UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

CXA La Paloma, LLC v. California Independent System Operator Corporation	Docket No. EL18-177-000

AFFIDAVIT OF ROBERT B. STODDARD ON BEHALF OF THE NRG COMPANIES

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 a senior consultant. My consulting work focuses 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. Related to this docket, I was intimately involved in 2006–8 in the parallel tracks at the California Independent System Operator Corporation ("CAISO") and the California Department of Public Utilities ("DPUC") to develop a centralized capacity market, having developed a framework that received broad support from CAISO and most stakeholders but was ultimately rejected by the CPUC. I have also been heavily involved in the initial development and subsequent reforms to capacity markets in the Eastern Interconnection, particularly in PJM and ISO New England. I was an invited speaker at the Commission's technical conference on the topic of integrating public policy in

wholesale markets last year.[1] 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 NRG Companies to review CPX La Paloma's complaint in this proceeding, including the accompanying Affidavit of Jeffrey Tranen and Joseph Cavicchi (the "Tranen/Cavacchi Affidavit") and to provide my perspective and additional evidence on the merits of the complaint.

3. In summary, based on my knowledge of the California resource adequacy ("RA") mechanism and the outcomes thereof, the Complaint is well-founded. CAISO's RA mechanism has all the indicia of market failure exhibited in New England in the early 2000s and ultimately led the Commission to order ISO New England to develop a centralized, locational capacity market.[2] In particular, the increasing reliance on Reliability Must-Run ("RMR") contracts and other backstop procurement by the CAISO, particularly the Capacity Procurement Mechanism ("CPM"), even though sufficient resources were available but uncontracted, in conjunction with a series of other issues I discuss in more detail below indicate a serious disconnect between the design of the RA mechanism and its ability to ensure reliability. This dysfunction occurs at a critical time in the evolution of CAISO's resource base, with California policy driving towards a greater reliance on renewable resources, particularly solar, which places heightened demands on and for dispatchable, highly flexible resources. RA can no longer be measured solely by counting installed megawatts, but CAISO lacks any framework to attract and retain capital investment in the flexible resources that will be required to reliably operate the low-carbon grid envisioned by California policymakers. Lacking prompt and decisive Commission action to require CAISO, in conjunction with both California and Nevada state regulators and other stakeholders, to develop a unified RA framework for this multi-state RTO, CAISO's dependence on *ad hoc* backstop procurement will continue and likely expand, undermining reasonable price formation and market signals for investment and retirement.

4. Where I disagree with the Complaint is in the narrowly proscriptive remedy sought. While an adaptation of the capacity markets of either PJM or New England could be an option—and was, in fact, the option I put forward a dozen years ago—it is not the only approach that could work. Indeed, in light of the ongoing issues in both of those markets

[1] State Policies and Wholesale Markets Operated by ISO New England Inc., New York Indep. Sys. Operator, Inc. and PJM Interconnection, L.L.C., Docket No. AD17-11-000).

[2] *Devon Power LLC et al.*, FERC Docket No. ER03-563-030.

about how to include subsidized policy resources, such as renewables, and the much larger scale of those resources in the CAISO market, a fresh consideration of options in a joint CAISO/CPUC stakeholder process seems appropriate. In the final section of this affidavit I suggest threshold requirements and objectives that I recommend the Commission place on the ultimate RA redesign to ensure its sound functioning, durability, and ability to assure reliable system operations.

III. THE CURRENT RA MECHANISM IS INTRINSICALLY AND IRREMEDIABLY FLAWED

5. Well-designed markets share basic characteristics. They are transparent and understandable, with clear prices for the products sold. Prices reflect fundamentals of supply and demand, and small changes in either supply or demand result in small changes in prices, helping to reduce market risk that would increase costs and prices. This transparency and stability in prices, in turn, leads to efficient decisions by suppliers and consumers, with investment in new supply or retirement of existing supply based on the expected future market value. Good market design uses competition as the first defense against market power but includes robust protections from market power abuse. Finally, good market design minimizes the frequency of procurement through extraordinary means.

6. In sharp contrast to this ideal, the current mechanism used by CAISO to assure resource adequacy is tangled, non-transparent, and frequently relies on top-up procurements. It notably lacks two principles of market design articulated by Harvard economics professor Alvin Roth: "thickness" and "safety."[3] The market is not "thick" because there are few buyers and, because of the short time-frames of most RA procurement, no opportunity to either enter or exit in a forward, orderly fashion in response to prices. Nor is the market "safe" in the sense of providing a low-risk environment for capital investment; instead of acting on fundamentals, both buyers and sellers seek ways to game the market design. This lack of coherence and the resulting procurement gaps reflect the fact that roles and responsibilities are scattered across different parties with no central oversight. For the majority of CAISO's footprint, load is forecast by the CEC, locational resource needs are defined by the CAISO, while the CPUC regulates RA procurement by utilities and certain other LSEs. Collectively, this loosely-coordinated process set the stage for systemic failures.

7. The most glaring deficiency in the current RA mechanism is that the CPUC plays the central role, but the CAISO has reliability responsibility for a larger footprint, including

[3] Alvin E. Roth, "The Art of Desiging Markets" *Harvard Business Review*, October 2007, available at https://hbr.org/2007/10/the-art-of-designing-markets.

transmission owners and loads that are not jurisdictional to the CPUC. With the addition of Valley Electric Cooperative (which subsequently sold its transmission assets to GridLiance West), CAISO became a multi-state RTO. Even before this event, however, CAISO operated—and continues to operate—the transmission systems of several municipal utilities that are not CPUC jurisdictional. The CAISO, however, has the ultimate reliability responsibility for all of its footprint and cannot, therefore, rely solely on the RA mechanisms and policies of its constituent transmission owners and their regulators. The tools CAISO currently as to address deficiencies in the resources collectively offered by its load-serving entities ("LSEs"), however, are not sufficient to result in efficient procurement of requirements.

8. In part reflecting this layered jurisdictional landscape in CAISO, the existing RA mechanism is highly complex and not transparent. The RA process is comprised of interweaving steps passed back and forth among the CAISO, the CPUC and the California Energy Commission ("CEC"). While complexity is not intrinsically bad—indeed, if the entire RA process of any RTO or ISO were diagrammed, it would be complex—the diverse responsibility with no common regulator leads to the potential for mismatches.

9. The RA mechanism is further set up for failure because market fundamentals such as the quantity demanded and quantity supplied are not uniformly defined across the CAISO footprint. On the demand side, for example, the CAISO defines 10 relevant RA local capacity areas and over 45 sub-areas.[4] In enforcing RA procurement on its jurisdictional LSEs, however, the CPUC only measures compliance at ten larger RA zones, creating the potential that capacity needed for reliability in one part of a zone is not part of a resource plan, while duplicative resources elsewhere in the state are procured instead. The CEC has the responsibility for forecasting load (omitting the Nevada portion of CAISO, which submits its own load forecast), but this forecasting is month-to-month (owing to the monthly design of the California RA program) and recently has been subject to large errors. On the supply side, it is the CPUC, not the CAISO, that sets the 'counting rules' which determine how many megawatts of RA a resource will count towards. Non-CPUC jurisdictional LSEs use their own counting, potentially inconsistent rules.[5] But ultimately it is the CAISO, not the CPUC or any other party, that needs to ensure that the resources

[4] The current list of CAISO local capacity areas and sub-areas is found in the 2019 Local Capacity Technical Analysis, available at http://www.caiso.com/Documents/Final2019LocalCapacityTechnicalReport.pdf.

[5] For example, Valley Electric owns no generation and procures all supplies by contract. It is unclear whether these contracts carry the same reserve margins, similarly defined, as other LSEs.

supplied to the market collectively provide the region with sufficient resource adequacy and, potentially, other required operating characteristics such as flexible ramping and low minimum generation points.

10. The RA mechanism also clearly discriminates among resources providing identical services. New interconnected generation[6] is procured through a Request for Proposal process by California's three investor-owned utilities ("IOUs") to meet the specific, forecasted need. Winning new resources are awarded long-term contracts. The process that identifies potential needs for new capacity assumes, however, that substantially all existing generation that serves the same need will remain in service—but without offering comparable compensation to them. Existing resources are compensated only with earnings from the sale of energy and ancillary services plus what is often a short-term stipend from the LSE (typically one of the IOUs) that includes that resource in its monthly RA showing. Suppliers are often in a highly asymmetric negotiating position in setting the monthly RA payment. The local IOU is, for all intents and purposes, a monopsonist with flexibility in how to procure resources. The IOUs can, and do, use this market power to extract favorable terms from suppliers, whose only alternative if they cannot reach such a contract is to do without *any* capacity payment, retire, or seek to be procured through a supplemental process at the CAISO.

11. The current RA mechanism also operates on time frames that are inconsistent with the investment horizons of generation resources. LSEs must make a showing monthly of sufficient capacity based on forecast load, but this month-to-month RA showing is inconsistent with the timeframe of years to decades on which capacity resources must be built and maintained. California's Long-Term Procurement Planning process implicitly acknowledged this problem with respect to new generation, offering them long-term contracts to provide them the opportunity to recover their investment and to earn a fair return over time. Existing resources are not provided the same investment horizon. RA contracts with LSEs are rarely longer than annual, and sometimes shorter. CAISO backstop capacity designations through its CPM are, for the vast majority of designations, for either only 30 or 60 days from the date when committed and, worse yet, often only pay for the portion of the resource from which energy was actually dispatched (often the minimum load, or PMIN, of the plant), while the entire unit remains available to the CAISO to be dispatched if needed.[7] Power plants do not exist for

[6] As opposed to behind-the-meter generation, such as small industrial generators and rooftop solar.

[7] See, *e.g.* CAISO "June 18th 2017 Exceptional Dispatch CPM Designation Report" available at http://www.caiso.com/Documents/June182017ExceptionalDispatchCPMDesignationReport.pdf which states in relevant part: "The ISO exceptionally dispatched several RA and non RA resources to PMIN

only a few months of the year, though; they are durable assets with ongoing operating and maintenance costs, as well as lumpy major capital improvements that are required for continued safe and reliable operations at a plant. The California RA construct, however, has no structured way for such periodic capital investment to be recovered. LSEs have no incentive to contract to pay for such costs, particularly when other units may be available without a current major capital need. If the unit is needed for local reliability, it is possible to recover these costs through an RMR contract, but there is no market mechanism to allow for recovery on and of capital renewal projects, or even to assure that existing resources have a dependable capacity payment, let alone a capacity payment equal to that being paid to new resources in the same zone serving the same reliability function.

IV. THE FLAWS IN THE RA STRUCTURE RESULT IN INEFFICIENT OUTCOMES

12. Given the numerous and serious flaws in the market mechanism currently used in CAISO's control area to secure resource adequacy, it is unsurprising to see abundant evidence that these flaws lead to inefficient outcomes. Foremost is the increasingly frequent need to use CPM or RMR designations, which clearly indicate that the RA mechanism is procuring either insufficient resources or resources with the wrong physical or locational characteristics. Second, the recent monthly load forecast errors driving huge swings in short-term backstop procurement, which indicts not only the quality of forecasting but more importantly the flawed concept that long-lived resources can reasonably be procured by short-term mechanisms to meet short-term forecasts of load. Third, we see sharp differences in compensation for new and existing resources, even though both are relied on not only for system operations but California's long-term resource planning. Fourth, we see substantial abuses of market power by the utilities both in the purchase and resale of capacity. Finally, we see growing problems related to increasing amounts of load departing the IOUs for Community Choice Aggregations ("CCA"). This dynamic introduces two real problems. The first is that IOUs are unwilling to contract for resources over the longer time horizon that these resources

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(Minimum Load) due to load forecast uncertainty in the context of an anticipated heat wave. These dispatches included the two Mandalay units in this report. The ISO started the units in preparation for a potential need for additional capacity. In the context of CPM, the tariff requires the ISO to designate as CPM the greater of the PMIN of the resource or the quantity of capacity needed from the resource to address the reliability issue. The day ahead market (including Residual Unit Commitment) for Sunday, June 18 ran successfully and met all peak load and reserve requirements, plus an additional 2% procurement for solar risk. There were no specific reliability issues requiring a designation greater than PMIN. Subsequent load forecasting for Sunday June 18th showed a downward trend in peak demand, so there was no subsequent need to increase the initial ED quantities to an amount above PMIN. Also, there was a significant amount of resource adequacy capacity that was available from various units that had been exceptionally dispatched to PMIN."

require, because the IOU does not know if they will have future load sufficient to justify that acquisition. Second, while smaller CCA LSEs seek to buy smaller quantities of existing units, the operators of these units may be unwilling to sell small amounts of capacity and commit to keeping those units in operation unless they know that they have a critical mass of sales locked in to justify continued operation. Separately and collectively, these issues clearly show that the current RA mechanism is not operating within the zone of reasonableness.

IV.A. Frequent reliance on backstop procurements indicates structural flaws in the current RA mechanism

13. Systematic and frequent use of out-of-market procurements is a hallmark of a failing market design. For example, the Commission found that ISO New England's continued reliance on RMR agreements to meet locational reliability requirements was evidence that ISO's then-current RA market needed reform to include appropriate modeling of zonal requirements.[8] As the Commission accurately stated:

> RMR contracts suppress market-clearing prices, increase uplift payments, and make it difficult for new generators to profitably enter the market. ... In short, extensive use of RMR contracts undermines effective market performance. In addition, suppressed market clearing prices further erode the ability of other generators to earn competitive revenues in the market and increase the likelihood that additional units will also require RMR agreements to remain profitable. Therefore, we believe that ISO-NE, rather than focusing on and using stand-alone RMR agreements, should incorporate the effect of those agreements into a market-type mechanism.[9]

14. California today is heading in the same direction that New England was 15 years ago. The CAISO tariff has two backstop mechanisms to procure capacity when the primary RA offerings are insufficient to meet system needs: the CPM and RMR agreements. The CPM is nominally a competitive auction, though with a soft offer cap of $6.31/kW-month. The CPM is used to address three specific failings of the primary RA mechanism:

> The ISO uses the competitive solicitation process to procure backstop capacity in three distinct processes. First, if insufficient cumulative system, local, or flexible capacity is shown in annual resource adequacy plans the ISO may procure backstop capacity through an annual competitive solicitation process using

[8] *Devon Power et al.* 103 FERC 61,082 (Docket No. ER03-563-000), issued April 25, 2003.

[9] *Id*. at P 20.

> annual bids. The annual process may also be used to procure backstop capacity to resolve a collective deficiency in any local area.
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> Second, the ISO may procure backstop capacity through a monthly competitive solicitation process in the event of insufficient cumulative capacity in monthly resource adequacy plans for local, system or flexible resource adequacy. The monthly process may also be used to procure backstop capacity in the event that cumulative system capacity is insufficient due to planned outages.
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> Third, the intra-monthly competitive solicitation process can be triggered by exceptional dispatch or other significant events. Capacity procurement mechanism designations for risk of retirement are not included in the annual, monthly or intra-monthly competitive solicitation processes.[10]

As detailed in the quoted report, CAISO designated 1,351 MW of CPM resources for a monthly CPM designation, at a cost of $12.46 million, and an additional 1,055 MW on a whole-year basis for 2018, at an additional cost of $80.3 million. Thus CAISO has recently procured backstop capacity commitments from 5,589 MW, or approximately nearly ten percent of the 52 GW of RA Resources, which is a very large portion of the total to be supported through supposedly backstop mechanisms.

15. The monthly designations were in some cases made for *force majeure* events, such as a local transmission outage or wildfires, but in other cases simply because load was higher than forecast or unit outages. For example, on May 22, 2017, CAISO procured 155 MW from the Ota Mesa Unit 2 because "Actual Load observed in the current day was significantly greater than forecasted load while there was no sufficient Resource Adequacy capacity to meet the ISO [Balancing Authority] load and reserve obligation."[11] In short, the RA Resources designated by Scheduling Coordinators ("SC") were insufficient to meet load with normal contingencies, so a resource was paid for merely *one month* to offset this systematic shortfall. Moreover, the CPM mechanism can pay for as little as the minimum generation level of a generator, creating a low-cost option for the CAISO to make or keep the capacity available as needed.

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[10] Department of Market Monitoring—California ISO, *Annual Report on Market Issues and Performance*, June 2018, at p.239.

[11] CAISO, "May 22 2017 Exceptional CPM Designation Report" available at http://www.caiso.com/Documents/May22_2017ExceptionalDispatchCPMDesignationReport.pdf.

16. The annual designations made in December 2017 were for 1,055 MW from three units needed to meet a "material sub-area deficiency."[12] In designating these three units for CPM throughout 2018, the CAISO provided the following reason:

> The ISO has performed technical analysis, including power flow studies, to assess the effectiveness of Generating Units under RMR Contracts, if any, and all Resource Adequacy Resources reflected in all submitted annual Resource Adequacy Plans and any supplements thereto, as permitted by the CPUC, Local Regulatory Authority, or federal agency and provided to the CAISO in accordance with Section 40.7, whether or not such Generating Units under RMR Contracts and Resource Adequacy Resources are located in the applicable Local Capacity Area.
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> The ISO analysis identified material capacity deficiencies for 2018 in the South Bay-Moss Landing sub-area, which is part of the Bay Area Local Capacity Area, and the San Diego-Imperial Valley Local Capacity Area. Specifically, the deficiencies in these two local capacity areas are relative to the Local Capacity Technical Study criteria provided in section 40.3.1.1 of the ISO tariff. The ISO's analysis also showed that there were both annual RA plan local capacity deficiencies and collective deficiencies in local capacity areas.
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> To address these material deficiencies, the ISO issued CPM designations for the capacity identified above.[13]

17. CAISO's explanation underscores the severe flaws in the California RA mechanism. The designation of RA Resources is not conducted through a uniform process, but rather under diverse jurisdictions. While these RA Resources may have been sufficient to meet the planning reserve requirements pool-wide, the designated resources did not result in sufficient resources to operate the system reliably, even at the local level. Assuming that the collective RA Plans were sufficient to meet system needs overall, the implication of this supplemental designation is that 1,055 MW were paid as RA Resources that need not have been designated, while the CAISO had to use its backstop authority to find that amount of capacity located where it could actually meet local reliability needs. This inefficient mechanism has two direct consequences. First, other RA Resources in the South Bay-Moss Landing sub-area and the San Diego-Imperial Valley Local Capacity

[12] Department of Market Monitoring—California ISO, *op. cit.*, at p. 241.

[13] CAISO, "December 22, 2017 Year Ahead Local CPM Designation Report" available at http://www.caiso.com/Documents/December222017YearAheadLocalCPMDesignationReport.pdf.

Area were likely not being paid the same prices of $6.19/kW-month and $6.31/kW-month, respectively, for their capacity, although they were providing the same RA value as the CPM-designated units. Second, consumers were paying too much for capacity because of a redundant 1,055 MW procured through their SC's RA plans. At the typical RA contract prices of about $30/kW-year,[14] this excess procurement costs customers about $32 million.

18. The second prong of the CAISO's backstop authority is RMR agreements. Revisions to the CPUC's RA mechanism in 2007 led initially to a decline in reliance on RMR contracting. As CAISO's resource base shifts increasingly towards intermittent renewables, however, that mechanism is not providing sufficient returns even for new, efficient gas-fired units. In the words of the Department of Market Monitoring:

> During 2017, however, capacity designated as being subject to reliability must-run contracts beginning in 2018 increased sharply. Three new, efficient gas units that represent almost 700 MW were designated by the ISO to provide reliability must-run service beginning in 2018. The designation of these newer and more efficient resources units as reliability must run units has highlighted problems with the current resource adequacy framework, and with the ISO's two mechanism for backstop procurement: the capacity procurement mechanism and reliability must-run contracts.[15]

Instances of modern gas-fired units seeking RMR status are likely to become more frequent. Energy margins are being squeezed by increasing penetration of zero-bid renewable energy, and neither the CAISO markets nor the RA markets properly value the flexibility and dispatchability of these units. With lower energy earnings and inadequate ancillary services rates, thermal units will rely increasingly on capacity payments to pay their bills. The many flaws in the RA program prevent many units from earning enough even in the RA market, forcing them into retirement or RMR status.

IV.B. Monthly procurements to meet monthly load forecasts is ineffective

19. The CAISO is the only RTO/ISO to operate with a resource adequacy framework that is built on a monthly product. The New York ISO sets requirements on a six-monthly basis; the more modern PJM and ISO New England capacity markets both set annual requirements approximately three years forward, and the Midwest ISO conducts an annual capacity auction. Particularly these longer horizons reflect two simple facts. First,

[14] Tranen/Cavicchi Affidavit, Exhibit JT/JC-1.

[15] Department of Market Monitoring—California ISO, *op. cit.* at pp. 241–242.

that it takes time to build new generators, when and where needed. Second, the owner of existing generation is unlikely to retire the unit because of a short-run revenue deficiency. Therefore a well-designed RA structure needs to provide both a relatively stable path of prices that reflect underlying market conditions, and as much forward visibility to market participants as possible.

20. California's RA framework does neither. LSEs do not need to provide annual plans for their entire expected *system* requirement, allowing them to "pick off" the lowest-cost resources for annual procurements and only buy capacity from more costly generators in local capacity zones for high-demand months.[16] Those generators have substantial costs even when they are not designated as an RA Resource in off-peak months that must be incurred to provide capacity in peak months.

21. This structural market issue is exacerbated by the wide swings in the CEC's market forecasts, resulting in emergency short-term backstop procurements. CAISO intends to designate CPM capacity pursuant to a CPM significant event triggered by a large gap between the official CEC monthly load forecast and an alternative forecast "derived from a later forecast vintage" by CEC staff.[17] As a result of this gap, the CAISO proposes to procure 1,434 MW (3% of total of RA requirement) of additional capacity for September. The projected gap for October is much larger, 5,103 MW (13%), but the CAISO has not yet announced its plans to address this gap. Thousands of megawatts of power plants cannot be added from one month to the next, nor can resources suddenly leave the market when they are not needed to serve load in *one* month. But fundamentally, an RA program should not be tied to month-to-month forecasts at all. For a system to be resource adequate, it must have the resources to meet the annual peak load with adequate margins, and these resources need compensation for the entire year.[18]

[16] This ability to "tier" the market is similar in effect to the short-lived Short Term Resource Procurement Target in the PJM Reliability Pricing Model, which suppressed capacity prices in the primary auction by buying only 97.5% percent of the requirements. While the intent was to leave room for resources not able to commit three years in advance, such as some forms of demand response, the market design had the practical effect of shifting procurement of the most costly resources to supplemental auctions.

[17] CAISO, "Intent to designate CPM capacity pursuant to CPM significant event", presentation by Delphine Hou, Manager, State Regulatory Affairs, of August 2, 2018, available at http://www.caiso.com/Documents/Presentation-CapacityProcurementMechanismSignificantEvent.pdf.

[18] With reasonable accommodation to allow seasonal resources to participate.

IV.C. Resources providing the same service do not receive the same payment

22. As the Tranen/Cavicchi Affidavit amply documents, the California RA construct overtly discriminates between new and existing resources.[19] New resources are procured though contracts with California's three IOUs that provide them with long-term recovery on and of invested capital. Existing resources are paid at a far lower rate, despite providing the same reliability service as new resources. As I noted earlier, the use of CPM and RMR designation leads to further price discrimination, because existing resources procured through a SC's RA Plan are likely receiving a lower payment than the CPM-designated units, which are typically paid at or near the soft offer cap.

23. Price discrimination between new and existing resources has been a pervasive issue in developing just and reasonable capacity markets elsewhere in the country. In my experience negotiating these designs in California and other regions, there is a strong allure to the prospect of minimizing capacity payments in the short run by "paying generators only what they need." While this strategy may have short-run payoffs, in the long run it results in substantial inefficiencies. The recent RMR designation by CAISO of three fairly new gas-fired units, totaling 700 MW, is tangible evidence that price discrimination is ultimately quite costly. If existing capacity retires because RA payments were too low, but that capacity was actually needed for reliable system operations, then new capacity must be built under high-cost contracts to replace the lower-cost existing units, or that the volume of RMR contracts will mushroom. Either outcome is extremely inefficient, which is why the capacity markets in the northeast all provide equal payments to similarly situated capacity, regardless of whether it is new or existing.

IV.D. Market power of IOUs leads to discriminatory and inefficient outcomes

24. One of Professor Roth's three principles of good market design is "thickness": a market should be designed to have many buyers and many sellers, which disseminates information, allows competitive price formation, and improves market efficiency. When there are structural reasons why a market cannot be thickly traded, then markets must include checks on potential market power of both buyers and sellers.

25. California's RA market is anything but "thick." While there is adequate capacity installed in each Local Capacity Area to meet Local Capacity Requirements, in some areas there is only a small surplus, one supplier is pivotal, or both. To guard against sellers' market power in these areas, the CPUC allows its LSEs to *not* procure local capacity if the price

[19] Tranen/Cavicchi Affidavit at PP 8–9 and exhibits JT/JC-1 through JT/JC-4.

is higher than a threshold, currently $40/kW-year.[20] While this opt-out does limit seller market power, if these resources are actually needed for local reliability, they must seek a CAISO CPM designation or cost-based RMR contract, resulting in over-procurement of capacity generally. This mitigation also has the effect of not allowing other suppliers in the constrained load zone to earn the fair market value for their capacity. If instead offer prices were mitigated using the approach CAISO takes in the energy market, limiting offers to cost-based levels when they supplier has market power, then the local capacity prices would reflect the true cost and scarcity of resources, attracting investment to those areas to displace high-cost resources.

26. In local areas where the capacity balance is not tight, the large buyers—that is, the IOUs—have substantial, largely unchecked market power in their bilateral negotiations with generators. Each IOU is the only buyer of any reasonable size in their respective service areas, and each has substantial knowledge of the cost structure of each resource. An IOU also has the information advantage of seeing (effectively) all the negotiations in its area, while suppliers only see their own. This information asymmetry and market dominance allows the IOUs to systematically price discriminate across its contracts.

27. The dominance of the IOUs in the market has a further impact on the resale of capacity to CCA and Direct Access customers. To meet their RA requirements, these competitive retailers need to file plans with the CPUC showing their designation of RA Resources, both overall and in any relevant Local Capacity Areas. When the local IOUs already has contracted with substantially all of the local resources, however, these retailers are now having to repurchase that capacity from the IOUs to meet their plans requirements. The CPUC does not require the IOUs to resell capacity or limit the resale price to the utility's own cost. Instead, the CPUC will allow retailers to procure capacity elsewhere instead of within the relevant zone or sub-zone. Under current CPUC rules, for example, parties may meet their local capacity obligation in one of the PG&E "Other" local capacity areas by procuring capacity in any of the "Other" local capacity areas in PG&E's service area, even those these sub-areas may be hundreds of miles apart and completely electrically distinct.[21] This accommodation – which makes no engineering sense whatsoever – was implemented to address concerns about the dominant IOU's market power with regards to local capacity.

V. RECOMMENDATIONS FOR PARAMETERS ON A MARKET REDESIGN

[20] CPUC Decision D.06-06-064.

[21] CPUC Decision D.06-06-064 at pages 35-38.

28. For the reasons I discuss above, the current RA framework by which the CAISO has access to sufficient resources to operate its grid reliably has fundamental design flaws that lead to poor market outcomes that are inconsistent with the standards the Commission has applied to other RTOs/ISOs. Complainant's experts and its experts seek a replacement market design that is very similar to PJM's Reliability Pricing Model ("RPM") and ISO New England's Forward Capacity Market ("FCM"). While I agree that such a design would remedy most of the issues I have discussed, both the RPM and FCM designs are challenged by the substantial and increasing quantity of resources that states are sponsoring to achieve their policy goals.

29. We do not yet have any track record on how to successfully accommodate large quantities of these policy resources in eastern-style capacity markets. Both PJM and ISO New England have recently proposed amendments to the core market design. New England has added substitution auction to follow its principal auction, providing existing generation the opportunity to be paid to retire and transfer its Capacity Supply Obligation to a policy resource.[22] This new mechanism has yet to be deployed, so its effectiveness is unknown. PJM recently proposed two alternatives for accommodating state-sponsored resources: a two-tiered capacity repricing option, and a redefinition of the Minimum Offer Price Rule. The Commission rejected both options, however, and set for hearing a third proposal.

30. Moreover, the issue of state policy resources in California is even a larger issue than in either PJM or New England. California has the most ambitious Renewables Portfolio Standard in the country. State law requires all retailers of electricity to purchase 33 percent of their supply from renewables by 2020 and 50 percent by 2030.[23] A bill has passed the California Senate and is in its third reading before the Assembly that would further increase this 2030 goal to 60% and would create the policy of planning to meet all of the state's retail electricity supply from zero-carbon resources by 2045.[24] The new grid-scale renewables needed to meet these goals have to date almost entirely relied on contracts with utilities or major end-use customers. Meeting these statutory targets while maintaining the integrity of CAISO's wholesale markets will require fresh thinking about an appropriate market design.

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[22] *ISO New England, Inc.*, 162 FERC ¶ 61,2015 (2018).

[23] California Energy Commission, Renewables Portfolio Standard http://www.energy.ca.gov/portfolio/

[24] California Legislative Information, SB-100 California Renewables Portfolio Standard Program https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=201720180SB100

31. So although I concur with the central argument of the Complaint, I would recommend that the Commission provide a more generalized set of market design principles for a new RA construct.

    a. A sound market design must clearly define *what* the product is. For RA the answers are not matters of policy, but rather electrical engineering. The CAISO tariff, therefore, should define, and the CAISO should ultimately control, all of the core elements of the construct relative to market definition including (i) rules for determining the capacity value of any resource, (ii) rules underlying the development of load forecasts for the system and all relevant control areas; (iii) determination of system and locational RA requirements; (iv) allocation of, and confirmation of compliance, with RA responsibilities to each LSE; and (v) measurement of resource performance. This requirement does not preclude extensive involvement by the various parties who now control these functions, but in a multi-jurisdictional RTO like the CAISO, there needs to be a common and coherent definition of market fundamentals, and only the CAISO can serve that role.

    b. No discrimination by vintage, fuel or other characteristic not directly related to operational adequacy and reliability.

    c. The tenor of the market must align with investment horizons of suppliers to achieve cost effective outcomes. Nearly all qualified capacity resources are physical generators that, first, take time to plan, permit and construct and, once constructed, have ongoing capital, operations and maintenance costs. Eastern capacity markets acknowledge these investment realities by two complementary rules. First, they procure capacity well in advance of the year in which it is needed, thereby allowing planned resources to compete with existing resources. Second, they procure capacity commitments for longer blocks of time, six to twelve months. The CAISO should establish appropriate market timing rules to broaden competition and de-risk investment and retirement decisions.

    d. Stable and sufficient price formation. The RA framework must be able to set prices sufficiently high to support entry of new capacity resources, when and where needed. Conversely, RA prices when there is an excess of generation should be below this level, but there needs to be a moderating element to the market design to prevent large swings in prices when there is a small change in the supply:demand balance. In eastern capacity markets, sloped demand curves have been successful in achieving these goals, but alternative mechanisms could

be explored. Relatively stable and predictable prices benefit consumers by lowering the cost of capital for new generation, which in turn lowers consumer costs through lower RA offers in the market.

e. Use markets where possible to ensure locational resource adequacy, but include sub-zonal reliability assessments directly in the design. As the Commission found in *Devon*, systematic and widespread use of backstop procurement is an indication that the market is not resolving locational issues appropriately. CAISO should consider what level of locational granularity is reasonable to model, balancing the costs of defining locations too broadly and thereby failing to send market signals to attract or retain resources in appropriate locations, versus thinning the market too finely and losing any meaningful competition among suppliers.

f. Use the RA mechanism where possible to achieve state policy goals, but if achievement is not possible, develop accommodation approaches that balance the legitimate interest of the states in guiding new generation investment against undue price suppression and implicit discrimination by vintage.

g. Develop and enforce clear performance standards and incentives for RA Resources to encourage investment in resources that best meet the reliability needs of the system.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

CXA La Paloma, LLC v. California Independent System Operator Corporation	Docket No. EL18-177-000

AFFIDAVIT OF ROBERT B. STODDARD
ON BEHALF OF THE NRG COMPANIES

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

Robert B. Stoddard

SUBSCRIBED AND SWORN
before me this 21 day of August, 2018

Notary Public

My commission expires: HANNA DANIEL
Notary Public, Maine
My Commission Expires October 13, 2022

Robert B. Stoddard

MA and MPhil Economics
Yale University

BA Economics and Music
summa cum laude
Amherst College

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

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

Grid Reliability and Resilience Pricing, FERC Docket No. RM18-1-000. Affidavit on behalf of PJM Power Providers calling for meaningful reforms in PJM's energy markets to ensure proper price formation to guard against premature retirements and other inefficiencies, November 2017.

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, affidavit on remand November 2017.

State Policies and Wholesale Markets Operated by ISO New England Inc., New York Independent System Operator, Inc., And PJM Interconnection, L.L.C., FERC Docket No. AD17-11-000. Prefiled comments "RTO Markets Must Change to Accommodate State Policies", April 2017, and invited remarks at FERC Technical Conference, May 2017.

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.

"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.

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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 Feburary 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.

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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).

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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.

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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.

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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 Failing 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.

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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.

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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.

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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.

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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	*Principal,* Power Market Economics LLC, Portland ME
2016-present	*President & CEO*, GWave LLC, Portland, ME
2013-present	*Senior Consultant,* Charles River Associates, Boston MA
2013–2016	*Executive Vice President,* GWave LLC, Boston MA
2003–2013	*Vice President*, Charles River Associates, Boston, MA
2001–2003	*Principal*, Charles River Associates, Boston, MA
1995–2001	*Managing Consultant*, 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	*Senior Health Economist and Acting Managing Director*, Benefit Research USA, a Quintiles company, Cambridge, MA
1990–1993	*Senior Associate*, Charles River Associates, Boston, MA
1985–1990	*Teaching and Research Fellow*, Department of Economics, Yale University
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Education

1990	M.Phil., Economics, Yale University
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1983	B.A. *summa cum laude*, Amherst College; Phi Beta Kappa