UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	**Docket No. ER19-1486-000** **EL19-58-000**

AFFIDAVIT OF A. JOSEPH CAVICCHI
ON BEHALF OF THE PJM POWER PROVIDERS ("P3") GROUP

June 20, 2019

I. SUMMARY

1. My name is A. Joseph Cavicchi and I am an Executive Vice President of Compass Lexecon, 200 State Street, Boston, MA 02109. I previously submitted an Affidavit in this proceeding on May 15, 2019.[1]

2. I have been asked by the P3 Group to review and comment on protests to the PJM Interconnection, L.L.C.'s March 29, 2019 Enhanced Price Formation in Reserve Markets filing.[2] I have reviewed the protests of the Independent Market Monitor for PJM and the PJM Customer/Load Coalition.[3] Based on my analysis of the protests and attached responsive affidavits I reach the following conclusions.

3. The Load Coalition and IMM prefer PJM's current operator biased operational paradigm and its attendant price suppression and inequitable resource compensation. Their responses to PJM's proposal focus almost exclusively on arguments that PJM's wholesale consumers will incur increased costs under PJM's proposal and that these costs represent an extra payment for capacity that should be "clawed back" if the Commission approves PJM's proposal. In their arguments these protestors don't even consider the benefits of improved market efficiency and system reliability. The positions taken by the Load Coalition and the IMM are clearly an all-out attack on PJM's efforts to improve its market design. Accepting the arguments of these protestors would signal a lack of support for efficient wholesale electricity market design whenever the impact is likely to be increased consumer (load) costs over the short-run.

4. The Load Coalition and IMM arguments, however, miss the forest from the trees. Their claims of increased consumer costs arise from interpretation of the detailed results of simplified PJM (and IMM) simulation analyses that were developed to try to provide some insight into how real-time market prices may change under PJM's proposal. These simulation analyses focus solely on estimating costs to load over a short historical time frame (2018), cannot model the actual market impact and must hold important inputs constant such as market offers and market

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1 Affidavit of A. Joseph Cavicchi on behalf of the PJM Power Providers ("P3") Group, Federal Energy Regulatory Commission ("FERC" or "Commission") Docket Nos. ER19-1486-000, EL19-58-000, May 15, 2019.

2 Enhanced Price Formation in Reserve Markets of PJM Interconnection, L.L.C., Docket Nos. ER19-1486-000, EL19-58-000, March 29, 2019 ("PJM Filing").

3 Protest of the Independent Market Monitor for PJM ("IMM") and Protest of the PJM Load/Customer Coalition ("Load Coalition"), FERC Docket Nos. ER19-1486-000, EL19-58-000.

interchange, and do not capture the market place dynamics that will result with a more efficient market design. Moreover, the exclusive focus on estimated changes in load costs ignore the key benefits associated with improved market efficiency (day-ahead to real-time market alignment, reduced uplift, and uniform pricing) and diminished operator biasing and out-of-market actions. PJM's proposal will incentivize a more cost-effective mixture of resources that will better serve its consumers' needs and put downward pressure on market prices over the longer-term.

5. The Load Coalition and the IMM allege there will be billions of dollars of increased costs to consumers that they argue will be double payments for capacity that must be clawed back from capacity sellers over a period of several years. However, these "double payment" arguments amount to nothing more than casual assertions based on the results of PJM's (and the IMM's) incomplete simulations and lack the careful analysis necessary to substantiate their validity. These arguments are based on the premise that a simulated increase in energy and ancillary services revenues translates one-to-one into a reduction in capacity payments. This simplistic assumption ignores several key factors that affect capacity market prices: determination of the Net Cost of New Entry ("Net CONE"), capacity market seller offer development, and the capacity market auction clearing mechanism. Without the ability to consider these key inputs into the capacity market auction process there is no basis upon which to conclude that any revenues ought to be subject to clawback.

6. Careful consideration of the key factors that affect capacity market auction outcomes reveals that there is not a sound basis for asserting that there should be a clawback mechanism either looking backward at capacity auctions already completed or forward for auctions that will be completed in the future. The reason for this is straightforward: In the absence of actual data on how PJM's proposal will affect day-ahead and real-time market outcomes relative to the status quo, there is no way to determine what the impact will be on capacity market outcomes, positive, negative, or negligible. For example, PJM completed an analysis for the Organization of PJM States, Inc. ("OPSI") that showed significant seller revenue ($550 million) and production cost ($400 million) declines resulting from the improved market efficiency and Operating Reserve Demand Curves ("ORDCs") over eleven simulated high demand days.[4] These results directly

[4] This analysis tested the impact of assuming elevated demand over a period of 11 days during the late summer of 2018 and comparing the outcome under PJM's proposal against the outcome with PJM's current market design (Simulations – Reserve Price Formation, March 27, 2019, See, https://www.pjm.com/-

contradict the assumption that seller revenues will only be increasing such that a clawback mechanism is required.

7. Moreover, the establishment of a clawback mechanism can be expected to harm those capacity sellers that have already made investments based on completed capacity market auctions and reduce the incentives for capacity market sellers to make investments going forward. Simple analyses based on past offering behavior cannot capture how the dispatch of resources may change going forward under PJM's proposal.[5] For example, PJM's proposed enhancements will improve day-ahead scheduling and result in an on-line real-time resource mixture that is different relative to the status-quo. These changes in resource dispatch can be expected to cause some resource owners to produce less energy during some hours and realize lower energy market margins. Clawing back a portion of a resource's reduced revenues can diminish the performance of an investment that was made based upon settled capacity market outcomes. At the same time, resource owners will be hesitant to make investments when seller revenues are subject to uncertain future clawbacks. Given the difficulty and uncertainty of even putting a positive or negative sign on what the impact might be on the capacity market outcomes, instituting a claw back mechanism would be subject to significant errors and likely do more harm than good.

8. Next, the Load Coalition and the IMM fail to acknowledge the benefits that an improved market design can be expected to deliver. Instead, they argue that the current market design is working fine and that consumers and suppliers already face efficient price signals. For example, the Load Coalition's Mr. Al-Jabir states: "PJM's proposed reforms fail to recognize that its current reserve market construct provides adequate price signals and incentives to procure reserves that are more than sufficient to meet its MRR and to preserve system reliability."[6] However, PJM's current market design relies on biasing and out of market actions to ensure reliability, not efficient price signals. As the Commission has recognized, market-based uniform clearing prices provide incentives to sellers to minimize costs and invest more cost-effectively reducing costs to

/media/committees-groups/task-forces/epfstf/postings/pjm-opsi-energy-price-formation-simulation-results-summary.ashx?la=en, accessed May 30,2019).

5 It is also important to recognize that a recent Commission order that shifts certain maintenance costs from the capacity market to the energy market will impact resource energy market offers (PJM Interconnection, L.L.C., 167 FERC ¶ 61,030 (2019)).

6 (Load Coalition, Attachment A, Affidavit of Ali Al-Jabir ("Al-Jabir Affidavit") at P 11).

consumers through competition.[7] Benefits arise both from improved day-ahead and real-time market alignment and scheduling and improved reliability through the ORDCs. Acknowledging and including the benefits is a crucial component of a properly structured cost-benefit analysis and the Load Coalition and the IMM simply ignore the expected benefits.

9. The Load Coalition also suggests that there is a possibility of windfall payments to suppliers based on the hypothetical that there could be a catastrophic outage that creates a billion dollar day of costs for consumers. This hypothetical is complete fiction. The hypothetical example fails to recognize that PJM's market design produces financially binding day-ahead hourly schedules and ensures sufficient resources are scheduled to meet the following day's demand every day. Because buyers' demand is nearly fully represented in the day-ahead markets very little demand is exposed to real-time market prices.[8] The costs of a major outage will fall primarily on suppliers who are unable to perform, not consumers.

10. Finally, arguments that the proposed design is not economically efficient are also based on the misplaced concern that consumers will be exposed to penalty factor prices that are too high. PJM's proposed penalty factor is based on legitimate energy market opportunity costs that may arise during those rare intervals when capacity is pushed up to its limits. PJM's cascading reserve pricing framework is consistent with other U.S. Independent System Operators ("ISOs"). Again, in the highly unlikely instances where prices rise to cap levels during real-time market intervals, the costs will be expected to fall primarily on suppliers that fail to perform, not consumers that will be for the most part hedged by long-term contracts and day-ahead market schedules.[9]

11. In conclusion, I find that the Load Interest's and the IMM's claims of enormous financial impacts are unreliable and vastly overstated. I urge the Commission not to give weight to unsubstantiated claims that PJM's proposed market enhancements will only result in increased costs to consumers. To the contrary, there are several reasons that the improved efficiency of PJM's reserve markets will lower costs for consumers over the long-run.

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7 PJM Interconnection, L.L.C., 117 FERC ¶ 61,331 at P 141 (2006).

8 Monitoring Analytics, Independent Market Monitor for PJM, 2018 State of the Market Report for PJM, Volume II: Detailed Analysis, 3.14.2019 ("PJM 2018 SOM") at Figure 3-25.

9 Suppliers will be expected to perform better under PJM's proposal given the increased costs of poor performance.

II. ANALYSIS

A. Alleged Financial Impacts of PJM's Proposal are Substantially Inflated

12. Protestor filings opposing PJM's filing assert that two types of financial impacts would result from PJM's proposal. First, several affidavits supporting inventor filings argue that the Commission's acceptance of PJM's proposal will impose significant costs on consumers as the result of alleged "double payments" for capacity and propose the definition of "clawback" or "capacity transition" payments funded by capacity resources. Second, Protestor filings assert that PJM's current reserve market design and operator biasing is efficient such that alleged financial impacts associated with the implementation of PJM's proposed enhancements would increase costs to consumers without any offsetting benefits. Moreover, the Load Coalition proposes a mechanism to cap energy and reserve payments based on the assertion that PJM's filing could lead to "billion dollar days."[10] However, protestors offer little or no substantive evidence to support their assertions that PJM's Filing will impose such costs on consumers.

1. Capacity Market Impacts

13. The Load Coalition asserts that capacity market double payments could approach $2.5 billion per year, and reach as high as $10 billion.[11] The IMM asserts increased payments of $1.7 billion per year, or $6.8 billion in total over four years, and an additional $2.4 billion over three following years.[12] These assertions assume that simplified simulations that show only increased energy and ancillary services market revenues under PJM's proposal should be relied upon to demonstrate that capacity sellers should be subject to revenue clawbacks for a number of years. However, exclusive reliance on incomplete simulation analyses obfuscate the much broader impact of PJM's proposal and the complexity of assessing how it will affect PJM's markets.

14. There are several reasons that alleged capacity market double payments are difficult to substantiate. First, any alleged impact on capacity market prices must be consistent with an analysis of the expected impact of PJM's proposal on the capacity market. This means that the impact on capacity market auction parameters and market outcomes must be evaluated. Second, simulations of the impact of PJM's proposal are incomplete and do not include an analysis of the

[10] Load Coalition, Attachment D, Affidavit of James F. Wilson ("Wilson Affidavit - Transition") at P 37.

[11] Wilson Affidavit at P 29.

[12] IMM Protest at 53-54.

impact that improved day-ahead market price signals will have on the scheduling of imports and exports and the changes in uplift that are likely to result. Analyses of historical data cannot capture the improvements that will result when changes in interchange (and also price responsive load) are ignored. Finally, a clawback mechanism that would allegedly protect consumers against supposed capacity double payments must take into account the harm that can result when the assumptions underlying its conception are flawed. The public interest would not be served by a poorly conceived clawback mechanism that would be expected to unduly impact capacity suppliers.

15. An analysis of the potential impact on the capacity markets must be derived using a logically consistent framework that is empirically defensible. To evaluate the potential impact on the capacity market first requires recognizing that PJM's proposal includes both aligning and revising its reserve markets' design and introducing ORDCs. When considering each of these overarching aspects of PJM's proposal it is also important to recognize that there are capacity auctions that have already been completed and there are capacity auctions that will take place in the future. While the consideration of potential impacts on capacity market auctions follows the same analytical framework whether looking backward or forward, PJM's improved market design will drive longer-term dynamic changes in the capacity resource mixture making comparisons to prior periods increasingly less meaningful and uninformative.

16. First, PJM's proposed market alignment will replace PJM's current reserves' markets that result in sub-optimal resource schedules and non-uniform clearing prices that require PJM operators to rely on biasing and out-of-market actions. The implementation of an efficient reserve market design will immediately result in more optimal resource scheduling and an expansion in social welfare. It will ensure uniform price signals for resources providing reserves, improve performance requirements through two-settlement financial obligations and reduce the likelihood of reserve shortages that would otherwise result in operator biasing and out-of-market actions. Moreover, it can be expected to improve the efficiency of interchange scheduling in the day-ahead time frame and reduce uplift that can be associated with inefficient interchange schedules, biasing and out-of-market dispatch.

17. Next, at the same time, the introduction of PJM's proposed ORDCs will provide compensation for an enhanced reserve service that will provide PJM the "insurance" that it currently cannot obtain through its markets without operator biasing and/or out-of-market actions.

This enhanced reserve service will procure the reserve resources that PJM requires based on the actual uncertainty PJM faces seasonally and diurnally. New and existing resources will now be explicitly compensated for providing this insurance and will be incentivized to make investments to deliver a better, more innovative and reliable supply of flexible reserve capacity. At the same time energy market prices will also reflect the cost of this insurance to provide both sellers and buyers consistent price signals.[13] This ensures that buyers and sellers are incentivized at the margin to minimize costs and maximize revenues.

18. If these market design enhancements had existed at the time of prior capacity auctions there would have been different day-ahead and real-time prices, a different estimate for Net CONE, and different costs and revenues informing the development of physical capacity resource seller offers.[14] Consider first the impact of aligning the procurement of reserves such that the expected mixture of reserves scheduled day-ahead reflects a realistic estimate of the reserves that will be relied upon in real-time. The introduction of day-ahead reserve markets will result in day-ahead energy and reserve prices that reflect a mixture of resources that can vary significantly when compared to what is currently scheduled under PJM's day-ahead market design. Moreover, because prices are often suppressed as a result of PJM's operator actions, import and export scheduling can be expected to under-schedule imports and over-schedule exports, and potentially create uplift to support suboptimal schedules. Aligning the day-ahead and real-time markets improves resource and interchange scheduling and minimizes uplift that can be created as a result of suboptimal day-ahead schedules.[15] Introducing ORDCs will appropriately value the reserve resources that PJM routinely relies upon without providing equitable compensation.

19. Simulations seeking to quantify the impact of PJM's proposed market design enhancements provided by PJM and the IMM cannot capture the critical improvements in day-ahead market pricing, and the impact on real-time market pricing, that will result from PJM's market design improvements. Consider the impact of improved interchange scheduling which is uncaptured by simulations. In 2018 PJM was a net importer in the day-ahead market in many

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[13] PJM Filing, Attachment C: Hogan and Pope Affidavit, Exhibit 1: PJM ORDC Report at 9.

[14] I assume it would not have been likely that demand response capacity resource offers would have been materially impacted by the market design changes.

[15] See, Simulations – Reserve Price Formation, March 27, 2019, accessed May 30,2019, https://www.pjm.com/-/media/committees-groups/task-forces/epfstf/postings/pjm-opsi-energy-price-formation-simulation-results-summary.ashx?la=en

months, but in many of these same months was a net exporter in the real-time market.[16] At the same time, during some days where large uplifts have been observed there are also swings in actual interchange hour-to-hour, that can impact uplift.[17] Lower interchange volatility will reduce pricing swings and can be expected to reduce uplift. PJM's market alignment and improved energy and reserve pricing will change the market outcomes and absent simulating changes in interchange scheduling (including day-ahead market virtual bidding behavior) any alleged pricing changes based on simulations that hold these market responses constant will be inaccurate.

(a) Completed Capacity Auctions

20. Looking backward, in the absence of accurate historical day-ahead and real-time market prices, any estimates of the impact of PJM's proposal on the determination of Net CONE would be speculative and subject to error. To estimate an impact on Net CONE requires simulation of the dispatch of the reference resource (a combustion turbine capacity resource) to estimate an energy and ancillary services revenue offset that is used to establish Net CONE. PJM's tariff requires that the reference resource dispatch be carried-out using a "Peak-Hour Dispatch" methodology.[18] Under the peak-hour dispatch methodology the simulated dispatch of the reference resource occurs based on peak period day-ahead market prices, real-time market prices, or both, for distinct blocks of four continuous hours (up to a total of sixteen hours), considering first the day-ahead market prices.[19] Thus, there can be a number of combinations of day-ahead and real-time pricing outcomes that affect the calculation of Net CONE and under PJM's proposal the impacts can be positive or negative.

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16 PJM 2018 SOM, Volume II at 385. In particular, during the months of May, June, July, August and November the day-ahead market net interchange was the opposite of the real-time market.

17 For example, on September 13th and 26th of 2018 actual hourly net-interchange changed by ~1,500 MW or more from one hour to the next with high uplift reported for both days (see https://dataminer2.pjm.com/feed/uplift_by_zone/definition and https://dataminer2.pjm.com/feed/act_sch_interchange/definition, accessed May 29, 2019. In addition, during Winter 2014 there were large increases in imports that lowered energy prices and increased uplift as PJM ended up with an unexpected excess supply of high-cost resources that operated uneconomically (Analysis of Operational Events and Market Impacts During the January 2014 Cold Weather Events, PJM Interconnection, May 8, 2014 at 22-23 and 50-51).

18 PJM Open Access Transmission Tariff, Definitions, see https://agreements.pjm.com/oatt/3905, accessed May 29, 2019.

19 Id. Under the Peak-Hour Dispatch methodology if the reference resource is not economic in particular day-ahead four hour blocks then the analysis examines whether the resource is economic using real-time prices for the time block.

21. For example, recognizing that PJM's day-ahead unit commitment is currently sub-optimal without explicitly accounting for the reserves that are needed in real-time, aligning the markets and improving reserve pricing would clearly lead to instances where longer start-time resources would receive schedules in the day-ahead market and eliminate the need to dispatch fast-start units.[20] This would be expected to reduce the revenues and costs of the reference resource. There would also be instances where the day-ahead unit schedules would lead to the commitment of more fast-start resources in real-time. This would be expected to increase the revenues and costs of the reference resource. At the same time, the maintenance costs incurred by the reference resource will change in response to more or less starts. In addition, there will also be day-ahead and real-time market price changes driven by varying interchange schedules that result from having aligned day-ahead and real-time reserve markets and improved energy and reserve pricing. Finally, operator actions can still be expected to have an impact under certain circumstances. Thus, there are a number of factors that will affect day-ahead and real-time prices that are not accounted for in the simulation analyses conducted by PJM and the IMM.

22. Because there can be such a large number of combinations of variations in day-ahead and real-time schedules, interchange schedules, virtual bids and offers (which typically set prices in the day-ahead market[21]), and operator actions that influence day-ahead and real-time prices, it is speculative to assume that the impact on energy and ancillary services can be successfully simulated without accounting for these other factors. An evaluation of the impact on Net CONE would require an analysis that properly simulated the change in dispatch of the reference resource to determine how Net CONE would change and if the change would be significant.[22] Without explicitly accounting for the total impact on the day-ahead and real-time market outcomes it is speculative to conclude that there will be a material impact on Net CONE.

23. While PJM provided an analysis that sought to capture the impact of a re-optimized unit commitment and proposed ORDCs on historical real-time prices (recognizing the inability to

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[20] These schedules could be substitutes for resources that now receive post day-ahead market reliability unit commitments given the sub-optimal unit commitment or the result of more optimal day-ahead resource schedules.

[21] PJM 2018 SOM Volume II at Table 3-8.

[22] The Commission recently recognized how the projected operations of the reference resource changes revenues and costs and can result in little change to Net -CONE (PJM Interconnection, L.L.C., 167 FERC ¶ 61,029 (2019) at P 134).

capture the impact of other key changes to the outcomes in the day-ahead markets as well as the real-time markets) PJM's results, for the RTO, showed an increase of $12/kW-year in the energy and ancillary services offset.[23] However, these results do not nearly capture all the changes that can be expected, and the impact of the excluded changes can be expected to be most significant during those times when the markets are tight and when interchange provides important responsiveness to high prices.[24] For example, PJM carried out an analysis at the request of the OPSI that evaluated how PJM's proposal would impact a consumer payments and production costs over an eleven day period of elevated demand.[25] The results of the OPSI simulations showed that Locational Marginal Prices ("LMPs") would decline relative to PJM's current market design and consumer payments (and generator revenues) would be reduced by $550 million. The OPSI simulation results also showed that production costs would decline by $400 million and that uplift would decline by 20%. It should be expected that PJM's reserve market enhancements can also reduce seller revenues and margins and that this will affect the determination of Net CONE.

24. Next, an evaluation of the impact on the capacity market auctions must consider potential changes in the offers of the capacity market sellers. Generation capacity market seller offers are capped at the seller offer cap which is defined as Net CONE times the Balancing Ratio ("B").[26] If Net CONE does not change materially, generation capacity market seller offer caps will not change significantly. The basis upon which sellers are expected to develop their capacity market offers (i.e., considering the opportunity cost of taking on a capacity obligation except in rare instances where a resource specific offer cap is requested) will be expected to account for the costs and revenues of providing enhanced reserves.

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[23] See, https://www.pjm.com/committees-and-groups/task-forces/epfstf.aspx, 1/22/2019, Item 4A, Net CONE Calculations, expressed in terms of installed capacity. Note PJM's analysis was based on other backward looking simulations it had carried out in association with its reserve market filing.

[24] It is important to recognize that it is deceptive to simply assume that the energy and ancillary revenue offset for the reference resource would materially increase given that its simulated dispatch is dependent first on day-ahead prices, and then real-time prices, and no suitable historical day-ahead prices are available to test the impact on the reference resource's simulated dispatch.

[25] See, Simulations – Reserve Price Formation, March 27, 2019, See, https://www.pjm.com/-/media/committees-groups/task-forces/epfstf/postings/pjm-opsi-energy-price-formation-simulation-results-summary.ashx?la=en, accessed May 30,2019). Note also that these simulations cannot capture the additional impact that improved day-ahead and real-time market pricing will have on interchange scheduling and price responsive load (PJM Filing, Keech Affidavit at PPs 38 and 46 and Monitoring Analytics, The Independent Market Monitor for PJM, ORDC Simulation Results: Version 2, Revised, May 24, 2019).

[26] PJM's IMM reports that nearly all capacity market sellers are capped at Net-CONE times B or are price takers (PJM 2018 SOM Volume II at 281 and 284).

25. The Commission has recognized that the costs incurred to provide PJM an enhanced reserve service (i.e., increased starts/stops and wear and tear that affect resource maintenance agreement costs) are not recovered through the capacity market and will need to be accounted for when developing capacity market offers.[27] Capacity market sellers will have to factor these costs into their expected energy and ancillary services offset calculations. A reliable supply of reserve capacity is not available for free as PJM's IMM implies.[28] These costs are not accounted for in protestor pleadings and will reduce the revenues that are considered by capacity market sellers when developing offers. The impact on capacity market sellers' offers will be dependent upon the interaction of the changes in revenues and costs and would not be expected to be the same for all resources.

26. Moreover, PJM's recent capacity market auctions have cleared considerably below Net CONE signaling competition among capacity, demand response and energy efficiency resources as a pertinent driver of capacity auction clearing prices.[29] To the extent that capacity market auctions continue to clear below Net CONE, a reduction in Net CONE would be unlikely to impact the majority of capacity market seller offers (assuming capacity resource seller offer caps remain unchanged).

27. Finally, the capacity market auction clearing mechanism must be considered. Under PJM's capacity market auction design the clearing price can be established by a horizontal capacity seller offer segment or be set by a point along the auction demand curve (PJM's Variable Resource Requirement curve). The interaction of capacity seller offers and possible changes in Net CONE make projecting an auction price impact speculative. In addition, PJM's 2021/2022 capacity market auction included nearly 15,000 MW of capacity market offers from demand response and

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[27] In a recent order the Commission evaluated the costs associated with capacity resource operational flexibility (i.e., starts-stops and operational wear and tear) and approved PJM's proposal to recover maintenance adders for combustion turbines and combined cycles in energy market variable operation and maintenance costs (PJM Interconnection, L.L.C., 167 FERC ¶ 61,030). Capacity resource offers will need to account for the costs associated with increased performance requirements associated with the provision of enhanced reserve services.

[28] IMM Protest at 14.

[29] Since the 2015/2016 Base Residual Auction auctions have cleared at prices that were on average 60 percent below Net CONE (PJM Cost of New Entry, April 19, 2018, Brattle Group at 4). Note also that while reported Net CONE values for the 2022/2023 base residual auction have declined 10-25%, they still remain significantly above recent capacity auction clearing prices for the majority of capacity resources in the PJM geographic region (PJM 2022/2023 RPM Base Residual Auction Planning Period Parameters, PJM CERA #84444655 and 2021/2022 PJM Base Residual Auction Results, PJM #5154776).

energy efficiency resources, and not all these offers clear in the auctions implying that these resources could be the marginal supplier(s).[30] Because demand response and energy efficiency capacity resources are practically all "emergency only" resources,[31] their offering strategies are not likely to be materially impacted as a result of PJM's proposal. Thus, there is significant uncertainty associated with trying to project the impact of PJM's proposed enhancements on capacity auctions that rely on data that cannot reasonably incorporate the potential impact of PJM's proposed market design changes on its day-ahead and real-time markets.

(b) Future Capacity Auctions

28. Looking forward to those years where PJM's market design would be implemented, the ability to identify the impact of PJM's proposal on future capacity auctions is even more uncertain as the longer-term benefits that result as the capacity resource mixture evolves cannot be isolated. In the future, the potential impact of PJM's proposal will be a combination of the uncertain impacts associated with historical capacity delivery years during which the proposed market enhancements were not in effect and future years during which PJM's proposal will be in effect.[32] The same difficulties associated with seeking to account for the uncertain changes in the day-ahead and real-time market outcomes explained herein would apply for those years where the market design has not been implemented (i.e., to the extent that these years affect future auctions). Moreover, in future years an analysis of the possible impacts of PJM's proposed enhancements would be subject to even greater uncertainty.

29. In particular, for those future years where the capacity market would rely on historical data that include the implementation PJM's proposed enhancements, a counterfactual "but for" the impact of PJM's proposal would need to be defined to assess the benefits of an improved capacity resource mixture that would otherwise be foregone if PJM continued its current reliance on operator biasing and out-of-market actions. For example, the implementation of PJM's proposed enhancements will value new and existing resources that can most cost-effectively meet energy and reserve requirements, increase competition among capacity resources, increase participation of price responsive load, and improve interchange scheduling. Over time this will change the

30 2021/2022 PJM Base Residual Auction Results, PJM #5154776.

31 PJM 2018 SOM Volume II at 301.

32 Based on the use of three years of historical data to calculate the energy offset used to determine Net CONE for the reference resource.

capacity mixture relative to the resource mixture that would have been in place absent PJM's proposed enhancements (e.g., resource retirements and additions can be expected to change). The resulting resource mixture will be more cost effective, and the impact on capacity prices cannot be isolated without knowing what the resource mixture would have been in the absence of the reforms. In addition, the capacity mixture that would exist but-for PJM's enhancements would also evolve over time creating additional complexity in seeking to identify the impact of PJM's proposal. There are numerous important considerations that would need to be taken into account to isolate the impacts of PJM's proposed enhancements on past and future capacity market auctions to ensure that the benefits are quantified.

(c) Protestor Asserted Capacity Market Impacts

30. In contrast, Protestor assertions that capacity market double payments resulting from PJM's proposal could approach $2.5 billion per year, and reach as high an amount as $10 billion,[33] lack evidentiary support and represent a simple-minded approach to assert consumer cost impacts without cogent analysis. A properly structured analysis would have to take into account the improved market efficiency and the expected changes in day-ahead and real-time market prices, the extent to which these changes may actually materially impact Net CONE, how the changes may affect capacity market offers and the auction clearing mechanism, and over time the benefits to consumers of an improved resource mixture. In the absence of a comprehensive analysis, the alleged double counting of capacity market payments is based on incomplete simulations which cannot isolate the direction or magnitude of the supposed increased consumer costs. Moreover, to then assert without any sound basis that prospective new revenues should be "clawed back" can be expected to significantly harm PJM capacity market sellers.

31. Given uncertainty would cloud any clawback mechanism that simply assumes that the improved market design results in capacity market double payments, it should be expected that attempts to define these alleged obligations would be subject to significant errors. As I describe above, there will be various impacts on the day-ahead and real-time markets and the impacts will vary over time and across resources. Because there will be variation in the benefits and costs faced by different resources (similar to changes that will occur for the reference resource), assuming that

[33] Wilson Affidavit at P 29. The IMM asserts increased payments of $1.7 billion per year, or $6.8 billion in total over four years, and an additional $2.4 billion over three following years (IMM Protest at 53-54).

all energy and reserve market capacity resources should be forced to forego payments under PJM's proposal will result in inequitable treatment across resources. The impact of these errors is likely to be significant for some capacity resource owners.

32. For example, consider capacity resources that have committed to capital investments to ensure their resources maintain high availability and perform consistently based on capacity market auctions that have already been completed.[34] However, because of the proposed market design changes the resource operates differently than it had in the past (e.g., dispatched less often due to improved day-ahead resource scheduling), realizes lower revenues, and has a portion of those revenues subject to a claw back. This resource owner could encounter difficulty recovering the costs of the investment, and have the financial hardship made worse by being expected to forego energy and reserve payments through a clawback.

33. In addition, the threat of an uncertain clawback of revenues can be expected to reduce the incentive of resource owners to make future performance enhancing investments in resources. Resource owners will face uncertainty when evaluating the revenues associated with future investments and be forced to discount projected revenues to account for this uncertainty. This will reduce the competitive response of some resources and slow the implementation of enhancements that will improve resource performance. Moreover, the threat of revenue clawback has the potential to further distort decision-making as it is rational to seek to limit the uncertain financial impact of such mechanisms. Diminished investment incentives are directly contrary to the objective of PJM's proposal and will distort investment decision-making and reduce benefits to consumers.

34. While some protestors argue strongly for clawbacks and adjustments as if there is 100% certainty that the PJM proposal will result in capacity market double payments across all resources, the harm of creating an imperfect claw back mechanism outweighs the benefits of having resources aggressively respond to improved energy and reserve market pricing. There is no evidence put forth by protestors -- beyond referencing imperfect simulations -- that demonstrate that capacity double payments result, and no counterfactual is provided against which to assess how the resource

[34] Any of a number of capital investments can be made to improve unit availability and performance. For example, resources can improve control and monitoring systems, maintain larger spare parts inventories, invest in more comprehensive service agreements, modify system components to allow more frequent starts and allow for reduced down time between starts.

mixture will evolve going forward that would corroborate alleged capacity market double payments. The cost of introducing additional uncertainty through simplified assumptions for identifying alleged double counted capacity payments drives up resource costs and diminishes the longer-term benefits that will result as PJM's improved market design winnows out the least responsive, most expensive reserve resources and compensates those resource that remain.

2. Protestors Ignore Several Important Benefits of PJM's Proposal

35. Protestors opposing PJM's proposed reserve market enhancements ignore the benefits of PJM's proposal and reach conclusions that are inconsistent with Commission policy. The Load Coalition and the IMM generally assert that PJM's proposal increases consumer costs without acknowledging any offsetting benefits.[35] They argue that the status quo does not result in market inefficiencies, do not believe that the day-ahead and real-time markets need to be aligned, and object to the establishment of enhanced reserve requirements and ORDCs.[36] In doing so they ignore the benefits of improved day-ahead schedules and real-time dispatch, aligned day-ahead and real-time reserve products, uniform price signals for all reserves, reduced uplift and greater competition among resources. Focusing solely on costs, and not even considering benefits, ignores the basic economic principles associated with a properly structured economic cost-benefit analysis.

36. Minimizing biasing and out-of-market actions, compensating all resources equally through uniform market clearing prices, and valuing improved reliability results in substantial benefits that are ignored by the Load Coalition and the IMM. An economic cost-benefit analysis that includes just these immediate benefits demonstrates how the results of an analysis that focuses only on costs will be misleading.[37] However, the Load Coalition and the IMM prefer to critique PJM's proposal based solely on its costs and would prefer to perpetuate PJM's existing inefficient and inequitable reserve market design.

37. The benefits associated with PJM's proposal will extend beyond PJM's day-ahead and real-time markets. A wholesale market design that reduces uplift and transparently signals the

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[35] See, for example, IMM Protest at 6, Wilson Affidavit – Transition at P 7, and Al Jabir Affidavit at 3.

[36] See, for example, Al-Jabir Affidavit at 2-3 and IMM Protest at 7-22. The IMM does endorse some changes that are considerably different than PJM's proposal (IMM Protest at 62-74).

[37] The Affidavit of Michael Schnitzer on behalf of Exelon provides an example of a properly structured cost-benefit analysis that estimates both the benefits and costs of PJM's proposal using 2018 data (Comments of Exelon Corporation, Affidavit of Michael M. Schnitzer at Section III).

value of energy and reserves through uniform pricing[38] will reduce the cost of risks faced by utility default service providers (selling wholesale supply to utilities for resale to retail customers) and retail providers that directly serve consumers. Currently default service providers and retailers must guess at the uncertain cost of risks that cannot be hedged (e.g., uplift) and include these costs in fixed prices for longer-term wholesale default service or retail sales (multi-month and multi-year). Because these costs are not transparent, and it is impossible to know when they may arise (such as when PJM experiences days of very high uplift), sellers develop adders that are used to increase their offer prices to compensate for the cost of these risks.[39] With transparent pricing retailers and default service providers can reduce or eliminate these adders for the costs of the risks that they currently cannot project. These costs will be able to be hedged through market transactions and this will reduce costs to consumers by eliminating uncertainty that drives up default service and retail seller prices.

38. An additional benefit that is likely to result with the implementation of PJM's proposal is an increased likelihood of recovering the costs of investments to maintain and improve flexibility by explicitly providing value for the provision of reserves (being able to keep units hotter between starts and recover the costs of an increased number of starts). The Commission recently ordered that the costs associated with certain maintenance requirements for combined-cycles and combustion turbines be recovered as variable costs in the energy markets through start-up, no-load and incremental energy offers. However, recovering these costs through the energy markets requires resource owners to make estimates of numbers of resource starts and stops and expected run times in order to amortize these costs over time. There will surely be instances where errors are made when making cost amortization estimates such that some operational costs may go unrecovered. PJM's proposal provides an opportunity to recover costs that may not otherwise be recovered which will also help incentivize investments to improve unit performance.

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[38] See, e.g., PJM Interconnection, L.L.C., 117 FERC ¶ 61,331 at P 141 (2006) ("In a competitive market, prices do not differ for new and old plants or for efficient and inefficient plants; commodity markets clear at prices based on location and timing of delivery, not the vintage of the production plants used to produce the commodity.").

[39] It is difficult to estimate the adders associated with the cost of risks that cannot be hedged. However statistical modeling has shown that estimated hedging premiums (associated with load and spot price volatility) are 5-11% (see Faruqui, Ahmad, "The Ethics of Dynamic Pricing," The Brattle Group, March 30, 2010). Uplift costs can be very uncertain and volatile and would be expected to constitute a non-trivial percentage of retail or wholesale supplier prices.

39. Finally, Mr. Wilson argues that a "circuit breaker mechanism" should be established to protect consumers from what he alleges would be a possible "billion dollar day" windfall for suppliers.[40] However, Mr. Wilson's alleged billion dollar day example is complete fiction and demonstrates a fundamental misunderstanding of the day-ahead/real-time market interactions and the actions PJM would take in the event of a catastrophic resource or transmission system failures that prevent serving customer demand. First, it appears Mr. Wilson's example is based upon a hypothetical event that results in a substantial real-time shortage. Mr. Wilson suggests in this example that 100,000 MW of resources could get paid $2,000 MWh for 5 hours, resulting in a "billion dollar day." However, it is inconceivable that 100,000 MW of demand would be exposed to real-time shortage prices under U.S. ISO market designs.

40. A key design feature of centralized U.S. wholesale electricity markets is the day-ahead market. The day-ahead market uses market participant offers to sell and bids to buy and determines binding hourly financial schedules for the following day. In addition, following the completion of the day-ahead market, PJM runs a reliability analysis to determine if additional resources need to be scheduled to meet forecasted demand.[41] The result of these processes is that the forecasted demand for the next day is financially hedged and the only exposure to real-time market prices that remains is primarily the result of forecast uncertainty and potential outages.[42] Under Mr. Wilson's hypothetical scenario if there was a large scale outage in real-time, it would not be consumers that would be paying shortage prices, it would be suppliers needing to cover their obligations.[43] The simple fact is that the majority of consumers are financially hedged in the day-ahead market (and typically through longer-term products) and any shortage pricing events would be expected to be short-lived and have little financial impact on the majority of consumers. Billion

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40 Wilson Affidavit - Transition at V.A. and P 37.

41 Day-ahead market processes do not result in shortages for two reasons. First, virtual bidders participate in the day-ahead market and will compensate for potential supply/demand imbalances. Second, the reliability commitment following the running of the day-ahead market ensures that sufficient resources are scheduled for the following day.

42 There may be some market participants that elect to be exposed to real-time pricing.

43 It would be likely that such an event would also require PJM to initiate emergency procedures which specify a complex series of actions that would be taken to protect the electric grid and its resources (See PJM Manual 13: Emergency Operations, Revision: 69, Effective Date: April 1, 2019, Prepared by System Operations Division PJM © 2019).

dollar payments by consumers over the course of a day in the real-time market due to the $2,000/MWh penalty factor price are a fiction.

41. Next, Mr. Wilson goes on to suggest that these billion dollar days would possibly go on for days, weeks or longer. However, if a catastrophic event caused the PJM system to be unable to physically to meet all forecasted demand, PJM would have to initiate a series of actions to protect system equipment and prevent market outcomes that are physically infeasible. If a catastrophe of this magnitude was to occur PJM would surely take immediate action and make emergency filings as appropriate, not spend days or weeks as Mr. Wilson suggests working out what to file.[44]

III. THE ORDC STRUCTURE AND PRICING IS ECONOMICALLY EFFICIENT

42. Protestors go to great lengths to dispute PJM's proposed penalty factors and the sloping shape of the ORDCs.[45] In doing so they are compelled to support a clearly flawed reserve market design, and object to a penalty price that is consistent with seller offer price caps and the possibility of cascading prices in the event of an extreme real-time shortage. While the prospects of very high short-lived high real-time prices are attention grabbing, the reality is that today's wholesale electricity market designs are unlikely to experience such shortages with any notable frequency, and even when such an event might occur, consumers would not be expected to absorb the bulk of any costs associated with a high-priced shortage event.

43. PJM's proposal includes a proposed increase in the reserve penalty factor to ensure that the level that prices may reach in its energy market are consistent with the prices that would result from a reserve shortage.[46] By aligning the penalty factor price with the energy offer price cap PJM can ensure that in those very rare instances when energy prices in a particular 5-minute interval, or number of intervals, reach high levels or even the offer price cap that it will still be able to maintain reserves necessary to respond to contingencies. This is critical as in those instances when the market is tight, PJM would have difficulty maintaining reserves if resources are not

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[44] Wilson Affidavit at P 40.

[45] See, for example, Al-Jabir Affidavit at PPs 16-17, IMM protest at 32-51 and Load Coalition, Attachment B Affidavit of Charles S. Griffey at PPs 7-14.

[46] PJM Filing, Keech Affidavit at PPs 9-13.

compensated for the opportunity cost of being held for reserves or dispatched down as opposed to producing energy.

44. Mr. Al-Jabir disagrees with PJM's proposed penalty factor. He first argues that because high energy prices near to or at the offer caps are "rare" it is not a legitimate opportunity cost.[47] He then observes that for the opportunity cost to reach the level to reach the level of the penalty factor, PJM must accept an energy offer at the cap level and set the clearing price based on this offer.[48] Mr. Al-Jabir then concludes that there is no basis that the proposed penalty factor "reflects a legitimate opportunity cost for generation resources that offer their power [sic] into the reserve markets."[49]

45. However, Mr. Al-Jabir's analysis misses the mark. First, the alignment of the penalty factor with the energy offer cap is most crucial during those rare real-time intervals when the system is up against its capacity limit. It is not a valid argument to assert that because this outcome may be rare, it should be ignored. It is at precisely these times when PJM is concerned about being able to maintain reserves.[50] Second, the time at when the system presses up against its capacity limits will be in the real-time market. In these intervals generation resources are not "offering" their capacity into the synchronized reserve market; they are already on-line, operating and have no option but to make this reserve capacity available.[51] The definition of the opportunity cost at this time is based upon the fact that PJM may have to rely on an energy offer at the cap that sets the market clearing price and results in a legitimate opportunity cost for those resources that are retained to provide synchronized reserves during those 5-minute intervals. Mr. Al-Jabir's assertion that the proposed penalty factor is not a legitimate opportunity cost is simply incorrect.

46. The Load Coalition also express concern that PJM's cascading reserve pricing could result in a price above the energy offer price cap.[52] However, PJM's cascading pricing feature is not

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47 Al-Jabir Affidavit at P 15.

48 Id.

49 Id.

50 PJM Filing, Keech Affidavit at PPs 9-13.

51 In the case of a load responsive resource it would stand ready to reduce demand in response to real-time dispatch.

52 See, for example, Affidavit of Al-Jabir at 16.

new and is consistent with other U.S. ISO market designs.[53] While this is a highly unlikely event, it appropriately values the reserves being provided to the system based on geographic location.

47. Finally, PJM's approach for deriving the sloped portion of the ORDC is appropriate and should not be expected to increase prices significantly as suggested by the IMM.[54] While the example provided by the IMM appears to simply scale up the forecast error, it appears inconsistent with the experience of other regions that already have accommodated much larger numbers of renewable resources. For example, while California responds to significant ramping requirements on a daily basis, these requirements are well known ahead of time. Thus, the uncertainty that the California ISO reports in its real-time market is actually not very large (typically within plus or minus a few hundred MW).[55] I would expect that PJM, which covers a large geographic regions that will include on- and off-shore wind, will find the uncertainty manageable even as the system resource mixture changes.

48. This concludes my affidavit.

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[53] See, for example, ISO-NE Market Rule 1, Section III.2.7A(c) and (d) and NYISO: Market Services Tariff Section 15.4.4.3.

[54] IMM Protest at 49-50 and Figure 13.

[55] See, for example, California ISO, Market Performance and Planning Forum, February 20, 2018 at 26.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.)	**Docket No. ER19-1486-000** **EL19-58-000**

AFFIDAVIT

I, A. Joseph Cavicchi, do hereby swear and affirm under penalty of law that the statements in the foregoing Affidavit of A. Joseph Cavicchi. are true to the best of my knowledge, information and belief.

Executed this 20th day of June, 2019

A. Joseph Cavicchi