renewable energy production, generator outages, and load forecasting errors. Incorporated intermittent wind and solar generation profiles, fossil generators' variable costs, operating reserve requirements, various types of demand response, emergency procedures, administrative shortage pricing under ERCOT's ORDC, and criteria for load-shedding. Reported economic and reliability metrics across a range of renewable penetration and other scenarios. Results informed the PUCT's adjustments to the ORDC to support desired reliability outcomes.
- **Carbon Pricing to Harmonize NY's Wholesale Market and Environmental Goals.** Led a Brattle team to help NYISO: (1) develop and evaluate market design options, including mechanisms for charging emitters and allocating revenues to customers, border adjustments to prevent leakage, and interactions with other market design and policy elements; and (2) develop a model to evaluate how carbon pricing would affect market outcomes, emissions, system costs, and customer costs under a range of assumptions. Whitepaper initiated discussions with NY DPS and stakeholders. Supported NYISO in detailed market design and stakeholder engagement.
- **Vertical Market Power**. Before the NYPSC, examined whether the merger between National Grid and KeySpan could create incentives to exercise vertical market power. Employed a simulation-based approach using the DAYZER model of the NYISO wholesale power market and examined whether outages of National Grid's transmission assets significantly affected KeySpan's generation profits.
- **IESO's Market Renewal Program / Energy Market Settlements**. For the Ontario Independent Electricity System Operator (IESO), helped develop settlement equations for the new day-ahead and real-time nodal market, including make-whole payments for natural gas-fired combined-cycle plants participating as "pseudo-units" and for cascading hydro systems.
- **Forward Energy and Ancillary Services (EA&S) Revenues in PJM**. For PJM, developed a method for using forward prices to estimate energy and ancillary services revenues for the purposes of determining capacity market parameters. Collaborated with Sargent &

Lundy to establish resource characteristics, and with PJM staff to conduct hourly virtual dispatch. Filed successful testimony with FERC.

- **Energy Price Formation in PJM**. For NextEra Energy, analyzed PJM's integer relaxation proposal and evaluated implications for day-ahead and real-time market prices. Reviewed PJM's Fast-Start pricing proposal and authored report recommending improvements, which NextEra and other parties filed with FERC, and which FERC largely accepted and cited in its April 2019 Order.
- **Energy Market Monitoring & Market Power Mitigation**. For PJM, co-authored a whitepaper, "Review of PJM's Market Power Mitigation Practices in Comparison to Other Organized Electricity Markets."
- **Market Design for Energy Security in ISO-NE**. For NextEra Energy, evaluated and developed proposals for meeting winter energy security needs in New England when pipeline gas becomes scarce. Evaluated ISO-NE's proposed multi-day energy market with new day-ahead operating reserves. Developed competing proposal for new operating reserves in both day-ahead and real-time to incent preparedness for fuel shortages; also developed criteria and high-level approach for potentially incorporating energy security into the forward capacity market. Presented evaluations and proposals to the NEPOOL Markets Committee.
- **Evaluation of Major Initiatives**. With ISO-NE and its stakeholders, developed criteria for identifying "major" market and planning initiatives that trigger the need for the ISO to provide qualitative and quantitative information to help stakeholders evaluate the initiative, as required in ISO-NE's tariff. Developed guidelines on the kinds of information ISO-NE should provide for major initiatives.
- **Market Development Vision for MISO**. For the Midcontinent Independent System Operator (MISO), worked with MISO staff and stakeholders to codify a Market Vision as the basis for motivating and prioritizing market development initiatives over the next 2–5 years. Authored a foundational report for that Vision, including: describing the core services MISO must continue to provide to support a well-functioning market; establishing a set of principles for enhancing those services; identifying seven Focus Areas offering the greatest opportunities; and proposing criteria for prioritizing initiatives within and across Focus Areas.
- **RTO Accommodation of Retail Access**. For MISO, identified business practice improvements to facilitate retail access. Analyzed retail access programs in IL, MI, and OH. Studied retail accommodation practices in other RTOs, focusing on how they modified their procedures surrounding transmission access, qualification of capacity resources, capacity markets, FTR allocations, and settlement.
- **LMP Impacts on Contracts**. For a California state agency, reviewed the California ISO's proposed implementation of locational marginal pricing (LMP) in 2007 and analyzed implications for "seller's choice" supply contracts. Estimated congestion costs ratepayers would face if suppliers financially delivered power to the lowest priced nodes; estimated incremental contract costs using a third party's GE-MAPS market simulations (and helped

to improve their model inputs to more accurately reflect the transmission system in California). Applied findings to support the ISO in design modifications of the California market under LMP.

- **Australian Electricity Market Operator (AEMO) Redesign**. Advised AEMO on market design reforms for the National Electricity Market (NEM) to address concerns about operational reliability and resource adequacy as renewable generation displaces traditional resources. Also provided a report on potential auctions to ensure sufficient capabilities in the near-term.
- **Energy Market Power Mitigation in Western Australia**. Led a Brattle team to help Western Australia's Public Utilities Office design market power mitigation measures for its newly reformed energy market. Established objectives; interviewed stakeholders; assessed local market characteristics affecting the design; synthesized lessons learned from the existing energy market and from several international markets. Recommended criteria, screens, and mitigation measures for day-ahead and real-time energy and ancillary services markets. The Public Utilities Office posted our whitepaper in support of its conclusions.

TRANSMISSION PLANNING AND MODELING

- **Initial Report on the New York Power Grid Study**. With NYSERDA, NYDPS, and Pterra, submitted a report to the NYPSC projecting New York's transmission needs to support its long-term clean energy goals under the Climate Leadership and Community Protection Act. Our work synthesized findings from three sub-reports addressing local T&D needs, offshore wind, and overall bulk system needs.
- **Value of a NY Public Policy Transmission Project**. On behalf of NY Transco LLC, submitted testimony in 2020 regarding the economic benefits of Transco's proposed "Segment B" transmission project. Critiqued an opposing expert's production cost analysis and broader benefit-cost analysis.
- **Benefit-Cost Analysis of New York AC Transmission Upgrades**. For the New York Department of Public Service (DPS) and NYISO, led a team to evaluate 21 alternative projects to increase transfer capability between Upstate and Southeast NY. Quantified a broad scope of benefits: traditional production cost savings from reduced congestion, using GE-MAPS; additional production cost savings considering non-normal conditions; resource cost savings from being able to retire Downstate capacity, delay new entry, and shift the location of future entry Upstate; avoided costs from replacing aging transmission that would have to be refurbished soon; reduced costs of integrating renewable resources Upstate; and tax receipts. Identified projects with greatest and most robust net value. DPS used our analysis to inform its recommendation to the NY Public Service Commission to declare a "Public Policy Need" to build a project such as the best ones identified.
- **Evaluation of New York Transmission Projects**. For the New York Department of Public Service (DPS), provided a cost-benefit analysis for the "TOTS" transmission projects.

Showed net production cost and capacity resource cost savings exceeding the project costs, and the lines were approved. The work involved running GE-MAPS and a capacity market model, and providing insights to DPS staff.

- **Economic and Environmental Evaluation of New Transmission to Quebec**. For the New Hampshire Attorney General's Office in a proceeding before the state Site Evaluation Committee, co-sponsored testimony on the benefits of the proposed Northern Pass Transmission line. Responded to the applicant's analysis and developed our own, focusing on wholesale market participation, price impacts, and net emissions savings.
- **Benefit-Cost Analysis of a Transmission Project for Offshore Wind**. Submitted testimony on the economic benefits of the Atlantic Wind Connection Project, a proposed 2,000 MW DC offshore backbone from New Jersey to Virginia with 7 onshore landing points. Described and quantified the effects on congestion, capacity markets, CO_2 emissions, system reliability and operations, jobs and economic stimulus, and the installed cost of offshore wind generation. Directed Ventyx staff to simulate the energy market impacts using the PROMOD model.
- **Benefits of New 765kV Transmission Line**. For a utility joint venture between AEP and ComEd, analyzed renewable integration and congestion relief benefits of their proposed $1.2 billion RITELine project in western PJM. Guided client staff to conduct simulations using PROMOD. Submitted testimony to FERC.
- **Benefit-Cost Analysis of New Transmission in the Midwest**. For the American Transmission Company (ATC), supported Brattle witness evaluating the benefits of a proposed new 345 kV line (Paddock-Rockdale). Advised client on its use of PROMOD IV simulations to quantify energy benefits, and developed metrics to properly account for the effects of changes in congestion, losses, FTR revenues, and LMPs on customer costs. Developed and applied new methodologies for analyzing benefits not quantified in PROMOD IV, including competitiveness, long-run resource cost advantages, reliability, and emissions. Testimony was submitted to the Public Service Commission of Wisconsin, which approved the line.
- **Analysis of Transmission Congestion and Benefits**. Analyzed the impacts on transmission congestion, and customer benefits in California and Arizona of a proposed inter-state transmission line. Used the DAYZER model to simulate congestion and power market conditions in the Western Electricity Coordination Council region in 2013 and 2020 considering increased renewable generation requirements and likely changes to market fundamentals.
- **Benefit-Cost Analysis of New Transmission**. For a transmission developer's application before the California Public Utility Commission (CPUC) to build a new 500 kV line, analyzed the benefits to ratepayers. Analysis included benefits beyond those captured in a production cost model, including the benefits of integrating a pumped storage facility that would allow the system to accommodate a larger amount of intermittent renewable resources at a reduced cost.

- **Transmission Investments and Congestion**. Worked with executives and board of an independent transmission company to develop a metric indicating congestion-related benefits provided by its transmission investments and operations.
- **Analysis of Transmission Constraints and Solutions**. Performed a multi-client study identifying major transmission bottlenecks in the Western and Eastern Interconnections, and evaluating potential solutions. Worked with transmission engineers from client organizations to refine the data in a load flow model and a security-constrained, unit commitment and dispatch model for each interconnection. Ran 12-year, LMP-based market simulations using GE-MAPS across multiple scenarios and quantified congestion costs on major constraints. Collaborated with engineers to design potential transmission (and generation) solutions. Evaluated the benefits and costs of candidate solutions and identified several economic major transmission projects.
- **Merchant Transmission Impacts**. For a merchant transmission company, used GE-MAPS to analyze the effects of the Cross Sound Cable on energy prices.
- **Security-Constrained Unit Commitment and Dispatch Model Calibration**. For a Midwestern utility, calibrated their PROMOD IV model, focusing on LMPs, unit commitment, flows, and transmission constraints. Helped client to understand their model's shortcomings and identify improvement opportunities. Also assisted with initial assessments of FTRs in preparation for its submission of nominations in MISO's first allocation of FTRs.
- **Model Evaluation**. Led an internal Brattle evaluation of commercially available transmission and market simulation models. Interviewed vendors and users of PROMOD IV, Gridview, DAYZER, and other models. Intensively tested each model. Evaluated accuracy of model algorithms (e.g., LMP, losses, unit commitment) and ability to calibrate models with backcasts using actual RTO data.

ENERGY POLICY ANALYSIS

- **Life Extension for Diablo Canyon**. For an environmental organization in CA in 2022, evaluated the net benefits of extending the operating life of the Diablo Canyon Nuclear Power Plant. Calibrated the base case in Brattle's gridSIM capacity expansion model to existing studies sponsored by CA state agencies, and estimated the impacts of retaining Diablo Canyon in terms of emissions, fixed and variable costs, and ability to meet both reliability objectives and clean energy goals.
- **Tariffs on PVs**. For a renewable energy advocacy group in 2022, evaluated the impacts of potential anti-circumvention tariffs that the Department of Commerce was considering imposing on PVs from four countries. Our team developed a trade model to estimate the impact on market prices for panels in the US; then leveraged our gridSIM capacity expansion model to estimate the impact on utility-scale investments, emissions, and energy prices/costs; then incorporated into a macroeconomic model to estimate effects on jobs and GDP.

- **Renewable Energy Tax Policy Impacts**. For ACORE, a renewable energy advocacy group, evaluated alternative proposals to extend and expand tax credits in 2021. Simulated investment, costs, prices and emissions nationally to 2050 using gridSIM, Brattle's capacity expansion model. Informed client's policy position.
- **Clean Energy Transformation**. For NYISO, led a team to project how the fleet may evolve to meet the state's mandates for 70% renewable electricity by 2030 and 100% carbon-free electricity by 2040. Used gridSIM to model investment and operations subject to constraints on reliability and clean energy. Evaluated technology needs for meeting load during extended periods of low wind/solar. Study results helped inform questions about future market design and reliability.
- **Response to DOE's "Grid Reliability and Resiliency Pricing" Proposal**. For a broad group of stakeholders opposing the rule in a filing before FERC, evaluated DOE's proposed rule: the need (or lack thereof) for bolstering reliability and resilience by supporting resources with a 90-day fuel supply; the likely cost of the rule; and the incompatibility of DOE's proposed solution with the principles and function of competitive wholesale electricity markets.

GENERATION AND STORAGE ASSET VALUATION, AND PROCUREMENTS

- **Value of Flexibility in ERCOT**. For a large company evaluating a range of investment strategies, assessed the value of flexibility in ERCOT today and in the future as wind and solar penetration increases. Used Brattle's GridSIM model to project investments and retirements over the next 10 years. Analyzed the likely increase in demand for ancillary services. Simulated system operations accounting for short-term uncertainty in net load forecasts, using ENELYTIX PSO to model day-ahead and real-time operations.
- **Storage Development Company Due Diligence**. For an international investor consider an equity investment in a storage development company in ERCOT, reviewed the developer's business model, interviewed the developer, and compared their revenue projections to our own.
- **Storage Asset Development in New York**. For a renewable generation company considering developing large new storage assets in New York City and Long Island, provided a market analysis, including a 20-year estimate of net revenues. Used Brattle's GridSIM model to simulate investment, operations, prices, and revenues over that timeframe, after calibrating the model to current actual prices.
- **Valuation of a Gas-Fired Combined-Cycle Plant in ERCOT**. For a generation company, estimated net revenues for an existing plant, using Brattle's GridSIM model to project investment/retirement, operations, prices, and revenues over that timeperiod, after calibrating the model to recent prices. Assessed market risks.
- **Evaluation of Hydropower Procurement Options**. For a potential buyer of new transmission and hydropower from Quebec, evaluated costs and emissions benefits

under a range of contracting approaches. Accounted for the possibility of resource shuffling and backfill of emissions. Considered the value of storage services.

- **Valuation of a Gas-Fired Combined-Cycle Plant in New England**. For a party to litigation, submitted testimony on the fair market value of the plant. Simulated energy and capacity markets to forecast net revenues, and estimated exposure to capacity performance penalties. Compared the valuation to the transaction prices of similar plants and analyzed the differences. Collaborated with a co-testifying export on project finance to assess whether the estimated value would suffice to cover the plant's debt and certain other obligations.
- **Valuation of a Portfolio of Combined-Cycle Plants across the U.S.** For a debt holder in a portfolio of plants, estimated the fair market value of each plant in 2018 and the plausible range of values five years hence. Reviewed comparables. Analyzed electricity markets in New England, New York, Texas, Arizona, and California using our own models and reference points from futures markets and publicly available studies. Performed probability-weighted discounted cash flow valuation analyses across a range of scenarios. Provided insights into market and regulatory drivers and how they may evolve.
- **Wholesale Market Value of Storage in PJM**. For a potential investor in battery storage, estimated the energy, ancillary services, and capacity market revenues their technology could earn in PJM. Reviewed PJM's market participation rules for storage. Forecast capacity market revenues and the risk of performance penalties. Developed a real-time energy and ancillary service bidding algorithm that the asset owner could employ to nearly optimize its operations, given expected prices and operating constraints. Identified changes in real-time bid/offer rules that PJM could implement to improve the efficiency of market participation by storage resources.
- **Valuation of a Generation Portfolio in ERCOT**. For the owners of a portfolios of gas-fired assets (including a cogen plant), estimated the market value of their assets by modeling future cash flows from energy and ancillary services markets over a range of plausible scenarios. Analyzed the effects load growth, entry, retirements, environmental regulations, and gas prices could have on energy prices, including scarcity prices under ERCOT's Operating Reserve Demand Curve. Evaluated how future changes in these drivers could cause the value to shift over time.
- **Valuation Methodology for a Coal Plant Transaction in PJM**. For a part owner of a very large coal plant being transferred at an assessed value that was yet to be determined by a third party, wrote a manual describing how to conduct a market valuation of the plant. Addressed drivers of energy and capacity value; worked with an engineering subcontractor to describe how to determine the remaining life of the plant and CapEx needs going forward. Our manual was used to inform their pre-assessment negotiation strategy.
- **Valuation of a Coal Plant in PJM**. For the lender to a bidder on a coal plant being auctioned, estimated the market value of the plant. Valuation analysis focused especially

on the effects of coal and gas prices on cash flows, and the ongoing fixed O&M costs and CapEx needs of the plant.

- **Valuation of a Coal Plant in New England**. For a utility, evaluated a coal plant's economic viability and market value. Projected market revenues, operating costs, and capital investments needed to comply with future environmental mandates.
- **Valuation of Generation Assets in New England**. To inform several potential buyers' valuations of various assets being sold in ISO-NE, provided energy and capacity price forecasts and cash flows under multiple scenarios. Explained the market rules and fundamentals to assess key risks to cash flows.
- **Valuation of Generation Asset Bundle in New England**. For the lender to the potential buyer of generation assets, provided long-term energy and capacity price forecasts, with multiple scenarios to test whether the plant could be worth less than the debt. Reviewed a broad scope of documents available in the "data room" to identify market, operational, and fuel supply risks.
- **Valuation of Generation Asset Bundle in PJM**. For a potential buyer, provided energy and capacity price forecasts and reviewed their valuation analysis. Analyzed supply and demand fundamentals of the PJM capacity market. Performed locational market simulations using the DAYZER model to project nodal prices as market fundamentals evolve. Reviewed the client's spark spread options model.
- **Wind Power Development**. For a developer proposing to build a several hundred megawatt wind farm in Michigan, provided a revenue forecast for energy and capacity. Evaluated the implications of several scenarios around key uncertainties.
- **Wind Power Financial Modeling**. For an offshore wind developer proposing to build a 350 MW project in PJM off the coast of New Jersey, analyzed market prices for energy, renewable energy certificates, and capacity. Provided a detailed financial model of project funding and cash distributions to various types of investors (including production tax credit). Resulting financial statements were used in an application to the state of New Jersey for project grants.
- **Contract Review for Cogeneration Plant**. For the owner of a large cogen plant in PJM, analyzed revenues under the terms of a long-term PPA (in renegotiation) vs. potential merchant revenues. Accounted for multiple operating modes of the plant and its sales of energy, capacity, ancillary services, and steam over time.
- **Generation Strategy/Valuation**. For an independent power producer, acted for over two years as a key advisor on the implementation of the client's growth strategy. Led a large analytical team to assess the profitability of proposed new power plants and acquisitions of portfolios of plants throughout the U.S. Used the GE-MAPS market simulation model to forecast power prices, transmission congestion, generator dispatch, emissions costs, energy margins for candidate plants; used an ancillary model to forecast capacity value.
- **Generation Asset Valuation**. For multiple banks and energy companies, provided valuations of financially distressed generating assets. Used GE-MAPS to simulate net

energy revenues; a capacity model to estimate capacity revenues; and a financial valuation model to value several natural gas, coal, and nuclear power plants across a range of scenarios. Identified key uncertainties and risks.

INTEGRATED RESOURCE PLANNING (IRP)

- **Resource Planning in Hawaii**. Assisted the Hawaiian Electric Companies in developing its Power Supply Improvement Plan, filed April 2016. Our work addressed how to maintain system security as renewable penetration increases toward 100% and displaces traditional synchronous generation. Solutions involved defining technology-neutral requirements that may be met by demand response, distributed resources, and new technologies as well as traditional resources.
- **IRP in Connecticut (for 2008, 2009, 2010, 2012, and 2014 Plans)**. For two major utilities and the state Dept. of Energy and Environmental Protection (DEEP), led the analysis for five successive IRPs. Plans involved projecting 10-year Base Case outlooks for resource adequacy, customer costs, emissions, and RPS compliance; developing alternative market scenarios; and evaluating resource procurement strategies focused on energy efficiency, renewables, and traditional sources. Used an integrated modeling system that simulated the New England locational energy market (with the DAYZER model), the Forward Capacity Market, REC markets, and suppliers' likely investment/retirement decisions. Addressed electricity supply risks, natural gas supply into New England, RPS standards, environmental regulations, transmission planning, emerging technologies, and energy security. Solicited input from stakeholders. Provided oral testimony before the DEEP.
- **Contingency Plan for Indian Point Nuclear Retirement**. For the New York Department of Public Service (DPS), assisted in developing contingency plans for maintaining reliability if the Indian Point nuclear plant were to retire. Evaluated generation and transmission proposals along three dimensions: their reliability contribution, viability for completion by 2016, and the net present value of costs. The work involved partnering with engineering sub-contractors, running GE-MAPS and a capacity market model, and providing insights to DPS staff.
- **Analysis of Potential Retirements to Inform Transmission Planning**. For a large utility in Eastern PJM, analyzed the potential economic retirement of each coal unit in PJM under a range of scenarios regarding climate legislation, legislation requiring mercury controls, and various capacity price trajectories.
- **Resource Planning in Wisconsin**. For a utility considering constructing new capacity, demonstrated the need to consider locational marginal pricing, gas price uncertainty, and potential CO_2 liabilities. Guided client to look beyond building a large coal plant. Led them to mitigate exposures, preserve options, and achieve nearly the lowest expected cost by pursuing a series of smaller projects, including a promising cogeneration application at a location with persistently high LMPs. Conducted interviews and

facilitated discussions with senior executives to help the client gain support internally and begin to prepare for regulatory communications.

DEMAND RESPONSE (DR) MARKET PARTICIPATION, MARKET POTENTIAL, AND MARKET IMPACT

- **Demand Response (DR) Integration in MISO**. Through a series of assignments, helped MISO incorporate DR into its energy market and resource adequacy construct, including: (1) conducted an independent assessment of MISO's progress in integrating DR into its resource adequacy, energy, and ancillary services markets. Analyzed market participation barriers; (2) wrote a whitepaper evaluating various approaches to incorporating economic DR in energy markets. Identified implementation barriers and recommended improvements to efficiently accommodate curtailment service providers; (3) helped modify MISO's tariff and business practices to accommodate DR in its resource adequacy construct by defining appropriate participation rules. Informed design by surveying the practices of other RTOs and by characterizing the DR resources within the MISO footprint.
- **Survey of Demand Response Provision of Energy, Ancillary Services, and Capacity.** For the Australian Energy Market Commission (AEMC), co-authored a report on market designs and participation patterns in several international markets. AEMC used the findings to inform its integration of DR into its National Energy Market.
- **Integration of DR into ISO-NE's Energy Markets.** For ISO-NE, provided analysis and assisted with a stakeholder process to develop economic DR programs to replace the ISO's initial economic DR programs when they expired.
- **Compensation Options for DR in ISO-NE's Energy Market**. For ISO-NE, analyzed the implications of various DR compensation options on consumption patterns, LMPs, capacity prices, consumer surplus, producer surplus, and economic efficiency. Presented findings in a whitepaper that ISO-NE submitted to FERC.
- **ERCOT DR Potential Study**. For ERCOT, estimated the market size for DR by end-user segment based on interviews with curtailment service providers and utilities and informed by penetration levels achieved in other regions. Presented findings to the Public Utility Commission of Texas at a workshop on resource adequacy.
- **DR Potential Study**. For an Eastern ISO, analyzed the potential for DR and price responsive demand in the footprint, and what the ISO could do to facilitate them. For each segment of the market, identified the ISO and/or state and utility initiatives that would be needed to develop various levels of capacity and energy market response. Also estimated the potential and cost characteristics for each segment. Interviewed numerous curtailment service providers and ISO personnel.
- **Wholesale Market Impacts of Price-Responsive Demand (PRD)**. For NYISO, evaluated the potential effects of widespread implementation of dynamic retail rates. Utilized the PRISM model to estimate effects on consumption by customer class, applied empirically-based elasticities to hourly differences between flat retail rates and projected dynamic

retail rates. Utilized the DAYZER model to estimate the effects of load changes on energy costs and prices.

- **Energy Market Impacts of DR**. For PJM and the Mid-Atlantic Distributed Resources Initiative (sponsored by five state commissions), quantified the market impacts and customer benefits of DR programs. Used a simulation-based approach to quantify the impact that a three percent reduction of peak loads during the top 20 five-hour blocks would have had in 2005 and under a variety of alternative market conditions. Utilized the DAYZER market simulation model, which we calibrated to represent the PJM market using data provided by PJM and public sources. Results were presented in multiple forums and cited widely, including by several utilities in their filings with state commissions regarding investment in advanced metering infrastructure and implementation of DR programs.
- **Value of DR Investments**. For Pepco Holdings, Inc., evaluated its proposed DR-enabling investments in advanced metering infrastructure and its efficiency programs. Estimated reductions in peak load that would be realized from dynamic pricing, direct load control, and efficiency. Built on the Brattle-PJM-MADRI study to estimate short-term energy market price impacts and addressed long-run equilibrium offsetting effects through supplier response scenarios. Estimated capacity price impacts and resource cost savings over time. Submitted a whitepaper to DE, NJ, MD, and DC commissions. Presented findings to DE Commission.

GAS-ELECTRIC COORDINATION

- **Gas Pipeline Investment for Electricity.** For the Maine Office of Public Advocate, co-sponsored testimony regarding the reliability and economic impacts if the Maine PUC signed long-term contracts for electricity customers to pay for new gas pipeline capacity into New England. Analyzed other experts' reports and provided a framework for evaluating whether such procurements would be in the public interest, considering their costs and benefits vs. alternatives.
- **Gas Pipeline Investment for Electricity.** For the Massachusetts Attorney General's office, provided input for their comments in the Massachusetts Department of Public Utilities' docket investigating whether and how new natural gas delivery capacity should be added to the New England market.
- **Fuel Adequacy and Other Winter Reliability Challenges**. For an ISO, co-authored a report assessing the risks of winter reliability events due to inadequate fuel, inadequate weatherization, and other factors affecting resource availability in the winter. Evaluated solutions being pursued by other ISOs. Proposed changes to resource adequacy requirements and energy market design to mitigate the risks.
- **Gas-Electric Reliability Challenges in the Midcontinent**. For MISO, provided a PowerPoint report assessing future gas-electric challenges as gas reliance increases. Characterized solutions from other ISOs. Provided inputs on the cost of firm pipeline gas vs. the cost and operational characteristics of dual-fuel capability.

RTO PARTICIPATION AND CONFIGURATION

- **Market Impacts of RTO Seams**. For a consortium of utilities, submitted written testimony to the FERC analyzing the financial and operational impact of the MISO-PJM seam on Michigan and Wisconsin. Evaluated economic hurdles across RTO seams and assessed the effectiveness of inter-RTO coordination efforts underway. Collaborated with MISO staff to leverage their PROMOD IV model to simulate electricity markets under alternative RTO configurations.
- **Analysis of RTO Seams**. For a Wisconsin utility in a proceeding before the FERC, assisted expert witness on (1) MISO and PJM's real-time inter-RTO coordination process, and (2) the economic benefit of implementing a full joint-and-common market. Analyzed lack of convergence between MISO's and PJM's energy prices and shadow prices on reciprocal coordinated flow gates.
- **RTO Participation**. For an integrated Midwest utility, advised client on alternative RTO choices. Used GE-MAPS to model the transmission system and wholesale markets under various scenarios. Presented findings to senior management. Subsequently, in support of testimonies submitted to two state commissions, quantified the benefits and costs of RTO membership on customers, considering energy costs, FTR revenues, and wheeling revenues.

ENERGY LITIGATION

- **Enforcement Matter in ISO-NE's Day-Ahead Load Response Program**. Provided expert testimony on behalf of the FERC Office of Enforcement in "Fed. Energy Regulatory Comm'n v. Silkman" in the U.S. District Court of Maine regarding allegations that defendant "engag[ed] in a fraudulent scheme to manipulate the ISO New England, Inc. (ISO-NE) Day-Ahead Load Response Program" by gaming the baseline and claiming false reductions in load. Submitted initial and rebuttal reports analyzing whether defendant's conduct was consistent with industry practice and the purpose of demand response. Matter settled.
- **Valuation of Alleged Misrepresentations of Demand Response Company.** Provided expert testimony on behalf of a client that had acquired a demand response company and alleged that the company had overstated its demand response capacity and technical capabilities. Analyzed discovery materials including detailed demand response data to assess the magnitude of alleged overstatements. Calculated damages primarily based on a fair market valuation of the company with and without alleged overstatements. Provided deposition, expert report, and oral testimony before the American Arbitration Association (non-public).
- **Contract Damages.** For the California Department of Water Resources and the California Attorney General's office, supported expert providing testimony on damages resulting from an electricity supplier's alleged breaches of a power purchase agreement. Analyzed two years of hourly data on energy deliveries, market prices, ISO charges, and invoice

charges to identify and evaluate performance violations and invoice overcharges. Assisted counsel in developing the theory of the case and provided general litigation support in preparation for and during arbitration. Resulted in successful award for client.

- **Contract Damages**. For the same client described above, supported expert providing testimony in arbitration regarding the supplier's alleged breaches in which its scheduled deliveries were not deliverable due to transmission congestion. Quantified damages and demonstrated the predictability of congestion, which the supplier was allegedly supposed to avoid in its choice of delivery points.
- **Contract Termination Payment**. For an independent power producer, supported expert testimony on damages from the termination of a long-term tolling contract for a gas-fired power plant in PJM, involving power market forecasting, financial valuation techniques, and a detailed assessment of the plant's costs and operating characteristics. Prepared witness for arbitration and assisted counsel in deposing and cross-examining opposing experts. Resulted in resounding victory for client.

TARIFF AND RATE DESIGN

- **Wholesale Rates.** On behalf of a G&T co-op in the Western U.S., provided testimony regarding its wholesale rates, which are contested by member co-ops. Analyzed the G&T co-op's cost of service and its marginal cost of meeting customers' energy and peak demand requirements.
- **Transmission Tariffs**. For a merchant generating company participating in FERC hearings on developing a Long Term Transmission Pricing Structure, helped lead a coalition of stakeholders to develop a position on how to eliminate pancaked transmission rates while allowing transmission owners to continue to earn their allowed rate of return. Analyzed and presented the implications of various transmission pricing proposals on system efficiency, incentives for new investment, and customer rates throughout the MISO-PJM footprint.
- **Retail Rate Riders**. For a traditionally regulated Midwest utility, helped general counsel to evaluate and support legislation, and propose commission rules addressing rate riders for fuel and purchased power and the costs of complying with environmental regulations. Performed research on rate riders in other states; drafted proposed rules and tariff riders for client.
- **Rate Filings**. For a traditionally regulated Midwest utility, assisted counsel in preparing for a rate case. Helped draft testimonies regarding off-system sales margins and the cost of fuel.

BUSINESS STRATEGY

- **Preparing a Gentailer for a Transformed Wholesale Market Design.** Supported a gentailer in Alberta to prepare its generation and retail businesses for the implementation of a capacity market.
- **Evaluation of Cogeneration Venture**. For an unregulated division of a utility, evaluated a venture to build and operate cogeneration facilities. Estimated the market size and potential pricing, and assessed the client's capabilities for delivering such services. Analyzed the target customer base in detail; performed technical cost analysis for building and operating cogeneration plants; analyzed retail/default rate structures against which new cogeneration would have to compete. Senior management followed our recommendations to shut down the venture.
- **Strategic Sourcing**. For a large, diversified manufacturer, coordinated a cross-business unit client team to reengineer processes for procuring electricity, natural gas, and demand-side management services. Worked with executives to establish goals. Gathered data on energy usage patterns, costs, and contracts across hundreds of facilities. Interviewed energy managers, plant managers, and executives. Analyzed potential suppliers. Helped draft RFPs and develop negotiating strategy. Designed internal organizational structure (incorporating outsourced service providers) for managing energy procurement on an ongoing basis.
- **M&A Advisory**. For a European utility aiming to enter the U.S. markets and enhance its trading capability, evaluated acquisition targets. Assessed potential targets' capabilities and their value versus stock price. Reviewed experiences of acquirers in other M&A transactions. Advised client against an acquisition, just when the market was peaking (just prior to collapse).
- **Marketing Strategy**. For a power equipment manufacturer, identified the most attractive target customers and joint-venture candidates for plant maintenance services. Evaluated the cost structure and equipment mix of candidates using FERC data and proprietary data. Estimated the value client could bring to each customer. Worked with company president to translate findings into a marketing strategy.
- **Distributed Generation (DG) Market Assessment**. For the unregulated division of a utility, performed a market assessment for DG technologies by segment in the U.S.
- **Fuel Cells**. For a fuel cell manufacturer, provided electricity market analysis to inform a market entry strategy in the U.S.

ARTICLES & PUBLICATIONS

- Capacity Resource Accreditation for New England's Clean Energy Transition: Report 1: Foundation of Resource Accreditation, report prepared for Massachusetts Attorney General's Office June 2022 (with K. Spees and J. Hingham).

- Capacity Resource Accreditation for New England's Clean Energy Transition: Report 2: Options for New England report prepared for Massachusetts Attorney General's Office June 2022 (with K. Spees and J. Hingham).
- *Offshore Wind Transmission: An Analysis of Options for New York*, report prepared for Anbaric, August 2020 (with J. Pfeifenberger, W. Graf, and K. Spokas).
- *Singapore Foreward Capacity Market—FCM Design Proposal (third Consultation Paper)*, prepared for the Singapore Energy Market Authority, May 2020 (with J. Chang and W. Graf). Followed draft proposals in first and second Consultation papers in May 2019 and Dec 2019.
- *Quantitative Analysis of Resource Adequacy Structures*, report prepared for NYSERDA and NYSDPS, July 1, 2020 (with K. Spees, J. Imon Pedtke, and M. Tracy). Update to version from May 29, 2020.
- New York's Evolution to a Zero Emission Power System: Modeling Operations and Investment Through 2040 Including Alternative Scenarios, report prepared for NYISO Stakeholders, June 22, 2020 (with R. Lueken, J. Weiss, S. Crocker Ross, and J. Moraski). Update to version from May 18, 2020.
- *Qualitative Analysis of Resource Adequacy Structures for New York*, report prepared for NYSERDA and NYSDPS, May 19, 2020 (with K. Spees and J. Imon Pedtke).
- *Offshore Transmission in New England: The Benefits of a Better-Planned Grid*, report prepared for Anbaric, May 2020 (with J. Pfeifenberger and W. Graf).
- *Implementing Recommended Improvements to Market Power Mitigation in the WEM*, report prepared for Energy Policy WA in Western Australia, April 2020 (with T. Brown).
- *Gross Avoidable Cost Rates for Existing Generation and Net Cost of New Entry for New Energy Efficiency*, report prepared for PJM, March 17, 2020 (with M. Hagerty, S. Sergici, E. Cohen, S. Gang, J. Wroble, and P. Daou).
- "Forward Clean Energy Markets: A New Solution to State-RTO Conflicts," *Utility Dive*, January 27, 2020 (with K. Spees and J. Pfeifenberger.)
- How States, Cities, and Customers Can Harness Competitive Markets to Meet Ambitious Carbon Goals: Through a Forward Market for Clean Energy Attributes: Expanded Report Including a Detailed Market Design Proposal, report prepared for NRG, September 2019 (with K. Spees, W. Graf, and E. Shorin).
- *International Review of Demand Response Mechanisms in Wholesale Markets*, report for the Australian Energy Market Commission, June 2019 (with T. Brown, K. Spees, and C. Wang).

- How States, Cities, and Customers Can Harness Competitive Markets to Meet Ambitious Carbon Goals: Through a Forward Market for Clean Energy Attributes, report prepared for NRG, April 2019 (with K. Spees, W. Graf, and E. Shorin).
- *Estimation of the Market Equilibrium and Economically Optimal Reserve Margins for the ERCOT Region, 2018 Update, Final Draft*, prepared for the Electric Reliability Council of Texas, December 20, 2018 (with R. Carroll, A. Kaluzhny, K. Spees, K. Carden, N. Wintermantel, and A. Krasny).
- Harmonizing Environmental Policies with Competitive Markets: Using Wholesale Power Markets to Meet State and Customer Demand for a Cleaner Electricity Grid More Cost Effectively, discussion paper, July 2018 (with K. Spees, J. Pfeifenberger, and J. Chang).
- *Fourth Review of PJM's Variable Resource Requirement Curve*, report prepared for PJM Interconnection LLC for submission to FERC and PJM stakeholders, April 16, 2018 (with J. Pfeifenberger, K. Spees, and others).
- *PJM Cost of New Entry Combustion Turbines and Combined-Cycle Plants with June 1, 2022 Online Date*, report prepared for PJM Interconnection LLC for submission to FERC and PJM stakeholders, April 19, 2018 (with J. Michael Hagerty, J. Pfeifenberger, S. Gang of Sargent & Lundy, and others).
- *Evaluation of the DOE's Proposed Grid Resiliency Pricing Rule*, whitepaper prepared for NextEra Energy Resources, October 23, 2017 (with M. Celebi, J. Chang, M. Chupka, and I. Shavel).
- *Near Term Reliability Auctions in the NEM: Lessons from International Jurisdictions*, report prepared for the Australian Energy Market Operator, August 23, 2017 (with K. Spees, D.L. Oates, T. Brown, N. Lessem, D. Jang, and J. Imon Pedtke).
- *Pricing Carbon into NYISO's Wholesale Energy Market to Support New York's Decarbonization Goals*, whitepaper prepared for the New York Independent System Operator, August 11, 2017 (with R. Lueken, J. Weiss, K. Spees, P. Donohoo-Vallett, and T. Lee).
- "How wholesale power markets and state environmental Policies can work together," *Utility Dive*, July 10, 2017 (with J. Pfeifenberger, J. Chang, and K. Spees).
- *Market Power Mitigation Mechanisms for the Wholesale Electricity Market in Western Australia*, whitepaper prepared for the Public Utilities Office in the Government of W. Australia's Department of Finance, September 1, 2016 (with T. Brown, W. Graf, J. Reitzes, H. Trewn, and K. Van Horn).
- *Western Australia's Transition to a Competitive Capacity Auction*, report prepared for Enernoc, January 29, 2016 (with K. Spees and C. McIntyre).

- *Cost-Benefit Analysis of ERCOT's Future Ancillary Services (FAS) Proposal*," report prepared for ERCOT, December 2015 (with R. Carroll, P. Ruiz, and W. Gorman).
- Enhancing the Efficiency of Resource Adequacy Planning and Procurements in the Midcontinent ISO Footprint—Options for MISO, Utilities, and States, report prepared for NRG, November 9, 2015 (with K. Spees and R. Lueken).
- *International Review of Demand Response Mechanisms*, report prepared for Australian Energy Market Commission, October 2015 (with T. Brown, K. Spees, and D.L. Oates).
- Resource Adequacy in Western Australia — Alternatives to the Reserves Capacity Mechanism, report prepared for EnerNOC, Inc., August 2014 (with K. Spees).
- *Third Triennial Review of PJM's Variable Resource Requirement Curve*, report prepared for PJM Interconnection, LLC, May 15, 2014 (with J. Pfeifenberger, K. Spees, A. Murray, and I. Karkatsouli).
- *Cost of New Entry Estimates for Combustion Turbine and Combined Cycle Plants in PJM*, report prepared for PJM Interconnection, LLC, May 15, 2014 (with M. Hagerty, K. Spees, J. Pfeifenberger, Q. Liao, and with C. Ungate and J. Wroble at Sargent & Lundy).
- *Developing a Market Vision for MISO: Supporting a Reliable and Efficient Electricity System in the Midcontinent*, foundational report prepared for Midcontinent Independent System Operator, Inc., January 27, 2014 (with K. Spees and N. Powers).
- *Estimating the Economically Optimal Reserve Margin in ERCOT*, report prepared for the Public Utilities Commission of Texas, January 2014 (with J. Pfeifenberger, K. Spees, and I. Karkatsouli).
- "Capacity Markets: Lessons Learned from the First Decade," *Economics of Energy & Environmental Policy*. Vol. 2, No. 2, Fall 2013 (with J. Pfeifenberger and K. Spees).
- *ERCOT Investment Incentives and Resource Adequacy*, report prepared for the Electric Reliability Council of Texas, June 1, 2012 (with K. Spees, J. Pfeifenberger, R. Mudge, M. DeLucia, and R. Carlton).
- "Trusting Capacity Markets: does the lack of long-term pricing undermine the financing of new power plants?" *Public Utilities Fortnightly*, December 2011 (with J. Pfeifenberger).
- Second Performance Assessment of PJM's Reliability Pricing Model: Market Results 2007/08 through 2014/15, prepared for PJM Interconnection LLC, August 26, 2011 (with J. Pfeifenberger, K. Spees).

- *Cost of New Entry Estimates for Combustion-Turbine and Combined-Cycle Plants in PJM*, report prepared for PJM Interconnection LLC, August 24, 2011 (with J. Pfeifenberger, K. Spees, and others).
- "Fostering economic demand response in the Midwest ISO," *Energy* 35 (2010) 1544–1552 (with A. Faruqui, A. Hajos, and R.M. Hledik).
- "DR Distortion: Are Subsidies the Best Way to Achieve Smart Grid Goals?" *Public Utilities Fortnightly*, November 2010.
- Midwest ISO's Resource Adequacy Construct: An Evaluation of Market Design Elements, report prepared for MISO, January 2010 (with K. Spees and A. Hajos).
- Demand Response in the Midwest ISO: An Evaluation of Wholesale Market Design, report prepared for MISO, January 2010 (with A. Hajos).
- *Cost-Benefit Analysis of Replacing the NYISO's Existing ICAP Market with a Forward Capacity Market*, whitepaper for the NYISO and stakeholders, June 15, 2009 (with A. Bhattacharyya and K. Madjarov).
- *Fostering Economic Demand Response in the Midwest ISO*, whitepaper written for MISO, December 30, 2008 (with R. Earle and A. Faruqui).
- *Review of PJM's Reliability Pricing Model (RPM)*, report prepared for PJM Interconnection LLC for submission to FERC and PJM stakeholders, June 30, 2008 (with J. Pfeifenberger and others).
- "Reviving Integrated Resource Planning for Electric Utilities: New Challenges and Innovative Approaches," *Energy*, Vol. 1, 2008, The Brattle Group (with M. Chupka and D. Murphy).
- Enhancing Midwest ISO's Market Rules to Advance Demand Response, report written for MISO, March 12, 2008 (with R. Earle).
- "The Power of Five Percent," *The Electricity Journal*, October 2007 (with A. Faruqui, R. Hledik, and J. Pfeifenberger).
- Quantifying Customer Benefits from Reductions in Critical Peak Loads from PHI's Proposed Demand-Side Management Programs, prepared for Pepco Holdings, Inc., September 21, 2007 (with A. Faruqui).
- *Review of PJM's Market Power Mitigation Practices in Comparison to Other Organized Electricity Markets*, Report prepared for PJM Interconnection LLC, September 14, 2007 (with P. Fox-Penner, J. Pfeifenberger, J. Reitzes, and others).
- "Valuing Demand-Response Benefits in Eastern PJM," *Public Utilities Fortnightly*, March 2007 (with J. Pfeifenberger and F. Felder).

- *Quantifying Demand Response Benefits in PJM*, study report prepared for PJM Interconnection, LLC and the Mid-Atlantic Distributed Resources Initiative, January 29, 2007 (with F. Felder).
- "Modeling Power Markets: Uses and Abuses of Locational Market Simulation Models," *Energy*, Vol. 2, 2006, The Brattle Group (with J. Pfeifenberger).
- "Innovative Regulatory Models to Address Environmental Compliance Costs in the Utility Industry," October 2005 Newsletter, American Bar Association, Section on Environment, Energy, and Resources; Vol. 3 No. 1 (with J. Pfeifenberger).

PRESENTATIONS & SPEAKING ENGAGEMENTS

- "Observations and Implications of the 2021 Texas Freeze," presented to Power Markets Today webinar on the February 2021 ERCOT electricity failure, April 14, 2021.
- "Offshore Wind Transmission: An Analysis of Options for New York," presented at LCV Virtual Policy Forum, August 6, 2020 (with J. Pfeifenberger, W. Graf, and K. Spokas).
- "Possible Paths Forward from MOPR," presented to Power Markets Today webinar on "Capacity Market Alternatives for States," July 15, 2020.
- "Considerations for Meeting Sub-Annual Needs, and Resource Accreditation across RTOs," presented to MISO Resource Adequacy Subcommittee, July 8, 2020 (with J. Pfeifenberger, M. Hagerty, and W. Graf).
- "New York's Evolution to a Zero Emission Power System—Modeling Operations and Investment through 2040 Including Alternative Scenarios," presented to NYISO Stakeholders, June 22, 2020 (with R. Lueken, J. Weiss, S. Ross, and J. Moraski).
- "Singapore Foreward Capacity Market Design—Industry Briefing Sessions," presented via video to Singapore electricity market stakeholders, June 5&9, 2020 (with W. Graf).
- "Industry Changes in Resource Adequacy Requirements," presented to MISO Resource Adequacy Subcommittee, May 6, 2020 (with J. Pfeifenberger, M. Hagerty, and W. Graf).
- "NYISO Grid in Transition Study: Detailed Assumptions and Modeling Description," presented to NYISO Stakeholders, March 30, 2020 (with R. Lueken, J. Weiss, J. Moraski, and S. Ross).
- "Electricity Market Designs to Achieve and Accommodate Deep Decarbonization," presented to Advanced Energy Economy (AEE) video conference, "ISO-NE in 2050: Getting To An Advanced Energy Future In New England," March 18, 2020.

- "U.S. Offshore Wind Generation, Grid Constraints, and Transmission Needs," presented at Offshore Wind Transmission, USA Conference, September 18, 2019 (with J. Pfeifenberger and K. Spokas).
- "Pollution Pricing in the Power Sector: Market-Friendly Tools for Incorporating Public Policy," presented to GCPA Spring Conference, Houston, TX, April 16, 2019.
- "The Transformation of the Power Sector to Clean Energy: Economic and Reliability Challenges," keynote address to the Power Engineers 4th Annual Power Symposium, Weehawken, NJ, April 4, 2019.
- "Market Design for Winter Energy Security in New England: Further Discussion of Options," presented to The New England Power Pool Markets Committee on behalf of NextEra Energy Resources, Westborough, MA, February 6, 2019 (with D.L. Oates and P. Ruiz).
- "Market Design for Winter Energy Security in New England: Discussion of Options," presented to The New England Power Pool Markets Committee on behalf of NextEra Energy Resources, Westborough, MA, January 9, 2019 (with D.L. Oates).
- "Market Equilibrium Reserve Margin in ERCOT," presented to Power Markets Today webinar, "A Post Summer Check-in of ERCOT's Market," October 31, 2018.
- "Carbon Pricing in NYISO's Wholesale Energy Market, and Applicability to Multi-State RTO markets," presented to Raab Policy Roundtable, May 23, 2018; presented to the Energy Bar Association, 2018 EBA Energizer: Pricing Carbon in Energy Markets, June 5, 2018; presented to Bank of America Merrill Lynch, June 25, 2018.
- "Reconciling Resilience Services with Current Market Design," presented to RFF/R-Street Conference on "Economic Approaches to Understanding and Addressing Resilience in the Bulk Power System," Washington, D.C., May 30, 2018.
- "System Flexibility and Renewable Energy Integration: Overview of Market Design Approaches," presented to Texas-Germany Bilateral Dialogue on Challenges and Opportunities in the Electricity Market, Austin, TX, February 26, 2018.
- "Natural Gas Reliability: Understanding Fact from Fiction," panelist at the NARUC Winter Policy Summit presented to The Committee on Gas, Washington, D.C., February 13, 2018 (with A. Thapa, M. Witkin, and R. Wong).
- "Carbon Pricing in Wholesale Markets: Takeaways from NYISO Carbon Charge Study," presented to Harvard Electric Policy Group, October 12, 2017.

- "Pricing Carbon into NYISO's Wholesale Energy Market: Study Overview and Summary of Findings," presented to NYISO Business Issues Committee, September 12, 2017.
- "Carbon Adders in Wholesale Power Markets—Preventing Leakage," panelist at Resources for the Future's workshop on carbon pricing in wholesale markets, Washington, D.C., August 2, 2017.
- "Market-Based Approaches to Support States' Decarbonization Objectives," panelist at Independent Power Producers of New York (IPPNY) 2017 Spring Conference, Albany, NY, May 10, 2017.
- "ERCOT's Future: A Look at the Market Using Recent History as a Guide," panelist at the Gulf Coast Power Association's Fall Conference, Austin, TX, October 4, 2016.
- "The Future of Wholesale Electricity Market Design," presented to Energy Bar Association 2016 Annual Meeting & Conference, Washington, DC, June 8, 2016.
- "Performance Initiatives and Fuel Assurance—What Price Mitigation?" presented to Northeast Energy Summit 2015 Panel Discussion, Boston, MA, October 27, 2015.
- "PJM Capacity Auction Results and Market Fundamentals," presented to Bloomberg Analyst Briefing Webinar, September 18, 2015 (with J. Pfeifenberger and D.L. Oates).
- "Energy and Capacity Market Designs: Incentives to Invest and Perform," presented to EUCI Conference, Cambridge, MA, September 1, 2015.
- "Electric Infrastructure Needs to Support Bulk Power Reliability," presented to GEMI Symposium: Reliability and Security across the Energy Value Chain, The University of Houston, Houston, TX, March 11, 2015.
- Before the Arizona Corporation Commission, Commission Workshop on Integrated Resource Planning, Docket No. E-00000V-13-0070, presented "Perspectives on the IRP Process: How to get the most out of IRP through a collaborative process, broad consideration of resource strategies and uncertainties, and validation or improvement through market solicitations," Phoenix, AZ, February 26, 2015.
- "Resource Adequacy in Western Australia—Alternatives to the Reserve Capacity Mechanism (RCM)," presented to The Australian Institute of Energy, Perth, WA, October 9, 2014.
- "Customer Participation in the Market," panelist on demand response at Gulf Coast Power Association Fall Conference, Austin, TX, September 30, 2014.

- "Market Changes to Promote Fuel Adequacy—Capacity Market to Promote Fuel Adequacy," presented to INFOCAST- Northeast Energy Summit 2014 Panel Discussion, Boston, MA, September 17, 2014.
- "EPA's Clean Power Plan: Basics and Implications of the Proposed CO_2 Emissions Standard on Existing Fossil Units under CAA Section 111(d)," presented to Goldman Sachs Power, Utilities, MLP and Pipeline Conference, New York, NY, August 12, 2014.
- "Capacity Markets: Lessons for New England from the First Decade," presented to Restructuring Roundtable Capacity (and Energy) Market Design in New England, Boston, MA, February 28, 2014.
- "The State of Things: Resource Adequacy in ERCOT," presented to INFOCAST – ERCOT Market Summit 2014 Panel Discussion, Austin, TX, February 24-26, 2014.
- "Resource Adequacy in ERCOT," presented to FERC/NARUC Collaborative Winter Meeting in Washington, D.C., February 9, 2014.
- "Electricity Supply Risks and Opportunities by Region," presentation and panel discussion at Power-Gen International 2013 Conference, Orlando, FL, November 13, 2013.
- "Get Ready for Much Spikier Energy Prices—The Under-Appreciated Market Impacts of Displacing Generation with Demand Response," presented to the Cadwalader Energy Investor Conference, New York, NY, February 7, 2013 (with K. Spees).
- "The Resource Adequacy Challenge in ERCOT," presented to The Texas Public Policy Foundation's 11th Annual Policy Orientation for legislators, Austin, TX, January 11, 2013.
- "Resource Adequacy in ERCOT: the Best Market Design Depends on Reliability Objectives," presented to the Harvard Electricity Policy Group conference, Washington, D.C., December 6, 2012.
- "Resource Adequacy in ERCOT," presented to the Gulf Coast Power Association Fall Conference, Austin, TX, October 2, 2012.
- "Texas Resource Adequacy," presented to Power Across Texas, Austin, TX, September 21, 2012.
- "Resource Adequacy and Demand Response in ERCOT," presented to the Center for the Commercialization of Electric Technologies (CCET) Summer Board Meeting, Austin, TX, August 8, 2012.
- "Summary of Brattle's Study on 'ERCOT Investment Incentives and Resource Adequacy'," presented to the Texas Industrial Energy Consumers annual meeting, Austin, TX, July 18, 2012.

- "Market-Based Approaches to Achieving Resource Adequacy," presentation to Energy Bar Association Northeast Chapter Annual Meeting, Philadelphia, PA, June 6, 2012.
- "Fundamentals of Western Markets: Panel Discussion," WSPP's Joint EC/OC Meeting, La Costa Resort, Carlsbad, CA, February 26, 2012 (with J. Weiss).
- "Integrated Resource Planning in Restructured States," presentation at EUCI conference on "Supply and Demand-Side Resource Planning in ISO/RTO Market Regimes," White Plains, NY, October 17, 2011.
- "Demand Response Gets Market Prices: Now What?" NRRI teleseminar panelist, June 9, 2011.
- Before the PJM Board of Directors and senior level representatives at PJM's General Session, panel member serving as an expert in demand response on behalf of Pepco Holdings, Inc., December 22, 2007.
- "Resource Adequacy in New England: Interactions with RPS and RGGI," Energy in the Northeast Law Seminars International Conference, Boston, MA, October 18, 2007.
- "Corporate Responsibility to Stakeholders and Criteria for Assessing Resource Options in Light of Environmental Concerns," Bonbright Electric & Natural Gas 2007 Conference, Atlanta, GA, October 3, 2007.
- "Evaluating the Economic Benefits of Transmission Investments," EUCI's Cost-Effective Transmission Technology Conference, Nashville, TN, May 3, 2007 (with J. Pfeifenberger, presenter).
- "Quantifying Demand Response Benefits in PJM," PowerPoint presentation to the Mid-Atlantic Distributed Resources Initiative (MADRI) Executive Committee on January 13, 2007, to the MADRI Working Group on February 6, 2007, as Webinar to the U.S. Demand Response Coordinating Council, and to the Pennsylvania Public Utility Commission staff April 27, 2007.
- "Who Will Pay for Transmission," CERA Expert Interview, Cambridge, MA, January 15, 2004.
- "Reliability Lessons from the Blackout; Transmission Needs in the Southwest," presented at the Transmission Management, Reliability, and Siting Workshop sponsored by Salt River Project and the University of Arizona, Phoenix, AZ, December 4, 2003.
- "Application of the 'Beneficiary Pays' Concept," presented at the CERA Executive Retreat, Montreal, Canada, September 17, 2003.