

ATTACHMENT A

AFFIDAVIT OF ROBERT B. STODDARD

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

Grid Reliability and Resilience Pricing

Docket No. RM18-1

**AFFIDAVIT OF ROBERT B. STODDARD
ON BEHALF OF PJM POWER PROVIDERS**

I, Robert B. Stoddard, being duly sworn, depose and say:

I. QUALIFICATIONS

1. My name is Robert B. Stoddard. I am an economist and principal of Power Market Economics LLC at 28 Monument Square, Portland, Maine 04101. I am also the president and chief executive of GWave LLC, an ocean wave energy technology firm. As CEO of GWave, I provide executive leadership for a technology startup developing a new generation of ocean wave energy converters. Prior to joining GWave, I led the energy practice at Charles River Associates, a global consultancy, where I remain “of counsel.” My work there focused on electricity industry restructuring, capital investment in power markets, and providing both strategic analyses and testimony for utilities, generation owners, and governments regarding the practical implications of market design. I have frequently testified to the Federal Energy Regulatory Commission (“the Commission”) as well as to state utility commissions and legislatures on competitive market design, rates, and market power issues, particularly in the regions managed by the northeastern Regional Transmission Organizations. Over the past year I have been supporting the Conservation Law Foundation’s work on the NEPOOL “Integrating Public Policy and Markets” initiative and was an invited speaker at the Commission’s recent technical conference on this topic. I hold degrees in economics from Amherst College and Yale University. My complete *curriculum vita* is attached as Exhibit RBS-1.

II. PURPOSE AND BACKGROUND

2. I have been asked by the PJM Power Providers (“P3”), a non-profit organization dedicated to properly designed and well-functioning markets in the PJM region¹, to respond to comments filed in this docket by PJM and other parties about market reforms that could help address the Secretary of Energy’s stated concern for supporting resilience of the power grid in competitive electric markets.
3. In initiating this rulemaking, the Secretary of Energy has asserted that the resilience of bulk power system in the control areas of the three northeast Regional Transmission Organizations (“RTOs”), *viz.* PJM, the New York Independent System Operator (“NYISO”)

¹ The views expressed in this statement are my own and do not necessarily represent the views of any individual P3 members with respect to any issue.

and ISO New England (“ISO-NE”) is under immediate threat from the “premature retirement” of “fuel-secure traditional baseload resources”—notably coal-fired and nuclear generators.

4. In these three regions, competitive markets have been the foundation of the bulk power system, providing not only prices to achieve least-cost system dispatch but also to guide private investment needed to build and maintain the generation fleet. If the markets are not delivering the reliability and resilience sought, the Commission should first seek to improve the markets. Since their founding nearly twenty years ago, the RTOs have constantly been refining their market designs. In the last several years, the RTOs have given particular focus to enhancing incentives for performance, and penalties for underperformance, in critical operating situations. These advances in the design of energy and capacity markets have made material improvements; however, there are underlying market issues that remain and need to be addressed for this success of the competitive markets to continue.
5. Unfortunately, PJM’s locational marginal prices (“LMPs”) do not reflect incremental costs to serve load as well as they could, resulting in prices that undervalue numerous resources, including baseload units. Inaccurate pricing has contributed to declining, or even negative, profitability among generators and to the consequent retirements and announced closures of many older plants, as documented in the DOE Staff Report.²
6. Whether these retirements are “premature retirement” depends on one’s perspective. As an economist, “premature retirement” suggests a situation when a unit is retired even when the present value of the generator’s outputs exceed the present value of its costs. With a capital asset like a power plant, losses in any one year should not lead to a permanent retirement. At worst, if the owner cannot cover these losses on its own balance sheet, it can sell the asset (for a positive amount) to a buyer that can fund a short-run loss. But if losses are expected to continue, then retirement is the rational decision—if, and only if, the prices paid to the generator reflect the economic value of its products. When prices do not capture value, then a generator’s decision to retire may reflect a negative *market* value of the facility even though the *societal* value is still positive. Therefore, from my perspective as an economist, the means to forestall “premature retirement” is to align market prices as closely as possible to the social value of the goods and services provided by all electricity market resources.
7. There is work to be done yet, however, and the Commission should use this opportunity to spur further progress in advancing market design to bolster investment in the generation and infrastructure that will best meet consumers’ demand for reliable, affordable power delivered by a resilient system. Sound pricing leads to sound decisions.

III. PJM’S PROPOSED EXTENDED LMP DESIGN IS WELL FOUNDED

8. In its comments, PJM identifies two improvements to its energy markets that it expects will improve its markets’ ability to attract and retain resources needed to assure reliable

² U.S. Department of Energy (2017), *Staff Report on Electricity and Reliability*, pp.15–60.

and resilient operations: adopting an “Extended LMP” model and improvements to shortage pricing. I comment on shortage pricing in the following section.

9. I concur with Prof. William Hogan’s conclusion that PJM’s Extended LMP initiative “is an appropriate step forward in price formation in the PJM region” “to ensure that the incremental cost of serving load is reflected in LMP to the fullest extent possible, uplift is reduced and incentives are maintained.”³ Owing to simplifying assumptions in the current LMP markets, prices do not always reflect incremental costs. While individual units are compensated through make-whole “uplift” payments, operating profit margins are lower than they should be were the LMP reflected incremental costs more fully. This margin compression affects baseload units particularly, and thus Extended LMP addresses in part the Secretary’s concern that such units may not currently be compensated appropriately.
10. The shortcomings of the existing LMP model have recently been a subject of study both before the Commission and in academia. In its Fast-Start Pricing NOPR the Commission expressed concern, in regard to fast-start units, “that some existing practices may not ensure that prices accurately reflect the marginal cost of serving load, potentially resulting in prices that do not reflect the value of fast-start resources, potentially creating unnecessary uplift payments, and potentially failing to provide incentives for market participants to make efficient investments.”⁴ Notwithstanding this concern, “PJM has not yet adopted the level of reforms as other regions with respect to fast-start pricing.”⁵
11. Leading energy market economists have made important contributions to improving on the basic LMP framework to account more fully for the cost of serving load in the energy price. Their work recognizes that incremental load not only changes dispatch, incurring marginal energy costs, but may also change unit commitment, incurring additional start-up and minimum-load costs. Currently, these commitment costs are not priced in the basic LMP design; instead, some units are guaranteed to recover these costs through uplift payments. Dr. Brendan Ring, later joined by Prof. William Hogan, Dr. Susan Pope, and Dr. Paul Gribik, began work on extending the basic LMP to minimize uplift payments, and other scholars have made important contributions to this area of research.⁶ Their

³ Correspondence of William W. Hogan to Stu Bresler, Oct. 23, 2017, appended to *Initial Comments of PJM Interconnection, L.L.C. on the United States Department of Energy Proposed Rule* in this docket (“PJM Comments”).

⁴ Notice of Proposed Rule-Making, *Fast-Start Pricing in Markets Operated by Regional Transmission Organizations and Independent System Operators*, Docket No. RM17-3 (“Fast-Start Pricing NOPR”) at ¶13.

⁵ PJM Comments at p.40.

⁶ See, e.g., Brendan J. Ring, “Dispatch Based Pricing in Decentralized Power Systems,” Ph.D. thesis, Department of Management, University of Canterbury, Christchurch, New Zealand, 1995; William W. Hogan and Brendan J. Ring, “On Minimum-Uplift Pricing for Electricity Markets,” March 19, 2003; Alexis L. Motto and Francisco D. Galiano, “Equilibrium of Auction Markets with Unit Commitment: the Need for Augmented Pricing,” *IEEE Transactions on Power Systems*, Vol. 17, No. 3, August 2002, pp. 798–805; Ramteen Sioshansi, Richard O’Neill, and Schmuuel S. Oren, “Economic Consequences of Alternative Solution Methods for Centralized Unit Commitment in Day-Ahead Electricity Markets,” January 2007 (http://www.ieor.berkeley.edu/~ramteen/papers/mip_lr.pdf), and Paul R. Gribik, William W. Hogan, and Susan L. Pope, “Market-Clearing Electricity Prices and Energy Uplift,” (December 31, 2007, available at

collective work laid the foundation for Extended LMP that, in a modified form, was implemented by the Midcontinent Independent System Operator (“MISO”) in 2015 and underlies the reforms under consideration by PJM.⁷

12. A central observation by Ring *et al.* is that optimizing power dispatch requires not only optimizing a set of continuous choices, namely the set point for each resource, but also a set of *integer* choices, namely the unit commitment decision, and then computing a set of prices that supports this solution as an equilibrium.⁸ In the basic LMP model—such as PJM’s—the unit commitment process influences prices only indirectly, by limiting which resources are available in the dispatch. The resulting LMPs may not, therefore, support the dispatch but instead require some additional make-whole, or uplift, payment. “When there is no set of energy prices that supports the solution, this requires some accommodation in selecting a workable rule for pricing electric energy and treating the implications for any deviation from the equilibrium solution.”⁹ The Extended LMP model provides such a solution that minimizes uplift charges.
13. A simple example helps to illustrate the issue.¹⁰ Suppose the operator has two generating units available to meet load in one hour:

Table 1: Example Unit Characteristics

	Q (MW)	Unit A	Unit B
Fixed Cost (\$)		0	6000
Var Cost 1	100	65	40
Var Cost 2	100	110	90

By construction both units have two blocks of 100 MW capacity, for a combined total capacity of 400 MW. Unit A has no startup cost, while Unit B has a startup cost but lower marginal energy costs. If startup costs are ignored, the marginal variable costs are as shown in Exhibit RBS-2, stepping upward from \$40 to \$65 to \$90 and finally to \$110 as load rises from 0 to 400 MW.

14. The implied solution is not least cost, however, at least in this one-period model. To access the \$40 energy, the operator must assure that the unit earns its \$6000 startup cost, either through energy margins or uplift. At loads below about 178 MW, the least-cost solution is

https://sites.hks.harvard.edu/fs/whogan/Gribik_Hogan_Pope_Price_Uplift_123107.pdf (henceforth “Gribik *et al.*”).

⁷ PJM introduces its “Extended LMP” proposal briefly in PJM Comments at 42–46 and with some additional detail in a white paper, “Energy Price Formation and Valuing Flexibility,” (June 15, 2017) <<http://www.pjm.com/~media/library/reports-notice/special-reports/20170615-energy-market-price-formation.ashx>> (“PJM Report”).

⁸ Even this simplifies the problem considerably, as not all of the products required, e.g. black start, are typically included in the formal model.

⁹ Gribik *et al.* at 2]

¹⁰ This example is borrowed from Gribik *et al.* at 3.

to commit only Unit A. So, if unit commitment is included in the optimal dispatch and price calculations, the marginal cost is very different, as shown in Exhibit RBS-3. As Gribik *et al.* note:

[the chart reproduced in Exhibit RBS-3] looks quite different than the well-behaved marginal cost or supply curve in the core model. Now the marginal cost increases and then decreases, and then increases with increasing load. Furthermore, there may be no set of prices that satisfy the market equilibrium conditions that there is “no arbitrage”, meaning that suppliers would not want to change the dispatch at the given prices. This raises the question of how to define the “market clearing” prices and how to treat other payments needed to support the solution. (p.8)

15. The challenge implied by this integrated unit commitment and dispatch is high. Indeed, as a large mixed-integer problem, modern hardware and software cannot solve it exactly in an acceptable amount of time to operate a power grid. Hence market design has introduced some simplification or approximation to have a computable general solution.
16. The basic LMP approach, as originally implemented in markets like PJM, approximates the solution by breaking the problem into two steps: commitment and dispatch. Each problem on its own was simple enough to be handled by hardware and software available to RTOs in the 1990s. Unit commitment is an integer program that can be solved using standard techniques and heuristics. The results are then handed to the dispatch algorithm, which now is a (comparatively) simple linear program with continuous variables. The problem that arises from this approach, however, is that the LMPs are derived entirely from the dispatch step, ignoring entirely the constraint costs from the commitment phase—that is, unit start-up and minimum-load costs. Hence, these basic LMPs from the two-step model omit incremental costs to serve load unless those costs are in the marginal energy bids.
17. As computing capacity has advanced, energy economists and market designers have considered ways of improving the approximation to include all incremental costs more fully and accurately. Various alternatives have been proposed, but Gribik *et al.* demonstrate that a “convex hull” approach has the desirable property of minimizing uplift payments by keeping total costs as close as possible to the theoretical optimum while preserving the well-behaved properties of the (weakly) upward sloping marginal cost curve of the core model. Moreover, Gribik *et al.* show that the dual of this convex hull approach yields a computable set of prices that approximately support the commitment and dispatch.
18. Although no RTO has yet implemented the full “convex hull” commitment and dispatch algorithm, practice is clearly evolving in this direction. The Commission’s Fast-Start Pricing NOPR sketches a market design that recognizes that costs of certain inflexible units, whether committed or not, should enter into LMP price formation. MISO’s Extended LMP design is an example of this design in use since March 2015. MISO has been evolving its implementation to include an increasing set of inflexible units in price

formation. Viewed in this context, PJM's Extended LMP proposal is the next step along the road from the basic LMP design toward a more complete recognition of costs in prices.

19. This approach is more sophisticated than what is suggested by illustrations published in the PJM Report and cited, with concern, by the PJM Independent Market Monitor ("IMM") in his comments in this docket.¹¹ PJM's white paper on this topic suggests that the Extended LMP approach would merely fill in any valleys in the marginal cost curve, such as that shown in RBS-3. The actual solution to the convex hull approach is shown in RBS-4. As the diagram shows Extended LMPs are, at various load levels, either higher *or lower* than the simple LMPs. Thus the IMM Comments' concern that Extended LMPs will result only in cost increases to consumers is not well founded.
20. The IMM Comments assert, apparently on the basis of this one graph, that "the PJM Report's proposal would impose significant additional cost on load to increase generator revenue, with a disproportionately large increase in revenues for nuclear and coal units." It is too early to know whether, or by how much, energy prices would rise; moreover, these hypothetical increased energy margins could result in lowered capacity market prices, which could offset some or all of any energy price increase. Furthermore, a core goal of the Extended LMP design is to minimize uplift payments. For example, MISO's External Market Monitor estimated that expanding MISO's Extended LMP from the initial small set of fast-start generators to nearly all on-line peaking generation would reduce uplift payments by \$20 million annually, about 14% of total uplift payments.¹² Broadening the design as PJM has proposed should result in even greater reductions. Reducing uplift is particularly important to market participants because they cannot hedge or control them, adding uncertainty and risk to energy markets, which translate to increased costs for consumers. PJM's proposed reform should decrease market uplift risk, and consequently decrease the cost of risk imputed in consumer costs.
21. The IMM Comments also overlook consumer savings from efficiency benefits that PJM's proposal is likely to create. A potentially large savings would be not having to replace thousands of MWs of prematurely retired baseload capacity that, under a more appropriate pricing mechanism, might remain in service. Other investments will also be made with better information about the system's true incremental costs, supporting not only efficient entry and exit but also improvements in unit efficiency and operational capabilities. While some object to paying flexible units more than their costs, it is exactly this ability to earn profits when other, more costly units set the clearing price that underlies the entire logic of single clearing-price markets long supported by the Commission.
22. Moreover, there is no basis for the IMM Comments to assert that baseload resource would benefit "disproportionately" from the proposal unless we first know the extent to which

¹¹ Comments of the Independent Market Monitor for PJM in this docket ("IMM Comments") at 35–38.

¹² Potomac Economics, Independent Market Monitor for MISO (June 2016), *2015 State of the Market Report for the MISO Electricity Markets*, at page xi. (<https://www.potomaceconomics.com/wp-content/uploads/2017/02/2015-State-of-the-Market-Report.pdf>) ("2015 MISO Market Report").

the current LMP prices disproportionately harm baseload units' profitability. The Market Monitor implicitly takes the current LMP system as the one, true and indisputable price formation algorithm, notwithstanding the extensive academic literature and Commission precedent finding that the simple LMPs used in PJM today do not fully or properly reflect costs.

23. The IMM Comments assert that PJM's proposal "undermines market incentives for flexible resources."¹³ I reach exactly the opposite conclusion. Today, an inflexible resource is paid its costs, but a competing, lower-cost flexible resource may be backed down to accommodate that inflexible resource's minimum generation. Today, the flexible resource is paid less for this energy, and is paid no uplift to cover its opportunity cost of not generating because of the inflexible resource's size; thus, the current system penalizes flexible units while making whole inflexible ones. Under PJM's proposal, however, the earnings of flexible generators would not be driven down by inflexible units, in part because of adjustments to the LMP, and in part by payments of lost opportunity costs as uplift. The IMM Comments criticize this opportunity cost payment, however, noting that the "owner [of the marginal unit] becomes indifferent to whether or not it follow the cost-minimizing dispatch instruction."¹⁴ But this outcome is precisely what occurs today—the marginal unit sets the LMP at its marginal bid cost, and so is indifferent about the precise set point (given the fact that units bid in MW blocks of uniform marginal cost). If the new PJM system did *not* pay opportunity costs as an uplift, then the flexible, marginal unit would have a positive incentive to ignore PJM's dispatch instruction and generate excess energy to earn additional margin. These opportunity cost uplift payments have a direct analog in the reserve markets, where the price of spinning reserves includes payment for the lost opportunity to earn margins by generating more power.
24. Gribik *et al.* contemplated that these opportunity cost uplift payments would be part of the "convex hull" pricing:

Another possibility is that a generator is partially dispatched and has remaining unused capacity. If the energy price is above its variable cost, the profit maximizing solution might be to increase output and upset the aggregate energy balance. This condition cannot occur in the core model, but it can arise in the more general framework. Depending on how the energy price is determined the generator sees opportunity costs in foregone profits from complying with the dispatch. An uplift payment for the opportunity cost makes the generator whole and further supports the dispatch. (p.12)

It is important to note that these opportunity cost uplift payments are part of the total uplift payments that are, by construction, minimized by the "convex hull" dispatch that underlies PJM's proposal. Thus, even including these opportunity costs in uplift, total uplift under PJM's proposal will be lower than uplift today.

¹³ IMM Comments at 39.

¹⁴ *Id.*

25. The IMM Comments also mischaracterize the PJM market reforms as “new and unprecedented.” (p.35) While I agree that no RTO has used the Extended LMP approach as fully as PJM is contemplating, its proposal is consistent with the academic literature and is a natural extension of the Extended LMP already implemented by MISO and the logic of the Fast-Start Pricing NOPR. While MISO’s design only considers price impacts of inflexible fast-start units, the price distortions are not only caused by inflexible peakers, as the example above illustrates. Start-up costs, minimum load blocks, and other intrinsic unit characteristics all create real constraints in the unit commitment and dispatch that are currently unpriced.
26. The IMM Comments also raise concerns with other aspects of PJM’s proposed Extended LMP implementation. Without commenting directly on most of these issues, I note that the PJM Report lacks sufficient details of the market design to allow careful consideration of most of these issues. MISO’s External Market Monitor recommended several changes in that market’s Extended LMP design based on early experience, and PJM should be incorporating this experience into its proposed market redesign.¹⁵
27. I believe the Commission should require timely filings by PJM to address the systematic mis-pricing of energy in its markets. Investment and retirement decisions are being made in real time. Improving markets and their pricing structures to more accurately reflect costs will yield better decisions about economic investments and retirements that ultimately yields the most cost-effective solutions for maintaining a reliable and resilient bulk power system in PJM.

IV. PJM’S PROPOSED SHORTAGE PRICING ALSO IMPROVES MARKETS

28. PJM’s identified changes to its shortage pricing are important improvements that will, in my judgment, sharpen incentives for resource owners to invest in equipment, infrastructure, and technology to be available when most needed. Such investments are also likely to enhance grid resilience.
29. Accurately valuing energy and reserves is most difficult during scarcity conditions, when there is a risk to system reliability. PJM’s introduction of operating reserve demand curves in 2012 for 10-minute reserves was an important step, monetizing the incremental reliability value rather than pricing solely based on units’ marginal costs. The current rule’s exclusive focus on 10-minute reserves does not, however, reflect the reliability value of replacement reserves such as 30-minute reserves.
30. Although resilience and reliability are not the same, providing appropriate price signals to support investments for reliability also enhance resilience. If 30-minute reserves can earn higher shortage prices, unit owners will have more incentive to ensure that their units are providing either energy or reserves in scarcity conditions. Such investments might include winterizing equipment, installing or raising seawalls or river dikes, making units dual-fuel capable, holding more inventory of fuel on-site, or firming up fuel delivery. Any of these

¹⁵ 2015 MISO Market Report at p. xi.

responses would not only improve the unit's ability to respond to a reliability event but would also enhance grid resilience.

IV. CONCLUSIONS

31. In summary:

- a. PJM's proposed Extended LMP design has a firm foundation in the academic literature and is a natural extension of the Fast-Start Pricing NOPR. The current LMP design fails to reflect all incremental costs incurred to serve load, but focuses narrowly on dispatch costs of a subset of flexibly dispatched units;
- b. Likewise, PJM's proposed expansion of shortage pricing appears well considered to embed the reliability value of resources during near-shortage conditions in market prices;
- c. Correcting these prices in the Extended LMP framework and shortage conditions will improve the alignment between prices and cost, and therefore reduce the risk of premature retirements, which is consistent with the stated goals of the Secretary's Proposed Rule.

32. My recommendation to the Commission would be that it holds PJM to the ambitious schedule for market reforms that it has laid out, while assuring stakeholders sufficient opportunity to review and comment. By providing certainty to PJM generation owners that long-standing problems will be quickly and reasonably solved, the Commission would create a better investor environment in which decisions about investments and unit retirements will be made.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Grid Reliability and Resilience Pricing

Docket No. RM18-1

**AFFIDAVIT OF ROBERT B. STODDARD
ON BEHALF OF PJM POWER PROVIDERS**

I, Robert B. Stoddard, being duly sworn, depose and state that the contents of the foregoing Affidavit on behalf of PJM Power Providers is true, correct, accurate and complete to the best of my knowledge, information and belief.



Robert B. Stoddard

SUBSCRIBED AND SWORN
before me this 7 day of November 2017



Notary Public

My commission expires: 10-5-2023

Chad Daley
Notary Public, State of Maine
My Commission Expires October 5, 2023



Robert B. Stoddard

Principal, Power Market Economics LLC
President & CEO, GWave LLC
Senior Consultant, Charles River Associates

MA and MPhil Economics
Yale University

BA Economics and Music
summa cum laude
Amherst College

Robert Stoddard has over thirty years of experience assisting clients in defining, analyzing, and interpreting the economic issues involved with competition and product valuation in energy markets. As CEO of GWave, Robert provides executive leadership for a technology startup developing a new generation of ocean wave energy converters. He has raised over \$30 million in 2016 to construct and test the first full-scale prototype, secured contracts, a berth site and all regulatory licenses for its first commercial installation, and managed an extensive supply chain designing and fabricating the prototype. He recently completed a licensing agreement to commercialize the technology.

Prior to joining GWave, Robert led the energy practice at Charles River Associates, a global consultancy. His work there focused on electricity industry restructuring, capital investment in power markets, and on providing both strategic analyses and testimony for utilities, generation owners, and governments regarding the practical implications of market design and structure, particularly of Regional Transmission Organizations. He has frequently testified to the Federal Energy Regulatory Commission as well as to the utility commissions and legislatures on competitive market design, rates, and market power issues.

Clients

Mr. Stoddard has been an expert witness or consultant on electric market issues to many leading law firms and to a wide range of energy market stakeholders including ArcLight Capital Management, AES, American Wind Energy Association, Astoria Generating, Babcock & Wilcox, Bangor Hydro Electric, California Independent System Operator, Citibank, City of New York, Connecticut Department of Public Utility Control, Consolidated Edison Co. of New York, Constellation Energy Commodities Group, CSG Investments, Dayton Power & Light, Devon Canada, Dominion, Duke Energy, Edison Mission Energy, EDF, Electricity Supply Board of Ireland, Emera, Energia dos Portugal, Energy Capital Partners, Energy East, Entergy Nuclear, FirstEnergy, FirstLight, GenOn, Hydro Québec, Independent Energy Producers Association, IGS Energy, International Power, J. Aron & Company, King Street Capital Management, Maine Energy Recovery Co., Maine Public Service, Midlands Cogeneration Venture, Morgan Stanley Capital Group, Morris Energy Group, New England Power Generators Association, New York City Economic Development Corporation, New York Energy Buyers Forum, NextEra Energy Resources, North American Energy Alliance, Northeast Utilities, NRG Energy, Orange & Rockland Utilities, Pepco Energy Services, Pinnacle West, PJM Power Providers, Portland General Electric, Powerex Corporation, Rhode Island Speaker and the House of Representatives, San Diego Gas & Electric, Sithe Global, Southern California Edison, Sunoco, Tenaska, Tonbridge Power, USGen New England, USPowerGen, and Williams Power.

Electricity market design

- Project director and testifying expert for capacity market design litigation and settlement negotiations for the New England and PJM markets, representing coalitions of the major generation owners in the region.
- Principal author of SDG&E and California Forward Capacity Market Advocates' proposal for a centralized capacity market structure to address resource adequacy needs of the California electricity markets. Subsequently offered a market-based approach to backstop capacity pricing in California on behalf of NRG Energy and the Independent Energy Producers Association.
- In the redesign of the wholesale power market for the Republic of Ireland, responsible for development of rules regarding demand-side integration, interconnection management, financial transmission rights, and transmission loss representation.
- Testifying expert on behalf of a major importer into the California electricity market on the allocation of financial transmission rights across external interties.
- Project director for a review for the California Independent System Operator of transmission rights allocations in the proposed California wholesale market.
- Principle drafter of the current form of the utility restructuring laws in Rhode Island, implementing improved retail market access.
- Project director for a major policy initiative by a major generation owner to review key flaws in modern RTO design that distort competitive pricing and outcomes.
- Project manager and testifying expert for litigation regarding the market rules governing use of phase angle regulators between New York and PJM. Subsequently, assisting the negotiated design of these rules pursuant to the FERC orders.
- Working with other CRA experts, prepared a white paper on capacity market design for Energia dos Portugal.

Market power analysis and mitigation

- Testifying expert successfully defending against charges of market manipulation by largest capacity importer to New England.
- Led preparation of report successfully defending against charges of market manipulation by a power marketer scheduling transactions through multiple jurisdictions.
- Lead expert defending a major financial institution against charges of manipulating ICE index markets (ongoing).
- Lead economist in team developing alternative mitigation measures for buyer-side market power in the New England capacity market.
- Testified on appropriate metrics for market power in PJM energy and capacity markets.
- Testified as to vertical and horizontal market power issues related to affiliation of merchant generation and the host distribution utility.

- Testifying expert and project director supporting the integration of Virginia Electric and Power (Dominion) into the PJM marketplace.
- Project manager for an acquisition of generation assets in Connecticut by a competing supplier, using detailed hourly analyses of power flows and potential future competition, and presenting the results to the FERC, US Department of Justice, and the Connecticut Office of the Attorney General.
- Project manager for a market power analyses needed to obtain federal and state regulatory approval of the merger of the leading natural gas transporter and distributor in the eastern US with a vertically integrated utility with substantial gas holdings.
- Project manager for study of the potential competitive effects of the divestiture of substantially all the New York City utility generation to independent power producers, including detailed behavioral modeling that took account of the complex transmission system and design of market power mitigation measures for the energy and capacity markets.

Strategy

- Led creation of business model and market-entry strategy for company developing an innovative renewable power technology.
- Led creation of business model and business plan for a combined wind-farm / transmission company in Canada.
- Assisted major utility in strategic and tactical plan to support transfer between Regional Transmission Organizations, providing both analytic and regulatory advisory support.
- Directed the development of the master energy infrastructure strategy for the City of New York, working with key stakeholders to develop a strategy to develop the infrastructure needed to meet the city's future energy needs economically and reliably.
- Developing a detailed forecasting model for capacity prices in PJM resulting from the new capacity market design and, using this information, worked with a major market participant's strategy and financing staff to identify under-valued assets for acquisition.
- With senior management of a major utility, developing a transmission investment strategy to reflect shifting competitive opportunities, RTO market design, and state and federal regulation. Identifying of key opportunities to leverage and redirect capital expenditures to significantly decrease cost of delivered power and increase rate of return to corporate shareholders.
- Developing a competitive bidding strategy for a complex hydroelectric generation asset to recognize opportunity costs, limitations of market rules, and effects of key transmission constraints in a two-settlement, locational pricing regime.
- Assisting a leading provider of utility outsourcing services to develop a comprehensive regulatory strategy for its service offerings to a major utility.

Electricity contracts and project valuation

- Reports to support long-term contracts with critical new generation facilities in Massachusetts.

- Testimony (in progress) to support the tax valuation of independent power production facilities in New York and Maryland, evaluating the free cash flows from sales of energy and other products' net of fuel, emissions, and other relevant costs.
- Testimony successfully supporting claims against industrial customer in breach-of-contract claims by a retail energy provider.
- Testimony supporting the cost-effectiveness of a long-term power purchase agreement between Cape Wind and National Grid in furtherance of Massachusetts policy goals.
- Testimony regarding the market value of a nuclear power facility excluding idiosyncratic nuclear risks using a comparable transactions analysis.
- Expert testimony supporting the reliability must-run (RMR) applications of over 2 GW of generation in New England, documenting need for RMR contracts to maintain the financial viability of needed resources. The case resulted in a settlement agreement that provided for significant support payments for these resources during the transition to compensatory market payments.
- Testimony for a bankruptcy court regarding damages arising from a power purchase agreement that had been rejected at the time of bankruptcy.
- Testimony in arbitration proceedings to determine the product specification and price of the capacity product contracted for in a period of regulatory change.
- Support of project financials for major purchase of New York City generation to investor community.
- Testimony in arbitration proceedings about the interpretation of, and damages owed under, the electricity section of a contract for the purchase of a large petrochemical refinery and resale of the refinery's output.
- State-appointed auditor of Connecticut's utilities' first Standard Offer power procurement auction, reviewing reasonableness of pricing and the terms and conditions of contract offers to supply essentially all of the state's power needs for a three-year period.
- Testimony on fuel costs adders reasonably allowable in a long-term power contract between NRG and Connecticut Light & Power and attendant retail rate design to fairly allocate the incremental costs.
- Assisting Consolidated Edison Co. of New York negotiate the sale of its nuclear facilities and linked buyback of power for the license life of the units.
- Working with Pinnacle West staff to develop options-based contracts to transfer power between its generating, trading, and distribution affiliates to preserve appropriate performance incentives.
- Project manager for bankruptcy evaluation of a New England cooperative, involving assessment of value of hydroelectric, nuclear assets, and long-term contracts.

Articles

With Richard D. Tabors and Scott Englander, "Who's on First? The Coordination of Gas and Power Scheduling," *Electricity Journal*, Vol. 25, No. 5, June 2012, pp. 9-15.

With Richard D. Tabors, "The Confluence of Utility Regulation: Water, Electricity and Natural Gas," paper delivered at the 2012 Eastern Conference of the Center for Research in Regulated Industries at Rutgers University.

With Edward L. Kim, Richard D. Tabors and Todd E. Allmendinger, "Carbitrage: Utility Integration of Electric Vehicles and the Smart Grid," *Electricity Journal*, Vol. 25 No. 2, March 2012, pp.16–23.

With Richard D. Tabors, "Flaws in Reliability Options as a Mechanism for Resource Adequacy: Evidence from New England," paper delivered at the 2011 Eastern Conference of the Center for Research in Regulated Industries at Rutgers University.

With Harry Foster, "Optimal Pricing of Energy-Limited Resources in Capacity Markets," paper delivered at the 2009 Eastern Conference of the Center for Research in Regulated Industries at Rutgers University.

With Seabron Adamson, "Comparing Capacity Market and Payment Designs for Ensuring Supply Adequacy," Proceedings of the 42nd Hawaii International Conference on System Sciences, 2009.

Testimony and reports

California Independent System Operator Corporation, FERC Docket No. ER13-550-000. Affidavit in support of the NRG Companies and the Dynegy Companies, protesting the creation of a Flexible Capacity and Local Reliability Resource Retention Mechanism in lieu of a comprehensive market structure for resource adequacy, January 2013.

GenOn Bowline, LLC v. Town of Haverstraw, et al., Index No. SU-2009-6850 *Hudson Valley Gas Corporation. v. Town of Haverstraw, et al.*, Supreme Court of the State of New York, County of Rockland, Index No. SU-2009-6860. Report projected energy and capacity revenues, March 2013; testimony January 2014.

PJM Interconnection, L.L.C., FERC Docket No. ER13-535-000. Affidavit in support of NRG Energy protesting proposed changes to the Minimum Offer Price Rule in PJM's Reliability Pricing Model, December 2012, reply affidavit March 2013.

"*Analysis of the Impact of Salem Harbor Repowering on New England Air Emissions*," CRA report authored by Mr. Stoddard on behalf of Footprint Power Salem Harbor Development LP, Massachusetts Electric Facilities Siting Board Docket 12-2, November 2012.

Capacity Deliverability Across the Midwest Independent Transmission System Operator, Inc./PJM Interconnection, L.L.C. Seam, FERC Docket No. AD12-16-000. Affidavit supporting comments of Duke Energy Corporation, August 2012.

In the matter of, on the Commission's own motion, to initiate a proceeding to establish a state compensation mechanism for alternative electric supplier capacity in Indiana Michigan Power Company's Michigan service territory, MPSC Case No. U-17032. Testimony on behalf of FirstEnergy Solutions Corp. supporting use of RPM capacity pricing retail rates, July 2012.

In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company and The Toledo Edison Company For Authority to Provide for a Standard Service Offer Pursuant to R.C. § 4928.143 in the Form of an Electric Security Plan, PUCO Case No. 12-1230-EL-SSO. Rebuttal testimony on behalf of Applicants supporting reasonableness of multi-year contracts to hedge price risk, June 2012.

In the Matter of the Application of Columbus Southern Power Company and Ohio Power Company for Authority to Establish a Standard Service Offer Pursuant to §4928.143, Ohio Rev. Code, in the Form of an Electric Security Plan, PUCO Case No. 11-346-EL-SSO et al. Testimony on behalf of FirstEnergy Solutions Corp. supporting use of RPM capacity pricing in retail rates. May 2012.

In the Matter of the Commission Review of the Capacity Charges of Ohio Power Company and Columbus Southern Power Company. PUCO Case No. 10-2929-EL-UNC. Testimony and deposition on behalf of FirstEnergy Solutions Corp. supporting use of market pricing for capacity, April 2012.

*"Update to the Analysis of the Impact of Cape Wind on Lowering New England Energy Prices," CRA report authored by Mr. Stoddard, on behalf of Cape Wind Associates, LLC, filed in *Petition of NSTAR Electric Company for Approval of a Proposed Long-Term Contract for Renewable Energy with Cape Wind Associates, LLC Pursuant to St. 2008, c. 169, § 83*, March 2012.*

FirstEnergy Solutions Corp. & Allegheny Energy Supply Company, L.L.C. v PJM Interconnection, L.L.C., FERC Docket EL12-50-000. Affidavit in support of complaint seeking to require allocation of partial-year Auction Revenue Rights, March 2012.

California Independent System Operator, Inc., FERC Docket No. ER12-897-000. Affidavit in support of protest by NRG Energy, Inc. of proposed waiver of provisions of the Capacity Procurement Mechanism, February 2012.

FirstEnergy Solutions Corp. & Allegheny Energy Supply Company, L.L.C. v PJM Interconnection, L.L.C., FERC Docket EL12-19-000. Affidavit in support of complaint seeking to fund Financial Transmission Rights solely from Day-Ahead Market settlement surplus, December 2011.

"Resource Adequacy in Ohio's Restructured Market," CRA report authored by Robert B. Stoddard, on behalf of Duke Energy Ohio, December 2011.

Bangor Hydro Electric Company and Maine Public Service Company Request for Exemptions and Reorganization Approvals, Maine Public Utilities Commission Docket No. 2011-170. Rebuttal testimony on behalf of Emera regarding potential horizontal and vertical market power issues of proposed acquisitions, September 2011; live testimony, December 2011, March 2012.

PJM Interconnection, L.L.C., Duke Energy Ohio, Inc. and Duke Energy Kentucky, Inc., FERC Docket No. ER12-91-000. Affidavit on behalf of Duke providing cost-benefit analysis of its proposed transition from MISO to PJM in support of inclusion of transition costs in transmission rates, October 2011; rebuttal affidavit, November 2011.

In the Matter of Portland General Electric Company 2012 Annual Power Cost Update Tariff (Schedule 125), Oregon Public Utilities Commission Docket No. UE-228. Rebuttal testimony on behalf of Portland General Electric assessing reasonableness of its mid-term hedging strategy for gas and electricity procurement, August 2011.

California Independent System Operator Corporation, FERC Docket No. ER11-2256. Affidavit on behalf of the Independent Energy Producers Association protesting flawed elements of the Capacity Procurement Mechanism, December 2010; presentation to FERC Technical Conference, March 2011.

Expert Report on behalf of Mirant Mid-Atlantic, LLC, Maryland Tax Court Case Nos. 09-RP-CH-261-265; 09-RP-CH-280-294; and 09-RP-CH-294-298, July 2010; live testimony, February 2011.

PJM Interconnection, LLC, FERC Docket No. ER11-2288. Affidavit on behalf of GenOn Energy Management, LLC and Edison Mission Energy protesting the creation of a summer-only demand resource capacity product and the continuation of a limited demand resource capacity product in the PJM Reliability Pricing Model, December 2010.

Testimony on behalf of the PJM Power Providers before the Maryland Public Service Commission in Administrative Docket PC22 regarding the PJM Reliability Pricing Model and the 2013/2014 Delivery Year Base Residual Auction Results, October 2010.

ISO New England Inc. and New England Power Pool, FERC Docket No. ER10-787-000, and *New England Power Generators Association v. ISO New England, Inc.*, FERC Docket No. EL10-50-000 (combined). Affidavit on behalf of New England Power Generators Association supporting need for revisions to Forward Capacity Market design, March 2010. Rebuttal affidavit, April 2010. Pre-filed testimony, July 2010; supplemental affidavits, September 2010.

Maryland Tax Court Case Nos. 09-RP-CH-261-265; 09-RP-CH-280-284; and 09-RP-CH-294-298. Expert report projecting energy and capacity revenues for Mirant Mid-Atlantic Morgantown facility, July 2010; live testimony February 2011.

Petition of Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid for Approval of Proposed Long-Term Contracts for Renewable Energy with Cape Wind Associates, LLC Pursuant to St. 2008, c. 169, § 83, Massachusetts D.P.U. Docket No. 10-54. Direct testimony on behalf of Cape Wind Associates, LLC, June 2010.

Richard Blumenthal, Attorney General for The State of Connecticut v. ISO New England Inc., Brookfield Energy Marketing Inc., et al. FERC Docket No. EL09-47-000, and *The Connecticut Department of Public Utility Control and the Connecticut Office of Consumer Counsel v. ISO New England Inc., Brookfield Energy Marketing Inc., et al.*, FERC Docket No. EL09-48-000. Prefiled testimony on behalf of Brookfield Energy Marketing Inc. regarding scheduling of capacity imports. June 2009. Answering testimony, February 2010.

Pepco Energy Services, Inc. v. Constellation Energy Commodities Group, Inc. (ad hoc arbitration); expert report on behalf of Constellation on alleged mis-payment under a bilateral contract for PJM capacity, April 2008; testimony, October 2009.

Application of MidAmerican Energy Company for the Determination of Ratemaking Principles, IUB Docket No. RPU-2009-0003. Rebuttal testimony on behalf of NextEra Energy Resources, June 2009; surrebuttal testimony, July 2009, live testimony, August 2009.

Midwest Independent Transmission System Operator Inc., FERC Docket Nos. ER08-394-007 and -009. Affidavit regarding monitoring and mitigation of resource adequacy auctions on behalf of Duke Energy Corp., July 2009.

Calpine Corporation, Citigroup Energy Inc., Dynegy Power Marketing, Inc., J.P. Morgan Ventures Energy Corporation, BE CA, LLC, Mirant Energy Trading, LLC, NRG Energy, Inc., Powerex Corporation, and RRI Energy, Inc. v. California Independent System Operator Corp., FERC Docket No. EL09-62-000. Affidavit on behalf of complainants, June 2009; reply affidavit, July 2009.

Report on ISO New England Internal Market Monitoring Unit Review of the Forward Capacity Market Auction Results and Design Elements, prepared for New England Power Generators Association, Inc. and filed in *ISO New England, Inc.*, FERC Docket No. ER09-1282-000 (June 2009).

Richard Blumenthal, Attorney General for Connecticut, v. ISO New England Inc. et al., FERC Docket Nos. EL09-47-000 and EL09-48-000. Prefiled testimony on behalf of Brookfield Energy Marketing Inc. regarding scheduling of capacity imports, June 2009.

Master Transmission Plan for New York City, report prepared for the New York City Economic Development Corporation, April 2009.

California Independent System Operator Corporation, FERC Docket No. ER09-589-000. Affidavit on behalf of Powerex Corp. regarding changes to the CAISO credit policy regarding unsecured credit, February 2009.

“Contracting and Investment: A Cross-Industry Assessment” report filed with Post-Conference Comments of Reliant Energy, Inc., *Credit and Capital Issues Affecting the Electric Power Industry*, FERC Docket No. AD09-002-000, January 2009.

PJM Interconnection, LLC FERC Docket No. ER09-412-000. Affidavit and reply affidavit on behalf of Mirant, Edison Mission Energy, International Power, and FPL (NextEra Energy Resources) regarding omnibus changes to the PJM RPM capacity market tariff, January 2009.

Midwest Independent System Transmission Operator, Inc. FERC Docket Nos. ER08-394-000, -003, -007. Affidavit on behalf of Duke Energy protesting the market monitoring standards proposed for the voluntary capacity auction in Midwest ISO, January 2009.

Devon Canada Corp. et al. v. Pittsfield Generating Company LP et al. Expert report for defendant regarding damages from alleged breach of natural gas supply contract to a reliability must-run electric generator, December 2008.

Maryland Public Service Commission v. PJM Interconnection, LLC, FERC Docket Nos. EL08-34-000 and EL08-47-000. Affidavit on behalf on Mirant Parties on appropriate structural and behavioral market power tests in PJM, October 2008; reply affidavit, November 2008.

ISO New England, Inc., FERC Docket No. ER08-1209-000. Affidavit on behalf of the New England Power Generation Association on compensation to reliability resources, July 2008; reply affidavit, September 2008.

Midwest Independent Transmission System Operator, Inc. FERC Docket No. ER08-1169-000. Affidavit on behalf of FPL Energy, LLC, regarding revisions to Generation Interconnection Procedures, July 2008.

RPM Buyers v. PJM Interconnection, LLC, FERC Docket No. EL08-67-000. Affidavit on behalf of PJM Power Providers opposing *ex post* changes to initial RPM auction results, June 2008.

Assessment of Maine's Continued Participation in ISO New England and Alternatives, Expert report in Maine Public Utilities Commission Docket No. 2008-156, prepared on behalf of Bangor Hydro-Electric Company, June 2008; testimony to the MPUC, October 2008.

"Reliability at Stake: PJM's Reliability Pricing Model" report prepared for PJM Power Providers in conjunction with FERC technical conference to discuss the operation of forward capacity markets in New England and the PJM region, FERC Docket No. AD08-4-000, May 2008.

Estimation of Indian Point 2 Fair Market Value Using a Statistical Analysis of Comparable Transactions, Testimony in *Consolidated. Edison Co. of New York v. United States*, No. 04-0033C (Fed.Cl.), February 2008.

Critique of the APPA/CMU Study "Do RTOs Promote Renewables?" (with David Riker) commissioned by Electric Power Supply Association, January 2008.

Midwest Independent Transmission System Operator, Inc. Electric Tariff Filing Regarding Resource Adequacy, FERC Docket No. ER08-394-000. Affidavit on behalf of Duke Energy Corp. and FirstEnergy Services Co. on the urgency of implementing a uniform resource adequacy requirement, January 2008.

Mirant Energy Trading, LLC, et al. v PJM Interconnection, LLC, FERC Docket No. EL08-8-000. Affidavit on the flaws in the market power mitigation rules for the Third Incremental Auction of the PJM Reliability Pricing Model capacity market., November 2007.

In the matter of the application of Midland Cogeneration Venture Limited Partnership for the Commission to eliminate the "availability caps" which limit Consumers Energy Company's recovery of capacity payments with respect to its power purchase agreement with Midland Cogeneration Venture Limited Partnership, Michigan P.S.C. Case No. U-15320, testimony analyzing the relative economics of petitioner's facility to support the waiver. September 2007.

Wholesale Competition in Regions with Organized Electric Markets, FERC Docket Nos. RM07-19-000 and AD07-7-000. Affidavit on role of demand-side resources in organized electric markets on behalf of Duke Energy Corp., September 2007.

Order Instituting Rulemaking to Consider Refinements to and Further Development of the Commission's Resource Adequacy Requirements Program, California PUC Rulemaking 05-12-013. Principal author of SDG&E Track 2 Resource Adequacy Program Proposal, March 2007; principal author, "Joint Pre-Workshop Comments of the California Forward Capacity Market Advocates," May 2007, and "Proposal for a Forward California Capacity Market," August 2007.

People of the State of Illinois, ex rel. Illinois Attorney General Lisa Madigan v. Exelon Generating Co., LLC et al., FERC Docket No. EL07-47-000. Affidavit assessing reasonableness of outcomes in the Illinois power procurement auction on behalf of J. Aron & Company and Morgan Stanley Capital Group, July 2007.

PJM Interconnection, LLC, FERC Docket Nos. EL03-236-000 *et al.* Affidavit regarding three-pivotal-supplier market power test and scarcity pricing in PJM's energy markets on behalf of Mirant Energy Trading et al., May 2007.

Midwest Independent Transmission System Operator, FERC Docket No. ER07-550-000. Affidavit regarding resource adequacy issues in ancillary services market design on behalf of Duke Energy Co., March 2007.

PJM Interconnection LLC, FERC Docket No. EL05-148-000 *et al.* Affidavit regarding redesign of the long-run resource adequacy market in PJM on behalf of the Mirant Parties, October 2005; supplemental affidavit on behalf of the Mirant Parties, NRG and Williams Power Co., November 2005; presentation to FERC Technical Conference, February 2006; prefiled comments to FERC Technical Conference Panel 1, May 2006, on behalf of the Mirant Parties, Williams Power Co., and Dayton Power & Light; prefiled comments to FERC Technical Conference Panel 2, May 2006, on behalf of the Mirant Parties; supplemental affidavit on behalf of the Mirant Parties, June 2006; affidavit and reply affidavit supporting settlement agreement, September and October 2006.

Mystic Development, LLC, FERC Docket No. ER06-427-000. Affidavit analyzing future revenues in support of RMR filing, December 2005; supplemental affidavit, September 2006.

In re USGen New England, Inc. Debtor. United States Bankruptcy Court for the District of Maryland, Case No. 03-30465. Expert report on damage resulting from PPA rejection on behalf of USGen New England, March 2006; supplemental report, September 2006.

California Independent System Operator Corporation, FERC Docket No. ER06-615-000. Joint affidavit with Paul Kevin Wellenius regarding FTR allocations under new CAISO market design on behalf of Powerex Corp, June 2006

Fore River Development, LLC, FERC Docket No. ER06-822-000. Affidavit analyzing future revenues in support of RMR filing, December 2005.

Assessment of the New York City Electricity Market and Astoria, Gowanus, and Narrows Generating Stations. Report prepared for Morgan Stanley Senior Funding, Inc. related to financing for US Power Generating Co. and Madison Dearborn Capital Partners IV, L.P., January 2006.

Review of Initial Execution of Protocol for Implementation of Commission Order No. 476. Report to FERC in Docket EL02-23-000, regarding operation of controllable lines between NYISO and PJM, on behalf of Con Edison, September and December 2005.

Honeywell International Inc. v. Sunoco, Inc. AAA Case No. 13 181 Y 02588 04. Expert report, deposition and live testimony on contract energy pricing in petrochemicals, May 2005.

Con Edison Energy, Inc. v. ISO New England, Inc. and New England Power Pool, FERC Docket No. EL05-61-000. Affidavit on behalf of complainant regarding bidding rules in capacity deficiency auction, February 2005.

KeySpan Ravenswood LLC v. New York Independent System Operator, Inc., FERC Docket No. EL05-17-000. Affidavit on behalf of Consolidated Edison Company of New York, Inc. regarding retroactive damage claims from a capacity market, November 2004.

Devon Power LLC et al., FERC Docket No. ER03-563-030. Affidavit and rebuttal affidavit regarding design of locational installed capacity markets on behalf of FPL Energy, April and May 2004; answering testimony on behalf of Capacity Suppliers, November 2004; cross-answering testimony, December 2004; supplemental cross-answering testimony, January 2005; deposition and hearing testimony, February to March 2005; affidavit supporting Settlement Agreement, March 2006.

Application of Dominion North Carolina Power to Join PJM as PJM South, North Carolina Utilities Commission, Case No. E-22 SUB 418. Direct testimony and cost-benefit study on behalf of applicant, April 2004; rebuttal testimony, December 2004; examination, January 2005.

Application of Virginia Electric and Power Company to Join PJM as PJM South, State Corporation Commission of Virginia Case No. PUE-2000-00551; direct testimony and cost-benefit study on behalf of applicant, June 2003; supplemental direct testimony, March 2004; rebuttal testimony, September 2004; examination, October 2004.

Consolidated Edison v. Public Service Electric and Gas Co. et al., FERC Docket No. EL02-23-000 (Phase II); direct testimony on behalf of Consolidated Edison Company of New York, Inc., June 2002 regarding transmission facilities contracts. Remand testimony, January to March 2003.

In the Matter of the Siting of Electric Transmission Facilities Proposed to be Located at the West 49th Street Substation of Consolidated Edison Company of New York, Inc. et al., New York State Public Service Commission Case Nos. 02-M-0132, 01-T-1474, 02-T-0036, 02-T-0061; testimony on behalf of Consolidated Edison Company of New York, Inc., April 2002 (direct) and May 2002 (rebuttal).

Testimony before the Rhode Island Special Legislative Commission on the Quonset-Davisville Steamplant, January and April 2002.

Testimony before the Committee on Corporations, Rhode Island House of Representatives, regarding 2002 House Bill 7786, *An Act Relating to Public Utilities and Carriers*, April 2002.

Keyspan-Ravenswood, Inc. v. New York Independent System Operator, FERC Docket No. EL02-59-000, direct testimony on behalf of Consolidated Edison Company of New York, Inc. regarding implementation of market power mitigation in installed capacity markets, March 2002.

DPUC Investigation Into Viability of Power Supply Contracts to the Connecticut Light and Power Company and the United Illuminating Company, Connecticut DPUC Docket No. 01-12-05, direct testimony on behalf of NRG Energy, Inc. and affiliates, February 2002.

Joint Study by the Department of Public Utility Control and the Office of the Consumer Counsel Regarding Electric Deregulation and How Best to Provide Electric Default Service After January 1, 2004, Connecticut DPUC Docket No. 01-12-06, direct testimony on behalf of NRG Energy, Inc. and affiliates, January 2002.

The Narragansett Electric Co. Rate Changes for January 1, 2002, Rhode Island PUC Docket No. 3402, direct testimony on behalf of the Hon. John B. Harwood, Speaker of the House of Representatives, State of Rhode Island and Providence Plantations, December 2001.

Wisvest-Connecticut, LLC et al., FERC Docket No. EC01-70-000, technical conference presentation on behalf of NRG Energy, Inc. and affiliates, September 2001.

New York Independent System Operator, Inc., FERC Docket No. ER01-2536-000, affidavit on behalf of Consolidated Edison Co. of New York, the City of New York, the New York Energy Buyers Forum, and the Association for Energy Affordability, Inc., July 2001.

Testimony before the Committee on Corporations, Rhode Island House of Representatives regarding electricity restructuring; various dates, 2001.

Consolidated Edison Co. of New York, Inc., FERC Docket Nos. EL01-45-000 and ER01-1385-000, affidavit and rebuttal affidavit (joint with William H. Hieronymus) on behalf of Consolidated Edison Co. of New York, March and April, 2001.

Joint Petition of Consolidated Edison Co. of New York, Inc. and Entergy Nuclear Indian Point 2, LLC, for Authority to Transfer Certain Generating and Related Assets and for Related Relief, NYSPSC Case 01-E-0040, technical conference presentation on behalf of applicants, February 2001.

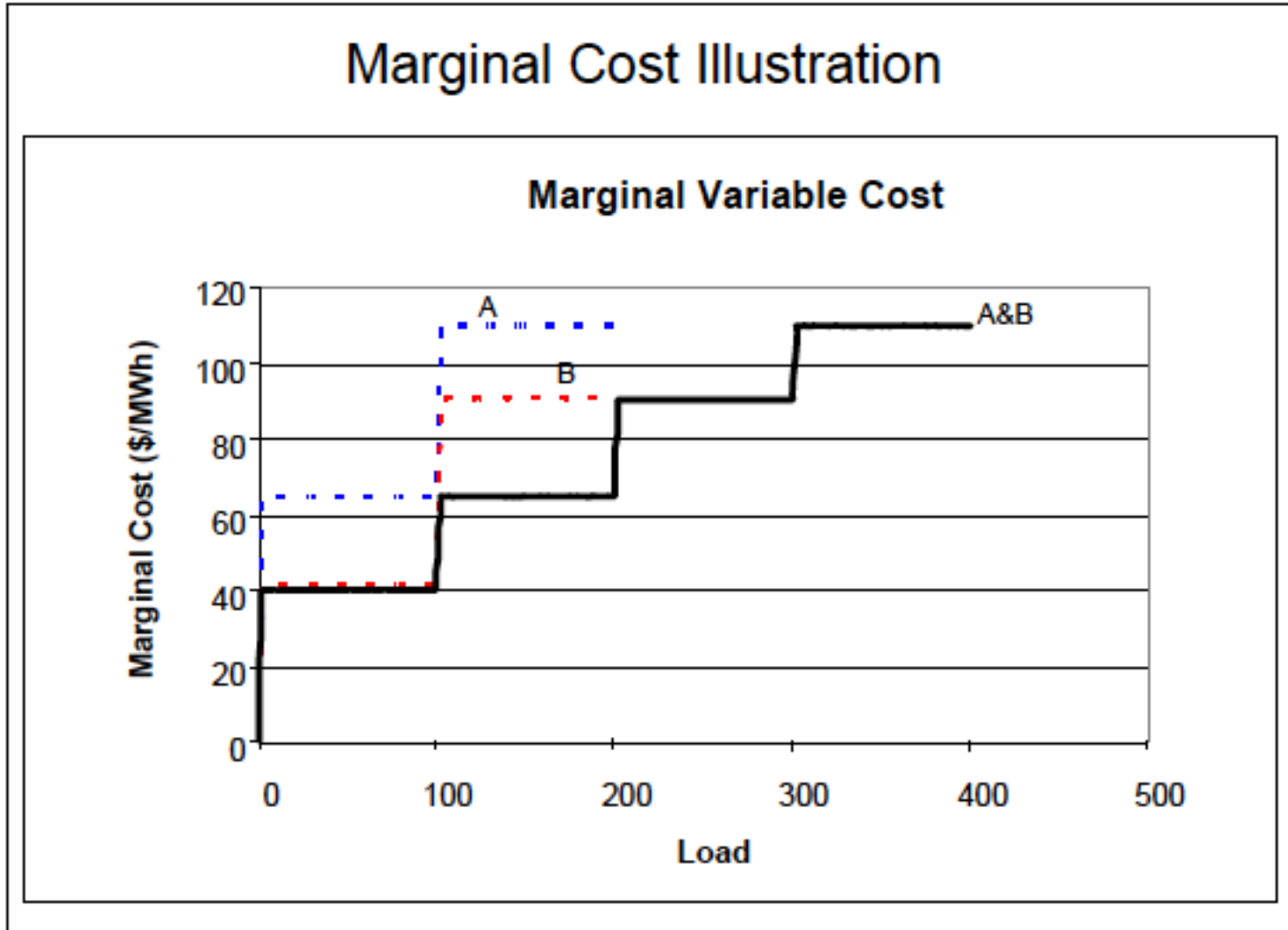
Professional history

2017-present	<i>Principal</i> , Power Market Economics LLC, Portland ME
2016-present	<i>President & CEO</i> , GWave LLC, Portland, ME
2013-present	<i>Senior Consultant</i> , Charles River Associates, Boston MA
2013–2016	<i>Executive Vice President</i> , GWave LLC, Boston MA
2003–2013	<i>Vice President</i> , Charles River Associates, Boston, MA
2001–2003	<i>Principal</i> , Charles River Associates, Boston, MA
1995–2001	<i>Managing Consultant</i> , PA Consulting Group, Cambridge, MA PA purchased PHB Hagler Bailly, formed by the merger of Hagler Bailly and Putnam, Hayes & Bartlett, where Mr. Stoddard had been a Principal.
1993–1995	<i>Senior Health Economist and Acting Managing Director</i> , Benefit Research USA, a Quintiles company, Cambridge, MA
1990–1993	<i>Senior Associate</i> , Charles River Associates, Boston, MA
1985–1990	<i>Teaching and Research Fellow</i> , Department of Economics, Yale University
1983–1985	<i>Assistant Economist</i> , Federal Reserve Bank of New York

Education

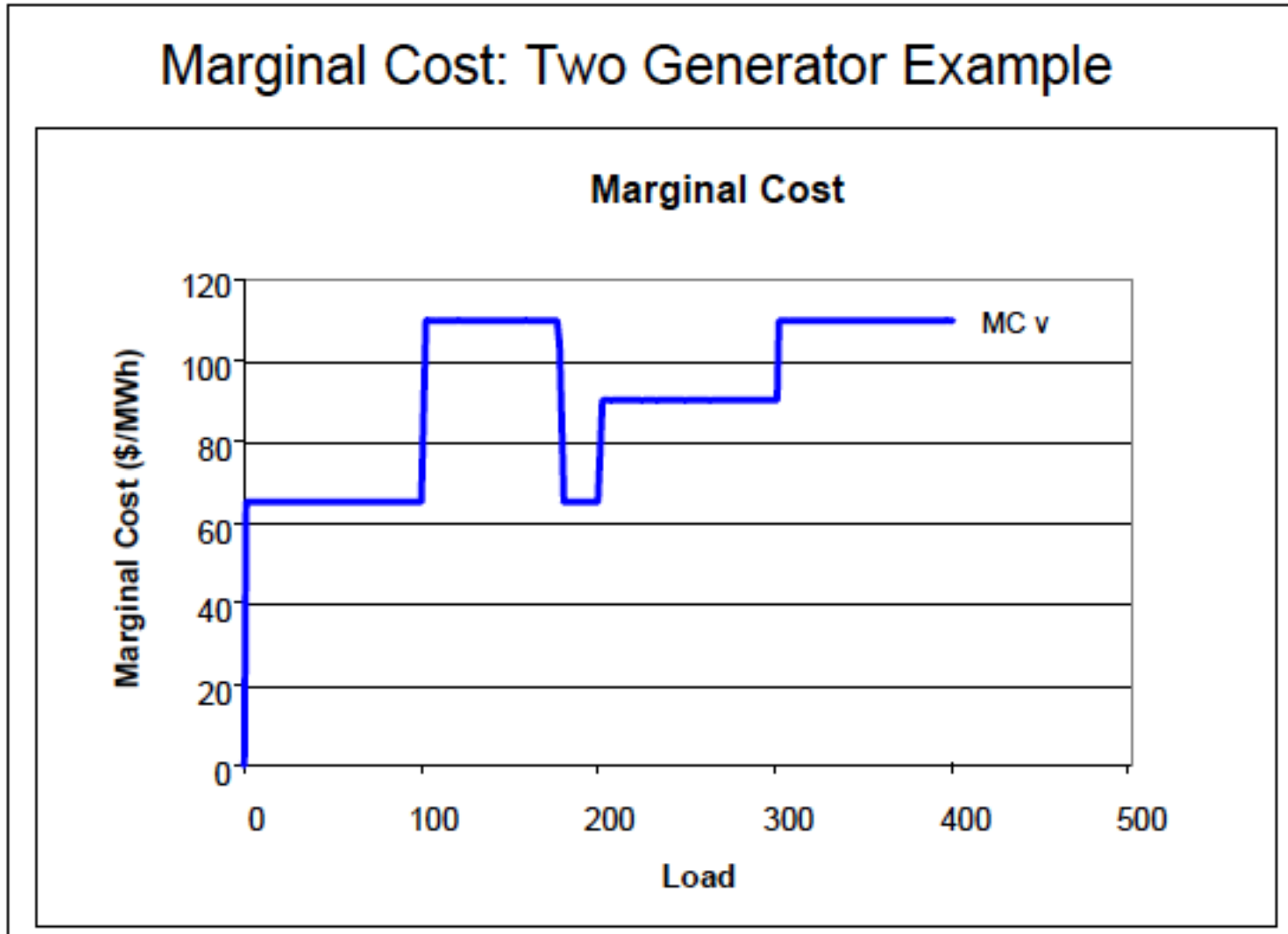
1990	M.Phil., Economics, Yale University
1986	M.A., Economics, Yale University
1983	B.A. <i>summa cum laude</i> , Amherst College; Phi Beta Kappa

EXHIBIT RBS-2: CURRENT LMP SUPPLY CURVE



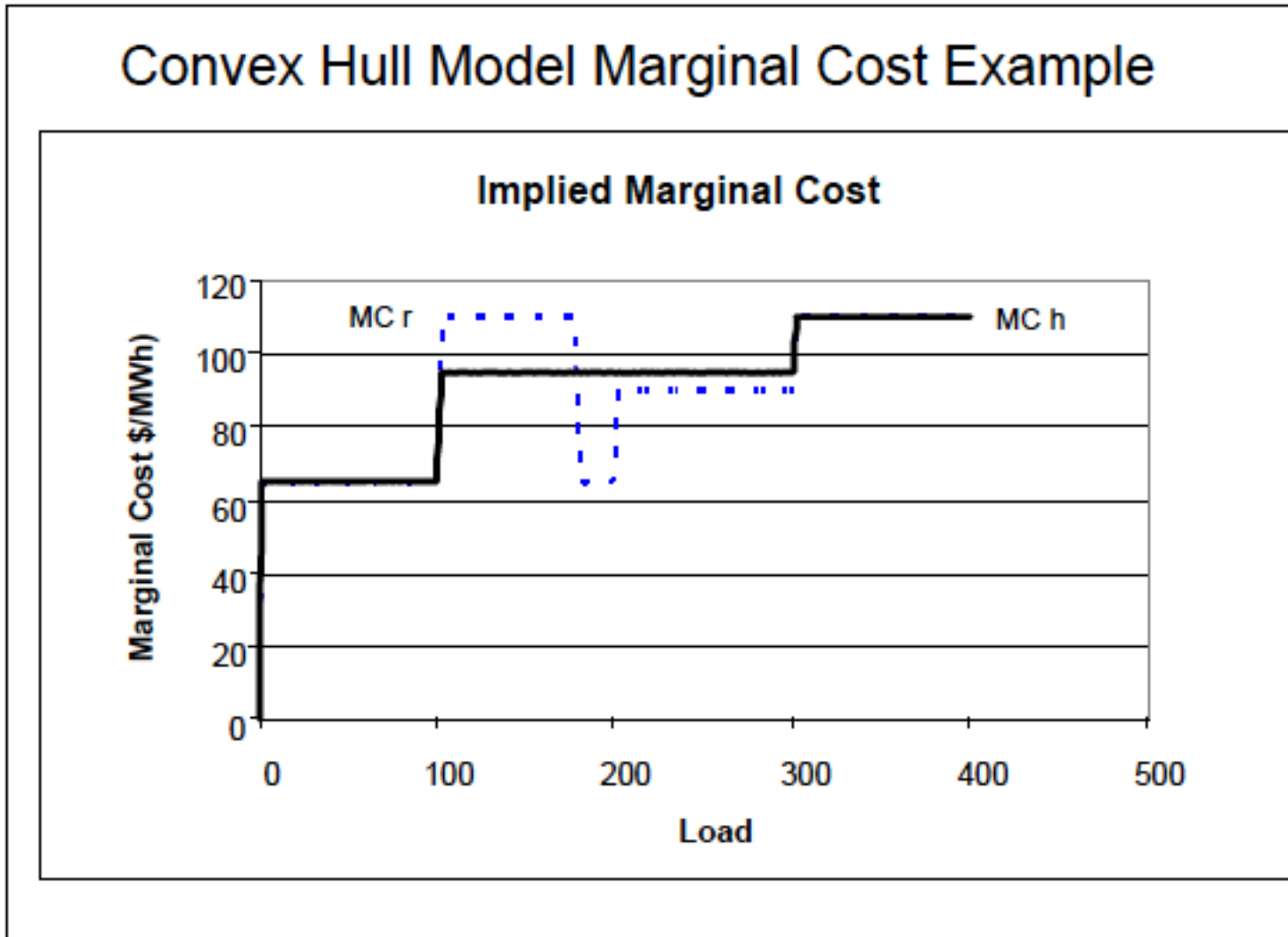
Source: Gribik *et al.* at 5.

EXHIBIT RBS-3: EXACT EXTENDED LMP SUPPLY CURVE



Source: Gribik *et al.* p.8

EXHIBIT RBS-4: CONVEX HULL LMP SUPPLY CURVE



Source: Gribik *et al.* p.19