UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnections, L.L.C.	)	**Docket Nos: ER19-1486-000**
	)	**EL19-58-000**

Comments of the PJM Power Providers Group

The PJM Power Providers Group ("P3")[1] respectfully submits comments in support of the March 29, 2019, PJM Filing[2] regarding energy price formation in reserve markets[3] as an important step to ensure that actions taken to maintain reliability are included in market clearing prices as further explained herein.

PJM's current reserves market design is unjust and unreasonable because it does not equitably compensate resources for the services that they provide. PJM's operators must frequently intervene in the market processes to ensure sufficient resources are available to ensure reliable system operations such that PJM energy and ancillary service prices do not reflect the value of the service provided. PJM's Filing appropriately recognizes that continued reliance on

[1] P3 is a non-profit organization dedicated to advancing federal, state and regional policies that promote properly designed and well-functioning electricity markets in the PJM Interconnection, L.L.C. ("PJM") region. Combined, P3 members own approximately 84,000 MWs of generation assets, produce enough power to supply over 20 million homes and employ over 40,000 people in the PJM region covering 13 states and the District of Columbia. For more information on P3, visit www.p3powergroup.com. The comments contained in this filing represent the position of P3 as an organization, but not necessarily the views of any particular member with respect to any issue.

[2] *PJM Interconnection, L.L.C.,* Docket No. ER19-1486-000, March 29, 2019 ("PJM Filing").

[3] On March 29, 2019, PJM Interconnection, L.L.C. ("PJM") submitted proposed revisions to the PJM Open Access Transmission Tariff ("Tariff") to effectuate enhanced price formation in PJM's reserve markets. On March 29, 2019, the Federal Energy Regulatory Commission (the "Commission" or "FERC") issued a Combined Notice of Filings #2 setting May 15, 2019, as the deadline to intervene or protest the filing. On May 7, 2019, pursuant to Rule 214 of the Rules of Practice and Procedure of the Commission, 18 C.F.R. § 385.214 (2014), the PJM Power Providers Group ("P3") submitted a doc-less motion to intervene

its current reserve market design structure will perpetuate load biasing and other out-of-market actions by PJM operators, and create unduly discriminatory and inefficient (i.e., unjust and unreasonable) market prices.[4]

The PJM grid is transforming, and PJM's tariff provisions need to keep pace with this remarkable change. As consumer demands and technological innovations drive the market to more decentralized, intermittent forms of generation (both behind and in front of the meter), PJM is going to need to use its generation differently in order to pursue its mission of reliability at the least cost.

In addition to properly designed capacity and energy markets, an essential feature of this "grid of the future" is a reserve product procurement structure that provides sufficient reserves through a market-based mechanism that encourages suppliers of these reserves to provide them in the most efficient means necessary to assure reliability. Reserves are necessary for reliability – they need to be procured at the right level and at a competitive price.[5]

P3 agrees with PJM that its current rules are not well-equipped to meet the demands of the current or future market and cannot be considered just and reasonable. As explained in great detail by PJM in its filing and in the attached affidavit from Joseph Cavicchi, Attachment A, the current PJM rules do not properly price the reserves that the grid requires and, as result, forces PJM's operators to take market-distorting out-of-market actions that will likely grow if not addressed. Moreover, as explained by Dr. Emma Nicholson in the attached whitepaper, Attachment B, PJM's proposal to procure more reserves is not inconsistent with approaches that have been adopted or

[4] PJM Filing at 5-9.

[5] PJM must maintain reserves in the face of net load, interchange, and generator performance uncertainty to be prepared to respond to the single largest contingency on the system at any given time, in compliance with NERC reliability standards. Affidavit of Christopher Pilong on Behalf of PJM, as Attachment E ("Pilong Affidavit") at P 21.

considered in other RTOs to address the challenges of an evolving grid in which resources are more intermittent and load is less predictable.

P3 believes that PJM has put forth a just and reasonable proposal aimed at filling the gaps in the current rules. Dr. Nicholson's whitepaper shows that, from a market design perspective, "PJM's general proposal to revise its ORDC [Operating Reserve Demand Curve] and procure reserves beyond the minimum reserve requirements and assign a non-zero value to those reserves is a just and reasonable approach to address the challenges associated with an increasingly variable and uncertain net load and will allow PJM operators to use a market-based mechanism to procure operational flexibility instead of the out-of-market approach operators currently employ."[6] In addition, as Mr. Cavicchi points out, PJM's valuation of its proposal fails to "..capture the total change in social welfare over time;"[7] and ignores the numerous long-term benefits it provides. P3 urges the Commission to approve PJM's filing.

I. PJM's Current Market Rules Related to the Procurement and Pricing of Reserves Are Not Just and Reasonable and Are Unduly Discriminatory.

P3 agrees with PJM's conclusion that its current market rules are not just and reasonable and are unduly discriminatory and that the shortcomings associated with the current rules will only become more pronounced as the grid evolves. Because PJM's current reserve market rules are not appropriately structured and prevent operators from managing uncertainty within PJM's market, PJM's operators are forced to rely on load biasing and out of market actions that are inefficient and detrimental to the market. As PJM candidly admits, "….the onus of recognizing and managing this uncertainty today falls largely on PJM dispatchers, who bias their schedules, or

[6] Whitepaper of Emma Nicholson, Attachment B, ("Nicholson Whitepaper") at p. 20.

[7] Affidavit of A. Joseph Cavicchi, Attachment A ("Cavicchi Affidavit") at P 49.

take other out-of-market actions, to help ensure (among other reliability objectives) that the PJM Region will not fall short of MRRs (minimum reserve requirements). Those out-of-market actions suppress clearing prices, fail to correctly recognize the essential value of reserves in managing uncertainty, and increase out-of-market uplift."[8]

PJM is remarkably forthcoming about the decisions made by PJM operators when confronted with inadequate reserves in the face of system stress and increased intermittent generation.[9] PJM frequently makes the understandably conservative decision to procure sufficient resources outside of the market but does so at the expense of the market. These outcomes blunt market signals and ultimately do not incent the supplier response that will lead to reliability at the least cost.

There are many specific failings of the current market rules that lead to this undesirable outcome that both PJM identifies in its filing and Joseph Cavicchi supports in the attached affidavit, Attachment A. Among the many problems, the current PJM market rules are problematic as follows:

- PJM primarily relies on a single, day-ahead market signal that does not align with the reserve needs in real time; this is different than almost all other RTOs that acquire day ahead what is needed in real time.

- PJM's unique procurement of Tier 1/Tier 2 reserves is unnecessary and inefficient and, because of this inefficient construct, response rates for Tier 1 resources are "unacceptably low."[10]

[8] PJM Filing at pp. 12-13.

[9] "…….during a morning load pick-up when demand is increasing rapidly, the dispatcher may bias the cases by 2,000-3,000 [MWs] to account for faster-than-expected load, lower-than-expected generation, and generators that are slow to ramp-up. Use of a bias, and the amount of the bias, are based on the dispatcher's training, experience, and judgement." Pilong Affidavit at P 9.

[10] PJM Filing at p. 23.

- PJM's current ORDC penalty factors are too low and the ORDC's current structure does not provide a market-based means to procure adequate reserves.[11]

- PJM's current reserve market design reliance on different reserve products in the day-ahead and real-time markets create multiple operational and economic challenges and can contribute to energy price divergence between the day-ahead and real-time markets and create opportunities for virtual traders to profit without enhancing market efficiency.

PJM details these shortcomings in its filing and P3 wholeheartedly endorses PJM's analysis of its existing rules as supported by the attached whitepaper by Dr. Nicholson, Attachment B, and the affidavit of Mr. Cavicchi, Attachment A Both P3-retained experts independently arrived at the similar conclusions on the need for reform to PJM's current reserve pricing rules. As Mr. Cavicchi succinctly observes, "In absence of a transparent market clearing price that appropriately compensates resources providing reserves PJM will continue to incur uplift and not signal the value of flexibility that it requires to maintain reliable system operations."[12]

Dr. Nicholson details the critical need for flexible reserves in PJM and other RTOs as the generation mix and load profiles evolve. The proliferation of behind the meter resources is driving consumers off the grid during certain hours of the day and causing them to return at other times. NERC even noted in a 2017 report that, distributed energy resources such as solar panels are leading to, "…unanticipated power flows and increased demand forecast errors."[13]

With the understanding that PJM forecasters are going to face greater challenges predicting day ahead loads, the proliferation of intermittent resources on the system will serve to compound

[11] PJM Filing at 26.

[12] Cavicchi Affidavit at P 21.

[13] North American Electric Reliability Corporation, Distributed Energy Resources, Connection Modeling and Reliability Considerations (February 2017) available at: https://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/Distributed_Energy_Resources_Report.pdf.

that challenge. Indeed, Dr. Nicholson confirms that, "These challenges will become more acute in the near future as the existing thermal generation fleet retires and the majority of new resource investments in the US will be non-hydroelectric renewable resources like solar and wind."[14]

Moreover, if nothing is done to address the current deficiencies, PJM's reliance on out of market actions to maintain adequate reserves, will likely worsen, As Mr. Cavicchi explains, "Continued reliance by PJM operators on net-load biasing in its IT SCED and biasing in other operator system reserve requirements undermine energy and ancillary services market efficiency and perpetuate a lack of transparency in the market commitment and dispatch process. An efficient market design should ensure reliable system operations without placing operators in the position of regularly having to make so many significant adjustments. PJM's current reserve market design drives up costs, does not maximize welfare, and unduly discriminates providers of synchronized reserves. Given this situation, the Commission should conclude that PJM's current reserve markets design is unjust and unreasonable."[15]

The case that PJM's current reserve product procurement structure is not just and reasonable is compelling and well-supported by PJM. As indicated by PJM, Dr. Nicholson and Mr. Cavicchi, the problems associated with the current rules will only grow more problematic as additional intermittent resources with more variable and less predictable production profiles emerge. The matter is ripe for Commission action and P3 urges the Commission to find PJM's current reserves rules unjust and unreasonable and unduly discriminatory.

[14] Nicholson Whitepaper at p. 3.

[15] Cavicchi Affidavit at P 28.

II. PJM's Proposal Offers a Just and Reasonable Means to Address the Current Tariff Infirmities.

A. Consolidation of Tier 1 and Tier 2 Will Remove Several Current Incentives That Lead to Out of Market Operator Actions.

PJM's current rules provide for two types of Synchronized Reserve products, Tier 1 and Tier 2. Tier 1, "…is provided from non-emergency resources that are on-line and generating, but not fully loaded, and that can provide additional energy within 10 minutes with no departure from their energy profit maximizing economic dispatch point."[16] Tier 1 resources are currently not compensated for the reserve services they provide and similarly are not penalized if they fail to provide reserves when called upon.

Tier 2 resources are "…those resources that must be dispatched away from their energy profit maximizing dispatch point in order to maintain their reserve capability."[17] In other words, Tier 2 resources are needed by PJM to provide reserves when they otherwise would be selling energy. Tier 2 resources are compensated for providing these reserves and penalized for non-performance.

In the seventeen years since its inception, this two-tier structure has understandably led to a bias to procure Tier 1 (free) reserves from PJM and a reluctance from suppliers to respond given the absence of incentive or punishment. As PJM noted, most of the reserve resources procured are Tier 1 resources that provide reserve services for free and have no obligation to respond to a

[16] PJM Filing at p. 15.

[17] *Id.*

Synchronized Reserve event. Not surprisingly, the response rate for Tier 1 resources has dwindled to levels PJM describes as "unacceptably low."[18]

At the same time, on days when the system is stressed, price signals to provide reserves are muted. As PJM details, "…the extremely cold conditions PJM experienced in this past January 2019, wherein prices (for reserves) were $0/MWh for 29 hours of the 48-hour period, and were less than (and mostly significantly less than) $10/MWh for 41 hours of the 48-hour period."[19] However, under these stressed conditions PJM operators were understandably concerned about reliability and procured the needed reserves outside of the market leading to prices that do not reflect the value of the service provided and uplift that cannot be hedged.

Given the numerous problems associated with the current two-tier structure, PJM's proposal to consolidate the two tiers into a single tier in which reserves are compensated for their services and penalized for non-performance simply makes sense and is "…a logical evolution for PJM's synchronized reserves."[20] P3 urges the Commission to approve this aspect of the filing.

B. ORDC Reforms Will Appropriately Improve Incentives for Reserve Products While Recognizing Their Value.

The heart of PJM's proposal relates to overdue changes to the ORDC to reflect the actual uncertainties that PJM faces throughout the year. The current reserve market design and ORDC does not incentivize reserve performance due to an outdated and conservative penalty factor and an insufficient demand curve. In PJM's current market design, real-time reserve markets are cleared using ORDCs that are generally vertical. Under such a construct, if PJM ever falls short

[18] PJM Filing at p 23.

[19] PJM Filing at p 21.

[20] Cavicchi Affidavit at P 30.

of the minimum reserve requirement, the penalty factor is used as the signal to market participants that shortage conditions are approaching, and capacity should come online. However, and at the root of the problem, PJM's current reserve requirements and penalty factors do not consider all the actions that PJM's operators may need to take to maintain minimum reliability resulting in increased uplift and market prices that do not reflect market conditions. Fortunately, PJM proposes a just and reasonable solution to remedy these current market shortcomings that consists of a revised penalty factor and a downward sloping demand curve that values reserves that are necessary to ensure reliable operations past the minimum reliability requirement.

1. Revised Penalty Factor

PJM proposes to update the penalty factor to $2000/MWh to more appropriately align reserve prices with energy prices so as to not incent suppliers to only provide one service (energy or reserves) and to better reflect the cost of emergency actions PJM will take to avoid experiencing a reserve shortage. The current penalty factor of $850/MWh creates an opportunity cost for suppliers who could potentially sell energy at prices up to $2,000/MWh. Such a significant opportunity cost naturally creates a disincentive to those, such as demand response, providing reserves as energy suppliers will be naturally attracted to the price signal being provided by the energy market as prices rise during times of system stress. Further, PJM will take emergency and pre-emergency actions, such as voltage reductions and emergency energy purchases, that cost in excess of $850/MWh.[21] Capping the price of reserves at $850/MWh thus fails to reflect the value PJM places on avoiding a reserve shortage.

PJM seeks to instill the same penalty factor for all reserve requirements (synchronized, non-synchronized and 30 second) and align the reserve penalty factors (2,000/MWh) with the

[21] PJM Filing at pp 49-50.

energy market offer cap. This alignment represents a logical approach to setting the penalty factor. At that level, generators will receive appropriate price signals to supply either energy and/or reserves and be incented to follow those price signals as market conditions change.

With suppliers incented to provide reserves and/or energy as system conditions signal needs, a market-based response will reduce the need of PJM operators to take out of market actions to preserve reliability. These economic signals will appropriately motivate suppliers to provide these reserves at the lowest price possible rather than the current construct which dissuades suppliers from providing reserves even when needed. The economic signal will also be in line with the out-of-market costs PJM would otherwise incur to avoid a reserve shortage. Indeed, PJM's proposal if enacted should, "…reliably signal a shortage caused by running out of reserves, rather than simply an economic choice to go short on reserves."[22]

2. Revised Sloping ORDC

PJM's current rules come up woefully short in valuing reserves beyond the minimum reserve requirement. Reserves beyond the minimum have tremendous value to PJM and need to not only be procured, but also compensated.[23] PJM's current rules allow for a very small within market procurement of reserves beyond the MRR and at capped price of $300/MWh. Given these limitations, PJM's operators take out-of-market action, like load biasing, to be prepared to maintain reserve levels in the face of net load uncertainty. In the absence of the out of market actions by PJM operators, PJM would have likely been short reserves 29% of the time in 2018.[24]

[22] PJM Filing at p. 52.

[23] "reserves procured beyond the reserve requirement have value to the ISO/RTO and its loads because the reserves give operators additional operational flexibility to balance net loads." Nicholson Whitepaper at p. 17.

[24] Pilong Affidavit at P 8. While Mr. Pilong notes that this represents a worst case, it is indicative of a substantial increase in reserve shortages in the absence of biasing and out of market actions.

It is unrealistic to expect PJM's operators to stop biasing and taking out-of-market actions to manage net load uncertainty without a mechanism that addresses the reliability need and also reflects the value of that need in prices.

PJM rightly seeks to shift the mechanism to procure reserves from operator decisions to the market. PJM proposes a downward sloping demand curve beyond the MRR to reflect the fact that reserves are less valuable, but still have value, as additional reserves are acquired past the MRR. PJM justifies its proposed slope based on an extensive analysis from Dr. Rocha Garrido. P3 generally agrees with Dr. Rocha Garrido's analysis and offers that it serves as a solid basis to render PJM's proposal just and reasonable.[25]

The revised penalty factor combined with the revised sloping ORDC, results in reserve pricing rules that will procure reserves at sufficient levels to maintain reliable operations while appropriately compensating those resources for the services they provide. As Mr. Cavicchi concludes, "…the proposed design of PJM's ORDCs is a reasonable basis for the development of a pricing schedule to value reserves. By basing the shape of the curve on the probability that reserves fall below MRRs measured based on observed real-time net-load uncertainty, PJM explicitly links its flexibility requirements to its reserve pricing schedule. The additional reserves that PJM will procure using the ORDCs will be optimized based on the economic trade-offs among resources that results when procuring a complete set of energy and reserves in the day-ahead and real-time markets."[26]

[25] Mr. Cavicchi provides commentary on the Garrido affidavit in PP 35-36 in the attached affidavit, Attachment A. Without repeating the many details here, Mr. Cavicchi explains the benefits of PJM's proposed approached as supported by Dr. Rocha Garrido.

[26] Cavicchi Affidavit at P 8.

III. Day Ahead and Real Time Reserve Alignment Will Improve Market Efficiency.

PJM requires reserves that can be available within 10 minutes in order to balance the system, yet, under PJM's current rules, only 30-minute reserves are acquired in the day ahead market based on the day ahead forecast. In the event that there is a forecast error day ahead, the system could easily be short the 10-minute reserves necessary to preserve reliability, because there is no guarantee that reserves procured in the day ahead market will be able to deliver 10-minute reserves in the real time market.

PJM acknowledges that, "Clearing the day-ahead market when modeling only a 30-minute reserve requirement, as opposed to modeling both a 30-minute reserve requirement and 10-minute reserve requirements, will likely produce the commitment of a different set of resources and different market clearing prices."[27] Not only could the current rules lead to PJM "missing the mark" on the needs of the system, but it also could likely lead to higher costs in order to procure the necessary 10-minute resources in real time as resources that could have been available day ahead at a lower cost are not available in real time at any cost. As PJM reveals, such a discrepancy is fertile ground for virtual traders seeking to arbitrage the difference in prices between day ahead and real time; however, such arbitrage inures to the benefit of the traders without enhancing the efficiency of the overall market.[28]

PJM proposes to end this misalignment between the day ahead and real time markets by procuring the same reserve products to meet the same reserve requirements both day-ahead and in real-time. This proposed change would conform PJM's reserve procurement with that of other

[27] PJM Filing at p. 43.

[28] PJM Filing at p. 44.

RTO's and yield an efficient procurement of the resources that are needed while providing the proper incentives to the providers of those services.

Compounding the need for this change, as PJM acknowledges, the procurement of additional reserves under the proposed ORDC will only exacerbate this divergence if not addressed in this proceeding.[29] As has been well-documented, PJM's generation mix is changing rapidly and with 82% of the projects in the PJM queue being renewable projects and with the continued retirements of thermal generation units, the pace of this change is likely to hasten.[30]

Specifically, PJM is proposing to have three reserve products procured: 1. Secondary reserves (30 minute), 2. Synchronized Reserves (10 minute) and 3. Non-synchronized Reserves (10 minutes). These reserve products would be procured based on the similarly shaped demand curves to align with the real time needs of the system and priced based on the value they provide. Each reserve product would be calculated using the same analytical approach based on the historical net-load, interchange and generator performance uncertainties that operators now react to via biasing and out of market actions.

P3 supports PJM's proposed reserve product structure and urges the Commission to find it just and reasonable. The structure will improve PJM's market efficiency as well as align PJM's structure with other RTOs. As Joseph Cavicchi concludes, "Not only does PJM's proposal bring PJM's market design in line with the best practices of almost all other U.S. ISOs, but it importantly will establish day-ahead reserve obligations that will be the primary means by which reserves will be procured in PJM's markets. The day-ahead market will create schedules that better maximize

[29] PJM Filing at p. 75.

[30] Nicholson Whitepaper at pp. 18-19.

welfare and new incentives will be created for resources that receive reserve schedules to perform in real-time."[31]

IV. Conclusion

PJM's grid is not standing still in the face of increasing consumer demands and prolific changes in technology. Independent of these changes, PJM always needs to stand firm in its ability to run a functional market that provides reliable wholesale electricity at the lowest price possible. By properly valuing reserves with a market-based construct that incents suppliers to provide these services as efficiently as possible, PJM will gain the flexibility it needs to meet the challenges of today and tomorrow consistent with its mission. The PJM filing accomplishes that goal and should be approved.

Respectfully submitted,

On behalf of the PJM Power Providers Group

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[31] Cavicchi Affidavit at P 31.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the Official Service List compiled by the Secretary in this proceeding.

Dated at Washington, D.C., this 15th day of May, 2019.

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ATTACHMENT A

AFFIDAVIT OF A. JOSEPH CAVICCHI

ATTACHMENT B

Emma Nicholson, Ph.D. Whitepaper on RTO/ISO Market Design Changes to Increase Operational Flexibility