171 FERC ¶ 61,153
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Neil Chatterjee, Chairman;
Richard Glick, Bernard L. McNamee,
and James P. Danly.

PJM Interconnection, L.L.C. Docket Nos. EL19-58-000
ER19-1486-000

ORDER ON PROPOSED TARIFF AND OPERATING AGREEMENT REVISIONS

(Issued May 21, 2020)

1. On March 29, 2019, PJM Interconnection, L.L.C. (PJM) submitted filings pursuant to sections 205 and 206 of the Federal Power Act (FPA)[1] asserting that reserve market provisions of its Open Access Transmission Tariff (Tariff) and the Amended and Restated Operating Agreement of PJM (Operating Agreement) are unjust and unreasonable, and proposing revisions to the Tariff and Operating Agreement (Reserve Market Proposal) as a just and reasonable replacement rate.

2. As discussed below, we find PJM's existing Tariff and Operating Agreement unjust and unreasonable, largely adopt PJM's proposed replacement rate as just and reasonable, subject to certain modifications, and direct PJM to submit a compliance filing to revise its Tariff and Operating Agreement within 45 days of the date of this order. We also find that adoption of the proposed revisions renders one element of PJM's Reliability Pricing Model (RPM) capacity market, in Attachment DD to PJM's Tariff, unjust and

[1] 16 U.S.C. §§ 824d-824e (2018). PJM filed the proposed revisions to the Operating Agreement pursuant to section 206 of the FPA and filed pursuant to section 205 to include the same revisions to its Tariff, Attachment K-Appendix, which merely repeats certain provisions of the Operating Agreement. PJM Transmittal at 1 n.1. As PJM recognized in its transmittal letter, because PJM does not have authority under its Operating Agreement to file these revisions unilaterally pursuant to section 205, its section 205 filing remains subject to the requirements of section 206 of the FPA. *Id.* All citations to the "PJM Transmittal" herein, unless otherwise noted, refer to the transmittal filed in Docket No. EL19-58-000, which, aside from the cover letter and Attachments A and B, is identical to the transmittal filed in Docket No. ER19-1486-000.

unreasonable, establish the just and reasonable replacement rate, and direct PJM to submit a compliance filing within 45 days of the date of this order. As part of its further compliance filing, we direct PJM to propose an effective date as early as practicable that will allow it sufficient time to implement the revisions directed herein, including any necessary software changes. We recognize the interaction between the directives in this order and the pending revisions to the capacity market minimum offer price rules in Docket Nos. EL16-49-000 *et al*.[2] PJM's compliance filing should therefore present an implementation schedule for the instant revisions that appropriately harmonizes the revisions here with ongoing revisions in the other proceeding while minimizing any auction delays. The Commission will set the effective date for these Operating Agreement and Tariff revisions upon review of the compliance filing ordered herein.

I. Background

3. Reserves play an important role in maintaining the reliability of the bulk power system. The North American Electric Reliability Corporation (NERC) mandates that each regional transmission organization and independent system operator (RTO/ISO), as Balancing Authorities, maintain sufficient reserves to respond to the loss of the largest single contingency on its system within 15 minutes.[3] RTOs/ISOs also seek to maintain sufficient reserves to address other real-time operational uncertainties, such as deviations of load, generator availability and performance, and interchange from forecast values. RTOs/ISOs use different reserve product specifications and set different minimum reserve requirement (MRR) quantities, but the objective is the same—to adequately prepare for operational uncertainties.

4. In PJM, resources capable of converting reserve capability into energy in 30 minutes or less are eligible to provide 30-minute Reserves, which PJM refers to as Day-Ahead Scheduling Reserves. Resources capable of converting reserve capability into energy in 10 minutes or less are eligible to provide 10-minute Reserves, which PJM terms Primary Reserves. PJM currently procures Day-Ahead Scheduling Reserves in the day-ahead market and Primary Reserves in the real-time market. Primary Reserves, which PJM uses to meet NERC Reliability Standard BAL-002, are sub-divided into Synchronized and Non-Synchronized Reserves (depending on whether the supplying resource is synchronized to the transmission system), and Synchronized Reserves are

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[2] *Calpine Corp. v. PJM Interconnection, L.L.C.*, 169 FERC ¶ 61,239 (2019), *reh'g and clarification*, 171 FERC ¶ 61,035 (2020).

[3] *See* N. Am. Elec. Reliability Corp., *Standard BAL-002 – Disturbance Control Performance* (2019).

further sub-divided into Tier 1 and Tier 2 reserves.[4] Tier 1 reserves represent the headroom on an online resource that could be converted to energy within 10 minutes based on the resource's current dispatch point and ramp rate. Resources providing Tier 1 reserves are generally not compensated and have no performance requirements or associated penalties for non-performance. Tier 2 reserves are provided by resources that, absent the need for additional reserves, would be dispatched to their profit-maximizing output for energy. Resources providing Tier 2 reserves are eligible for compensation and pay a penalty for failing to perform.

5. Demand for reserves within PJM's reserve market is represented by Operating Reserve Demand Curves (ORDCs). PJM currently uses step-function ORDCs, where the horizontal segments represent the maximum price the market is willing to pay for the associated quantity of reserves. These maximum prices are known as Reserve Penalty Factors. Reserve Penalty Factors can also be thought of as the maximum cost PJM will incur, within market, to redispatch its system to procure an additional megawatt (MW) of reserves. PJM currently uses ORDCs with two steps: (1) a step at a Reserve Penalty Factor of $850/MWh that extends to the MRR quantity for the particular reserve product (Step 1); and (2) a step at a Reserve Penalty Factor of $300/MWh that extends 190 MW beyond the MRR quantity (Step 2A). In certain circumstances, PJM can extend the second step of the ORDCs beyond 190 MW (Step 2B).

II. PJM's Filings

6. PJM explains that reserves play an important role in maintaining the reliability of its bulk power system, including managing system uncertainties. PJM states that the solution to managing these uncertainties is to line up resources that are not scheduled to serve load during the target period but that are capable of providing energy on short notice if needed.[5]

7. PJM explains that its reserve requirements, and the procedures and products used to meet those requirements, have evolved over time. PJM explains that with any complex system, flaws can develop and become more apparent the longer they are left unaddressed. PJM states that several such flaws have developed within the PJM reserve

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[4] Superior reserve products are used to meet targets for inferior reserve products. For example, while there is a Synchronized Reserve Requirement, resources providing Synchronized Reserve also contribute to meeting the Primary Reserve Requirement.

[5] PJM Transmittal at 2.

market which are unique to PJM and which lead to unjust and unreasonable rates that are unduly discriminatory and preferential.[6]

8. PJM identifies the following concerns: (1) a Synchronized Reserve product definition that has led to under-compensation and poor performance because it is subdivided into Tier 1 and Tier 2 reserve products with disparate rules for commitment, compensation, and non-performance penalties; (2) ORDCs that fail to address uncertainties around load, wind and solar forecasts, and unanticipated supply resource outages and thus require PJM operators to frequently bias their scheduling of supply resources and take other out-of-market actions to preserve reliability; (3) reserve market clearing prices that do not reflect the operational value of flexibility; (4) a Reserve Penalty Factor of $850/MWh that is below the legitimate opportunity cost some resources could face in shortage or near-shortage conditions; and (5) misalignment of reserve products between the day-ahead and real-time markets that leads to inadequate procurement of forward reserves and inefficient commitment and pricing outcomes.[7]

9. To address these concerns, PJM proposes to: (1) consolidate the Tier 1 and Tier 2 reserve products into one product—Synchronized Reserve—with uniform commitment, compensation, and non-performance penalty structures; (2) raise the Reserve Penalty Factors to $2,000/MWh; (3) revise the ORDCs' shape to be based on a probabilistic analysis of the risk of a reserve shortage due to operational uncertainties; and (4) align reserve procurement in the day-ahead and real-time markets by establishing two 10-minute Reserve requirements (Synchronized Reserve Requirement and Primary Reserve Requirement) and one 30-minute Reserve requirement (30-minute Reserve Requirement) in each market.[8] PJM also proposes to define two new terms that are related but distinct: 30-minute Reserve and Secondary Reserve. Secondary Reserve is the reserve capability of resources that can be converted fully into energy within 30 minutes.[9] Secondary Reserve implicitly excludes reserve capability of resources that can be converted fully into energy within 10 minutes, which would be categorized instead as Synchronized Reserve or Non-Synchronized Reserve. By contrast, 30-minute Reserve is *all* reserve capability that can be converted fully into energy within 30 minutes, and

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[6] *Id.* at 2-3.

[7] *Id.* at 5-9.

[8] *Id.* at 9-14.

[9] *See* Operating Agreement, OA Definitions S - T (15.0.0).

is thus comprised of Synchronized Reserve, Non-Synchronized Reserve, and Secondary Reserve.[10]

10. PJM submitted two concurrent filings—Tariff revisions pursuant to FPA section 205 and Operating Agreement revisions pursuant to FPA section 206, with identical provisions in each.

III. Notice of Filings and Responsive Pleadings

11. Notices of PJM's filings in Docket Nos. ER19-1486-000 and EL19-58-000 were published in the *Federal Register*, 84 Fed. Reg. 13,284 (Apr. 5, 2019) and 84 Fed. Reg. 13,650 (Apr. 4, 2019), respectively, with interventions, comments, and protests due on or before May 15, 2019. Notices of intervention and timely-filed motions to intervene were submitted by the entities noted in Appendix B to this order. In addition, a motion to intervene out-of-time was submitted by North Carolina Electric Membership Corporation (NCEMC) in both Docket Nos. EL19-58-000 and ER19-1486-000 on May 16, 2019. A late-filed motion to intervene was submitted by American Wind Energy Association (AWEA) in Docket No. EL19-58-000 on May 16, 2019.[11]

12. R Street Institute (R Street), Exelon Corporation (Exelon), Clean Energy Entities (CEE),[12] Energy Trading Institute (ETI), FirstEnergy Utility Companies (FirstEnergy),[13] Duke Energy Corporation (Duke), Nuclear Energy Institute (NEI), Dominion Energy Services, Inc. (Dominion), Calpine Corporation and LS Power Associates, L.P. (together, Calpine and LS Power), Institute for Policy Integrity at New York University School of Law (IPI), Direct Energy Business Marketing, LLC and Direct Energy Business, LLC (collectively, Direct Energy), Vistra Energy Corporation and Dynegy Marketing and Trade, LLC (collectively, Vistra), and Electric Power Supply Association (EPSA) filed supporting comments in both dockets. The American Petroleum Institute (API) filed

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[10] *See* Operating Agreement, OA Definitions A - B (7.0).

[11] AWEA filed a timely motion to intervene in Docket No. ER19-1486-000 on May 15, 2019.

[12] CEE is comprised of AWEA and the Solar Energy Industries Association.

[13] The FirstEnergy utilities include: Ohio Edison Company, The Cleveland Electric Illuminating Company, The Toledo Edison Company, West Penn Power Company, Pennsylvania Power Company, Pennsylvania Electric Company, Metropolitan Edison Company, Jersey Central Power & Light Company, Monongahela Power Company, and The Potomac Edison Company.

supporting comments in Docket No. EL19-58-000. The PJM Power Providers Group (P3) late-filed supporting comments in both dockets.

13. The Maryland Public Service Commission (Maryland Commission), Public Citizen, Inc. (Public Citizen),[14] the Public Utilities Commission of Ohio (Ohio Commission), Old Dominion Electric Cooperative (ODEC), Organization of PJM States, Inc. (OPSI),[15] the PJM Load/Customer Coalition (PJM Load Coalition),[16] Clean Energy Advocates (CEA),[17] American Electric Power Service Corporation (AEP), and the PSEG

[14] In conjunction with its protest, Public Citizen also requested an evidentiary hearing and the recusal of Commissioner McNamee. On May 21, 2020, Commissioner Bernard L. McNamee issued a memorandum to the file documenting his decision not to recuse himself from these dockets, based on memoranda dated May 20, 2020 and January 2, 2019 from the Designated Agency Ethics Official and Associate General Counsel for General and Administrative Law in the Office of General Counsel.

[15] The OPSI members supporting the protest include: Delaware Public Service Commission, Public Service Commission of the District of Columbia, Illinois Commerce Commission, Indiana Utility Regulatory Commission, Maryland Public Service Commission, Michigan Public Service Commission, New Jersey Board of Public Utilities, Pennsylvania Public Service Commission, and the Tennessee Public Service Commission. The Kentucky Public Service Commission, North Carolina Utilities Commission, and the Virginia State Corporation Commission abstained from taking a position on specific concept solutions suggested in OPSI's protest. The Public Service Commission of West Virginia and the Public Service Commission of West Virginia joined only certain aspects of OPSI's protest. The Ohio Public Utilities Commission abstained. OPSI Protest at 1 n.2.

[16] The PJM Load Coalition is comprised of the following: American Municipal Power, Inc., American Public Power Association, District of Columbia Office of People's Counsel, District of Columbia Public Service Commission, Indiana Office of Utility Consumer Counsel, Kentucky Office of the Attorney General, Maryland Office of People's Counsel, New Jersey Board of Public Utilities, New Jersey Division of Rate Counsel, Pennsylvania Office of Consumer Advocate, Pennsylvania Public Utility Commission, PJM Industrial Customer Coalition, Public Power Association of New Jersey, Southern Maryland Electric Cooperative, Inc., Delaware Division of the Public Advocate.

[17] CEA is comprised of the Sierra Club, Natural Resources Defense Council, and Sustainable FERC Project.

Companies (PSEG)[18] filed timely protests in both dockets. The Union of Concerned Scientists (UCS) filed a timely protest in Docket No. EL19-58-000. Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM (IMM), late-filed a protest in both dockets on May 16, 2019.

14. On May 31, 2019, the IMM filed a motion for leave to answer and answer in both dockets (IMM First Answer). On June 19, 2019, Exelon filed a motion for leave to answer and answer in both dockets. On June 20, 2019, Vistra, CEA, and PSEG filed motions for leave to answer and answers in both dockets. On June 21, 2019, P3 filed a motion for leave to answer and answer in both dockets.

15. On June 21, 2019, PJM filed its answer to the comments and protests in both dockets (PJM Answer). On July 2, 2019, PJM submitted a signed verification to the Reply Affidavit of Christopher Pilong (Pilong Reply Affidavit), which was appended to its June 21, 2019 answer.

16. On June 24, 2019, Calpine and LS Power filed a request for leave to answer and answer in both dockets. On June 26, 2019, EPSA and Steel Producers filed motions for leave to answer and answers in both dockets. On July 15, 2019, OPSI filed a motion for leave to answer and answer in both dockets. On July 16, 2019, the IMM filed a motion for leave to answer and answer in both dockets (IMM Second Answer). On July 19, 2019, the PJM Load Coalition filed a motion for leave to answer and answer in both dockets.

IV. Discussion

A. Procedural Matters

17. Pursuant to Rule 214 of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214 (2019), the notices of intervention and timely, unopposed motions to intervene serve to make the entities that filed them parties to the proceedings in which they were filed.

18. Pursuant to Rule 214(d) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214(d) (2019), we grant NCEMC's and AWEA's late-filed motions to intervene given their interests in the proceeding, the early stage of the proceedings, and the absence of undue prejudice or delay.

19. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.213(a)(2) (2019), prohibits an answer to a protest or answer unless otherwise

[18] PSEG includes: PSEG Power LLC, PSEG Energy Resources & Trade LLC, and Public Service Electric and Gas Company.

ordered by the decisional authority. We accept the parties' answers because they have provided information that assisted us in our decision-making process. We also accept P3's late-filed comments and the IMM's late-filed protest.

20. After granting a complaint filed pursuant to FPA section 206, the Commission must establish a refund effective date that is no earlier than the date of the complaint and no later than five months subsequent to the date of the complaint.[19] We establish the refund effective date as of the earliest date possible: March 29, 2019. However, no party claims, and we find no evidence that, any refunds would be warranted as a result of the Operating Agreement and Tariff revisions adopted herein.[20]

21. We reject Public Citizen's request for an evidentiary hearing to further investigate the merits of PJM's filings.[21] A significant record has been developed in this proceeding, which has provided us with sufficient information to make the findings detailed herein. We do not agree that further process in the form of an evidentiary hearing would assist in our decision-making process.

B. Substantive Matters

22. As detailed below, we find that PJM's existing reserve market design is unjust and unreasonable, and we establish a replacement rate that largely adopts PJM's proposed Tariff and Operating Agreement revisions, subject to certain modifications, and require PJM to submit a compliance filing within 45 days of the date of this order. In addition, we find, pursuant to section 206 of the FPA, that the reserve market changes adopted herein render PJM's existing methodology for calculating the energy and ancillary services offset (E&AS Offset) in PJM's capacity market unjust and unreasonable, establish as the just and reasonable replacement rate a forward-looking E&AS Offset, and direct PJM to submit a compliance filing within 45 days of the date of this order to revise Attachment DD of its Tariff accordingly. As noted above, we direct PJM to propose an effective date as early as practicable that will allow it sufficient time to implement both sets of revisions. PJM's compliance filing should present an implementation schedule that appropriately harmonizes the revisions here with ongoing revisions in the proceeding in Docket Nos. EL16-49-000 *et al.* while minimizing any capacity market auction delays.

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[19] 16 U.S.C. § 824e(b).

[20] *Ameren Servs. Co. v. Midwest Indep. Transmission Sys. Operator, Inc.*, 127 FERC ¶ 61,121, at P 157 (2009) ("In cases involving changes to market design, the Commission generally exercises its discretion and does not order refunds when doing so would require re-running a market.").

[21] Public Citizen Protest at 3.

The Commission will set the effective date for these Operating Agreement and Tariff revisions upon review of the compliance filing ordered herein.

1. Existing Market Design

23. In this section, we address PJM's argument that its current reserve market construct is unjust and unreasonable. The vast majority of the comments to this proceeding agree with PJM that it is unjust and unreasonable and must be revised.[22] The Ohio Commission, the Maryland Commission, the PJM Load Coalition, and the IMM argue that PJM has not met its burden to show that its current reserve market is unjust and unreasonable.

24. As discussed in Section IV.B.1.d below, we find that PJM has met its burden to show that its current reserve market design is unjust and unreasonable.

a. PJM's Filings

25. PJM argues that "facts specific to the PJM region and design flaws specific to the PJM reserve market rules," have led to a reserve market design that is no longer just and reasonable.[23] PJM states that its reserve markets no longer deliver the benefits that result from "better formed prices," such as reliable operations and transparent pricing.[24]

26. PJM explains that it currently uses two types of Synchronized Reserve products, Tier 1 and Tier 2 reserves, to meet its Synchronized Reserve Requirement.[25] PJM explains that both the Tier 1 and Tier 2 products are provided from online resources that are synchronized to the electric grid and that can provide energy within 10 minutes. PJM states that Tier 1 reserves are provided from non-emergency resources that are not fully loaded and that can provide energy without departure from their energy profit-maximizing economic dispatch point. PJM states that Tier 2 reserves are provided from resources that have been dispatched away from their energy profit-maximizing dispatch

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[22] *See infra* note 65 (Exelon, CEE, ETI, Duke, NEI, P3, Dominion, API, Calpine and LS Power, IRI, Direct Energy, Vistra, EPSA, and PSEG).

[23] PJM Transmittal at 5.

[24] *Id.* at 4 (quoting *Settlement Intervals & Shortage Pricing in Mkts. Operated by Reg'l Transmission Orgs. & Indep. Sys. Operators*, Order No. 825, 155 FERC ¶ 61,276, at P 163 (2016)).

[25] *Id.* at 15. The Synchronized Reserve Requirement is based on NERC Reliability Standard BAL-002.

point to create reserve capability.[26] PJM explains that Tier 2 reserves must submit sell offers and failure to perform results in a resource being subject to a non-performance penalty via a loss of revenue.[27] PJM explains that its market clearing process assumes Tier 1 reserves are free, and Tier 1 resources are not compensated in the event that PJM needs to procure Tier 2 reserves—even though both resource types are providing the same product and are relied upon by system operators. PJM explains that Tier 1 resources do not face a penalty for non-performance.[28] PJM notes that its Tier 1/Tier 2 reserve construct is unique among RTOs/ISOs.[29]

27. PJM argues that the Tier 1/Tier 2 reserve construct is unjust and unreasonable because it does not properly incentivize the supply and response of Synchronized Reserves in PJM. PJM provides several examples of Tier 1 resources not responding to Synchronized Reserve Events during 2016, 2017, and 2018–years in which the Tier 1 reserve response rate was 75.1, 60.1, and 63.3%, respectively.[30] While PJM argues that Synchronized Reserves are not appropriately valued on any given day, it states that it is most problematic that it occurs when the system is most stressed. PJM points to evidence during cold weather in January 2019 where reserve prices were $0.00/MWh for 29 hours of the 48-hour period and less than $10/MWh for 41 hours of the 48-hour period.[31] PJM explains that operators needed to take out-of-market actions to ensure adequate reserves during these stressed conditions, which led to a spike in uplift.[32]

28. PJM also argues that the Tier 1/Tier 2 reserve construct is unjust and unreasonable because it impedes price transparency. As a result of the under-performance of Tier 1 reserves, PJM explains that it is difficult to estimate the amount of Tier 1 reserve resources on the system that will respond at any given time, often resulting in system operators' taking actions, such as manually assigning Tier 2 reserves intra-hour, reducing

[26] *Id.* at 15-16.

[27] *Id.*

[28] *Id.* at 16.

[29] *Id.* at 17.

[30] *Id.* at 17-20 (citing Monitoring Analytics, LLC, *State of the Market Report for PJM*, at 455-56 (2019); Monitoring Analytics, LLC, *State of the Market Report for PJM*, at 444, tbl.10-6 (2018); Monitoring Analytics, LLC, *State of the Market Report for PJM*, at 416, tbl.10-20 (2017)).

[31] *Id.* at 20.

[32] *Id.* at 20-22.

the hour-ahead Tier 1 reserve estimate via a manually entered bias in the hour-ahead procurement tool, and planning to meet the contingency recovery requirements by using Non-Synchronized Reserves.[33] In addition, PJM states that the confidence in Tier 1 reserves differs by operator and scenario, which can create inconsistent interventions, and in some cases suppress prices and create uplift.[34]

29. In addition to the purported unjust and unreasonable aspects of how its reserve market currently compensates Synchronized Reserves, PJM also argues that its current ORDCs are unjust and unreasonable. PJM explains that it currently clears its real-time reserve markets with ORDCs, which are vertical curves that use step functions. When the reserve requirements cannot be met, PJM explains that the reserve shortage is priced using a Reserve Penalty Factor (i.e., the price for being unable to meet the MRR). PJM explains that the ORDCs administratively set the amount of reserves to clear and determine the limit on the price the market is willing to pay to substitute reserves for energy—the Reserve Penalty Factor. PJM states that the ORDCs only explicitly affect prices when not enough reserves are available at or below the MRR, or are at or below a level 190 MW greater than the MRR.[35]

30. PJM states that Step 1 of the ORDCs are priced at Reserve Penalty Factors of $850/MWh, based on an analysis of the out-of-market payments made for reserves from an operating event in 2007.[36] PJM states that Step 2A, priced at a Reserve Penalty Factor of $300/MWh, was added to each ORDC in 2017 in response to Order No. 719 to avoid system volatility due to large swings in price from small changes in reserve amounts.[37] PJM states that Step 2B, which is also priced at a Reserve Penalty Factor of $300/MWh, was added in 2015 with the purpose of providing an optional step to extend the reserve

[33] *Id.* at 22-23 (citing Pilong Aff. ¶¶ 24-26).

[34] *Id.* at 23.

[35] *Id.* at 24-25.

[36] *Id.* at 24 (citing *PJM Interconnection, L.L.C.*, 139 FERC ¶ 61,057 (2012) (Order No. 719 Compliance Order)).

[37] *Id.* at 24-25 (citing *PJM Interconnection, L.L.C.*, Docket No. ER17-1590-000 (Jul. 7, 2017) (delegated order); *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,017 (2015)).

requirements when PJM operators took actions to schedule additional reserves during conservative operations.[38]

31. PJM argues that the current ORDCs are unjust and unreasonable because the Reserve Penalty Factors are inadequate, as they do not capture all actions PJM operators will take to meet PJM's MRRs, forcing actions at costs above the Reserve Penalty Factors to be taken out-of-market and not reflected in price. PJM also argues that the current ORDCs do not attempt to estimate the value reserves beyond Step 2A (i.e., beyond the MRR plus 190 MW) can provide in reducing the risk of falling below that level in real time.[39]

32. PJM argues that it is unique among RTOs/ISOs given its relatively modest reserve requirements in proportion to its load. PJM explains that in 2018 it carried an average of 2,139 MW of Synchronized Reserve (1.43% of its peak load) and 3,282 MW of Primary Reserve (2.19% of its peak load), while comparable RTOs/ISOs carry 2.2% of their peak load in Synchronized Reserves and 4.4–6.7% of their peak load in Primary Reserves.[40] PJM contends that, given its relatively small margin of reserves, it has a greater probability of a reserves shortage than other RTOs/ISOs.[41]

33. PJM states that it first proposed an $850/MWh Reserve Penalty Factor in 2012 in compliance with Order No. 719 as a compromise between accommodating most operating conditions and allaying stakeholder concerns over high prices.[42] PJM explains that setting the Reserve Penalty Factor too low risks the possibility of economic shortages, where the Reserve Penalty Factor is less than resources' opportunity costs and thus the Security Constrained Economic Dispatch (SCED) engines cannot procure reserves and reflect the marginal cost of reserves in market clearing prices. PJM explains

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[38] *Id.* at 25-26 (citing PJM Interconnection, L.L.C., *Manual 13: Emergency Operations*, § 3.2 (rev. 68, Jan. 1, 2019)). PJM states that Step 2B has never been invoked. *Id.* at 25 n.40.

[39] *Id.* at 26.

[40] *Id.* at 26-27 (explaining that ISO New England Inc.'s (ISO-NE's) 10-Minute Total Reserve requirement is 6.7% of its peak load, New York Independent System Operator's (NYISO's) Total Synchronous Reserves requirement is 2.2% of its peak load, and NYISO's Total 10-Minute Reserves requirement is 4.4% of its peak load).

[41] *Id.*

[42] *Id.* at 27-28 (citing Order No. 719 Compliance Order, 139 FERC ¶ 61,057 at P 62).

that $850/MWh was a reasonable Reserve Penalty Factor at the time, because the energy market offer cap was $1,000/MWh, so it was unlikely resources' opportunity costs would exceed $850/MWh and cause an economic shortage.[43]

34. PJM argues that its $850/MWh Reserve Penalty Factors are now unjust and unreasonable because Order No. 831 increased the price-setting energy offer cap to $2,000/MWh.[44] PJM explains that Order No. 831 increased the cap on price-setting energy offers to $2,000/MWh, provided offers above $1,000/MWh are cost-justified.[45] PJM explains that if offers above $1,000/MWh set the Locational Marginal Price (LMP), it will significantly increase the opportunity cost for resources to be dispatched away from their profit-maximizing output level in order to provide reserves.[46] PJM explains that its operators will dispatch resources with opportunity costs greater than $850/MWh to provide reserves, but those resources' costs will not be reflected in market prices and will instead be covered through uplift.[47]

35. PJM also argues that the current ORDCs unreasonably fail to account for the uncertainties that PJM operators currently address to maintain system reliability. PJM explains that it must conduct prospective forecasting and planning on an ongoing basis to ensure that reserve requirements are maintained throughout the operating day.[48] PJM explains that some level of error is always present with forecasts, including factors such as actual load, actual interchange, and the actual performance and availability of generation resources. PJM states that, to account for these operational uncertainties, its operators will often bias the load forecast input to the Intermediate Term (IT) SCED engine to ensure that adequate generation is online and available for the Real-time (RT)

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[43] *Id.* at 28-29.

[44] *Offer Caps in Mkts. Operated by Reg'l Transmission Orgs. & Indep. Sys. Operators*, Order No. 831, 157 FERC ¶ 61,115 (2016), *order on reh'g & clarification*, Order No. 831-A, 161 FERC ¶ 61,156 (2017), *amended by* 165 FERC ¶ 61,136 (2018).

[45] PJM Transmittal at 29.

[46] *Id.* at 29-31 (noting that in addition to the marginal cost, LMP also includes congestion and losses which may increase or decrease the LMP relative to the marginal energy offer). PJM provides several examples of how the operators may need to manually commit resources to provide reserves. *Id.* at 29-30.

[47] *Id.* at 31-33.

[48] *Id.* at 34-35 (citing Pilong Aff. ¶¶ 5-7).

SCED engine to meet PJM's reserve requirements.[49] In certain instances, PJM explains that operators will also take out-of-market actions to manually commit additional generating resources, which may occur when longer-lead-time resources must be committed prior to the two-hour IT SCED window or if there is a locational need for reserves due to major transmission constraints.[50]

36. PJM states that neither biasing nor out-of-market commitments are presently incorporated into the design of the ORDCs. PJM also states that the purpose of Step 2A on the ORDCs was not explicitly to value reserves beyond the MRR, and the magnitude of Step 2A is not consistent with the magnitude of the real-time uncertainties in the PJM market, where the average wind forecast error alone is around 160 MW. PJM states that the vertical ORDCs prohibit PJM from explicitly scheduling the flexibility it needs to accommodate forecasting uncertainties, which PJM argues mutes investment incentives for flexible resources.[51] PJM also states that both biasing and out-of-market commitments can result in uplift if a resource needed to provide reserves is scheduled outside of the market clearing engine.[52]

37. PJM explains that the existing ORDCs run counter to the Commission's prior acknowledgement of the value to reliability and price stability that excess capability provides in other contexts. PJM cites to the RPM[53] settlement where the Commission identified the failure of vertical demand curves in PJM to reflect the incremental value to reliability that capacity beyond the Installed Reserve Margin creates.[54] In that order, PJM states that the Commission observed that "'[u]nder a vertical demand curve, capacity above the Installed Reserve Margin[[55]] is deemed to have no value,' but nonetheless '[i]ncremental capacity above the Installed Reserve Margin is likely to provide additional

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[49] *Id.* at 35 (citing Pilong Aff. ¶¶ 6-9).

[50] *Id.* at 36 (citing Pilong Aff. ¶¶ 18-20).

[51] *Id.* at 36-37.

[52] *Id.* at 37-38.

[53] The RPM is PJM's construct for obtaining capacity needed to ensure long-term reliability.

[54] *Id.* at 38 (citing *PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,331 (2006)).

[55] The Installed Reserve Margin is the installed capacity percent above the forecasted peak load required to satisfy a loss of load expectation of one occurrence in 10 years.

reliability benefits, albeit at a declining level.'"[56] PJM states that Commission also stated on rehearing that "the vertical demand curve results in extremely volatile pricing, because as long as supply exceeds the required amount, the price falls precipitously, while, when capacity is short, price will rise to the deficiency penalty level."[57] PJM argues that the underlying concerns regarding PJM's vertical demand curves in the capacity market are also applicable to the vertical ORDCs, which prevent PJM from accommodating legitimate forecasting uncertainties while ignoring the incremental value that the reserves provide.[58]

38. Finally, in addition to arguing that its current Synchronized Reserve design and its ORDCs are unjust and unreasonable, PJM also argues that the current misalignment between its day-ahead and real-time reserve markets renders its reserve market construct unjust and unreasonable. PJM explains that its current market design utilizes a 30-minute Reserve product in the day-ahead market, known as Day-Ahead Scheduling Reserve, but utilizes 10-minute Reserve products in real time, both Synchronized Reserves and Primary Reserves, with no attempt at a forward procurement of the 10-minute Reserve products in the day-ahead market. PJM states that the lack of a day-ahead market product precludes resources capable of providing 10-minute Reserves from being able to lock in a forward revenue stream.[59] PJM states that this lack of day-ahead commitment is not procuring 10-minute Reserves at the lowest cost because, in real time, PJM ignores longer-lead-time resources that may have been available and more cost-effective, relative to a day-ahead procurement. PJM states that, in extreme circumstances, this could result in under-scheduling the needed reserves, causing unnecessary real-time shortages.[60]

39. Conversely, PJM explains that the 30-minute Reserve product is not valued in real time, as there is no 30-minute real-time reserve requirement. Without a real-time requirement, PJM argues that the market fails to recognize any value the 30-minute product may have in real-time operations.[61]

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[56] *Id.* (quoting *PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,331 at P 76).

[57] *Id.* (quoting *PJM Interconnection, L.L.C.*, 119 FERC ¶ 61,318, at P 99 (2007)).

[58] *Id.* at 38-39 (stating that the uncertainties are projected to increase in the future).

[59] *Id.* at 39-40.

[60] *Id.* at 40-41.

[61] *Id.* at 41.

40. PJM states that the lack of day-ahead and real-time alignment creates additional commitment mismatches, as the 30-minute Reserve product will impact the commitment of resources in the day-ahead market and influence which resources are cleared to provide energy or reserves. PJM states that the misalignment can also result in different transmission constraints binding between the day-ahead and real-time markets, leading to additional balancing congestion, which is a cost that is allocated to real-time load and exports.[62] PJM explains that there is no guarantee that resources procured as 30-minute Reserves in the day-ahead market can provide 10-minute Reserves in real time due to ramping capabilities and the two different time horizons.[63] PJM states the modeling discrepancies can also provide opportunities for harmful arbitrage, which PJM argues will not lead to market efficiencies that price convergence could engender since there are no prices to converge given the different products.[64]

b. <u>Comments and Protests</u>

41. Several parties filed comments supporting PJM's claims and rationale for why the existing reserve market construct is no longer just and reasonable.[65] Exelon, for example, argues that PJM's evidence of operators taking extensive, inefficient, and discriminatory out-of-market-actions to ensure reliability demonstrates that the current reserve market construct is unjust and unreasonable.[66] Further, Exelon explains that PJM's current reserve market design leads to non-performance by resources, artificial shortages,

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[62] *Id.*

[63] *Id.* at 41-42.

[64] *Id.* at 43.

[65] Parties include Exelon, CEE, ETI, Duke, NEI, P3, Dominion, API, Calpine and LS Power, IRI, Direct Energy, Vistra, EPSA, and PSEG.

[66] Exelon Comments at 1-5, 8-9, 10-22 (noting that the operators' actions effectively lead to the procurement of reserve capacity without payment for that service, and that such actions distort prices); *see also* IPI Comments at 4-6 (arguing that operator actions and out-of-market payments are non-transparent to market participants and distort market prices); Direct Energy Comments at 2-3; EPSA Comments at 9-10 (arguing that operators' biasing raises filed rate doctrine concerns, because such actions significantly affect rates) (citing 16 U.S.C. § 824d(c) (2018)). Exelon argues that although PJM has a large planning reserve margin—currently 22%—this capacity does not help PJM's operators in real-time if those resources have not been mobilized to be ready to respond to changing system conditions. Exelon Comments at 7-8.

unnecessary uplift, and price suppression.[67] Exelon notes that in similar contexts, the Commission has made clear that an individual component of an existing market design may be just and reasonable, but its combination with other design elements can still result in unjust and unreasonable rates.[68]

42. CEE, ETI, P3, Dominion, IPI, and EPSA argue that pursuant to PJM's current reserve market design, Tier 1 reserves are undercompensated in an unduly discriminatory manner, operator actions mute proper price signals, and the $850/MWh Reserve Penalty Factors and misalignment of the day-ahead and real-time markets leads to market inefficiencies, all of which together create an unjust and unreasonable rate.[69] NEI notes that operators often manually increase reserves through biasing even when conditions do not warrant such concern, leading to a surplus of Synchronized Reserves of more than 1,000 MW in 25% of all hours.[70] API argues that evidence of reserve prices near $0.00/MWh, with significant uplift payments, during various cold snaps (peak demand conditions) is indicative of an unjust and unreasonable market construct.[71] Dominion and PSEG argue that the current $850/MWh Reserve Penalty Factors, which are significantly lower than the $2,000/MWh energy offer cap) impede the ability of reserve prices to reflect the true cost of generation to meet load and reserve requirements.[72] IPI argues that PJM's current market construct ignores the value of reserve beyond the MRR, which is unjust and unreasonable.[73] EPSA argues that the Tier 1/Tier 2 reserve construct

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[67] *Id.* at 14-20; *see also* PSEG Protest at 3, 14-17 ("[t]he willingness of consumers to pay for reserves is not being reflected in the [current PJM reserve market] pricing algorithm which frequently assigns no value to reserves deemed necessary by the operators for reliability").

[68] Exelon Comments at 9 (citing *PJM Interconnection, L.L.C.*, 115 FERC ¶ 61,079, at P 29 (2006); *Midcontinent Indep. Sys. Operator, Inc.*, 162 FERC ¶ 61,176, at PP 56, 79 (2018)).

[69] CEE Comments at 4-10; ETI Comments at 2-3; P3 Comments at 3-6; *see also* Dominion Comments at 2-5; IPI Comments at 4-8; EPSA Comments at 5-13.

[70] NEI Comments at 7-8 (citing Pilong Aff. at tbl.1).

[71] API Comments at 2.

[72] Dominion Comments at 3; PSEG Protest at 12-13.

[73] IPI Comments at 8 (citing Hogan & Pope Aff.); *see also* PSEG Protest at 17-19 (arguing that PJM's current market design fails to maximize social welfare and reflect consumers' willingness to pay for reserves).

is "discriminatory on its face," because Tier 1 reserves are paid nothing for providing the same exact product as Tier 2 reserves—textbook undue discrimination forbidden by the FPA.[74]

43. Dominion also argues that the inefficient dispatch and poor price signals created by the current PJM market disrupt long-term investment signals.[75] CEE, P3, ETI, and PSEG argue that the problems present in PJM's current reserve market are only going to become more problematic moving forward, as more price-responsive and dispatchable load, Distributed Energy Resources, and utility-scale variable resources are added to the system.[76]

44. Exelon states that during hot weather alerts, PJM typically increases the Day-Ahead Scheduling Reserve by 2 to 3 times the normal level, which translates to between 8,000 to 16,000 MW of reserves.[77]

45. The Ohio Commission, the Maryland Commission, the PJM Load Coalition, and the IMM argue that PJM has not met its burden under FPA section 206 to show its current reserve market construct is unjust and unreasonable. The Ohio Commission argues that while "certain aspects of PJM's filing may represent improvements over the

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[74] EPSA Comments at 7-8 (citing *Sebring Utils. Comm'n v. FERC*, 591 F.2d 1003, 1009 n.24 (5th Cir. 1979) (explaining that the "essence" of the statutory prohibition against undue discrimination "is that those who are similarly entitled must be treated equally"); *Transwestern Pipeline Co.*, 36 FERC ¶ 61,175, at 61,433 (1986) ("Undue discrimination is in essence an unjustified difference in treatment of similarly situated customers.") (citation omitted)).

[75] Dominion Comments at 4-5.

[76] CEE Comments at 10; P3 Comments at 6 (citing Cavicchi Aff. ¶ 28; Nicholson Whitepaper at P 3); ETI Comments at 2; PSEG Protest at 11; *see also* NEI Comments at 6 (stating that distorted price signals in the reserve market are affecting choices by certain resources, in particular nuclear resources, of whether to stay in the market or close); Calpine and LS Power Comments at 6; PSEG Protest at 3 (arguing that current construct fails to value unit flexibility and is inefficient approach to deal with changing grid); PSEG Protest at 19-22 (same).

[77] Exelon Comments at 17-18.

existing market design, PJM has not adequately demonstrated that the existing overall market design is unjust and unreasonable."[78]

46. The Maryland Commission and the PJM Load Coalition argue that PJM has not shown that the Tier 1/Tier 2 reserve structure is unjust and unreasonable or unduly discriminatory. These parties state that Tier 1 reserves and Tier 2 reserves differ, because calling on Tier 1 reserves does not require a departure from the resources' profit-maximizing economic dispatch point (i.e., Tier 1 reserves incur no opportunity cost), unlike Tier 2 reserves.[79] Second, the Maryland Commission argues that PJM's operational uncertainty argument associated with Tier 1 reserves is illogical, because the average response rates of Tier 1 and Tier 2 reserves are not significantly different and instead suggest similar response concerns for both products.[80] The IMM argues that PJM mischaracterizes the response of Tier 1 reserves to spinning events, noting that the Tier 1 response rate actually typically exceeds PJM's Tier 1 reserve estimates, and thus Tier 1 response rates do not provide evidence that the Synchronized Reserve market is unjust and unreasonable.[81]

47. The Maryland Commission and the PJM Load Coalition state that PJM has not demonstrated that the current first-step Reserve Penalty Factor of \$850/MWh is no longer just and reasonable.[82] The Maryland Commission argues that while cost-based incremental energy offers can now rise to \$2,000/MWh, PJM's filing does not address

[78] Ohio Commission Protest at 2-3. The Ohio Commission supports PJM's efforts to consolidate the Tier 1 and Tier 2 reserve products, to value reserves in excess of the MRR, and to align its reserve products in the day-ahead and real-time markets. *Id.* at 3-10.

[79] Maryland Commission Protest at 4-5; PJM Load Coalition Protest at 21-22 (arguing that Tier 1 and Tier 2 resources are not "similarly situated" as required for a finding of undue discrimination).

[80] Maryland Commission Protest at 4-5 (arguing that PJM provides no logical reasoning why Tier 2 reserves respond only slightly better than Tier 1 reserves). The Maryland Commission argues that the real problem is that PJM fails to provide operators with actual, real-time resource operating data and performance capabilities. *Id.* at 5-6.

[81] IMM Protest at 19-21.

[82] Maryland Commission Protest at 6-8; PJM Load Coalition Protest at 26.

the likelihood of this happening.[83] Similarly, the PJM Load Coalition argues that a particular energy price level cannot constitute a legitimate opportunity cost if it rarely or never is available.[84] The Maryland Commission states that under the existing reserve market construct, PJM has not reported excessive MRR shortages or significant spinning events, or significant events when energy prices exceeded $1,000/MWh and reserves prices did not respond.[85] The Maryland Commission also rejects PJM's argument that emergency energy imports from neighboring regions, which may exceed $2,000/MWh, justify a higher Reserve Penalty Factor.[86]

48. The PJM Load Coalition and the IMM argue that PJM has not shown that its current ORDC shape is unjust and unreasonable. The PJM Load Coalition and the Maryland Commission argue that PJM ignores Step 2B on the current ORDC, which it has yet to utilize.[87] The PJM Load Coalition and the Maryland Commission argue that PJM can currently utilize Step 2B to procure additional reserves to address operational uncertainty during Hot/Cold Weather Alerts and other escalating emergency conditions, when needed, without increasing the Reserve Penalty Factors above existing levels.[88]

49. The IMM also argues that PJM misidentifies the vertical nature of the ORDC as preventing PJM from scheduling additional reserves, but a vertical ORDC is consistent with scheduling more reserves under a market design where PJM can update the reserve requirements.[89] The IMM argues that PJM's reliance on the variable resource

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[83] Maryland Commission Protest at 7 (stating that PJM's own prior analysis, which found that only one five-minute interval experienced any individual bus-level LMP over $1,000/MWh during times of reserve shortage, refutes the need to increase the penalty factor) (citing PJM Interconnection, L.L.C., *PJM Market Participants' Response to Prices Exceeding $1,000/MWh* (2019), https://www.pjm.com/-/media/committees-groups/committees/mc/20190422-webinar/20190422-item-07b-ferc-required-reserve-shortage-report.ashx).

[84] PJM Load Coalition Protest at 26-27 (citing Al-Jabir Aff. ¶ 14).

[85] Maryland Commission Protest at 8 (noting that these were concerns of the Commission in 2012).

[86] *Id.* at 8-9.

[87] *Id.* at 6, 9-10 (arguing that the $300/MWh Reserve Penalty Factor for Step 2B incentivizes sufficient resource response); PJM Load Coalition Protest at 31-32.

[88] PJM Load Coalition Protest at 30-32; Maryland Commission Protest at 10.

[89] IMM Protest at 15-16.

requirement (VRR) curve used in PJM's capacity market as justification for moving away from the vertical ORDC is not correct, as the VRR curve is not based on the value of lost load but on the cost of new entry (CONE) of a reference unit, and the VRR curve is designed to provide incentives to invest in capacity, while the ORDC is not.[90] The PJM Load Coalition argues that the Electric Reliability Council of Texas' (ERCOT's) ORDC provides no support for PJM's FPA section 206 complaint, because PJM has a capacity market construct and ERCOT does not, so their ORDCs have different purposes.[91]

50. The PJM Load Coalition argues that PJM has not demonstrated that energy and reserve prices are unjust, unreasonable, or otherwise fail to fairly compensate generators. The PJM Load Coalition argues that PJM only cites one example as evidence that Synchronized Reserves are undercompensated—cold weather conditions from January 30-31, 2019—which does not prove that the current market design is flawed, but rather that low prices occur when there is excessive supply relative to demand. The PJM Load Coalition argues that PJM was carrying reserves significantly in excess of its MRR during the cited period, and that PJM's analysis confirms that many supply resources with capacity obligations were simply not needed to meet demand.[92]

51. The PJM Load Coalition argues that PJM has not shown that it is incapable of attracting sufficient reserves to meet its MRR, nor has it presented any analysis to substantiate its speculative assertion that, absent reserve pricing changes, anticipated higher levels of intermittent resources will lead to future reliability problems.[93] The IMM similarly argues that the projection of future increases in intermittent resources does not render PJM's current market unjust and unreasonable.[94] The IMM rejects PJM's argument that it has less flexibility available than other RTOs/ISOs, and that it is different from other RTOs/ISOs, explaining that efficient energy and reserve market

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[90] *Id.* at 16-17.

[91] PJM Load Coalition Protest at 27-28 (arguing more generally that ORDC approaches in other regions do not render PJM's ORDC approach unjust and unreasonable).

[92] *Id.* at 18-19 (noting that PJM had a reserve margin of upwards of 25% during the peak hour of January 30-31, 2019).

[93] *Id.* at 22-24 (noting that PJM has failed to identify any specific instance where transmission system reliability was threatened due to an insufficient procurement of reserves and noting that PJM on average carries reserve levels well in excess of its reserve requirements) (citing Al-Jabir Aff. ¶ 8, Graph 1).

[94] IMM Protest at 18-19.

pricing does not differ based on whether the RTO/ISO relies on a capacity market or cost-of-service regulation.[95]

52. The PJM Load Coalition and the IMM argue that PJM has not demonstrated that uplift cost levels are unjust or unreasonable. The PJM Load Coalition argues that efficiency should be evaluated in relation to the cost to consumers of procuring the reserves that are needed to maintain system reliability, and PJM's own calculations show its Reserve Market Proposal will increase net expenses for consumers.[96] The IMM argues that uplift in PJM is low, accounting for $0.23/MWh of energy, with the majority driven by specific issues with certain supply resources or local transmission system conditions. Further, the IMM argues that there is a lack of evidence to directly link operator actions, reserve market outcomes, or the ORDC shape to quantifiable levels of uplift.[97]

53. The IMM argues that PJM's assertion that it needs to maintain reserves does not necessitate that reserve prices always or usually exceed $0.00/MWh. The IMM argues the supply and demand, not operational value, should determine the most efficient market price.[98] The IMM asserts that the principles of energy pricing hold for reserves pricing as well—if the marginal cost of the marginal unit providing reserves is $0.00/MWh, the efficient reserve price is zero. The IMM explains that this is frequently the case because reserves exceed the reserve requirement during most hours of the day and the majority of energy in PJM is provided by coal and combined cycle units that create large quantities of zero-cost Synchronized Reserves.[99]

54. The IMM argues that PJM has not established that misalignment between reserve products in the day-ahead market and the real-time market is grounds for finding the reserve markets unjust and unreasonable. The IMM argues that the misalignment between the day-ahead and real-time markets cannot be resolved given the intra-hour ramp sensitivity necessary when determining a resource's ramping capability in real-time. The IMM argues that PJM has not provided evidence to support the claim that the

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[95] *Id.* at 19 (citing *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,030, at P 46 (2019)).

[96] PJM Load Coalition Protest at 25-26.

[97] IMM Protest at 17-18.

[98] *Id.* at 13.

[99] *Id.* at 13-14.

current practice results in higher costs than if PJM had procured the 10-minute Reserve products in the day-ahead market.[100]

55. The PJM Load Coalition argues that substantial administrative market design changes are already underway in PJM, and the Commission should avoid introducing additional complexity into the energy and capacity markets at this time through implementation of these reserve market reforms.[101]

c. Answers

56. In response to commenters, the IMM argues that PJM does not reach any conclusion about whether load forecast uncertainty or generator behavior is the larger issue. While PJM states that its operators bias the load forecasts in IT SCED, the IMM argues that PJM fails to point out that if the negative bias is too large, prices will be inflated. The IMM argues that PJM does not assert that operator bias is systematically wrong.[102] The IMM contends that if PJM is concerned about operator actions not being clear, transparent, or rule-driven, PJM should address that issue directly.[103]

57. The IMM argues that PJM did not provide evidence to show that operators actually commit units based on positive bias, contrary to what Exelon argues, as IT SCED is a recommendation not a defined action.[104] Further, the IMM argues that the claim that, absent biasing, PJM would have been in shortage conditions 29.1% of the time in 2018 is inaccurate, because it assumes that the IT SCED recommendations always result in actual commitments. The IMM asserts that the IT SCED analysis assumes that all recommendations result in unit commitment decisions which is not correct, as there is no evidence that suggests a one-for-one causal relationship.[105]

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[100] *Id.* at 21-22.

[101] PJM Load Coalition Protest at 32-36 (referencing fast-start pricing change in Docket No. EL18-34, variable operations and maintenance cost changes in Docket Nos. ER19-210 and EL19-8, and capacity market minimum offer price rule changes in Docket Nos. EL18-178 et al.).

[102] IMM First Answer at 6-7.

[103] *Id.* at 7.

[104] *Id.* at 7-8.

[105] *Id.* at 9.

58. PJM and Exelon argue that there is substantial evidence to show that the current reserve market rules are unjust and unreasonable.[106] Exelon argues that treating resources differently for providing the same reserves is discriminatory and creates "pseudo-reserves" that are not compensated.[107] PJM disagrees with the IMM over the calculation of the Tier 1 response rates, arguing that RT SCED reflects the actual amount of Tier 1 reserves PJM is relying on to maintain reliability, not settlement data.[108] PJM explains that all resources that increase their output following a Synchronized Reserve Event receive Tier 1 reserve credits; thus, the universe of resources receiving Tier 1 reserve credits is greater than the resources on which PJM was relying to provide Tier 1 reserves.[109]

59. PJM reiterates its rationale for why the $850/MWh Reserve Penalty Factor is unjust and unreasonable, pointing again to the changed circumstances since 2012.[110] PJM avers that no party has refuted that the Reserve Penalty Factor should be based on the opportunity cost of providing reserves instead of energy.[111] PJM states that the IMM's argument that the Reserve Penalty Factor should not be capped at a historical opportunity cost level but at one that captures expected opportunity costs is what PJM has proposed.[112]

60. PJM argues that supply is skewed by rules that deem Tier 1 reserve Market Sellers to be providing reserves at zero price even though they have not offered, or been committed, to provide reserves. PJM argues that relying on other resources to provide the reserves in the event of a shortfall only underscores the difficulty in constructing an accurate supply curve when a significant portion of the purported reserve suppliers have no obligation to respond. PJM argues that hoping that other suppliers respond is not a

[106] PJM Answer at 3-5; Exelon Answer 5-6.

[107] Exelon Answer at 6-7.

[108] PJM Answer at 33-34.

[109] *Id.* at 35.

[110] *Id.* at 31.

[111] *Id.* at 32.

[112] *Id.* at 32-33.

reasonable administrative market construct. PJM states that the current reserve market rules are not a formula for efficient market prices.[113]

61. PJM argues that the record shows that the current ORDC does not adequately reflect the reliability value of procuring reserves above the MRR—it assumes such reserves have zero value.[114] PJM argues that the current rules for demand are determined not by economic fundamentals, but by an overly simplistic demand curve that does not reflect the need for reserves based on load and resource uncertainties. PJM states that the disconnect between the ORDC and the system's needs for reserves will only grow as the share of intermittent resources climbs in the future.[115]

62. As explained further in the Reply Affidavit of Adam Keech (Keech Reply Affidavit), PJM states that in 2018, in 56.8% of hours the Synchronized Reserve market clearing price was $0.00/MWh and in 97.5% of the hours the Non-Synchronized Reserve market clearing price was $0.00/MWh. PJM states that under market simulations, these percentages drop to 8.8% and 9.7%, respectively, when PJM corrects for market deficiencies. PJM argues that this shows that $0.00/MWh prices are not an efficient market outcome based on supply and demand, but a consequence of the shortcomings of the existing market rules.[116] PJM also points to the fact that 50% of the current Tier 2 reserve market is settled through uplift payments.[117]

63. In response to the Maryland Commission, PJM explains that Step 2A is not discretionary, as it was revised in 2017 to be permanent.[118] PJM explains that the dispatch tools used by operators assume that reserves will be purchased at the Reserve Penalty Factor of $300/MWh up to the MRR. PJM explains that operators do not choose to bias instead of utilizing Step 2A; rather they continue to bias even considering Step 2A.[119] PJM explains that Step 2A is limited to 190 MW and was designed to address and prevent transient shortages that would cause price spikes. PJM explains that the 190 MW

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[113] *Id.* at 11.

[114] *Id.* at 7-19.

[115] *Id.* at 11-12.

[116] *Id.* at 12.

[117] *Id.* at 12-13.

[118] *Id.* at 14 (citing of PJM Interconnection, L.L.C. Filing, Docket No. ER17-1590-000, at 7-8 (filed May 12, 2017)).

[119] *Id.* at 14-15.

value was the average Synchronized Reserve deficiency shown in the RT SCED over a 14-month period prior to Step 2A's implementation. PJM argues that Step 2A was not designed to address the prevalence and magnitude of its current market uncertainties.[120]

64. PJM argues that Step 2B of its current two-step ORDC is not a solution to the dispatch schedule biasing or other out-of-market operator actions. PJM argues that Step 2B was intended to address a variety of out-of-the-ordinary or emergency conditions when PJM declares Conservative Operations. These situations, PJM argues, cover events that threaten major transmission lines, such as fires, hurricanes, tornados, geo-magnetic disturbances, and physical or cyber-attacks. PJM reiterates that Step 2B has not yet been invoked because these conditions have not occurred.[121] PJM explains that operator biasing is meant to create headroom in the face of general uncertainty that is constantly present, and because uncertainty is always present, using Step 2B is not practical as a long-term solution; thus Step 2B is not the answer for addressing operational concerns detailed in its Reserve Market Proposal.[122] P3 and Exelon share this view, arguing that Step 2B assumes that operational uncertainties do not exist in normal operating conditions, which is likely why it has never been used.[123]

65. Exelon argues that load biasing is a primitive tool that impairs the efficiency of the market. Exelon explains that load biasing is not based on a formula or historical data, as it lacks an objective standard, formula, or data, and is an inaccurate means of accounting for operating uncertainties.[124]

66. PJM argues that the Commission should reject the IMM's view that reserves beyond the MRR do not have value, and thus PJM should rely on a vertical demand curve. PJM argues that reserves beyond the MRR have value because they help avoid the costs of emergency actions taken when reserves fall below the MRR.[125]

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[120] *Id.* at 15.

[121] *Id.* at 15-17.

[122] PJM Answer at 16-17.

[123] P3 Answer at 11; Exelon Answer at 13-14.

[124] Exelon Answer at 7.

[125] PJM Answer at 18-19. PJM argues that the IMM's view that an ORDC should not pay any price for reserves beyond the MRR runs contrary to the Commission's prior acceptance of PJM's current ORDC. *Id.*

67. PJM argues that the PJM Load Coalition attempts to downplay the significance of the market placing little to no value on reserves during extreme weather events in January 2019. PJM argues that operator bias caused the excess supply that led to low prices. PJM explains that operators performed out-of-market actions to schedule extra supply, and therefore prices did not transparently reflect the core supply-and-demand fundamentals that would have signaled a need for more reserves.[126] Exelon argues that neither the IMM nor the PJM Load Coalition, in their protests, address the state of the system before out-of-market intervention by the operators. Exelon argues that the fundamental point is that PJM's operators cannot trust the existing market mechanism to ensure sufficient reserves are procured.[127]

68. Exelon avers that the IMM's argument – that PJM engages in negative load biasing as well as positive load biasing – somehow suggests that they cancel each other out. Exelon argues that the existence of negative load biasing is no reason to ignore market flaws that have made positive load biasing necessary, nor does it mitigate the fact that in up to 29% of 5-minute intervals PJM operators needed to engage in positive load biasing to prevent a reserves shortage.[128]

69. Exelon states that uplift costs are a symptom of price formation inaccuracies that result in the market failing to see the correct price signal. Exelon states that when this occurs the traditional single-clearing-price market gets converted into a pay-as-bid system on the margin. Exelon argues that the deviation from a single-clearing-price market is antithetical to a properly functioning competitive market for which the Commission strives.[129]

70. PJM states that several protestors have argued that its Reserve Market Proposal is not warranted because the amount of uplift in the reserve market is small, particularly when compared to the energy market uplift. However, PJM argues that barely a third of reserve production costs were compensated through reserve market clearing prices, while the remainder was covered only through uplift. PJM states that, in 2018, it paid 46.2% of Tier 2 reserves through uplift, covering only 36.1% of production costs, instead of through market clearing prices. PJM avers that this is a sign that the reserves market is

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[126] *Id.* at 26-27 (citing Pilong Reply Aff. ¶¶ 7-8, tbl.1).

[127] Exelon Answer at 8-9.

[128] *Id.* at 9-10.

[129] *Id.* at 12-13 (citing *PJM Interconnection, LLC*, 117 FERC ¶ 61,331 at P 141; *Midwest Indep. Transmission Sys. Operator, Inc.*, 102 FERC ¶ 61,196, at P 32 (2003)).

not a well-functioning market.[130] Exelon adds that relative to the energy market, which is 6 times larger than the reserve market, an equivalent uplift figure would be $4.2 billion.[131]

71. P3 notes that as the generation fleet changes over time, with higher penetrations of intermittent and behind-the-meter resources, the standard reserve product may no longer meet the MRR because of fast or unexpected load ramps.[132] PJM argues that the Commission has long held that an RTO/ISO need not wait for a reliability emergency before seeking reforms under FPA section 206.[133]

72. The IMM restates its earlier position that PJM did not show that the existing reserve market rules are unjust and unreasonable. The IMM argues that, given the co-optimization of energy and reserves, PJM is arguing that LMP is not just and reasonable.[134] The IMM repeats its assertion that PJM has not provided any analysis to link IT SCED biasing to actual commitments in RT SCED and market results,[135] noting that operators do not act on the majority of commitments recommended by IT SCED cases. The IMM states that the IT SCED bias is a form of sensitivity analysis. The IMM states that when PJM biased the IT SCED cases the most in January 2019, the IT SCED recommended a 2,562 MW commitment, but only 932 MW were committed by PJM: 793 MW were self-scheduled, and 116 MW had no commitment reason.[136]

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[130] PJM Answer at 28 (citing Keech Reply Aff. ¶¶ 19-20).

[131] Exelon Answer at 11.

[132] P3 Answer at 12 (citing Nicholson Aff. ¶¶ 70-72).

[133] PJM Answer at 10 (citing *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208, at P 4 (2015), *order on reh'g*, 155 FERC ¶ 61,157 (2016)).

[134] IMM Second Answer at 4.

[135] *Id.* at 5.

[136] *Id.* at 6-7 (noting that PJM did not raise the IT SCED load biasing issue during the Energy Price Formation Senior Task Force stakeholder process).

73. The IMM argues that reserve market uplift does not warrant changes to the ORDC. The IMM argues that PJM's answer shows the uplift paid for the Synchronized Reserve market, but states that uplift payments can include incorrect settlement calculations and a mismatch between the dispatch interval and the pricing interval.[137]

d. Commission Determination

74. We find that PJM has met its burden under section 206 of the FPA to show that its current reserve market is unjust and unreasonable. PJM presents record evidence that its reserve market is systematically failing to acquire within-market the reserves necessary to operate its system reliably, to yield market prices that reasonably reflect the marginal cost of procuring necessary reserves, and to send appropriate price signals for efficient resource investment. PJM also demonstrates that the reserve products it procures in the day-ahead and real-time markets produce poor incentives for resource performance and inhibit efficient procurement of the types of reserves needed to address various operational uncertainties.

75. As PJM explains, the need for reserves in a system is rooted in uncertainties.[138] As PJM affiant Dr. Patricio Rocha Garrido states, "if no uncertainties are present, then no reserves are needed."[139] However, PJM confronts numerous uncertainties when selecting supply resources to serve demand, and thus procures reserves to provide operational flexibility and ensure reliability in the face of those uncertainties. NERC requires that PJM acquire adequate reserves to recover from the largest contingency on the system, but, as PJM contends, the sum of numerous individual uncertainties renders the NERC-mandated quantity insufficient. For example, in the real-time market PJM procures reserves in advance of each operating interval based on a number of forecasts, including load, generator availability and performance, and interchange. Knowing that actual values for those parameters will deviate—possibly by large quantities—from the forecasts, PJM may deem it necessary to procure additional reserves beyond the NERC-mandated quantity. We agree with PJM's contention that its existing reserve market design does not reliably accomplish this task; it is evidence of a serious flaw.

76. Demand for reserves within PJM's market is represented by the ORDCs, which are tied to the NERC-mandated reserve requirements. We agree with PJM that its existing ORDCs, and the various reserve requirements on which they are based, fail to reflect the universe and magnitude of the operational uncertainties with which PJM operators must contend. As evidence of this shortcoming, PJM describes the biasing and

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[137] *Id.* at 8-9.

[138] PJM Answer, Rocha Garrido Reply Aff. ¶¶ 2-8; PJM Transmittal at 2.

[139] PJM Answer, Rocha Garrido Reply Aff. ¶ 8.

out-of-market actions its operators regularly take to procure quantities of reserves in excess of those determined by the ORDCs.

77. PJM provides data from calendar year 2018 that shows PJM operators frequently bias demand in the market software by hundreds or even thousands of MWs.[140] In operating intervals in which PJM ultimately found itself in a reserve shortage, operators' *average* bias was 1,471 MW, suggesting that at times the bias was even greater.[141] This is consistent with the testimony of PJM affiant Mr. Pilong, who states that, "[f]or example, during a morning load pick-up when demand is increasing rapidly, the dispatcher may bias the cases by 2,000-3,000 [MW] to account for faster-than-expected load, lower-than-expected generation, and generators that are slow to ramp-up."[142] While the load increase during morning ramp periods may be more pronounced on some days than others (e.g., on weekdays versus weekends or in peak seasons versus shoulder seasons), morning ramp periods are not anomalous. They are regular operational conditions with which operators must contend. Data demonstrating that PJM operators are routinely biasing market software inputs by such large quantities because, in their judgment and experience, the need for reserves to operate the PJM system reliably will far exceed the contingency-based MRRs is strong evidence of a flaw in the existing reserve market design.

78. PJM also provides data on operator biasing during a two-day January 2019 cold snap that is representative of particularly challenging operational conditions. Those data show that operators biased demand for reserves by between 1,328 MW and 2,048 MW on average across 576 five-minute intervals spanning those two days.[143] The data also suggest that even during periods when PJM likely anticipates challenging operational conditions due to forecasted weather, and therefore when PJM may invoke additional pre-emergency steps such as calling on pre-emergency demand response, the need for reserves still exceeds the existing MRRs.

79. PJM explains why its existing MRRs are proving insufficient. Like other RTOs/ISOs, which are also Balancing Authorities, PJM must comply with NERC standard BAL-002, which mandates that PJM maintain reserves to respond to the loss of the largest single contingency on the PJM system.[144] PJM utilizes Primary Reserves—a

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[140] PJM Transmittal, Pilong Aff. ¶¶ 8-17, tbl.1.

[141] *Id.*

[142] *Id.*, Pilong Aff. ¶ 9.

[143] PJM Answer, Pilong Reply Aff. ¶¶ 7-9.

[144] PJM Transmittal, Pilong Aff. ¶ 6.

minimum subset of which must be Synchronized Reserves—to comply with that standard, and sets its Synchronized Reserve and Primary Reserve Requirements at levels that reflect that compliance requirement. PJM states that on average on its system this translates to a Synchronized Reserve Requirement of roughly 1,600 MW and a Primary Reserve Requirement of roughly 2,300 MW, values that are in line with similar requirements in other RTOs/ISOs.[145] However, PJM notes that these requirements are significantly lower as a percentage of system peak load compared to most other RTOs/ISOs.[146] At the same time, PJM presents evidence that it faces among the highest levels of non-contingency operational uncertainties of all RTOs/ISOs. Data showing the average aggregated error, in MW, across the common categories—load forecast error, forced outages, solar forecast error, and wind forecast error—demonstrates that PJM faces among the highest quantity of operational uncertainty among RTOs/ISOs, no doubt due in part to the large size of its system.[147] PJM notes that among itself, the Midcontinent Independent System Operator (MISO), and the California Independent System Operator (CAISO), the other two RTOs/ISOs with similarly high levels of error-based uncertainty, PJM is the only one that does not procure and employ a ramping product, which is one market mechanism to address that uncertainty.[148] The result is that PJM faces significant operational uncertainty that is not currently reflected within its MRRs, and that PJM operators must address through biasing and other out-of-market actions.

80. We agree with PJM that there is substantial evidence in the record in these proceedings that its existing reserve market design fails to recognize and consistently procure within-market a sufficient quantity of reserves to both satisfy the requirements of NERC Reliability Standard BAL-002 and address significant, non-contingency operational uncertainties. This shortcoming does not directly threaten reliability because operators have the flexibility to procure reserves outside the market or by biasing the inputs to market software. However, the fact that PJM operators regularly need to procure thousands of additional MW of reserves—quantities upward of 50-100% of the MRRs—is evidence of a market design that is unjust and unreasonable.

81. We agree with PJM that its existing reserve market fails to produce market prices that reflect the marginal cost of providing reliable service—including reserves necessary to address legitimate non-contingency operational uncertainties. The evidence shows that PJM's operators will, and do, acquire needed additional reserves at costs in excess of

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[145] *Id.* at 26-27.

[146] *Id.*

[147] PJM Answer, Rocha Garrido Reply Aff. ¶ 27, tbl.2.

[148] *Id.* at Rocha Garrido Reply Aff. ¶ 27.

what the current reserve market design allows to be reflected in price.[149] We agree with PJM that the resulting lack of price transparency is inconsistent with proper market design, "which values reserves appropriately and transparently through the market [to] not only support reliability but also incentivize investment in new resources that will provide additional flexibility and efficiency."[150]

82. As further evidence of this problem, data from the IMM's 2018 State of the Market Report shows that nearly half (46.2%) of the revenue for the provision of Synchronized Reserves in PJM is paid through out-of-market, pay-as-bid uplift payments, rather than through market clearing prices.[151] This problem will only be exacerbated with the recent increase in the energy market offer cap, which increases the probability that resources will face opportunity costs of providing reserves in excess of the existing Reserve Penalty Factors. When this occurs, PJM operators will be forced to commit those resources outside of the market to assign them reserves, further stifling accurate reserve price formation.

83. We agree with PJM that the existing market design is consistently failing to produce prices reflecting the marginal cost of procuring necessary reserves.[152] The Commission has previously stated the importance of ensuring accurate, transparent market prices when possible. For example, in its order on PJM's Order No. 719 compliance filing, which approved PJM's use of an ORDC for the first time, the Commission agreed with PJM that "the costs of resources procured to alleviate shortages should be reflected in transparent market prices whenever possible," and that "[p]ayments made only to individual resources and recovered in uplift fail to send clear market signals."[153] We continue to believe that market clearing prices should reasonably reflect the marginal cost of providing necessary reserves, and the record evidence in this proceeding indicates that PJM's existing market design is falling short of that standard. While operators must maintain the flexibility to take actions outside the market when necessary, and not every such action must be captured within market prices to yield a just and reasonable market design, PJM has adequately demonstrated that the shortcomings of its reserve market pricing are substantial and warrant revision.

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[149] PJM Transmittal at 34-35.

[150] *Id.*, Pilong Aff. ¶ 27.

[151] *Id.*, Keech Aff. ¶ 6; PJM Answer, Keech Reply Aff. ¶ 33.

[152] PJM Transmittal at 7-8.

[153] Order No. 719 Compliance Order, 139 FERC ¶ 61,057 at P 63.

84. Finally, the evidence on the record shows that PJM's current reserve product definitions and procurement across the day-ahead and real-time markets is inefficient and provides perverse incentives for resource performance. Specifically, we find compelling data presented by PJM showing that the Tier 1/Tier 2 reserve product distinction among Synchronized Reserves, and particularly the lack of performance obligations and non-performance penalties for resources providing Tier 1 reserves, has failed to properly incentivize performance from Tier 1 reserves when they are called upon to convert reserves into energy.[154] We agree with PJM that its procurement of only 30-minute Reserves in the day-ahead market and only 10-minute Reserves in the real-time market hinders true co-optimization of energy and reserves in the resource commitment timeframe and therefore does not minimize total procurement cost.[155] As PJM also notes, it is the only RTO/ISO without a forward procurement of the reserve type (10-minute Reserves) that it relies on in real-time operations.[156]

85. We agree with PJM that these reserve market design elements poorly incentivize resource performance and present obstacles to the cost-effective procurement of necessary reserves. Synchronized Reserves are the most valuable type of reserves to an operator seeking to maintain system balance, because they are already synchronized to the transmission system and should be capable of responding quickly when called upon. Counting resources toward satisfying the critically important Synchronized Reserve Requirement when those resources have no explicit obligation to respond to a Synchronized Reserve Event and face no consequences for failing to respond unnecessarily increases operational uncertainty and is inconsistent with a general market design that seeks to align incentives for resources with the needs of the PJM system.

86. Similarly, PJM's current failure to procure, on a forward basis, the Primary Reserves on which it relies to meet its requirement under NERC Reliability Standard BAL-002 inhibits the efficient acquisition of those reserves. PJM's current practice potentially excludes from the Primary Reserve supply pool all resources with longer lead times that could be called upon if the demand for Primary Reserves was represented in the day-ahead market. We also agree with PJM that the value it places on 30-minute Reserves should be accurately reflected in the real-time market in order to acquire those reserves in a cost-effective manner.

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[154] PJM Transmittal at 17-21.

[155] *Id.* at 40.

[156] *Id.* at 39.

87. For all of these reasons, we find that PJM has met its FPA section 206 burden to demonstrate that its existing reserve market design is unjust and unreasonable. We address specific protests in turn below.

88. The Maryland Commission, the PJM Load Coalition, and the IMM argue that PJM has not met its burden with regard to the Tier 1/Tier 2 reserves structure because PJM has either not demonstrated a meaningful difference between the two products' response rates when called to convert reserve capability into energy, or not demonstrated that Tier 1 reserves are similarly situated given that they incur no opportunity cost to provide reserves. We disagree. PJM presents data showing that Tier 1 reserves average response rates during the years 2016, 2017, and 2018 are 75.1%, 60.1%, and 63.3%, respectively, compared to Tier 2 reserve response rates of 85.5%, 87.6%, and 74.2% across the same years.[157] This evidence demonstrates a meaningful difference in response rate between Tier 1 and Tier 2 reserves, a difference that PJM reasonably attributes to the disparity in incentives that Tier 1 and Tier 2 reserves face under the existing reserve market rules. The Commission has previously found in other market contexts that good market design should provide adequate incentives for resource performance,[158] and that to the extent a market design fails to do so, it may be unjust and unreasonable.[159] In one such example, the Commission found that revisions to reserve market pricing were necessary as part of the just and reasonable replacement rate because of the performance-incentive benefits they would provide.[160]

89. We also disagree with the Maryland Commission and the PJM Load Coalition that Tier 1 and Tier 2 reserves should not be compensated equivalently because only Tier 2 reserves incur opportunity costs for providing Synchronized Reserves. These parties do not contend that Tier 1 and Tier 2 reserves are not providing an equivalent service when they respond to PJM's instruction to convert reserves into energy. Rather, the difference

[157] *Id.* at 17-19.

[158] *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208 at P 9 ("[I]t is not enough simply to ensure that 'capacity' . . . is procured to meet reserve targets; rather, that capacity must carry with it meaningful performance obligations, and corresponding incentives and penalties, to ensure that those resources actually deliver when needed."); *see also id.* PP 7, 22.

[159] *ISO New England Inc.*, 147 FERC ¶ 61,172, at P 23 (2014) ("[W]e find that ISO-NE's existing Tariff is unjust and unreasonable, because it fails to provide adequate incentives for resource performance, thereby threatening reliable operation of the system and forcing consumers to pay for capacity without receiving commensurate reliability benefits."), *reh'g denied*, 153 FERC ¶ 61,223 (2015).

[160] *See ISO New England Inc.*, 147 FERC ¶ 61,172 at PP 107-08.

they point to is in each resource type's *cost* of providing that service. This is equivalent to arguing that two resources with different marginal costs of providing energy should not be paid the same price for providing energy. But the Commission has long recognized the price transparency and efficiency benefits of uniform clearing-price auctions,[161] and those principles apply to the provision of Synchronized Reserves as well. To the extent a resource that would be designated as Tier 1 reserves under the existing rules provides Synchronized Reserves to the system, it is providing, as PJM asserts, "the exact same product" as a Tier 2 reserves providing Synchronized Reserves.[162] We therefore agree with PJM that the two resources should be compensated equivalently.

90. The IMM and PJM dispute the correct measurement for the Tier 1 reserve response rate—either the assigned response rate or the settlement data. However, PJM's overarching argument is that the resources that it assigns Tier 1 reserves do not respond in a meaningful way, thereby undermining the certainty PJM has in their ability to respond and undermining the purpose of designating resources as reserves in the first place. Thus, we find compelling the arguments and data provided by PJM to support its argument that the current compensation and penalty structure for Tier 1 reserves is inadequate.

91. The IMM argues that reserve prices in PJM are not too low and that the current reserve market design compensates resources appropriately. The IMM and the PJM Load Coalition both point to the evidence of January 2019 provided by PJM to argue that the reason prices were low was not the result of a market design flaw as asserted by PJM, but rather the result of supply exceeding demand. The IMM further argues that the existing reserve market construct follows the market dynamics of supply and demand. These arguments miss the point. As PJM notes, the reason that supply produced low prices during the January 2019 event is that PJM operators biased the scheduled supply to

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[161] *PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,331 at P 141 ("[A] competitive market with a single, market-clearing price creates incentives for sellers to minimize their costs, because cost-reductions increase a seller's profits. And when many sellers work to minimize their costs, competition among them keeps prices as low as possible. . . . This market result benefits customers, because over time it results in an industry with more efficient sellers and lower prices."), *order on reh'g*, 119 FERC ¶ 61,318; *N.Y. Indep. Sys. Operator*, 110 FERC ¶ 61,244, at P 65 (2005) ("Efficient pricing requires that suppliers receive the highest market value for their resources, independent of their bids. This gives all sellers the proper incentive to offer their resources at the marginal cost of their highest valued use. . . ."), *reh'g denied*, 113 FERC ¶ 61,155 (2005).

[162] PJM Transmittal at 16.

ensure additional reserves were on the system.[163] This goes to a central tenet of PJM's complaint: PJM operators' frequent need to intervene in reserve market outcomes indicates that the market is not functioning properly, and because those operator actions are not fully incorporated into market prices, those prices do not reflect the true marginal cost of providing necessary reserves.

92. The PJM Load Coalition and the IMM also argue that uplift in the reserves market is minimal, and not a significant problem. PJM counters this point by explaining that nearly half of the payments to Tier 2 reserves come from uplift.[164] We agree with PJM. While the dollar value of the uplift stemming from operators' procurement of needed reserves outside the market design may be relatively small in the context of total energy and ancillary services markets revenues, the reality that uplift represents such a large portion of total reserve compensation is indicative of a flawed market design.

93. The IMM also argues that load biasing causes IT SCED to recommend possible additional unit commitments, but that operators do not necessarily commit additional units based on IT SCED's modified recommendations. While the IMM is correct, the IMM does not argue or present evidence that biasing *never* results in unit commitments. The evidence of uplift, discussed above, suggests that the post-biasing IT SCED recommendations are translating into unit commitments, the need for which should be reflected in a properly functioning reserve market.

94. The PJM Load Coalition argues that PJM ignores the fact that Step 2B on its current ORDC could be used to procure additional reserves. PJM responds that Step 2B is designed for use in only a subset of conditions, such as during conservative operations, a limitation that the PJM Load Coalition acknowledges. We are not persuaded by the PJM Load Coalition's argument. The Step 2B mechanism is a narrow tool that provides PJM operators with only limited flexibility to schedule additional reserves outside a subset of system conditions. It does not address the suite of reserve market design shortcomings we identify above, as evidenced by the fact that its existence has not prevented those shortcomings from emerging.

95. The IMM argues that the misalignment of the day-ahead and real-time markets regarding reserve procurement cannot be solved, and that PJM has not provided evidence that failing to align the day-ahead and real-time procurement of reserve products results in higher costs. PJM argues that the misalignment can result in uncertainty in whether the reserves it assigns in the day-ahead market will be available in real time given a lack of a forward obligation. PJM also asserts that the lack of forward procurement prevents the commitment of longer-lead-time resources that could provide reserves more cost-

[163] PJM Answer at 26-27.

[164] *Id.*, Keech Reply Aff. ¶¶ 19-20.

effectively. As discussed in greater detail above, we are persuaded that the existing misalignment between day-ahead and real-time reserve products impedes the efficient acquisition of needed reserves, particularly by failing to represent the need for Primary Reserves in the day-ahead market. This failure unnecessarily restricts the supply pool of resources capable of providing Primary Reserves to those visible within the two-hour window of the IT SCED engine.

96. The PJM Load Coalition argues that the Commission should exercise its discretion to delay any action on PJM's proposal until other market rules are in place and their effects understood. We disagree. In finding that PJM has met its burden under FPA section 206, the Commission is required to determine a replacement rate. The PJM Load Coalition argues that PJM has not met its burden as to why the proposed revisions in the instant proceeding are necessary or worth the cost given other pending and recent market revisions. However, as the PJM Load Coalition admits, the other market revisions to which it refers are not meant to address the concerns PJM has raised in the instant proceeding. Therefore, we are not persuaded by PJM Load Coalition's request for delayed action.

2. <u>Replacement Rates</u>

97. Pursuant to section 206 of the FPA, once a complainant has met its burden to show that a rate is unjust, unreasonable, or unduly discriminatory, the burden then shifts to the Commission to determine the new just and reasonable replacement rate.[165] In Section IV.B.1, above, we found that PJM met its burden to show that its current reserve market construct is unjust and unreasonable. We now address the appropriate replacement rate.

98. Several parties support adopting PJM's proposed replacement rate as filed.[166] Only the PJM Load Coalition protests PJM's proposed consolidation of Tier 1 and Tier 2 Synchronized Reserves, though several parties advocate for minor revisions to how that modification is implemented. No party broadly protests PJM's proposed alignment of reserve products across the day-ahead and real-time markets, but the IMM and CEA oppose either the introduction of a 30-minute Reserve product into the real-time market or the rules governing that product. Numerous parties, generally support PJM's proposed ORDC changes, though some propose minor modifications or additional reforms.[167]

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[165] 16 U.S.C. § 824e; *Emera Maine v. FERC*, 854 F.3d 9, 21 (D.C. Cir. 2017).

[166] *See, e.g.*, Dominion Comments at 5-9; NEI Comments at 9-10; P3 Comments at 7-14.

[167] API, Calpine and LS Power, CEE, Direct Energy, Dominion, Duke, EPSA, ETI, Exelon, FirstEnergy, IPI, NEI, P3, PSEG, R Street, and Vistra.

However, many parties oppose most or all of PJM's proposed ORDC modifications, and in some cases propose alternatives.[168]

99. As discussed in more detail below, we largely adopt PJM's proposal as the just and reasonable replacement rate, subject to certain modifications. We discuss the major components of the replacement rate in turn. Several of PJM's proposed revisions are uncontested, and we adopt them as part of the just and reasonable replacement as filed without further discussion.

a. <u>Tier 1/Tier 2 Reserve Consolidation</u>

i. <u>PJM's Proposal</u>

100. PJM proposes to consolidate the Tier 1 and Tier 2 reserve products into one uniform Synchronized Reserve product. PJM explains that the consolidated Synchronized Reserve product will "(i) be assigned based on the market solution that maximizes social welfare (in part through minimizing production cost); (ii) be obligated to respond based on the assigned quantity; (iii) be compensated at the applicable clearing price for the assigned [MW] amount; and (iv) face a penalty if the resource does not respond during an event."[169] PJM states that the consolidated product will be treated comparably regardless of whether the reserves come from unloaded reserve capability or re-dispatched reserve capability.[170] PJM states that it will calculate a Synchronized Reserve resource's availability and reserve capability MW using the availability and unit parameters offered in for energy (with some exceptions), such as economic minimum, economic maximum, and energy ramp rate. Further, PJM states that participants will be provided with additional ability to update energy ramp rates intra-day and to update the Synchronized Reserve maximum MW intra-hour to enable more accurate representation of their reserve capability.[171]

101. PJM states that the variable operations and maintenance component will be removed from the Synchronized Reserve offer cap (as this component is already included in energy offers) and the presently effective $7.50/MWh offer margin will be reduced to

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[168] AEP, CEA, the IMM, the Maryland Commission, ODEC, the Ohio Commission, OPSI, the PJM Load Coalition, and Public Citizen.

[169] PJM Transmittal at 44.

[170] *Id.* at 44-45.

[171] *Id.* at 45.

the expected value of the penalty.[172] PJM explains that the existing \$7.50/MWh offer margin is based on the implicit margins in actual offers made by Tier 2 reserve participants prior to the implementation of the market in 2002, and that these offers included market power.[173] PJM states that \$7.50/MWh is well in excess of the near \$0.00/MWh expected value of the Synchronized Reserve penalty resources may face, which takes into account the average penalty rate, as well as the probability that a Synchronized Reserve Event will occur and that a resource will underperform in such event. PJM proposes to re-calculate the expected value of the penalty on an annual basis, rather than setting the cap to a static \$0.00/MWh based on current conditions. PJM estimates that the reserve offer cap would be \$0.02/MWh for 2018.[174]

102. PJM argues that the consolidation of the Tier 1 and Tier 2 reserve products into a single, unified product is just and reasonable for the following reasons: (1) the Commission has approved a consolidated product for Synchronized (or spinning) Reserve in every other jurisdictional RTO/ISO; (2) consolidation will provide more accurate reserve calculations that require less operator intervention;[175] (3) attaching a penalty to all Synchronized Reserve products will improve performance and hold resources accountable for providing their assigned reserves; (4) consolidation will provide more accurate energy and reserve pricing due to improved Synchronized Reserve measurement.[176]

ii. Comments and Protests

103. Exelon, ETI, CEE, P3, NEI, Dominion, AEP, API, Calpine and LS Power, IPI, the Ohio Commission, Vistra, EPSA, IMM, and PSEG support PJM's proposal to create a consolidated Synchronized Reserve product. Exelon, ETI, Dominion, IPI, the Ohio Commission, Vistra, and EPSA argue that eliminating the existing Tier 1/Tier 2 reserve

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[172] *Id.*

[173] *Id.* at 46 (citing PJM Interconnection, L.L.C. Filing, Docket No. ER02-2519-000, *Report on Spinning Reserve Market By: Joseph E. Bowring - Manger PJM Market Monitoring Unit*, ¶¶ 13, 20 (Sept. 4, 2002)).

[174] *Id.* at 46-47.

[175] *Id.* at 47 (citing Pilong Aff. ¶¶ 15-20) (explaining how the structural deficiencies inherent in the Tier 1 reserve product prevent PJM operators from developing accurate estimates of the amount of Tier 1 reserve that will reliably respond, which leads to biasing and out-of-market actions).

[176] *Id.*

products and implementing a new consolidated Synchronized Reserve product with clear performance requirements and penalties for non-performance will address concerns regarding the operational value of Tier 1 reserve resources and mitigate the need for the pervasive out-of-market actions demonstrated in PJM's filings.[177] Further, ETI, CEE, P3, Dominion, IPI, and PSEG state that a consolidated Synchronized Reserve product with consistent compensation of all resources (and appropriate penalties) will provide appropriate incentives for resources to perform when called upon by PJM and ensure just and reasonable treatment of all Synchronized Reserve resources.[178] Dominion states that PJM's proposal will ensure that resources on the margin are indifferent to providing reserves or energy.[179] EPSA comments that adopting a consolidated Synchronized Reserve product is consistent with the approach taken by other RTOs/ISOs, and will eliminate the undue discrimination created by the existing Tier 1/Tier 2 reserve construct.[180]

104. ETI explains that PJM's proposal will allow for more accurate reserve calculations, giving operators the necessary information they need to more accurately schedule the system, which will in turn yield more accurate energy and reserve pricing.[181] In addition, Dominion states that by requiring all generators seeking to obtain a Synchronized Reserve obligation to submit offers with the appropriate operating parameters, the marginal costs of suppling reserves will be accurately reflected in the clearing price for the Synchronized Reserve product.[182] API, Calpine and LS Power, the Ohio Commission, and EPSA argue that consolidation of the

[177] *See, e.g.*, Exelon Comments at 28; ETI Comments at 3-4; Dominion Comments at 5; IPI Comments at 9; Ohio Commission Protest at 6-7; Vistra Comments at 3-4; EPSA Comments at 15.

[178] *See, e.g.*, CEE Comments at 6; ETI Comments at 3-4; P3 Comments at 8; Dominion Comments at 5; IPI Comments at 9; *see also* NEI Comments at 9; AEP Comments at 3; PSEG Protest at 3-4.

[179] Dominion Comments at 6.

[180] EPSA Comments at 13-14.

[181] ETI Comments at 4; *see also* IPI Comments at 10 ("[PJM's Synchronized Reserve proposal] will increase the economic efficiency of the reserve market").

[182] Dominion Comments at 5.

Tier 1 and Tier 2 reserve products will provide greater transparency to the market regarding the need for Synchronized Reserve.[183]

105. The Ohio Commission agrees with PJM that a must-offer requirement for the consolidated Synchronized Reserve product will enhance PJM's ability to address shortage events.[184] Similarly, the IMM argues that PJM's proposal to strengthen the must-offer requirement for Synchronized Reserves is important to efficient market design and addressing structural market power.[185] The IMM explains that the must-offer rule will eliminate Market Sellers' current ability to withhold reserves by offering zero MW of Synchronized Reserves.[186]

106. Dominion agrees with PJM's proposed methodology for calculating Synchronized Reserve offers, its proposal to reduce the $7.50/MWh offer margin adder to the Synchronized Reserve penalty (updated annually), and its proposal to remove the variable operations and maintenance component from Synchronized Reserve offers.[187] The IMM argues that no offer margin is necessary for Synchronized Reserve offers, and states that PJM is right that the existing $7.50/MWh offer margin was based on offers that included market power and which exceeded efficient, competitive levels. The IMM does not agree with PJM's proposal to set the offer margin at the expected penalty; rather, the IMM argues that the reserve offer margin should be set at zero.[188]

107. Vistra argues that PJM should not reduce the presently effective $7.50/MWh offer margin to the expected value of the penalty.[189] Vistra argues that such a reduction "ignores the significant risk inherent in PJM's penalty structure" and "is inconsistent with

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[183] API Comments at 3 ("consolidating the bifurcated [S]ynchronized [R]eserve market will help with market transparency and proper price formation"); Calpine and LS Power Comments at 6; Ohio Commission Protest at 6; EPSA Comments at 14-16.

[184] Ohio Commission Protest at 6-7.

[185] IMM Protest at 71-72.

[186] *Id.* at 72.

[187] Dominion Comments at 6 (noting that the variable operations and maintenance component is already included in energy offers).

[188] IMM Protest at 72-73.

[189] Vistra Comments at 4.

PJM's stated belief that the penalty will encourage performance."[190] Vistra states that PJM's calculation of the average penalty also ignores the fact that the risk of non-performance is likely time- and resource-specific.[191] Vistra states that during high-load or high-ramp periods, the probability of a Synchronized Reserve Event is considerably higher than the 0.015% used to develop the $0.02/MWh cap; similarly, during periods of significant temperature uncertainty, resources face greater risk of non-performance.[192] Therefore, Vistra argues that the Commission should retain the existing $7.50/MWh offer cap, relying on competitive forces during surplus reserve periods to discipline offers and allowing resources to reflect risk in the periods when possibility of a penalty are highest.[193]

108. Calpine and LS Power argue that PJM's non-performance penalty calculations, which are based on the real-time Synchronized Reserve market clearing price, are too onerous in light of expected revenues for Synchronized Reserves, given that the price could theoretically rise to $14,000/MWh.[194]

109. The IMM argues that PJM's current penalty for Synchronized Reserve, which PJM does not propose to change, is insufficient, because resources can profitably offer reserves without ever performing during a spinning event.[195] The IMM explains that the penalty for a Synchronized Reserve resource failing to meet its scheduled obligation during a spinning event involves two components: (1) the resource foregoes payment for the MWs of under-response for all cleared hours of the day of the event, and (2) the resource is charged a penalty in the amount of its MWs of under-response during the spinning event against all of its Synchronized Reserve revenues during the Immediate Past Interval or since the resource last failed to respond to a spinning event, whichever is less. The IMM explains that the Immediate Past Interval is calculated yearly on

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[190] *Id.* at 4-5.

[191] *Id.* at 5.

[192] *Id.*

[193] *Id*.

[194] Calpine and LS Power Comments at 7-8.

[195] IMM Protest at 58-59, tbl.44. The IMM provides data showing that under PJM's current penalty structure, a resource that completely failed to respond to spinning events would earn 58.2% of what a resource that responded perfectly would earn and states that this is not a just and reasonable penalty structure. *Id.* at 59.

December 1 as the average number of days between spinning events over the past 2 years. The IMM states that market participants can aggregate resources in their portfolios with response from over-responders used to offset under-responders during a Synchronized Reserve Event. Under the penalty structure, the IMM states that non-performance is only defined for spinning events of 10 minutes or longer. For events of less than 10 minutes, all resources, regardless of actual performance, are considered to have performed perfectly. The IMM states that the Immediate Past Interval is defined as the number of days between spinning events, regardless of duration, which the IMM argues artificially shortens the period since the last requirement to perform.[196]

110. The IMM argues that the Immediate Past Interval used to identify the penalty period should be based on the actual time since the last spinning event of 10 minutes or longer during which the resource performed, which would capture the actual failure to perform, provide appropriate performance incentives, and serve as a just and reasonable penalty.[197] The IMM proposes that aggregation not be permitted to offset unit-specific penalties for failure to respond to an event, because it weakens the incentive to perform and creates an incentive to withhold reserves from other resources and further argues that the obligation to respond is unit specific.[198]

111. Further, the IMM proposes similar non-performance penalties for Non-Synchronized Reserve and Secondary Reserve.[199] Vistra argues that PJM should clarify that the penalty for the Non-Synchronized Reserve product is not being changed.[200]

112. The PJM Load Coalition argues that if the threshold section 206 showing is made, rather than adopting PJM's unjust and unreasonable replacement rate, the Commission should consider imposing a non-performance penalty on Tier 1 reserve resources to enhance Tier 1 reserve performance, without imposing significant additional costs on customers.[201] The PJM Load Coalition also argues that the Commission might consider

[196] *Id.* at 58-59.

[197] *Id.* at 73.

[198] *Id.* at 73-74.

[199] *Id.* at 74.

[200] Vistra Comments at 5.

[201] PJM Load Coalition Protest at 65 (citing Al-Jabir Aff. ¶ 20).

increasing the bonus incentive payment made to performing Tier 1 reserve resources during actual Synchronized Reserve Events.[202]

iii. **Answers**

113. PJM explains that it proposes to use a single, unified market clearing price to procure Synchronized Reserve, and all resources will receive the market clearing price, regardless of their opportunity costs. PJM reiterates that the cost of the marginal unit assigned to provide reserves will set the clearing price, just like in its energy market, which PJM argues is just and reasonable.[203] PJM points out that the IMM supports combining the Tier 1 and Tier 2 reserve products.[204]

114. Vistra reiterates that the $7.50/MWh reserve offer margin should be retained. Vistra argues that the IMM mischaracterizes what may constitute a legitimate marginal cost. Citing the must-offer requirements, Vistra argues that no resource would voluntarily participate in a market that exposes them to risk but does not allow them to reflect that risk in their offers. Vistra compares this to asking a resource to offer below incremental fuel cost.[205]

iv. **Commission Determination**

115. We adopt as part of the just and reasonable replacement rate PJM's proposal to consolidate the existing Tier 1 and Tier 2 reserve products into a uniform Synchronized Reserve product with a single clearing price. Uniform compensation for performing and uniform penalties for not performing will incentivize consistent performance across all Synchronized Reserve resources and improve price formation in the PJM reserve market. Incentivizing more consistent performance in the form of higher response rates will in turn help alleviate operational uncertainty by providing more accurate reserve calculations with less operator intervention.

116. We also find that PJM's proposed non-performance penalty for the consolidated Synchronized Reserve product—to mirror that of the existing Tier 2 reserve penalty being "equal to the lesser of the average number of days between Synchronized Reserve Events, or the number of days since the resource last failed to provide the amount of

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[202] *Id.* at 66 (suggesting the current $50/MWh bonus payment be doubled or tripled).

[203] PJM Answer at 55-56 (citations omitted).

[204] *Id.* at 33 (citing IMM First Answer at 3).

[205] Vistra Answer at 15-16.

Synchronized Reserve it was assigned or self-scheduled to provide in response to a Synchronized Reserve Event"[206]—is just and reasonable.

117. We disagree with Calpine and LS Power's argument that the proposed penalty is too onerous, given the potentially high reserve market clearing price (up to $10,000/MWh).[207] As we discuss in the following section, we find that the PJM's proposed Reserve Penalty Factor for Synchronized Reserve is appropriate, given the maximum potential market clearing price. Under PJM's proposal, the reserve market settlement is designed to mirror that of the energy market settlements already in use. In the energy market, resources assigned to provide energy received compensation in the day-ahead market. If those resources then fail to provide the scheduled amount, they must buy back the amount in the real-time market at the real-time price. The same reason aptly applies for reserve markets which utilize Reserve Penalty Factors to set reserve market clearing prices. We therefore find it just and reasonable for a resource which fails to provide reserves when needed to be penalized at the reserve market clearing price.

118. Similarly, we disagree with the IMM's arguments that PJM's proposed non-performance penalty for the consolidated Synchronized Reserve product is insufficient.[208] The IMM argues that the penalty for a Synchronized Reserve resource's failure to meet its scheduled obligation during a spinning event should be revised to be more strict by modifying the existing calculation of what is known as the Immediate Past Interval, on which any assessed penalty is based. The IMM asserts that rather than setting the Immediate Past Interval equal to the lesser of (1) the average number of days between spinning events of any duration over the past two years, or (2) the number of days since the resource last failed to respond fully, it should be set only based on the number of days since the last spinning event of 10 minutes or longer during which the resource performed. The IMM argues that this modification is necessary to properly incentivize resource performance. To support its contention, the IMM presents the results of an historical analysis of six of the most heavily scheduled resources in the Synchronized Reserve market to show that resources that fail to respond to spinning events would earn 58.2% of what a resource with a perfect response rate would earn. However, it is not clear that a penalty structure that would deprive a Market Seller of over 40% of potential reserve revenues (over what could be an extended period of time) for poor performance fails to provide strong incentives to perform. In the absence of additional evidence that the incentive structure resulting from the existing penalty calculation and the enhanced

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[206] PJM Transmittal at 86 n.194 (quoting Operating Agreement, Schedule 1, § 3.2.3A(j)).

[207] Calpine and LS Power Comments at 7-8.

[208] IMM Protest at 58-59, 73.

must-offer requirements discussed below will be inadequate, we decline to incorporate the IMM's proposed alternative as part of the just and reasonable replacement rate.

119. The IMM also argues that a Market Seller should not be permitted to aggregate the responses of multiple resources to meet a reserve commitment because it creates an incentive to withhold reserves from some resources.[209] We are not persuaded that there is sufficient evidence to justify prohibiting aggregation. As part of the replacement rate we adopt herein, PJM is making explicit in its Operating Agreement that Generation Capacity Resources have a must-offer requirement for Synchronized and Non-Synchronized Reserves and for Secondary Reserves, regardless of whether the resource is online or offline.[210] To the extent these resources fail to make their full reserve capability available to the market, these Operating Agreement provisions make clear that the Market Seller will be in violation of the Tariff.[211] In light of these updated Operating Agreement provisions, we find insufficient evidence that the existing ability for Market Sellers to aggregate resource performance to satisfy a reserve commitment will lead to withholding from the market.

120. We reject the PJM Load Coalition proposal that, as an alternative to a consolidated Synchronized Reserve product, the Commission could update the compensation structure for Tier 1 reserves, thereby addressing PJM's concern in a way that may result in lower costs to customers. We find that the PJM Load Coalition's alternative proposal does not address the problems PJM has identified regarding Tier 1 reserve performance and compensation. Since we find that PJM's proposal to create a single market for all resources providing Synchronized Reserves to be just and reasonable, we decline to adopt an alternative proposal to compensate resources providing the same reserve product in a different manner.

121. We also find that PJM's proposed removal of the variable operations and maintenance component of Synchronized Reserve offers and reduction of the Synchronized Reserve offer margin from $7.50/MWh to the expected value of the penalty is just and reasonable. Vistra argues that the $7.50/MWh offer margin should not be reduced to the expected value of the non-performance penalty. Conversely, the IMM argues that the expected value of the penalty should be capped at $0.00/MWh. We

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[209] *Id.* at 59.

[210] PJM Transmittal at 80-82; Operating Agreement, Schedule 1, §§ 1.10.1A(j)(i), 1.10.1A(m)(i).

[211] *See, e.g.*, Operating Agreement, Schedule 1, § 1.10.1A(j)(i) ("Market Sellers of Generation Capacity Resources subject to this must-offer requirement that do not make the reserve capability of such resources available when such resource is able to operate with a dispatchable range . . . will be in violation of this provision.").

disagree with both Vistra and the IMM. PJM co-optimizes reserves with energy, and energy market offers already permit Market Sellers in PJM to include a portion of their offers as variable operations and maintenance. Thus, including the additional $7.50/MWh adder would be duplicative. As PJM explains, the $7.50/MWh value was based on historical market values prior to 2012 and thus largely based on stale data. PJM's proposal to set the value based on the expected value of the Synchronized Reserve penalty is reasonable, as it is based on the probability of a Synchronized Reserve Event, the probability of underperformance, and the average penalty rate, which will be reviewed annually. The annual revision will allow PJM and stakeholders to review whether the reserve offer cap is meeting its intended goal. We therefore decline to adopt alternatives to either use non-formulaic values in the determination of the cap or set the price to $0.00/MWh.

b. ORDC - Penalty Factors

i. PJM's Proposal

122. PJM proposes to increase the Reserve Penalty Factor applicable up to the MRR to $2,000/MWh so that market prices can better reflect the cost of actions PJM takes to satisfy the NERC standard.[212] PJM explains that the Reserve Penalty Factor is intended to represent the maximum production cost the market is willing to pay to maintain the MRR and avoid a reserve shortage, and therefore the market will not commit a resource for reserves if the resource's cost to provide reserves exceeds the Reserve Penalty Factor.[213] PJM notes, however, that "*the market's* refusal to recognize that resource[] does not prevent *PJM* from relying on that resource."[214] PJM asserts that to maintain the MRR, in accordance with the NERC standard, PJM operators will commit all generation, even generation costing above the existing $850/MWh Reserve Penalty Factor, and will deploy pre-emergency and emergency load management reductions, also costing well above $1,000/MWh.[215]

123. PJM states that under its market rules, PJM operators can commit resources, or buy energy, at costs in excess of the existing $850/MWh Reserve Penalty Factor when needed to maintain reserves.[216] PJM states that it maintains several cost caps for energy

[212] PJM Transmittal at 48.

[213] *Id.* (citing Keech Aff. ¶ 16).

[214] *Id.*

[215] *Id.*

[216] *Id.*

purchases that exceed $850/MWh, including the $2,000/MWh energy offer cap for generation resources, offer caps ranging from $1,100 to $1,849/MWh for emergency and pre-emergency demand response resources,[217] and the $2,700/MWh price cap on emergency energy purchases from neighboring regions.[218] PJM explains that because PJM's current rules allow sellers to submit energy market offers that are eligible to set the LMP at price levels in excess of $850/MWh, PJM avers that resources providing reserves can have opportunity costs at approximately the same level of the energy offers of the resources committed to maintain reserves.[219] PJM explains that if such resources are committed as reserves, the reserve clearing market price will not reflect such resources' offers and opportunity costs, even if such a resource's total offer, including its opportunity cost, would have been the marginal offer needed by PJM to meet its MRR.[220]

124. PJM states that evolving market rules in PJM, including the 2017 rule change allowing cost-based energy offers of up to $2,000/MWh, make clear that in order to retain the benefits of a uniform clearing price market for reserves, it is reasonable for the Reserve Penalty Factor to be increased to $2,000/MWh.[221] PJM states that increasing the Reserve Penalty Factor to this level would allow reserve resources with costs of up to $2,000/MWh to set prices when they are needed at the margin to meet PJM's MRR.[222]

125. PJM supports this change by asserting that PJM's primary focus, as it developed a replacement for its currently effective Reserve Penalty Factor, was to set it "at the lowest level that is consistent with the actions that system operators will take to maintain reserves and allow those actions to be reflected in market clearing prices," which PJM affiant Mr. Keech attests is $2,000/MWh.[223] PJM states that a Reserve Penalty Factor at

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[217] PJM lists three offer caps for emergency and pre-emergency demand response resources, differentiated by lead time. PJM explains that emergency and pre-emergency demand response resources can submit offers up to $1,849/MWh to reduce demand with a 30-minute lead time, offers up to $1,425/MWh to reduce demand with a 1-hour lead time, and offers up to $1,100/MWh to reduce demand with a 2-hour lead time. *Id.* at 49.

[218] *Id.* at 50.

[219] *Id.* at 49.

[220] *Id.*

[221] *Id.*, Keech Aff. ¶ 10 (citing Order No. 831, 157 FERC ¶ 61,115).

[222] *Id.* at 50.

[223] *Id.* at 51 (citing Keech Aff. ¶ 9).

this level would reliably signal a shortage caused by running out of reserves, rather than simply an economic choice to go short on reserves.[224]

126. PJM argues that $2,000/MWh is a more appropriate cost at which to set its Reserve Penalty Factor than is an estimate of the value of lost load in PJM. In support of this claim, PJM cites Mr. Keech, who attests that the proposed Reserve Penalty Factor is not based on an estimated value of lost load because the existence of PJM's capacity market undermines the usefulness of setting the Reserve Penalty Factor in PJM at an estimated value of lost load.[225] PJM also cites to the ORDC Report authored by PJM affiants Dr. William W. Hogan and Dr. Susan L. Pope, in which the affiants conclude that PJM's selection of a Reserve Penalty Factor at $2,000/MWh is consistent with the theory that the value of incremental reserves is anchored around PJM-specific assumptions about the actions that will be taken as the level of reserves declines below the MRR.[226]

127. PJM notes that the Reserve Penalty Factor sets a horizontal segment of the ORDC at all reserve levels from zero to the MRR and defines the start of a vertical segment at the MRR.[227] PJM asserts that under the existing approved energy market rules the cost of taking those actions can, under multiple circumstances, exceed $850/MWh, and reach as high as $2,000/MWh under non-emergency conditions and exceed $2,000/MWh in emergency conditions.[228]

128. PJM explains that it proposes establishing the same Reserve Penalty Factor for all reserve requirements, including Synchronized Reserve, Primary Reserve, and 30-minute Reserve.[229] PJM supports this proposal by explaining that the 30-minute Reserve product should also have a $2,000/MWh Reserve Penalty Factor, because extreme system conditions could result in PJM potentially not deploying all of the economic resources it has available to maintain 30-minute Reserves.[230]

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[224] *Id.*

[225] *Id.* (citing Keech Aff. ¶ 7).

[226] *Id.* at 52 (citing PJM Transmittal, Hogan & Pope Aff., Attachment C, Ex. 1, Hogan & Pope PJM ORDC Report at 17).

[227] *Id.*

[228] *Id.*

[229] *Id.*

[230] *Id.*

129. PJM also proposes to remove the reserve price cap because PJM believes it arbitrarily suppresses the price for reserves when the cascading of shortages on the system indicate such reserves are most needed. PJM states that while this implies that the energy and reserve price could rise as high as $12,000/MWh, that price: (1) can occur only from the simultaneous occurrence and confluence of multiple product and locational shortages; (2) is necessary to recognize the independent value of avoiding each such shortage; (3) implies extreme conditions that demand immediate supplier response; (4) likely approximates consensus estimates of the value to load of avoiding curtailment; and (5) logically applies the current approved approach to the reserve products and Reserve Penalty Factors proposed in these filings.[231]

130. PJM claims a basic tenet of reserve pricing is that the clearing prices are additive for reserve products that can substitute for each other. As an example, PJM explains that because a MW of Synchronized Reserve can count toward meeting the Synchronized Reserve Requirement and the Primary Reserve Requirement, the Synchronized Reserve market clearing price reflects the cost of meeting both these requirements.[232] PJM explains that currently the Synchronized Reserve market clearing price is capped at the addition of only two Reserve Penalty Factors, despite the fact that if both the Synchronized Reserve and Primary Reserve Requirements could not be met for both the RTO-wide Reserve Zone and the Mid-Atlantic/Dominion Reserve Sub-Zone, the Synchronized Reserve market clearing price for the Mid-Atlantic/Dominion sub-zone

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[231] *Id.* at 11-12. In its Answer, PJM clarifies that $12,000/MWh is the sum of the energy price cap of $2,000/MWh plus the stacking of five $2,000/MWh Reserve Penalty Factors for falling below the Minimum Synchronized Reserve Requirement in the RTO-wide Reserve Zone and the Mid-Atlantic/Dominion Reserve Zone; the Minimum Primary Reserve Requirement in the RTO-wide Reserve Zone and the Mid-Atlantic/Dominion Reserve Zone; and the Minimum 30-minute Reserve Requirement in the RTO-wide Reserve Zone. PJM Answer at 53 n.180. PJM notes that the $12,000/MWh figure "could rise to $14,000/MWh if PJM models a subzone for the 30-minute requirement, but as a default PJM intends to only model the 30-minute reserve requirement for the RTO-wide Reserve Zone." PJM Transmittal at 12 n.12.

[232] PJM states that for this reason, the Synchronized Reserve market clearing price will always be greater than or equal to the Non-Synchronized Reserve market clearing price, which represents the price of meeting the balance of the Primary Reserve Requirement in excess of the Synchronized Reserve Requirement. Similarly, PJM explains, when the system becomes short on reserves, the Synchronized Reserve market clearing price includes the Reserve Penalty Factor for each reserve requirement and each Reserve Zone or Sub-Zone to which a MW of Synchronized Reserve can contribute, leading to additive prices. *Id.* at 99 (citing Operating Agreement, Schedule 1, §§ 3.2.3A(d), 3.2.3A.001(c)).

should reflect all four Reserve Penalty Factors in recognition that a MW of Synchronized Reserve in the Mid-Atlantic/Dominion sub-zone would satisfy all four reserve requirements. PJM proposes to calculate the day-ahead and real-time reserve market clearing price as the incremental cost of serving the next increment of demand, essentially removing any cap on the number of additive Reserve Penalty Factors.[233]

ii. <u>Comments and Protests</u>

131. ETI, FirstEnergy, P3, Dominion, IPI, EPSA, PSEG, and Vistra support PJM's proposal to increase the Reserve Penalty Factor to \$2,000/MWh.[234] Several commenters, including ETI, EPSA, and FirstEnergy, argue that PJM's proposed changes to the Reserve Penalty Factor are necessary to reflect a reserve shortage accurately.[235] ETI explains that PJM's currently effective Reserve Penalty Factor of \$850/MWh does not represent a resource's opportunity cost.[236] PSEG states that PJM's proposal explicitly addresses the need for a rational Reserve Penalty Factor that is consistent with potential operator actions.[237] Dominion contends that PJM's proposal to increase the Reserve Penalty Factor from \$850/MWh to \$2,000/MWh is just and reasonable, because it will more accurately be aligned with the energy market offer cap and more accurately reflect the cost customers are willing to pay to avoid an interruption of services.[238]

132. P3 states that PJM's proposal to revise the Reserve Penalty Factor is necessary to ensure reliable operations past the MRR.[239] Specifically, P3 argues that the proposed \$2,000/MWh Reserve Penalty Factor will ensure generators receive appropriate price signals to supply either energy and/or reserves and follow price signals as market conditions change.[240]

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[233] *Id.* at 100.

[234] *See, e.g.*, IPI Comments at 9; PSEG Protest at 24-25; Vistra Comments at 10.

[235] EPSA Comments at 16-17; ETI Comments at 4; FirstEnergy Comments at 3.

[236] ETI Comments at 4.

[237] PSEG Protest at 24-25.

[238] Dominion Comments at 6.

[239] P3 Comments at 9.

[240] *Id.* at 9-10.

133. CEE asserts that PJM's proposal to use a $2,000/MWh Reserve Penalty Factor for each reserve product and to add the penalty prices together when each product is below the applicable MRR is just and reasonable.[241] However, CEE expresses concern that the additive nature of PJM's proposal does not result in shortage prices that reflect the marginal value of reserves to load because it is not based on the value of lost load.[242] CEE states that the Reserve Penalty Factors for the three reserve products could be designed so that the sum of the Reserve Penalty Factors results in a scarcity price that reflects the marginal value of the reliability that the reserves cumulatively provide, so that the penalty regime more accurately reflects each reserve product's incremental contribution to maintaining reliability (typically measured as the probability the system has to shed load).[243] CEE also states that a technical conference or hearing could develop a more extensive record on the appropriate market design, including appropriate values for the Reserve Penalty Factors and whether the penalties should be combined together in the event of a shortage of two or more products.[244] CEE requests that if the Commission does not order a technical conference or hearing, the Commission instead establish a cap on the maximum reserve price that is less than PJM's theoretical maximum of $10,000/MWh, on top of the currently effective $2,000/MWh energy offer cap.[245]

134. The IMM, the Maryland Commission, AEP, ODEC, and the PJM Load Coalition argue that PJM's proposed Reserve Penalty Factor of $2,000/MWh is not just and reasonable.[246] AEP states that PJM's proposed Reserve Penalty Factor of $2,000/MWh is excessive and inconsistent with energy market rules.[247] The Maryland Commission argues that PJM's proposed new reserve market construct, which introduces layers of complexity to the existing market, including new reserve products, 24 new administrative ORDCs, and higher Reserve Penalty Factors, has not been shown to be just and reasonable and not unduly discriminatory.[248]

[241] CEE Comments at 14-15.

[242] *Id.* at 15.

[243] *Id.*

[244] *Id.* at 15-16.

[245] *Id.* at 15.

[246] ODEC Protest at 2.

[247] AEP Protest at 5.

[248] Maryland Commission Protest at 2, 10-16.

135. The IMM asserts that $2,000/MWh exceeds the cost of dispatching reserves efficiently. The IMM states that PJM's arguments do not support its claim that the value of the Reserve Penalty Factors must be at least $2,000 per MWh.[249] The IMM explains that the short-run marginal cost of generation rarely exceeds the current $850/MWh Reserve Penalty Factor. The IMM states that only under rare and foreseeable circumstances does PJM need to raise the value above $1,000/MWh. The IMM states that PJM does not deploy pre-emergency or emergency demand response prior to Synchronized or Primary Reserve shortages. The IMM states that PJM has not deployed pre-emergency or emergency demand response since April 22, 2015, even though PJM has experienced shortages since then. The IMM states that the maximum offer price for load management resources, $1,849/MWh, is not a short-run marginal cost. The IMM states that requiring the Reserve Penalty Factor to exceed the maximum offer price is not necessary for efficient dispatch. The IMM states that the maximum offer price, which is designed to be greater than the Reserve Penalty Factor, is an artificial price to permit PJM to implement a crude form of scarcity pricing.[250] The IMM states that PJM should eliminate the maximum offer price and modify the treatment of load management in defining a shortage. The IMM states that the proposed $2,000/MWh Reserve Penalty Factor is an overstated value for the highest marginal cost resource on the system. The IMM states that a $2,000/MWh Reserve Penalty Factor would impose unnecessary costs on customers, which is not just and reasonable.[251]

136. ODEC asserts that PJM has not supported its Reserve Penalty Factor as just and reasonable. ODEC supports the policy that the Reserve Penalty Factor should permit reserve market clearing prices to reflect incremental costs of reserve resources in shortage or near-shortage conditions.[252] ODEC asserts that PJM has presented no evidence regarding the number of times false positives were triggered with the existing Reserve Penalty Factor, or any realistic view of the likelihood of a false positive with the $2,000/MWh energy offer cap, aside from its admission that it is not likely to occur.[253] ODEC argues that PJM has not provided any analysis to demonstrate the probability of an economic shortage to support why PJM should abandon its "compromise position" of an $850/MWh Reserve Penalty Factor.[254] ODEC states that the significant increase in the

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[249] IMM Protest at 32 (citing PJM Transmittal at 48).

[250] *Id.* at 33 (citing Operating Agreement, Schedule 1, § 1.10.1A).

[251] *Id.*

[252] ODEC Protest at 7.

[253] *Id.* at 8-9.

[254] *Id.* at 9.

Reserve Penalty Factor to over two times the current level, if adopted by the Commission, could expose customers to paying greatly increased prices for reserves in a significant number of hours. ODEC characterizes this outcome as too great of an impact to impose upon load on the basis of PJM's hypothetical, and admittedly unlikely, scenarios.[255]

137. ODEC states that if the Commission is inclined to adopt PJM's ORDC approach, then PJM must modify its proposed Reserve Penalty Factor to one which will not result in unreasonably high reserve prices and is supported by more than hypothetical scenarios which PJM acknowledges are unlikely to occur.[256] ODEC urges the Commission not to accept PJM's "race-to-the-top" Reserve Penalty Factor.[257] ODEC argues that by PJM's own admission in the Affidavit of Adam Keech (Keech Affidavit), it is an unlikely scenario that PJM's system operators would take actions to maintain reserves that can have an incremental offer that reaches the $2,000/MWh offer cap.[258] ODEC suggests an alternative is for PJM to cap the Reserve Penalty Factor at the highest generation offer rate permitted in the day-ahead market, which in most instances will be $1,000/MWh.[259] ODEC adds that if there is an ex ante verified, cost-based offer in excess of $1,000/MWh, the Reserve Penalty Factor could be increased for the specific delivery day.[260] ODEC concludes that a Reserve Penalty Factor capped at the highest generation offer rate permitted in the day-ahead market should provide the additional benefits cited in the Keech Affidavit: simplicity, transparency, and removal of potential skewing from poor estimation of the marginal cost of energy.[261]

[255] *Id.*

[256] *Id.* at 7.

[257] *Id.* at 8.

[258] *Id.* (citing Keech Aff. ¶ 10).

[259] *Id.* at 9.

[260] *Id.*

[261] *Id.* at 9-10 (citing Keech Aff.; PJM Tariff, Attachment D, § 10).

138. ODEC further states that it has conducted a review of PJM's proposed Reserve Penalty Factors and has concluded that the use of a Reserve Penalty Factor in setting the demand curve for reserves will overstate the benefits of additional reserves, resulting in unjustifiably higher costs to consumers.[262]

139. The PJM Load Coalition claims that a theoretical maximum energy and reserve price of $12,000/MWh is well in excess of the theoretical maximums in other FERC-jurisdictional RTO/ISO markets.[263] The PJM Load Coalition claims that MISO does not allow any of its operating reserve products or the market price for energy to exceed $3,500/MWh, its estimate of the value of lost load.[264] The PJM Load Coalition also claims Southwest Power Pool (SPP) limits its cumulative scarcity pricing to $1,700/MWh.[265] Finally, the PJM Load Coalition claims PJM recently presented analysis indicating that CAISO, the NYISO, and ISO-NE limit their cumulative scarcity pricing to levels below $3,500/MWh.[266]

140. Several protesters suggest alternative proposals for constructing Reserve Penalty Factor levels and the associated additive capping. ODEC asserts that the Reserve Penalty Factor should be capped at the highest generation offer rate permitted in PJM's day-ahead market and that PJM should establish a $4,000/MWh cap on the total price for energy.[267] ODEC asserts that PJM has not demonstrated that its nested approach to reserve product modeling is just and reasonable, where the conceptual basis is that the reserve market clearing prices are the sum of the marginal prices associated with serving the next increment of demand for each reserve product.[268] ODEC argues that reserve costs reaching $12,000/MWh and energy prices (absent marginal losses and congestion)

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[262] *Id.* at 5.

[263] PJM Load Coalition Protest at 53 (citing Al-Jabir Aff. ¶ 16).

[264] *Id.*

[265] *Id.*

[266] PJM Load Coalition Protest at 53-54 (citing Al-Jabir Aff. ¶ 16; PJM Interconnection, L.L.C., *Price Formation Education 4: Shortage Pricing and Operative Reserve Demand Curve,* at 67 (Jan. 17, 2018), https://www.pjm.com/~/media/committees-groups/stakeholdermeetings/price-formation/20180117-pm/20180117-price-formation-education-4.ashx).

[267] ODEC Protest at 2, 12 (noting that a $4,000/MWh cap on energy prices is close to the $3,700/MWh maximum energy price under the existing market rules).

[268] *Id.* at 11.

reaching $14,000/MWh are not just and reasonable in an RTO/ISO with a formal capacity construct.[269]

141. The PJM Load Coalition argues that market clearing prices of $2,000/MWh in the PJM energy market will rarely (if ever) occur, explaining that LMPs in PJM rarely reach price levels in excess of $1,000/MWh.[270] To support its claim, the PJM Load Coalition presents an analysis of day-ahead and real-time LMPs from 2014 to 2018 at four pricing points: PJM-RTO, Western Hub, Eastern Hub, and the Northern Illinois Hub.[271] The PJM Load Coalition states that these LMPs never reached $2,000/MWh and never exceeded $1,850/MWh. According to the PJM Load Coalition, from 2015 to 2018, LMPs never exceeded $1,000/MWh, and LMPs over $1,000/MWh in 2014 constituted less than 0.1% of the pricing intervals for any given pricing point.[272] The PJM Load Coalition argues that even if future energy prices were to reach $2,000/MWh, such prices would occur only for a very limited time and under extreme system conditions involving unusually high fuel costs.[273]

142. The PJM Load Coalition also states that the Commission could consider raising the Reserve Penalty Factor to $1,000/MWh and imposing a cap of $3,500/MWh on the cumulative application of the Reserve Penalty Factor.[274] The PJM Load Coalition argues that a $1,000/MWh Reserve Penalty Factor is consistent with the actual PJM energy market price cap that applies in most time intervals and in most realistic situations. Therefore, the PJM Load Coalition contends, a $1,000/MWh Reserve Penalty Factor would reflect the highest opportunity cost that resources providing reserves in the PJM market would realistically face.[275] The PJM Load Coalition adds that the $3,500/MWh cumulative cap would be roughly equivalent to MISO's practice.[276]

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[269] *Id.* at 11-12.

[270] PJM Load Coalition Protest at 51 (citing Al-Jabir Aff. ¶ 15).

[271] *Id.* (citing Al-Jabir Aff. ¶ 15, tbl.1).

[272] *Id.* at 52 (citing Al-Jabir Aff. ¶ 15, tbl.1).

[273] *Id.*

[274] *Id.* at 65.

[275] *Id.* (citing Al-Jabir Aff. ¶ 20).

[276] *Id.* at 65-66.

143. Similarly, AEP asserts that PJM's additive approach to reserve pricing results in a price signal that is not reasonable or justified based on reliability needs and far exceeds the current capacity non-performance assessment of approximately $3,500/MWh that a capacity resource in PJM is subject to if it fails to respond to PJM's dispatch signal during a Capacity Performance event.[277]

iii. Answers

144. PJM notes that many parties opposing the proposed $2,000/MWh Reserve Penalty Factor nevertheless support increasing the Reserve Penalty Factor.[278] PJM also points out that protesters contend that because energy prices do not often exceed $1,000/MWh, the Reserve Penalty Factor should not be set at $2,000/MWh.[279] PJM asserts that these arguments miss the point because, even if unlikely, resources can face an opportunity cost up to $2,000/MWh or higher, and operators will take actions in this price range to maintain reserve requirements.[280]

145. PJM states that the marginal cost of producing energy is not the only determinant of the lost opportunity cost a resource incurs by providing reserves instead of energy. PJM explains that opportunity cost is a function of the difference between LMP and a resource's energy market offer. PJM notes that LMP is the sum of the short-run marginal cost of the resource that can serve the next load increment, the marginal transmission line losses, and the cost of transmission congestion.[281] PJM states that although energy market offers are almost always below $1,000/MWh, LMPs, and therefore opportunity costs, can rise above $1,000/MWh because of congestion (and to a much lesser extent transmission losses). Thus, PJM argues that the Reserve Penalty Factor should be based not only on the energy market offer cap, but also on opportunity costs that can be created when LMPs rise.[282] PJM states that a review of all the LMPs and energy and Synchronized Reserve offers from January 1, 2014, through April 30, 2019, shows that opportunity costs, which constitute the bulk of the offers used in forming the

[277] AEP Protest at 6.

[278] PJM Answer at 50 (citing IMM Protest at 65; AEP Protest at 5; ODEC Protest at 7-10; PJM Load Coalition Protest at 68).

[279] *Id.* (citing Maryland Commission Protest at 8; PJM Load Coalition Protest at 50-52).

[280] *Id.* (citing Keech Initial Aff. ¶ 10).

[281] *Id.* at 50-51.

[282] *Id.* at 51.

Synchronized Reserve supply stack, exceeded $1,000/MWh on 3.6% of the days (70 of 1947 days).[283] PJM adds that such days have become more frequent since PJM began allowing transmission constraint penalty factors of up to $2,000/MWh to set the shadow price of a constraint and therefore impact congestion prices.[284] PJM states that only in a small portion of the intervals with opportunity costs in excess of $1,000/MWh was the PJM system experiencing a reserve shortage—meaning that only in a handful of intervals were the $300/MWh or $850/MWh Reserve Penalty Factors affecting LMPs and therefore the opportunity costs. PJM claims opportunity costs exceeded $2,000/MWh in eight percent of these intervals, demonstrating that, while infrequent, resources could face opportunity costs of $2,000/MWh or greater when providing reserves over energy.[285]

146. In response to the PJM Load Coalition's contention that an energy price level cannot constitute a legitimate opportunity cost if that price level is rarely available to that resource, PJM states that the likely infrequency of being in a reserve shortage while overall opportunity costs are at or near $2,000/MWh does not make accounting for such a possibility unjust and unreasonable. To the contrary, PJM argues that planning for such events is appropriate to help ensure that: "(1) PJM's energy and reserve market prices accurately reflect the cost of meeting the system's energy and reserve needs . . .; and (2) PJM's clearing algorithms select the least-cost solution."[286] PJM reiterates that if the Reserve Penalty Factor is set too low, resources available to prevent or resolve a shortage may not receive a reserve assignment if their opportunity cost is greater than the Reserve Penalty Factor. Moreover, PJM adds, these resources receive out-of-market uplift payments, and the clearing price signals a shortage even though resources were available.[287]

147. PJM argues that protesters opposing the removal of the reserves price cap do not challenge the concept of adding Reserve Penalty Factors and the energy price; instead, they contend that a price of $12,000/MWh is per se too high.[288] PJM reiterates that allowing prices to rise to reflect the independent value of each reserve shortage is just and

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[283] *Id.*

[284] *Id.* at 51-52 (citing *PJM Interconnection, L.L.C.*, 166 FERC ¶ 61,015, at PP 7, 24 (2019)).

[285] *Id.* at 50-52.

[286] *Id.* at 52.

[287] *Id.* at 52-53 (citing PJM Load Coalition Protest at 50).

[288] *Id.* at 53-54 (citing PJM Load Coalition Protest at 53-54; IMM Protest at 31; ODEC Protest at 11-12).

reasonable.[289] Further, PJM contends that its proposal is consistent with the Commission's price formation objective of clearing prices that reflect the cost of serving load.[290] PJM reiterates that a $12,000/MWh price would signal extreme conditions and approximate the value of lost load. PJM argues that such prices would incent new or modified generation resources (or demand response resources) flexible enough to capture such prices.[291]

148. Vistra asserts that PJM's revised $2,000/MWh Reserve Penalty Factor appropriately takes account of the revenues a seller foregoes by committing to provide reserves, rather than sell energy, during shortage or near-shortage conditions.[292] Vistra agrees with PJM that the $2,000/MWh Reserve Penalty Factor is consistent with the actions that system operators will take to maintain reserves and allows those actions to be reflected in market clearing prices.[293] Vistra acknowledges arguments made during stakeholder discussions about setting the maximum price at $1,000/MWh during "normal" conditions, but argues that it is better to recognize the potential for offers greater than $1,000/MWh during cold weather and the fact that PJM may take out-of-market actions that cost more than $1,000/MWh in establishing the maximum price for the ORDC.[294] Vistra concludes that the revised $2,000/MWh Reserve Penalty Factor appropriately accounts for the revenues a seller forgoes by committing to provide reserves, rather than to sell energy, during shortage or near-shortage conditions.[295]

149. PSEG contends that the proposed ORDCs are appropriately anchored at the proposed $2,000/MWh Reserve Penalty Factor, because the current PJM Tariff allows operators to take actions costing up to around $2,000/MWh to avoid load shedding.[296]

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[289] *Id.* at 54 (citing Hogan & Pope Reply Aff., Attach. A, Ex. 1 at 8).

[290] *Id.* at 54 (citing *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,058, at P 35 (2019) ("We continue to find that fast-start pricing in PJM, with the reforms directed herein, will result in prices that more accurately reflect the marginal cost of serving load.")).

[291] PJM Answer at 54-55.

[292] Vistra Answer at 12 (citing PJM Transmittal at 48-53).

[293] *Id.*

[294] *Id.* at 13.

[295] *Id.*

[296] PSEG Answer at 7-8.

PSEG also responds to the Reserve Penalty Factor component of the IMM's alternate proposal. PSEG claims that applying the lower $300/MWh Reserve Penalty Factor to the IMM's proposal would increase LMPs by approximately $8.50/MWh, an amount that is many times greater than the impacts indicated by any of the simulations of PJM's proposal.[297] PSEG warns that the cost impacts of the IMM's proposal would be even higher if PJM's proposed Reserve Penalty Factor of $2,000/MWh were applied to an ORDC resembling the IMM's alternate proposal.[298]

150. P3 disagrees with the IMM and the PJM Load Coalition's argument that the Reserve Penalty Factor should be set at $1,000/MWh instead of PJM's proposed $2,000/MWh.[299] P3 argues that a $2,000/MWh Reserve Penalty Factor is appropriate because there is a link between the level that prices could reach in the energy market and the prices that should be assigned to a reserve shortage.[300] P3 contends that, although it is rare for PJM prices to rise above $1,000/MWh, they have done so under conditions of grid stress, and it is precisely at these moments of grid stress that reserve prices have to be allowed to reflect the market price of those services.[301]

151. The IMM asserts that a Reserve Penalty Factor less than $2,000/MWh is consistent with reliable grid operations.[302] The IMM offers several examples. The IMM explains that MISO's Market-Wide ORDC is a step function with the lowest price level at $200/MW for reserves shortages that are less than four percent of the reserve requirement, and higher prices as the shortage MW increase.[303] The IMM adds that MISO does not reach its maximum shortage price until reserves decline to four percent of the requirement and notes that SPP employs a similar shortage pricing scheme.[304]

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[297] *Id.* at 9.

[298] *Id.*

[299] P3 Answer at 9 (citing IMM Protest at 65; PJM Load Coalition Protest at 65).

[300] *Id.*

[301] *Id.*

[302] IMM Second Answer at 14.

[303] *Id.* at 15 (citation omitted).

[304] *Id.* (citations omitted).

152. The IMM also reiterates the position that the highest Reserve Penalty Factor need not exceed the highest generator offer.[305] The IMM refutes PJM's argument that congestion costs raise the cost of maintaining reserves, because, the IMM asserts, a resource relieving a constraint faces a higher LMP than other resources. The IMM asserts that PJM's logic is flawed because the congestion component of LMP allows for the economic dispatch of the market to reliably avoid the violation of transmission constraints.[306] The IMM adds that the congestion component of LMP works together with the jointly optimized reserve market price to allocate reserves to resources that are not needed for the relief of transmission constraints.[307]

iv. Commission Determination

153. We adopt as part of the just and reasonable replacement rate PJM's proposal to establish a Reserve Penalty Factor of $2,000/MWh for all reserve products. PJM's markets are designed such that the Reserve Penalty Factor is intended to be the key mechanism for setting and signaling shortage pricing in the PJM region. We agree with PJM and commenters that because generation resources can submit verified cost-based incremental energy offers up to $2,000/MWh, resources capable of providing reserves will more frequently face opportunity costs as high as $2,000/MWh. It is therefore appropriate that the Reserve Penalty Factor be revised to allow PJM to procure reserves from resources with such an opportunity cost, and that this action is captured in the market price. We also agree with PJM that setting the Reserve Penalty Factor at $2,000/MWh will allow emergency and pre-emergency demand response, which may submit offers up to $1,849/MWh to reduce demand with a 30-minute lead time, to set the clearing price for any reserve product.

154. We disagree with the assertion of CEE that PJM's proposal to use a $2,000/MWh Reserve Penalty Factor for each reserve product is unjust and unreasonable because PJM's ORDCs are not based on the value of lost load.[308] PJM presents a rational alternative to value-of-lost-load-based ORDCs that conforms to PJM's objective of maintaining its MRRs—which in the case of Primary Reserves is directly linked to PJM's responsibility to meet the NERC standard for recovery from the single largest contingency. Given this use of the MRR as, in PJM's words, the "security minimum,"[309]

[305] *Id.* at 18.

[306] *Id.*

[307] *Id.*

[308] CEE Comments at 15.

[309] PJM Transmittal, Keech Aff. ¶¶ 14-16.

it is rational to tie a violation of that minimum to PJM's willingness to pay to avoid such a violation. Having found $2,000/MWh to be a reasonable willingness to pay for the reasons stated above, we see no contradiction between the use of ORDCs that are not based on the value of lost load and a $2,000/MWh Reserve Penalty Factor. We therefore reject CEE's argument that the Reserve Penalty Factors for the three reserve products should be designed such that the sum of the Reserve Penalty Factors results in a shortage price that reflects the marginal value of the reliability that each provider of reserves contributes to the PJM system.

155. We similarly disagree with AEP that PJM's proposed Reserve Penalty Factor of $2,000/MWh is excessive and inconsistent with energy market rules. For the reasons discussed above, we instead agree with PJM that it is appropriate to align the Reserve Penalty Factor with the currently effective energy offer cap in order to improve the likelihood that market prices reflect the marginal cost of providing reserves and thus send appropriate price signals to Market Sellers.

156. The IMM argues that PJM should eliminate the load management strike price and modify its proposed treatment of load management in defining a shortage. The IMM contends that PJM does not deploy pre-emergency or emergency demand response prior to a Primary or Synchronized Reserve Event.[310] We dismiss these arguments as beyond the scope of this proceeding as they seek to amend rules associated with the pricing of pre-emergency and emergency demand response.

157. We find just and reasonable PJM's proposal to remove the cap on reserve and energy prices when the PJM system experiences multiple reserve shortages. We note that PJM's proposal to allow Reserve Penalty Factors to stack could result in reserve prices as high as $10,000/MWh.[311] Given that this maximum price would result only from the simultaneous occurrence of multiple product and locational shortages, we agree with PJM that it is reasonable for PJM's reserve pricing framework to recognize the independent value of avoiding each such shortage. We therefore decline to require PJM to modify its proposal with respect to reserve market price additivity, as requested by the PJM Load Coalition.[312] We similarly decline to grant ODEC's request that the Commission require PJM to establish a $4,000/MWh cap on the total price for energy and the PJM Load

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[310] IMM Protest at 32.

[311] This figure could theoretically reach $12,000/MWh if PJM models a 30-minute Reserve Requirement in a Reserve Sub-Zone.

[312] PJM Load Coalition Protest at 53 (citing Al-Jabir Aff. ¶ 16).

Coalition's request that the Commission impose a $3,500/MWh cap on the cumulative application of the Reserve Penalty Factors.[313]

158. Finally, we find that PJM's proposed Reserve Penalty Factor revisions are the best solution to address the identified shortcomings in PJM's reserve market design. Therefore, we decline to adopt alternative proposals, such as those put forth by ODEC and the PJM Load Coalition to cap the Reserve Penalty Factor at the highest generation offer rate permitted in the day-ahead market,[314] and by the Ohio Commission to only allow the Reserve Penalty Factor to increase to the proposed $2,000/MWh on days and hours when PJM has declared Tariff emergency procedures.[315]

c. ORDC - Reserves Beyond the MRR

i. PJM's Proposal

159. In order to address some of the shortcomings of its reserve market design, PJM proposes to replace the current Step 2 (both parts 2A and 2B) of its ORDCs with a downward-sloping demand curve to cover the uncertainty of meeting the MRR. PJM proposes to define the shape of its ORDCs beyond the MRR based on the likelihood that real-time conditions could negate or exhaust reserves of that quantity, resulting in a shortage below the MRR.[316] PJM states that formulating the shape of the ORDCs beyond the MRR in this way will address operational uncertainties and shift the burden of addressing system balance and reserve uncertainties from the operators to the market.[317]

160. PJM proposes to formulaically define the price at any given point on the ORDCs to the right of the MRR as the product of (1) the probability of falling below the MRR in real time despite procuring a quantity of reserves corresponding to that point multiplied by (2) the $2,000/MWh Reserve Penalty Factor.[318] PJM explains that, because the risk of

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[313] *Id.* at 65.

[314] ODEC Protest at 9.

[315] Ohio Commission Protest at 9.

[316] PJM Transmittal at 53.

[317] *Id.* at 53-55.

[318] For example, if the MRR is 1,400 MW and PJM is currently carrying 1,700 MW of reserves, then PJM would have 300 MW of reserves in excess of the MRR. However, based on forecast uncertainty, there is a non-zero probability that the net forecast error exceeds 300 MW between when PJM commits the 1,700 MW of reserves and 30 minutes from that time (the time for which those reserves were

falling below the MRR diminishes as reserve levels increase beyond the MRR, this formulation results in an ORDC that gradually slopes down and to the right.[319] PJM contends that reformulating the ORDCs as it proposes will resolve the price suppression and uplift concerns that make the current ORDCs unjust and unreasonable, and help to reduce the need for PJM operators to take actions based on their notions of real-time market uncertainties.[320]

161. PJM states that quantifying the uncertainties underlying the probability of falling below the MRR presents several questions: (1) what the main sources of the relevant uncertainty are; (2) what factors reliably and predictably reduce those uncertainties; (3) what the appropriate "look-ahead" period is, i.e., the time between the forecast and the actual occurrence of the conditions addressed by the forecast; (4) what span of historic data should be considered to measure the observed error; (5) what periods within the year should be assessed to recognize patterns of variation in forecast error; and (6) how the uncertainty reflected in the overall net error should be incorporated into the ORDC.

162. PJM explains that the main sources of the uncertainties relevant to the probability of falling below the MRR are load forecast error, interchange forecast error, intermittent generation forecast error, and generator forced outages.[321] PJM proposes to use historical data to derive the probabilistic distributions of these errors. PJM explains that it will then use those distributions to estimate the probability that these errors are greater than a given value of reserves above the MRR.[322]

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procured). PJM states that this probability, multiplied by the $2,000/MWh Reserve Penalty Factor, determines the maximum incremental cost that the system is willing to incur to maintain that level of reserves. *Id.* at 55-56.

[319] *Id.* at 55.

[320] *Id.*

[321] *Id.* at 57-58.

[322] *Id.* at 58 (citing Rocha Garrido Aff. ¶¶ 11, 15). PJM proposes to estimate uncertainties using historical data from the most recent three full calendar years. PJM contends that the choice of three years strikes a balance between reducing the impact that a single year may have on the probabilistic distribution and removing old data that may not reflect the most up-to-date status of PJM forecasting models. *Id.* at 60-61.

163. In addition to MRRs, PJM explains that it also has regulation requirements, which is a defined MW amount that PJM must procure in ramp hours and non-ramp hours.[323] PJM explains that the regulation requirement can help reliably and predictably reduce the probability that the system will fall short of the MRR in real-time.[324] PJM explains that the current regulation requirement is 800 MW during ramp hours and 525 MW during non-ramp hours, and that resources procured to meet the regulation requirement directly reduce the likelihood of falling short of the MRR at the end of the look-ahead time period.[325] Thus, PJM proposes to include the regulation requirement as an uncertainty-mitigating factor in its calculation of the probability of falling below the MRR.[326]

164. PJM's proposal utilizes look-ahead time periods to define how PJM will measure the uncertainty for purposes of constructing the ORDCs by comparing the forecast at the start of the look-ahead time period to the forecast at the end of the look-ahead time period. PJM contends that 30 minutes is a reasonable look-ahead period for the Synchronized and Primary Reserve Requirement and that 60 minutes is a reasonable look-ahead period for the 30-minute Reserve Requirement.[327] PJM explains that, for Synchronized Reserve and Primary Reserve, 30 minutes is appropriate to account for the total time elapsed between the reserve assignment in the RT SCED case solution and the end of the period in which the procured reserves are expected to respond, which is at least 20 minutes.[328] Similarly, for 30-minute Reserve, PJM explains that 60 minutes is appropriate to account for the total time elapsed between the RT SCED case solution and the end of the period in which the procured reserves are expected to respond, which is at least 40 minutes.[329]

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[323] *Id*. at 58. PJM procures these MW amounts for regulation to help maintain Area Control Error.

[324] *Id.*

[325] *Id.*

[326] *Id.*

[327] *Id.* at 59-60.

[328] *Id.* at 59.

[329] *Id.* at 59-60. PJM proposes to add an additional 10 minutes to the look-ahead period for the Synchronized and Primary Reserve Requirement and 20 minutes to the look-ahead period for the 30-minute Reserve Requirement to capture deviations from when the RT SCED case is run and to capture the value of reserves in subsequent intervals. *Id*. at 60.

165. In order to account for variation in uncertainties and forecast errors both by season and time of day, PJM proposes to measure uncertainty within six four-hour, time-of-day blocks across the four seasons of the year, resulting in 24 discrete time periods with separate probability distributions.[330] PJM states that the choice of 24 probability distributions results in 24 different ORDCs.[331]

166. PJM proposes to utilize probabilistic ORDCs for each of its three reserve requirements, i.e., Synchronized Reserve, Primary Reserve, and 30-minute Reserve.[332] Furthermore, PJM states that it will use zonal ORDCs to reflect its zonal reserve requirements, as it does currently with its stepped ORDCs.[333] PJM states that it will update the calculations of its ORDCs annually to account for the most recent calendar year's data, and post the revised ORDCs by the first of April each year.[334]

ii. <u>Comments and Protests</u>

167. API, Calpine and LS Power, CEE, Direct Energy, Dominion, Duke, EPSA, ETI, Exelon, FirstEnergy, IPI, NEI, P3, PSEG, R Street, and Vistra generally support PJM's proposal to implement downward-sloping ORDCs to procure reserves beyond the MRR.[335] These parties generally support PJM's proposed ORDCs because they will better reflect operational uncertainty in market prices, reduce the need for out-of-market operator actions, provide incentives for flexible resources, and/or reduce the relative

[330] *Id.* at 61.

[331] *Id.* PJM contends that the choice of 24 probabilistic distributions strikes a balance between quantifying uncertainty during specific periods and avoiding a large number of ORDCs that cause market outcomes to change too frequently. *Id.*

[332] *Id.* at 66.

[333] *Id.* at 66-67.

[334] *Id.* at 68.

[335] API Comments at 3; Calpine and LS Power Comments at 2-8; CEE Comments at 1-3; Direct Energy Comments at 1; Dominion Comments at 6-8; Duke Comments at 1-4; EPSA Comments at 16; ETI Comments at 5-6; Exelon Comments at 24-26; FirstEnergy Comments at 2-3; IPI Comments at 10-13; NEI Comments at 9-10; P3 Comments at 7-14; PSEG Protest at 22-25; R Street Comments at 2-3; Vistra Comments at 6-9.

importance of the capacity market for cost recovery.[336] However, several of these parties raise concerns with specific elements of PJM's proposal, as summarized below.

168. Direct Energy requests that the Commission condition its approval of PJM's proposed replacement rate on a requirement that PJM submit annual reports to the Commission evaluating the effect of its proposal.[337] Furthermore, Direct Energy requests that the Commission condition its approval on PJM demonstrating that its proposed ORDCs will not value reserves in excess of the MRR above $0.00/MWh during a minimum generation event, when PJM is required to take resources offline.[338] Finally, Direct Energy requests that the Commission allow at least six months between its determination of the replacement rate and the replacement rate's effective date.[339]

169. Exelon asks that the Commission require PJM to expand its Operator-Initiated Commitment Report,[340] posted monthly in compliance with Order No. 844, to include data on load biasing consistent with the data in the Affidavit of Christopher Pilong (Pilong Affidavit).[341] To support its request, Exelon notes that the "Commission required PJM and other RTOs/ISOs to post the Operator-Initiated Commitment Report to provide

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[336] *See, e.g.*, Exelon Comments at 24-26; IPI Comments at 9-14; CEE Comments at 10-13.

[337] Direct Energy Comments at 4-6.

[338] *Id.* at 8-10. A Minimum Generation Emergency is defined as "an Emergency declared by the Office of the Interconnection in which the Office of the Interconnection anticipates requesting one or more generating resources to operate at or below Normal Minimum Generation, in order to manage, alleviate, or end the Emergency." *See* PJM Tariff, Definitions L – M – N.

[339] Direct Energy Comments at 6-8.

[340] Exelon Comments at 32. Exelon explains that the Operator-Initiated Commitment Report provides granular information regarding the location, timing, causes, and sizes of operator-initiated commitments. *Id.* at 32 n.63 (citing *Uplift Cost Allocation and Transparency in Mkts. Operated by Reg'l Transmission Orgs. & Indep. Sys. Operators*, Order No. 844, 163 FERC ¶ 61,041, at P 99 (2018)). Exelon also notes that in Order No. 844, the Commission declined to adopt commenter suggestions to include load biasing in the Operator-Initiated Commitment Report, concluding that it would be outside the scope of that proceeding. *Id.* at 32-33.

[341] *Id.* at 32. Exelon states that alternatively, the Commission could require PJM to disclose load biasing data in a separate report posted commensurate with the Operator-Initiated Commitment Report. *Id.* at 32 n.64.

'transparency into operator-initiated commitments . . . because such commitments can affect energy and ancillary service prices and can result in uplift.'"[342] Because PJM demonstrates that load biasing is affecting prices and resulting in uplift, Exelon argues, the Commission likewise should require PJM to disclose information regarding load biasing. Exelon states that PJM also should report all other out-of-market actions that increase supply (or decrease load).[343] Exelon states that this reporting requirement would help ensure that PJM's Reserve Market Proposal achieves its primary purpose.[344]

170. FirstEnergy critiques several assumptions made in PJM's simulation of the potential impact that its proposal may have on LMP, asserting that PJM modeled certain dispatch and operator actions that are not likely to occur in a real-time situation and, therefore, overstate the impact of the Reserve Market Proposal. FirstEnergy explains that PJM provided a report to stakeholders in November 2017 that suggested potential increases of $3.50/MWh in LMP, which greatly exceeds the $0.46/MWh increase in LMP projected in PJM's filing.[345] FirstEnergy states that it regrets that the proposal "has been so significantly watered down" and will not be sufficient to bolster resources currently at risk of retirement.[346]

171. IPI requests the Commission order an interim review of the rules that establish the ORDC design parameters if it decides to adopt PJM's proposal.[347] IPI suggests an interim review to evaluate whether PJM's computations of the uncertainties and the associated incremental value of reserves based on historical data are correct, or whether a forward-oriented approach is needed for determining the shape of the ORDC.[348] IPI

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[342] *Id.* at 32 (quoting Order No. 844, 163 FERC ¶ 61,041 at P 99).

[343] *Id.*

[344] *Id.* at 33.

[345] FirstEnergy Comments at 3-4. (citing PJM Interconnection, L.L.C., *Proposed Enhancements to Energy Price Formation*, 50 (Nov. 15, 2017), https://pjm.com/-/media/library/reports-notices/special-reports/20171115-proposed-enhancements-to-energy-price-formation.ashx?la=en).

[346] *Id.* at 4.

[347] IPI Comments at 11.

[348] *Id.*

suggests a forward-looking approach might be warranted given the quick changes in the composition of generation resource types.[349]

172. PSEG argues that three additional reforms are needed to more fully realize the welfare maximization goal of the PJM reserve market.[350] First, PSEG contends that the Reserve Market Proposal shifts the ORDCs to the left by the amount of system regulation online based on a patently unreasonable assumption that cannot be supported.[351] PSEG recommends that the regulation shift in the ORDCs either be eliminated entirely or retained only for the 10-minute Reserve product based on the empirical level of regulation up historically available within a 30-minute uncertainty window.[352] Second, PSEG argues that the Reserve Market Proposal fails to address the need for PJM operators to respond to emergent reliability concerns.[353] Specifically, PSEG recommends that the Commission direct PJM to modify its proposal to increase the reserves requirement or shift the ORDCs to reflect all operator actions taken after the execution of the day-ahead market, including additional reserves associated with occurrences such as Conservative Operation or Hot/Cold Weather Alerts.[354] Third, PSEG contends that PJM must adopt measures to ensure that the ORDCs are properly updated as data becomes available and regularly evaluated to assure they neither overstate nor understate uncertainties.[355] PSEG argues that greater granularity than PJM's proposal to use three years of historic data is required, and that the Commission should direct PJM to include specific timing and criteria associated with periodic reviews of the ORDCs.[356]

173. R Street warns that there is a risk that PJM's ORDCs will not actually reflect operational reality, and therefore requests that the Commission require PJM and the IMM to report on whether out-of-market actions by operators diminish as a result of the market-based procurement of operating reserves.[357] R Street further suggests

[349] *Id.*

[350] PSEG Protest at 25-31.

[351] *Id.* at 26-28 (citing Keech Aff. ¶ 12).

[352] *Id.* at 28.

[353] *Id.*

[354] *Id.* at 29 (citing Shanker Aff. ¶ 110).

[355] *Id.* at 31.

[356] *Id.*

[357] R Street Comments at 3.

that the Commission require periodic re-evaluation of the appropriateness of the slopes of the ORDCs.[358]

174. AEP, CEA, the IMM, the Maryland Commission, ODEC, the Ohio Commission, OPSI, and the PJM Load Coalition oppose PJM's proposed downward-sloping ORDCs.[359] In general, parties opposing PJM's proposed ORDCs argue that: (1) the ORDCs overstate the value of reserves and conflict with reserve levels and shortage probabilities observed in PJM;[360] (2) the ORDCs fail to incentivize flexible resources as PJM claims;[361] (3) the formulas and assumptions used to construct the ORDCs are incorrect and should be resolved before implementing a replacement rate;[362] and (4) the ORDCs would significantly increase energy and reserve prices, and are unjust and unreasonable absent a mechanism to prevent over-recovery of costs in the capacity market.[363] However, several opposing parties voice general support for efforts to value flexibility,[364] the concept of a downward-sloping ORDC,[365] and lesser reliance on the capacity market for cost recovery.[366]

175. Parties protesting the shape of PJM's proposed ORDCs argue that they overstate the value of reserves beyond the MRR. AEP states that PJM projects it will regularly procure between 3,000 MW and 4,000 MW above the MRR for Synchronized Reserves,

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[358] *Id.*

[359] AEP Protest at 2-6; CEA Protest at 1-3; IMM Protest at 22-51; Maryland Commission Protest at 10-16; ODEC Protest at 3-7; Ohio Commission Protest at 7-10; OPSI Protest at 2-9; PJM Load Coalition Protest at 38-43.

[360] *See, e.g.*, AEP Protest at 5; Ohio Commission Protest at 8-9; PJM Load Coalition Protest at 38-40; IMM Protest at 43-47; ODEC Protest at 3-7.

[361] *See, e.g.*, IMM Protest at 47-49.

[362] *See, e.g.*, ODEC Protest at 10-11; PJM Load Coalition Protest at 40-43; IMM Protest at 33-43.

[363] *See, e.g.*, CEA Protest at 7-17; Maryland Commission Protest at 12-15; Ohio Commission Protest at 3-6; ODEC Protest at 12-13; OPSI Protest at 3-28; PJM Load Coalition Protest at 44-48; IMM Protest at 51-55. We address these protests in *infra* section IV.B.3.

[364] CEA Protest at 2.

[365] AEP Protest at 4; Ohio Commission Protest at 7.

[366] CEA Protest at 1-2.

regardless of the season, and contends that PJM has failed to demonstrate why this much excess reserves is needed to maintain reliability.[367] The Ohio Commission maintains that PJM's "best guess" approach to developing the extended "tail" of the ORDCs does not meet the standard of review that should apply to a FPA section 206 filing before FERC, and that PJM should have allowed the stakeholder process to form a consensus before unilaterally filing its proposal with the Commission.[368]

176. The IMM similarly argues that PJM's proposed ORDCs would procure more reserves than operators have historically committed.[369] The IMM estimates that the ORDCs will increase the amount of Primary Reserves carried by PJM by an average of 1,354 MW to 1,376 MW per hour, or 56.8% to 57.7%,[370] and argues that this discrepancy between the ORDCs and observed operator actions results from the fact that PJM overestimates the probability of a reserve shortage.[371] The IMM states that PJM's ORDC calculations find a 3.8% to 15.2% probability that a shortage will occur, depending on the time of day and year, at the historic average Primary Reserve level of 300 MW above the approximate 2,100 MW reserve requirement,[372] despite the fact that PJM had zero five-minute market intervals of Primary Reserve shortage in 2018.[373]

177. The PJM Load Coalition argues that the proposed ORDCs overstate risks and unnecessarily increase costs during periods when PJM believes more reserves are needed.[374] The PJM Load Coalition contends that the proposed ORDCs would assign a positive value to acquiring reserves in excess of the current Step 2A, despite the fact that PJM does not regularly need reserves in excess of this level to preserve reliability.[375] The

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[367] AEP Protest at 5-6.

[368] Ohio Commission Protest at 7.

[369] IMM Protest at 43.

[370] *Id.* (referencing Attach. B, Monitoring Analytics, LLC, *ORDC Simulation Results*, at tbl.1 (ver. 2, May 10, 2019)).

[371] *Id.* at 43-44.

[372] *Id.* at 44 (citations omitted).

[373] *Id.* (citing Monitoring Analytics, LLC, *2018 State of the Market Report for PJM*, Vol. 2, 209 (2019)).

[374] PJM Load Coalition Protest at 39.

[375] *Id.* (citing Al-Jabir Aff. ¶ 17).

PJM Load Coalition claims that reserves in excess of this level are only needed during limited high-risk periods of operation, when PJM could utilize the current Step 2B on its ORDCs.[376] The PJM Load Coalition argues that, because PJM has provided no evidence that the existing ORDCs have procured insufficient reserves, the proposed ORDCs would procure excess reserves and increase costs without any commensurate benefit.[377]

178. The Maryland Commission argues that procuring reserves above the MRR adds to an already conservative approach to ensuring system reliability but does not necessarily improve reliability. The Maryland Commission states that if the Commission determines that a more conservative approach is needed beyond the NERC reliability requirement, and that a downward-sloping demand curve is appropriate, then that curve can be appended to the second step and the pricing curve should reflect the currently effective $300/MWh Reserve Penalty Factor for that step.[378] The PJM Load Coalition similarly argues that the Commission could direct PJM to utilize Step 2B.[379] The PJM Load Coalition notes that PJM states that it has not yet used Step 2B, but contends that by using it, PJM could procure additional reserves without increasing the Reserve Penalty Factor.[380] The Ohio Commission recommends that PJM's Reserve Penalty Factor only be allowed to increase to the proposed $2,000/MWh on days and hours when PJM has declared Tariff-defined emergency procedures, including, but not limited to, extreme weather events.[381]

179. The IMM argues that PJM's proposed ORDCs provide more benefits to inflexible resources than flexible resources, contrary to PJM's claims.[382] The IMM states that any incentive to develop flexible resources created by increased reserve revenues is more than offset by increases in energy revenues to inflexible resources.[383] Thus, the IMM argues,

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[376] *Id.* at 40 (citing Al-Jabir Aff. ¶ 17).

[377] *Id.* (citing *Ill. Commerce Comm'n v. FERC*, 576 F.3d 470, 477 (7th Cir. 2009)).

[378] Maryland Commission Protest at 10.

[379] PJM Load Coalition Protest at 64.

[380] *Id.* at 65 (citing Al-Jabir Aff. ¶ 20).

[381] Ohio Commission Protest at 9.

[382] IMM Protest at 47 (citing PJM Transmittal at 70).

[383] *Id.* The IMM provides simulation results showing that nuclear resources would receive the largest increase in energy revenues under PJM's proposal, despite the fact that they are the least flexible resources in the PJM market. *Id.* at 48.

PJM's proposal to pay higher energy revenues to all units through extended ORDCs would create a windfall for inflexible capacity that does not provide reserves.[384]

180. The IMM and ODEC contest PJM's choice of a 30-minute look-ahead period for the 10-minute Reserve products.[385] The IMM explains that the time between when forecasts are input to the market software to when the forecasted load, generation, and reserves are realized is 10 to 14 minutes.[386] Thus, the IMM contends, it is appropriate to use a 15-minute look-ahead period to calculate forecast uncertainty, and a 30-minute look-ahead period is incorrect, unjust, and unreasonable.[387] The IMM provides simulation results demonstrating that cleared Synchronized Reserves would be 9.5% lower and reserve revenues would be 32.8% lower using a 15-minute look-ahead rather than a 30-minute look-ahead to calculate the Synchronized and Primary Reserve ORDCs.[388] ODEC contends that PJM dispatchers are presented with an RT SCED solution 10 minutes prior to providing operating instructions to resources that then have 10 minutes to supply those Primary Reserves in response to the operating instructions.[389] Thus, ODEC argues, 20 minutes is the most logical look-ahead period.[390] ODEC states that changing the look-ahead period from 30 minutes to 20 minutes would save load approximately $250 million per year without any degradation in the benefits of PJM's proposal.[391]

181. CEA and ODEC argue that PJM's proposal to base its ORDCs on the probability of incurring a reserves shortage and the associated Reserve Penalty Factor deviates from PJM affiants Dr. Hogan and Dr. Pope's ORDC model, which is based on the value of lost load and the loss of load probability.[392] CEA affiant James F. Wilson (Wilson) argues that a conservative application of the methodology proposed by Dr. Hogan and Dr. Pope

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[384] *Id.* at 49.

[385] *Id.* at 33-38; ODEC Protest at 10-11.

[386] IMM Protest at 33-34.

[387] *Id.* at 35-37.

[388] *Id.* at 37, Attach. B at tbl.1.

[389] ODEC Protest at 11.

[390] *Id.*

[391] *Id.*

[392] CEA Protest, Wilson Aff. ¶¶ 25-36; ODEC Protest at 3-7.

would result in a marginal reliability value of reserves at the MRR at $10/MWh, far less than proposed in PJM's ORDCs.[393] ODEC applies Dr. Hogan and Dr. Pope's model to demonstrate that PJM's ORDC for the "Summer 5" period implies a 4.5% probability of unserved load, implying loss of load on a weekly basis, which ODEC contends demonstrates that the ORDCs are fundamentally flawed and will lead to unreasonably high reserve prices.[394]

182. The Maryland Commission argues that PJM's proposal to use 24 administrative ORDCs falls short, because its reliance on three years of historic net load error data would rely on forced outage rates years prior to the full implementation of Capacity Performance, which incentivizes resources to be available and capable of providing energy and reserves throughout the entire delivery year.[395]

183. The PJM Load Coalition disagrees with PJM's choice to use historic net load error data and expected value to calculate the incremental value of reserves, arguing that the use of averages is not an appropriate means to set prices.[396] The PJM Load Coalition contends that PJM should instead measure actual reserves and changes in actual reserves as an input to its ORDCs.[397] Further, the PJM Load Coalition argues that PJM's net load error calculations fail to account for instances where errors might be negatively correlated, e.g., summer peak conditions where high pressure causes high demand but yield a lower wind forecast error because the wind is unlikely to blow, therefore overstating net load error and the probability of a reserves shortage.[398]

184. The IMM argues that PJM fails to account for instances where forecast error prevents rather than creates reserve shortages, and that the ORDCs should not reflect a 100% probability of a reserves shortage (and a $2,000/MWh price) for reserve quantities between zero and the MRR.[399] The IMM explains that there could be instances where RT SCED indicates the system is short reserves but due to an over-forecast of load or an under-forecast of wind or solar generation there is sufficient online generation and offline

[393] CEA Protest, Wilson Aff. ¶ 30.

[394] ODEC Protest at 6-7.

[395] Maryland Commission Protest at 14.

[396] PJM Load Coalition Protest at 40-41.

[397] *Id*.

[398] *Id.* at 42-43.

[399] IMM Protest at 38.

reserves to meet the energy and reserve requirements.[400] The IMM provides an alternative ORDC that applies PJM's probability calculations for reserve quantities between zero and the MRR, and demonstrates that it would result in significantly lower reserve prices at reserve quantities below the MRR.[401]

185. Furthermore, the IMM argues that PJM utilized datasets with missing data, incorrect data, or misaligned timestamps in constructing its ORDCs.[402] The IMM states that PJM must develop a well-defined process for the calculation of its ORDCs, and that the process used throughout the stakeholder process was not adequate.[403]

186. The IMM offers an alternative to PJM's proposed ORDCs that would account for operator actions in the market by increasing the reserve requirements to accurately reflect system needs when operators take actions, by shifting the ORDCs to the right at a marginal value of reserves equal to the defined Reserve Penalty Factor.[404] The IMM also proposes that PJM define the default reserve requirements in accordance with the NERC BAL-002 requirement, and asks that the Commission require PJM to define in its Tariff clear rules for when PJM increases the reserve requirements and to publicly post the applicable reserve requirements, applicable zones, and explicit start and end times of the requirement changes.[405] The IMM submits that such a change would allow operators to commit the resources they need without suppressing price, which is a just and reasonable proposal to address the potentially price-suppressive effects of operator actions.[406]

187. The PJM Load Coalition notes that in its order accepting $300/MWh as the Step 2B Reserve Penalty Factor, the Commission required PJM to file two annual reports with the Commission including, among other things, data on Hot/Cold Weather Alerts and any

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[400] *Id.*

[401] *Id.* at 39-40.

[402] *Id.* at 43.

[403] *Id.*

[404] *Id.* at 63-64.

[405] *Id.* at 64-65.

[406] *Id.* at 65. The IMM states that a sloped ORDC may be just and reasonable so long as it does not extend beyond the established reserve requirements. *Id*. at 65-66.

emergency conditions requiring the scheduling of additional reserves.[407] The PJM Load Coalition states that PJM submitted an annual report for the 2015/2016 Delivery Year, but it appears that PJM did not submit the report on the 2016/2017 Delivery Year.[408] The PJM Load Coalition states that PJM should file that report before the Commission considers and implements any reserve market design changes.[409]

188. The IMM contends that PJM has failed to specify its process for calculating zonal ORDCs in the Tariff.[410] The IMM also states that PJM claims that it will use load, wind output, solar output, forced outages, and interchange forecasts to calculate the zonal ORDCs, but PJM does not explain the location of such load, generation, and interchange relative to the zone. The IMM argues that because resources outside the zone can be used to meet the zonal requirement, it does not make sense to calculate the probability of falling below the MRR solely based on load and resources inside the zone. The IMM notes that PJM will use a zonal estimate of net interchange forecast, but notes that interchange applies to the entire RTO, not a subpart of PJM.[411]

iii. Answers

189. PJM disagrees with the IMM's claim that its proposal will reward inflexible resources.[412] PJM contends that reserves are inherently a ramping product, which values and rewards resources with the ability to quickly change output.[413] PJM acknowledges that its proposal will likely result in an increase in LMPs, which will be paid to all resources, including inflexible resources, but argues that the Commission has long held

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[407] PJM Load Coalition Protest at 30-31 (citing *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,017 at P 29, order oara. (B)).

[408] *Id.* at 31 (referencing Docket No. ER15-643-001).

[409] *Id.*

[410] IMM Protest at 40 (citing PJM Transmittal, Rocha Garrido Aff. ¶ 25).

[411] *Id.* at 40-41.

[412] *Id.* at 36-40 (citing IMM Protest at 47-49).

[413] *Id.* at 36.

that it is reasonable to increase LMPs when the supply of reserves is scarce.[414] PJM states that the IMM either misinterprets simulation results or fails to consider the scale of the energy market when compared to the reserves market in claiming that PJM's proposal rewards inflexible resources.[415] Furthermore, PJM states that the IMM's own analysis shows that flexible resources will receive between 65.3% and 76.5% of the total revenue increase resulting from PJM's proposal, and PJM provides evidence demonstrating that a combined-cycle plant simulated in ERCOT with the PJM ORDCs superimposed would be incentivized to increase its flexibility.[416]

190. PJM disagrees with the IMM's and ODEC's proposals to use alternative look-ahead periods which PJM argues fail to account for the time that can elapse between when PJM runs the forecast for the RT SCED case (i.e., the time of the forecast), and when the scheduled resource is expected to perform (i.e., the occurrence of the event being forecasted).[417] PJM contends that assuming away part of the time period between the forecast and the event may seem to reduce the probability of error, when in fact it is merely a choice to ignore some of the actual probability of error.[418] By contrast, PJM contends that its 30-minute look-ahead period fully captures the time that can elapse between the RT SCED forecast and the actual reserve performance, and is therefore a reasonable metric for the uncertainties used to design the ORDC.[419]

191. Exelon supports PJM's proposed look-ahead periods and disagrees with the IMM's proposed look-ahead periods. Exelon argues that the IMM advocates for a more aggressive approach that provides no margin for error.[420] Exelon states that the IMM's

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[414] *Id.* at 37 (citing *Wholesale Competition in Regions with Organized Elec. Mkts.*, Order No. 719, 125 FERC ¶ 61,071 (2008), *as amended*, 126 FERC ¶ 61,261, *order on reh'g*, Order No. 719-A, 128 FERC ¶ 61,059, *reh'g denied*, Order No. 719-B, 129 FERC ¶ 61,252 (2009)).

[415] *Id.* at 37-38.

[416] *Id.* at 38-40 (citing Keech Reply Aff. ¶¶ 15-16); *Id.* at Attach. E: Mort Webster, *Rewarding Flexibility: An Analysis of the Impact of PJM's Proposed Price Formation Reform on the Incentives for Increasing Generator Flexibility* (2019) (Webster Report).

[417] *Id.* at 41.

[418] *Id.*

[419] *Id.*

[420] Exelon Answer at 31 (citing IMM Protest at 37, fig.9).

method fails to account for two fundamental issues in the operation of the forecasts. First, Exelon states that the IMM's method fails to account for the multi-period nature of forecast uncertainties. Second, Exelon argues that the IMM's method fails to consider how operators behave.[421] According to Exelon, operators who identify a potential forecasting error do not wait until PJM's software triggers a concrete error; they take action early enough to remedy the error before it is realized. In responding to potential errors, operators first deploy regulation and only call Synchronized Reserves as a last resort. Exelon states that this multi-step process accurately reflects the range of actions in which operators respond to uncertainty, including a period of 20 to 30 minutes in advance for the 10-minute Reserves, and up to 60 minutes in advance for the 30-minute Reserves. Therefore, Exelon states that PJM's method for calculating the ORDC more sensibly balances potential costs with the need to accurately represent the actual demand for reserves needed for real-world reliable operation of the PJM system.[422]

192. PJM cites to the reply comments of Dr. Hogan and Dr. Pope, attached to the Reply Affidavit of Drs. William W. Hogan and Susan L. Pope (Hogan and Pope Reply Affidavit) affirming that the MRR is the appropriate reference point for setting the price equal to the costs of those emergency actions, in response to CEA's claim that the PJM methodology based on loss of load probability results in a marginal value or $10/MWh for reserves at the MRR.[423] PJM argues that CEA affiant Mr. Wilson's claims are not supported by quantitative analysis, and that Mr. Wilson incorrectly claims that "system operators have generally been comfortable with the MRR."[424]

193. PJM disputes ODEC's finding that PJM's proposed ORDCs are out of bounds when compared to Dr. Hogan and Dr. Pope's ORDC methodology.[425] PJM contends that ODEC's analysis ignores Dr. Hogan and Dr. Pope's acknowledgment that their approach can accommodate "an extension to include minimum contingency reserves (i.e., the [MRR])," and thus ODEC's formula only applies where there is no MRR.[426]

194. PJM disagrees with the IMM's argument that the ORDC price should be less than the Reserve Penalty Factor at reserve quantities below the MRR because forecast error

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[421] *Id.* at 32 (citing Rocha Garrido Aff. ¶ 14).

[422] *Id.* at 31-32.

[423] PJM Answer at 43 (citing Hogan & Pope Reply Aff., Attach. A, Ex. 1 at 9-10).

[424] *Id.* at 44 (quoting CEA Protest, Wilson Aff. ¶ 30).

[425] *Id.* (citing ODEC Protest at 6-7).

[426] *Id.*

can prevent rather than create shortages.[427] PJM concedes that there is a non-zero probability that the MRR is met ex post even if there is an ex ante MRR deficiency, but contends that using this non-zero probability to develop the ORDC would price reserve quantities below the MRR below the Reserve Penalty Factor.[428] PJM contends that such an ORDC would be inconsistent with operating the grid securely and reliably, and price reserves below the Reserve Penalty Factor even when the quantity of reserves is zero MW.[429]

195. PJM disputes the PJM Load Coalition's argument that its probability calculations fail to consider negatively correlated forecast errors.[430] PJM contends that the PJM Load Coalition either misunderstands or mischaracterizes PJM's proposal, and states that a careful review of the formula in its initial filing shows that all correlations between the uncertainties, whether negative, positive, or no correlation, are captured by the net load error empirical distribution that is ultimately used to construct the ORDCs.[431]

196. Similarly, PJM contends that the PJM Load Coalition either misunderstands or mischaracterizes its proposed use of expected value to construct the ORDCs.[432] PJM argues that the use of expected value is appropriate because there is both a probability that reserves beyond the MRR will be enough to avoid a shortage and that those reserves will not be enough to avoid a shortage.[433] PJM states that expected value provides a way to consider both of these probabilities and derive the downward-sloping section of the ORDCs.[434] PJM contends that the PJM Load Coalition incorrectly alleges in the Affidavit of Charles S. Griffey (Griffey Affidavit) that PJM is using three-year average forecast errors as proxies for actual changes in reserves.[435] PJM clarifies that it is

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[427] *Id.* at 45 (citing IMM Protest at 38-40).

[428] *Id.*

[429] *Id.* at 45-46.

[430] *Id.* at 46 (citing PJM Load Coalition Protest at 41-43).

[431] *Id.* (citing Rocha Garrido Reply Aff. ¶ 16).

[432] *Id.* (citing PJM Load Coalition Protest at 46).

[433] *Id.* at 47.

[434] *Id.*

[435] *Id.* (citing PJM Load Coalition Protest at 40-41, Griffey Aff. ¶ 7).

proposing to combine error data and regulation requirement data point-by-point to derive a net load error probabilistic distribution.[436]

197. PJM disagrees with protestors' arguments that its ORDCs will over-procure reserves.[437] PJM states that the Commission has found that the amount of reserves needed is not limited by the MRR, and thus procurement of reserves in excess of the MRR does not necessarily result in procurement of "excess" reserves.[438] PJM contends that it has established an objective demand for reserves in excess of the MRR using the probabilistic analysis underlying its ORDCs, and that the extent of the ORDCs is anchored in actual data and operational realities that operators need to take into account.[439]

198. Exelon argues that the IMM's alternative ORDC proposal would effectively codify reliance on operator actions as an ongoing solution. Exelon argues that the IMM's proposed mechanism will greatly increase reserve and energy price volatility, reducing the transparency and predictability of the market pricing. Exelon points out that the IMM's approach would lean on real-time interventions, whereas PJM's proposal relies primarily on the day-ahead market. Exelon claims that procuring reserves in advance is inevitably more efficient.[440]

199. P3 disputes the IMM and the PJM Load Coalition's argument that a vertical demand curve that stops at or minimally past the MRR is a just and reasonable means to value reserves.[441] P3 contends that this argument is essentially an argument for the status quo that systematically under-procures and misprices reserves and forces out-of-market actions to maintain reliability.[442] P3 argues that PJM's proposed sloped ORDC properly recognizes the value of reserves in excess of the MRR using quantitative methods, and

[436] *Id.* at 47-48.

[437] *Id.* at 48 (citing AEP Protest at 5-6, PJM Load Coalition Protest at 22-25).

[438] *Id.*

[439] *Id.* at 48-49.

[440] Exelon Answer at 29-30.

[441] P3 Answer at 10 (citing IMM Protest at 22).

[442] *Id.*

that the IMM and the PJM Load Coalition's alternative proposals have not been vetted with PJM or any other stakeholders and do not solve the problem at hand.[443]

200. The PJM Load Coalition argues that PJM's proposed downward-sloping ORDC would result in the procurement of reserves in excess of the level needed for reliability, and thus would produce a price that is not reflective of the actual marginal cost of serving load.[444]

201. PSEG contends that the IMM wrongly asserts that the Reserve Market Proposal would implement "scarcity pricing all the time, all hours of the day, all days of the year, regardless of actual shortage conditions."[445] Rather, PSEG explains that PJM's proposed downward-sloping ORDC would assign a value to reserves deemed to be necessary for reliable operations above the minimums necessary to be compliant with NERC reliability criteria, but scarcity pricing would only occur when the MRR is not met.[446] PSEG argues that employing the ORDCs will optimize the dispatch of resources to avoid scarcity.[447] PSEG contends that the fact that reserves procured above the MRR provide value to consumers is beyond dispute, and that PJM operators routinely take actions to increase the level of reserves above the MRR.[448] PSEG states that the problem is not that operators commit additional reserves but that these operator actions are not reflected in prices, and argues that the downward-sloping ORDCs will set reasonable prices for the value of additional reserves.[449]

202. PSEG disagrees with the IMM's assertion that consumer welfare benefits indicated by the area under the proposed ORDCs cannot be assumed or reasonably asserted because PJM does not propose using demand bids or any other metric of consumers' valuing lost load to construct the ORDCs.[450] PSEG states that no party contends that PJM proposes to include demand bidding as an element of the ORDC, and

[443] *Id.* at 11-12.

[444] PJM Load Coalition Answer at 12 (citing PJM Load Coalition Protest at 39).

[445] PSEG Answer at 4-5 (quoting IMM Protest at 7).

[446] *Id.* at 5.

[447] *Id.*

[448] *Id.* at 5-6.

[449] *Id.* at 6.

[450] *Id.* at 6-7 (citing IMM Protest at 17).

argues that the proposed ORDCs are designed to replicate market impacts that would be present if significant levels of demand bidding were present.[451] PSEG contends that the proposed ORDCs are appropriately anchored at the proposed $2,000/MWh Reserve Penalty Factor, because the current PJM Tariff allows operators to take actions resulting in costs up to around $2,000/MWh in order to avoid load shedding.[452]

203. PSEG contends that the IMM's alternate proposal to increase the MRR to reflect the amount of additional reserves committed by PJM operators would result in even higher costs to consumers and would not enhance social welfare.[453] PSEG argues that the IMM's alternative proposal would set up a scarcity pricing cliff in which any small drop below the higher MRR level would automatically result in scarcity pricing at the Reserve Penalty Factor.[454] PSEG claims that applying the current $300/MWh Reserve Penalty Factor to the IMM's alternative proposal would increase LMPs by approximately $8.50/MWh, which is greater than any of the simulations in PJM's proposal.[455] PSEG warns that the cost impacts of the IMM's alternative proposal would be much higher if PJM's proposed Reserve Penalty Factor of $2,000/MWh were applied.[456] PSEG also argues that PJM's proposed downward-sloping ORDC is far superior to the IMM's alternative proposal because it matches the supply of reserves with the implied demand for reserves at all times rather than only during scarcity conditions, and thereby optimizes social welfare.[457]

204. PSEG disputes the IMM's argument that the combination of the MRR representing the need for reserves to meet an N-1 set of operating constraints with the downward-sloping ORDC, creates a type of double counting or confounding of operational uncertainties.[458] PSEG contends that the ORDC fulfills a completely

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[451] *Id.* at 7.

[452] *Id.* at 7-8.

[453] *Id.* at 8.

[454] *Id.* at 9.

[455] *Id.*

[456] *Id.*

[457] *Id.* at 9-10.

[458] *Id.* at 17 (citing IMM Protest at 29); *see also* N. Am. Elec. Reliability Corp., *Standard TPL-001-4—Transmission System Planning Performance Requirements*, https://www.nerc.com/files/TPL-001-4.pdf.

different function than the reserves required to meet N-1 contingencies.[459] Specifically, PSEG explains that the MRR represents a compromise regarding the level of system contingencies to recognize in the dispatch and that the ORDC represents a measurement of the uncertainty associated with having sufficient reserves to meet that standard.[460] Moreover, PSEG argues that the IMM's contention clashes with the reality of how electric systems are operated, where operators consistently account for perceived risks beyond N-1 contingences.[461]

205. CEA argues that PJM's proposal is too incomplete to be approved as a replacement rate. CEA contends that, over a month after PJM initiated the instant proceedings, PJM acknowledged that it had not yet settled on a process for how forced outage uncertainty will be represented in the ORDCs.[462]

206. The IMM contends that commenters rely on PJM's misleading analysis of IT SCED biasing to present PJM's proposed ORDCs as a panacea for all energy market price formation imperfections.[463] First, the IMM contends that PJM's arguments surrounding IT SCED bias fail to acknowledge that positive bias occurs only about a third of the time, negative bias occurs almost half the time, and no bias occurs the remainder of the time.[464] The IMM argues that PJM fails to acknowledge the fact that it could require more accurate energy market offer parameters from generators to reduce the need for operator bias.[465] While PJM argues that its proposed reforms are needed to reduce operator biasing, the IMM argues that the use of negative operator bias would likely increase to counteract the proposed ORDCs' overstated need for reserves.[466] The IMM argues that IT SCED load bias does not translate directly into increased reserve MW, as the IT SCED is an advisory tool which PJM operators do not necessarily follow.

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[459] *Id.* at 18.

[460] *Id.* at 18-19.

[461] *Id.* at 19.

[462] CEA Answer at 11 (citations omitted).

[463] IMM First Answer at 6-13.

[464] *Id.* at 7.

[465] *Id.* at 7-8.

[466] *Id.* at 8.

Thus, the IMM argues, PJM's arguments that it would have been in shortage conditions 29.1% of the time in 2018 absent IT SCED bias is unrealistic and misleading.[467]

207. The IMM explains that even with perfect load forecasts and no need for reserves, operators would use IT SCED to recommend the commitment and decommitment of resources to follow the trajectory of load because PJM commits combustion turbines in the real-time market and not in the day-ahead market.[468] The IMM argues that, because IT SCED operates on a one- to two-hour time frame, IT SCED is not relevant to the near-term uncertainty addressed by PJM's proposed ORDCs, and thus IT SCED is not relevant to the issues raised in PJM's filing.[469]

208. The IMM cites the Affidavit of Rao Konidena (Konidena Affidavit) on behalf of the PJM Load Coalition to argue that some amount of operator intervention, including biasing, is inevitable, and that market transparency solutions implemented in MISO demonstrate a superior solution compared to PJM's proposed ORDCs.[470]

209. The IMM argues that commenters misrepresent the extent to which the penetration of renewable resources will increase in the future, and that commenters have not drawn any logical link between the increase in renewables and PJM's proposed ORDCs and fail to define what problem PJM's ORDCs will solve with regard to renewable resources.[471]

210. The IMM argues that commenters have provided no theoretical justification for PJM's proposed extended sloping ORDC.[472] The IMM argues that PSEG, P3, and Exelon incorrectly assert that the proposed ORDC has a theoretical basis rooted in welfare maximization, and incorrectly assume that the proposed ORDCs are derived from consumers' willingness to pay for reserves.[473] The IMM states that PJM's proposal

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[467] *Id.* at 9-10.

[468] *Id.* at 10-11.

[469] *Id.* at 11.

[470] *Id.* at 12.

[471] *Id.* at 13.

[472] *Id.* at 16-24.

[473] *Id.* at 16-19 (citing PSEG Protest, Shanker Aff. ¶ 19; P3 Comments, Cavicchi Aff. ¶ 16; Exelon Comments at 25).

makes no such assumption and is not based on any measure of consumers' willingness to pay for reserves.[474]

211. The IMM argues that P3 does not provide a theoretical or empirical basis for claiming PJM's proposal will result in "[g]reater efficiency in day-ahead and real-time energy and ancillary services prices."[475] The IMM argues that any changes in buyer or seller behavior prompted by PJM's proposed higher demand curve do not indicate greater efficiency because the increase in the demand curve is arbitrary and administratively determined.[476]

212. The IMM argues that the PJM Load Coalition's protest demonstrates that PJM's proposed ORDCs do not follow the model proposed by PJM affiants Dr. Hogan and Dr. Pope and employed by ERCOT.[477] Citing the PJM Load Coalition's comments, the IMM explains that: (1) ERCOT's ORDC is based on a probability distribution of actual changes in operating reserves, while PJM does not propose a reserve change distribution; (2) ERCOT's proposed ORDC limits the LMP plus ORDC to less than the value of lost load, while PJM's proposal has no such limits and could exceed the value of lost load; and (3) ERCOT relies on its ORDC and scarcity pricing as a replacement for the capacity market, while PJM does not propose any transition mechanism or offset to capacity market revenues.[478]

213. The IMM states that Direct Energy's comments demonstrate that the proposed ORDCs could threaten reliability.[479] The IMM argues that PJM's proposed extended reserve requirement could increase the likelihood of PJM having excess online capacity such that it dispatches all resources down to their physical operating limits.[480] The IMM contends that even during such a minimum generation event, the ORDC might indicate a positive reserve price and signal that resources should come online when reliability

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[474] *Id.* at 16-19.

[475] *Id.* at 19 (quoting P3 Comments, Cavicchi Aff. ¶¶ 42-47).

[476] *Id.*

[477] *Id.* at 20-21.

[478] *Id.* at 19-21 (citing PJM Load Coalition Protest, Griffey Aff.).

[479] *Id.* at 21-22 (citing Direct Energy Comments at 8-10).

[480] *Id.* at 21.

actually requires the opposite.[481] The IMM argues that the extended ORDC could mute the congestion component of LMP by failing to signal when the energy indicates that the resource should decrease its output.[482]

214. In addition, the IMM argues that the pending fast-start pricing reforms and PJM's proposed extended ORDCs have a compounding effect to raise energy prices above the efficient level and that without explicit recognition of the overlap and interactive effects between fast-start pricing and the extended sloped ORDCs PJM's filing is not just and reasonable.[483] The IMM states that the instant filing proposes to increase the number of energy and ancillary service prices from six to nine, and that the pending fast-start reforms would create a dispatch run with dispatch pricing signals and a pricing run with the final settled prices, increasing the number of prices to eighteen.[484] The IMM states that PJM has not addressed the settlement implications of different uplift calculations, such as how lost opportunity cost credit calculations will be affected by the implementation of the fast-start reforms.[485] Furthermore, the IMM cites Exelon's argument that the extended sloping ORDCs are meant to address instances where PJM operators commit block-loaded units to maintain sufficient energy and reserves, forcing steam units to reduce their output and provide reserves.[486] The IMM argues that this situation is the same situation the pending fast-start pricing reforms are meant to address, and therefore the proposed extended sloping ORDC is a redundant price formation tool that unnecessarily increases costs to consumers.[487]

215. The IMM disagrees with PJM's claim that the extended ORDCs effectively function as a ramping product.[488] The IMM explains that a ramping product considers the upcoming net load forecasts for consecutive upcoming market intervals, as opposed to the single upcoming interval, and holds back ramping capability to meet changes in

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[481] *Id.*

[482] *Id.* at 21-22.

[483] *Id.* at 22.

[484] *Id.* at 22-23.

[485] *Id.* at 23.

[486] *Id.* (citing Exelon Comments at 11-12).

[487] *Id.*

[488] IMM Second Answer at 10 (citing PJM Answer at 36).

load in multiple upcoming consecutive market intervals, not for a contingency.[489] The IMM explains that ramping capacity is needed in addition to the minimum Synchronized and Primary Reserve Requirements, and that the method for constructing the proposed extended sloping ORDCs is not based on predicting upcoming energy needs for multiple future intervals.[490] The IMM states that, while it is not clear that PJM needs a ramping product, a discussion focused on the actual details of ramping product options would be a constructive alternative to PJM's unsupported and vague assertions in its filing.[491]

216. The IMM presents several arguments that PJM's proposed ORDCs will not incentivize more flexible generation resources.[492] The IMM contends that PJM incorrectly describes the impact of its proposal based on percent changes in revenues rather than the magnitude of changes in dollars, and explains that a small percentage increase in LMP has a much more significant effect on a generator's total revenue than a large percentage increase in reserve prices because the energy market is the largest share of those revenues.[493] The IMM contends that the affidavit of Mort Webster, provided in PJM's Answer, fails to provide relevant results for PJM because it considers the potential increase in revenues to an ERCOT combined cycle unit that increases its flexibility.[494] The IMM contends that PJM incorrectly claims that the IMM misinterprets the simulation results and that PJM should have examined the results of its own simulation results rather than sponsoring a study based on ERCOT data to understand the impact of its proposal on inflexible units.[495] The IMM states that PJM fails to discuss more targeted and cost-effective ways to increase incentives for flexibility, such as increasing its capability to model combined cycle units, especially with the introduction of five-minute pricing and settlements.[496]

217. The IMM argues that PJM's proposed ORDC probability calculation is flawed. The IMM states that PJM uses historic net load forecast error rather than direct

[489] *Id.* (citing *Cal. Indep. Sys. Operator Corp.*, 156 FERC ¶ 61,226 (2016)).

[490] *Id.*

[491] *Id.*

[492] *Id.* at 10-14.

[493] *Id.* at 11-12.

[494] *Id.* at 12-13.

[495] *Id.* at 13-14.

[496] *Id.* at 14.

measurements of the change in reserves to estimate the probability of a reserve shortage. The IMM contends that a superior approach would be to measure the change in reserves directly, because it would avoid the additional measurement error introduced by PJM's use of separate load, wind, and solar forecast error and unforced outage MW as a proxy for the change in reserves.[497] Further, the IMM contends that PJM's current operational practices are inadequate to accurately measure available reserves at any given point in time.[498] The IMM disputes PJM's choice of a 30-minute look-ahead period, and argues that the uncertainty in the 10 minutes following a RT SCED target interval is the reason for procuring reserves to meet the MRR in the first place, and thus this 10 minutes should not be added to the look-ahead period used to procure additional reserves beyond the MRR.[499]

218. The IMM contends that PJM's proposed downward-sloping ORDCs are not derived from a theoretical foundation, such as the one described by Dr. Hogan and Dr. Pope, because PJM's ORDCs are not derived from the first principles of loss of load probability and the value of lost load.[500] The IMM states that PJM does not attempt to measure the actual economic cost of a reserves shortage to consumers, and instead uses the administratively imposed Reserve Penalty Factor based on worst-case scenario emergency actions.[501] The IMM argues that the ultimate goal of procuring reserves is to reduce the chance of involuntary load curtailment, yet PJM fails to tie its valuation of reserves to this goal.[502] The IMM also disputes Exelon affiant Michael Schnitzer's argument that PJM's methodology is comparable to Dr. Hogan and Dr. Pope's because the maximum reserve price in the PJM RTO region is $8,000/MWh, in the neighborhood of the $9,000/MWh used to represent the value of lost load in ERCOT's ORDC.[503] The IMM explains that within the Mid-Atlantic/Dominion reserve region, which Mr. Schnitzer omits for his comparison, the highest prices could exceed $14,000/MWh.[504]

[497] *Id.*

[498] *Id.* at 16.

[499] *Id.* at 16-18.

[500] *Id.* at 19.

[501] *Id.* at 19-20.

[502] *Id.* at 20.

[503] *Id.*

[504] *Id.* at 20-21.

Thus, the IMM argues, Exelon's conclusions are based on a selective comparison of price outcomes under extreme reserve shortage conditions in both markets.[505]

iv. <u>Commission Determination</u>

219. We adopt as part of the just and reasonable replacement rate PJM's proposal to modify its ORDCs to establish a downward-sloping portion to the right of the applicable MRR, and to construct that portion as a function of the Reserve Penalty Factor and the probability of experiencing a reserve shortage in real-time at varying reserve procurement quantities. We agree with PJM that it is just and reasonable for ORDCs to value reserves in excess of MRRs, and to determine the value of those reserves using the empirical probability formulas proposed.

220. In *supra* Section IV.B.1.d, we find that PJM's existing reserve market design is unjust and unreasonable for several reasons. One is that it fails to procure the reserves necessary for PJM to operate its system reliably in the face of numerous operational uncertainties. PJM's existing ORDCs do not represent the actual need for reserves after accounting for non-contingency operational uncertainties, leading PJM operators to take out-of-market actions to obtain required reserves. PJM's proposed ORDCs remedy this shortcoming by connecting the actual uncertainties that PJM's operators face to the construction of the ORDCs. For any given quantity of reserves procured in advance, PJM calculates the probability that it will ultimately go short of reserves in the real-time operating period. Those probabilities are then used to create the downward-sloping ORDC by calculating a set of price-quantity points (at quantities above the applicable MRR). By thus connecting the demonstrated operational uncertainties to the in-market representation of demand for reserves, PJM's proposed ORDCs will directly address the cited shortcoming that is leading to extensive operator biasing and other out-of-market actions.

221. Another reason for which we find the existing reserve market design unjust and unreasonable is that it does not yield market prices that reasonably reflect the marginal cost of procuring necessary reserves, and thus does not send appropriate price signals for efficient resource investment. For quantities of reserves at or below the MRRs, we find, in Section IV.B.2.b above, that PJM's proposal to utilize Reserve Penalty Factors equal to $2,000/MWh for all reserve products addresses this shortcoming. Here we discuss reserve pricing at quantities in excess of the MRRs.

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[505] *Id.* at 21.

222. PJM proposes to calculate the incremental value of reserves in excess of the MRR using an expected value formula. PJM affiant Dr. Rocha Garrido explains this application as follows:

> Expected value refers to the weighted average outcome of a given decision when all possible outcomes are considered weighted by the probability of each outcome. In the context of the ORDC, the decision is procuring reserves in excess of the MRR while the outcomes are either meeting the MRR or failing to meet the MRR.[506]

223. Using this approach, PJM proposes to set the price of X MW of reserves equal to the product of the new $2,000/MWh Reserve Penalty Factors times the aforementioned probability of falling below the MRR despite procuring X MW of reserves to deal with uncertainties. The resulting product serves to quantify the incremental reliability benefit, in dollars per megawatt-hour terms, of each unit of reserves in excess of the MRRs.

224. We agree with PJM that this is a rational approach to valuing and pricing reserves in excess of the MRRs. Having found that $2,000/MWh is a reasonable willingness to pay for reserves up to the MRRs, it is also reasonable to value reserves in excess of the MRRs as a percentage of $2,000/MWh based on the incremental reliability benefit provided by any specific unit of reserves in that range. This approach also addresses the pricing flaw we identify in determining that PJM's existing reserve market design is unjust and unreasonable. By setting reserve market prices as a function of the probability of falling short of reserves, and thus incorporating into those prices the same operational uncertainties that currently drive PJM's operators to procure reserves outside the market, reserve market prices will better align with the true marginal cost of acquiring needed reserves. And by aligning reserve market prices with the true marginal cost of reserves, those prices will send accurate price signals for retention of, and investment in, resources that can provide reserves most efficiently within the broader context of PJM's markets.

225. For these reasons, we find that PJM's proposal to modify its ORDCs to establish a downward-sloping portion to the right of the applicable MRRs is a component of the just and reasonable replacement rate. We address specific comments and protests below.

226. We decline FirstEnergy's request that the Commission require PJM to conduct a holistic review of all of its wholesale markets to ensure generation resources that provide key attributes, such as fuel security, fuel diversity, and resilience, receive compensation for the attributes they provide to the electric grid. We agree with PJM that its proposed replacement rate renders its reserve market design just and reasonable. To the extent

[506] PJM Transmittal, Rocha Garrido Aff. ¶ 17.

FirstEnergy is concerned with other aspects of PJM's markets, we find those concerns beyond the scope of this proceeding.

227. We decline to adopt PSEG's proposal that PJM adjust its ORDC calculations to remove the regulation requirement as an uncertainty-mitigating factor and shift the ORDCs to reflect any operator actions after the execution of the day-ahead market. We agree with PJM that it is appropriate to consider the regulation requirement as an uncertainty-mitigating factor, because operators can reasonably assume, at the beginning of the look-ahead period, that regulation service will be procured in the prescribed quantity and directly reduce the likelihood of falling short of the MRR at the end of the look-ahead period. Furthermore, we believe PJM's proposed probabilistic ORDCs reasonably account for operator actions after the execution of the day-ahead market, and that PSEG has not demonstrated why it would be just and reasonable to adjust the ORDCs further in response to operator actions. Finally, while we agree with PSEG that it is worthwhile to periodically review the ORDCs, at this time we find it is reasonable to derive the shape of the ORDCs using three years of historic data.

228. We decline to adopt Direct Energy's request to require that PJM demonstrate that its ORDCs will not value reserves in excess of the MRR above $0.00/MWh during a minimum generation event. We believe that PJM has adequately demonstrated that its proposed ORDCs will result in just and reasonable reserve pricing based on the real-time state of the PJM system, including during minimum generation conditions. We agree with PJM affiants Dr. Hogan and Dr. Pope that minimum generation conditions do not alter the facts and principles for formulation of the ORDC, so to the extent Direct Energy's concerns materialize they should be addressed through future PJM market reforms.[507]

229. We disagree with AEP's, the Ohio Commission's, the PJM Load Coalition's, and the IMM's arguments that PJM's proposed ORDCs overstate the value of reserves beyond the MRR and would procure more reserves than operators have historically committed. PJM's filing thoroughly demonstrates that the value its ORDCs assign to reserves is grounded in the historic net load error observed in the PJM system, and the corresponding probability of a reserve shortage. We therefore reiterate our finding above that PJM's proposed ORDCs appropriately tie demonstrated operational uncertainties to the in-market representation of demand for reserves.

230. We disagree with the IMM's argument that PJM's proposed ORDCs will fail to incentivize flexible resources. As PJM explains in its answer, it is reasonable for the LMP to increase in a predictable way as the system approaches a reserve shortage. While inflexible resources might benefit from increasing LMPs, flexible resources

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[507] PJM Answer, Hogan & Pope Reply Aff., Attach. A, Ex. 1 at 12.

would benefit from both the increase in LMPs and the increase in reserve prices. Thus, as PJM demonstrates in its answer, the majority of revenue increases resulting from PJM's proposal will likely go to flexible resources.[508]

231. We find unpersuasive the various contentions made by the IMM that PJM's proposal contains significant overlap with the fast-start pricing proceeding currently pending before the Commission. The fast-start pricing proceeding and the instant filing address separate price formation concerns in PJM that require separate solutions. In the instant filing, we adopt downward-sloping ORDCs to address the problem that the existing reserve market design is not procuring and accurately pricing reserves needed for PJM to reliably operate its system. This problem is distinct from that identified in the fast-start pricing proceeding and thus warrants a targeted remedy, which is the replacement rate we adopt in this order.

232. We disagree with the IMM's and ODEC's arguments that PJM's proposed look-ahead periods are too long. We agree with PJM's explanation that the look-ahead period should include both the time between RT SCED forecast execution and the start of the real-time interval and the performance period for the reserve product. Furthermore, we agree with PJM that it is reasonable to round up the look-ahead periods to 30 minutes for the 10-minute Reserves product and 60 minutes for the 30-minute Reserves product to account for deviations in when the RT SCED case is run and capture the value of reserves in subsequent RT SCED intervals.[509]

233. We disagree with CEA's and ODEC's arguments that PJM's proposed ORDCs are unjust and unreasonable because they deviate too much from the methodology proposed by Dr. Hogan and Dr. Pope, which is based on the value of lost load and the loss of load probability. As discussed above, we agree with Dr. Hogan and Dr. Pope that the MRR is the appropriate reference point for setting the reserve price equal to the cost of emergency actions (i.e., the Reserve Penalty Factor) and that PJM's proposal is a logical extension of their methodology.[510]

234. We disagree with the Maryland Commission's arguments that PJM's proposed ORDCs fall short because they are derived from three years of historic data when the Capacity Performance reforms were not in full effect. PJM's proposed ORDCs rely on historic net load error data to derive the probability of a reserve shortage, and the first delivery year where all resources meet the Capacity Performance requirements will not begin until June 1, 2020. Thus, there is insufficient data for PJM to measure the full

[508] *Id.*, Keech Reply Aff. ¶ 16.

[509] PJM Transmittal, Rocha Garrido Aff. ¶¶ 13-14.

[510] PJM Answer, Hogan & Pope Reply Aff., Attach. A, Ex. 1 at 9-10.

impact of Capacity Performance on generator forced outage rates at this time. As discussed below, we require PJM to conduct a review of its ORDCs so that changes such as improved generator performance can be incorporated.

235. In response to the PJM Load Coalition's argument that PJM's expected value methodology is flawed, that PJM should measure actual reserves instead of forecast errors, and that PJM fails to account for negative correlations between errors, we find that the PJM Load Coalition provides insufficient detail to demonstrate that PJM's proposal is unjust and unreasonable, and similarly fails to suggest a just and reasonable method to account for the factors the PJM Load Coalition describes. Thus, we decline to require any changes to PJM's proposed ORDCs in response to the PJM Load Coalition's claims.

236. We disagree with the IMM's argument that PJM should apply its probabilistic methodology to calculate the value reflected in the ORDCs for reserve quantities below the MRR. We agree with PJM that it is reasonable to value all reserve quantities below the MRR at the respective Reserve Penalty Factor to send a strong price signal when reserves are short. We agree with PJM's explanation in its Answer that an ORDC like the IMM proposes would be inconsistent with operating the grid securely and reliably.[511]

237. We decline to adopt the IMM's proposed alternative ORDC, which would increase the PJM reserve requirement at the discretion of PJM operators. We agree with Exelon's and PSEG's arguments that the IMM's alternative would effectively codify reliance on operator actions as an ongoing solution, increase reserve and energy price volatility, and reduce the transparency and predictability of market pricing.[512]

238. We dismiss the PJM Load Coalition's concern that PJM failed to submit the second required informational report in Docket No. ER15-643,[513] and its request that the Commission require that PJM submit the report before acting on the instant filing. PJM filed the report the PJM Load Coalition references on September 26, 2019.[514]

239. The IMM argues that PJM fails to specify the process for calculating zonal ORDCs in its Tariff. The IMM asserts that PJM does not explain the location of load, generation, and interchange that it will use to calculate zonal ORDCs. As an initial matter, PJM's proposed Tariff revisions do specify the method for establishing both

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[511] *Id.* at 45-46.

[512] Exelon Answer at 29-30; PSEG Answer at 9.

[513] PJM Load Coalition Protest at 31.

[514] *See* PJM Interconnection, L.L.C., *Report on Pricing and Cost Allocation of Reserves for 2016-2017 Delivery Year*, Docket No. ER15-643-001 (filed Sept. 26, 2019).

RTO-wide and zonal ORDCs.[515] With regard to the forecast details the IMM raises, which are details related to how the inputs for that method are determined, we do not find at this time that such details must be codified in the Tariff in order to be just and reasonable. To the extent that there are concerns over specific calculation details that reside in PJM's manuals, we encourage the IMM and other interested parties to work with PJM through its stakeholder process to address such concerns.

240. Direct Energy, IPI, PSEG, and R Street argue that PJM should periodically review its ORDCs to ensure the ORDCs are meeting PJM's stated goals of achieving improved price formation, increasing transparency, and improving system reliability. While PJM proposes to update its ORDCs each year to reflect the latest historical data used as inputs to construct the ORDCs, we agree that providing regular reports on whether the ORDCs are achieving the stated purpose and to provide a level of transparency as to the input data would be beneficial to stakeholders and the Commission. Thus, we require that PJM post on its website, annually, the following data for each reserve product (i.e., Synchronized Reserve, Primary Reserve, and Secondary Reserve): (1) the forecast error data and other factors used to estimate the probability of a reserve shortage that are inputs to the ORDCs, in a format similar to what PJM provided to stakeholders previously,[516] and (2) interval data for the previous year indicating the instantaneous reserve quantity, the shortage probability indicated by the ORDC for that reserve quantity, and whether the PJM system was in shortage. We direct PJM to post these data to its website coincident with its posting of the revised ORDCs by April 1 of each year for at least eight years.

241. Exelon also requests that PJM be required to expand its Operator-Initiated Commitment Report to include data on load forecast biasing. PJM has demonstrated that biasing the load forecasts input to the IT SCED engine can affect which resources are committed, affect prices, and increase uplift. We disagree with Exelon that PJM should be required to expand the Operator-Initiated Commitment Report. However, we find persuasive Exelon's argument that PJM's proposal indicates that load biasing and uplift have an intertwined role and that PJM should be required to report all load biasing after implementation of the downward-sloping ORDCs. Thus, we require that PJM post on its website monthly summary statistics demonstrating the average positive operator bias and average negative operator bias applied at different levels of Synchronized Reserve

[515] *See* PJM Tariff, Attach. K-Appendix, Section 3.2 - Market Buyers, 46.0.0, § 3.2.3A.02(b).

[516] *See* PJM, *Energy Price Formation Senior Task Force Uncertainty Data for ORDC*, https://www.pjm.com/-/media/committees-groups/task-forces/epfstf/postings/30-minute-uncertainty-data.ashx?la=en.

surplus, similar to the analysis PJM presents in the instant filing.[517] We direct PJM to post these data to its website within a reasonable timeframe after the conclusion of each calendar month, beginning with the month in which the modified ORDCs are implemented, and to continue this practice for at least eight years.

d. Day-Ahead and Real-Time Market Alignment

i. PJM's Proposal

242. PJM proposes to align its day-ahead and real-time reserve markets—i.e., to procure the same reserve products to meet the same reserve requirements in both markets.[518] PJM proposes to amend its market rules to procure, in both markets, one 30-minute Reserve product (Secondary Reserve) and two 10-minute Reserve products (Synchronized and Non-Synchronized Reserve). PJM explains that it will procure all reserve products using ORDCs based on the principles discussed in the ORDC sections above, using its joint co-optimization algorithm to achieve the least-cost solution. PJM states that to minimize modeling differences between the day-ahead and real-time markets, for each reserve product, PJM will use the same ORDCs (that is, they will be modeled on the same uncertainties and uncertainty time horizons) in both markets. PJM adds that there may be small deviations in the MRRs between the day-ahead and the real-time markets because the size of the largest system contingency (the driver behind the MRR) will potentially be different and possibly change throughout the operating day. PJM states that notwithstanding that minor difference, it will calculate the curves identically.[519]

243. PJM argues that alignment will (1) ensure that PJM has a forward procurement process for all reserve products needed in real time, putting PJM on par with other RTOs/ISOs; (2) ensure that PJM is minimizing the procurement costs by considering all product-specific requirements during the commitment of units for the next operating day; (3) eliminate modeling discrepancies between the day-ahead and real-time markets, which provide opportunities for profitable virtual transactions that do not benefit the market through price convergence; and (4) establish incentives for resources to perform in real time because resources with scheduled reserves in the day-ahead market will be required to "buy out" of their position in real time, as done today in the energy market.[520]

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[517] PJM Transmittal, Pilong Aff. ¶ 5, tbl.1; PJM Answer, Pilong Reply Aff. ¶ 3.

[518] PJM Transmittal at 72.

[519] *Id.* at 74.

[520] *Id.* at 72-73.

244. PJM further states that adding the 10-minute Reserve products to the day-ahead market will foster more efficient prices, moving day-ahead prices closer to what can be expected in real time. PJM also claims that the addition will provide for a more optimal commitment for 10-minute Reserves because PJM will assign the reserves as part of a least-cost co-optimization. In addition, PJM states the more comprehensive and optimal commitment process will help ensure, to a greater extent, that real-time reserves are consistently adequate.[521]

245. PJM states that adding a 30-minute Reserve product to the real-time market will ensure that PJM system operators can systematically (1) respond to various forecast errors (e.g., load, wind, solar, and net interchange); (2) backfill the 10-minute Reserve Requirement in the event such reserves are called upon; and (3) recover from larger losses of resources that could result from a contingency on the interstate natural gas pipeline system.[522]

246. To add the 30-minute Reserve Requirement to the real-time market, PJM proposes to rename the current Day-Ahead Scheduling Reserve product as Secondary Reserve. PJM states that because Secondary Reserve will now have a performance obligation and will be procured in the same general manner as Synchronized Reserve and Non-Synchronized Reserve, PJM is adding new market rules describing Secondary Reserve and providing for the clearing of Secondary Reserve based on those for Synchronized Reserve and Non-Synchronized Reserve.[523] PJM states that the proposed revisions (1) describe the types of resources eligible to provide Secondary Reserve; (2) require PJM to obtain and maintain sufficient Secondary Reserves (plus Synchronized and Non-Synchronized Reserves) to meet the 30-minute Reserve objectives for each applicable Reserve Zone and Reserve Sub-Zone; and (3) provide that a resource's Secondary Reserve capability is its ability to increase energy or reduce demand within 30 minutes, minus its ability to increase energy or reduce demand within 10 minutes.[524] That is, Secondary Reserve is the remainder of the capability a resource can provide

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[521] *Id.* at 74-75.

[522] *Id.* at 75.

[523] *Id.* at 76-77.

[524] *See* Operating Agreement, Schedule 1, § 1.7.19A.02 (20.0.0). PJM states that this new section generally mirrors sections 1.7.19A(a)-(c) and sections 1.7.19A.01(a)-(c), which set forth the same requirements applicable to Synchronized Reserve and Non-Synchronized Reserve, respectively. PJM Transmittal at 77.

within 30 minutes, after accounting for its capability to provide Synchronized Reserve or Non-Synchronized Reserve.[525]

247. PJM also is adding rules to schedule and dispatch Secondary Reserve, based on the existing provisions for Synchronized Reserve.[526] Similarly, PJM proposes to overhaul the rules for Day-Ahead Scheduling Reserve governing offers, charges, credits, and market clearing prices to align the rules with the provisions for Synchronized Reserve.[527] However, PJM states that the provisions for Secondary Reserve diverge from those for Synchronized Reserve in two substantive respects. First, offline resources can provide Secondary Reserve. Second, PJM is proposing that the non-performance penalty for Secondary Reserve apply only when PJM dispatches an offline generation resource for energy and it fails to come online within 30 minutes, or when PJM reduces a demand response resource for energy and it fails to reduce load.[528] PJM also proposes not to allow resources to submit a stated offer price for Secondary Reserve, as they currently do for Day-Ahead Scheduling Reserve; instead, such supply offers will be at $0.00/MWh.[529]

248. Finally, PJM proposes to make its must-offer requirement for Capacity Resources and online generation resources more explicit and extend it to cover Secondary Reserve and not only Synchronized and Non-Synchronized Reserves.[530] PJM proposes to clarify that all Generation Capacity Resources must offer all available reserve capability at all times, regardless of whether the resource is online or offline.[531]

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[525] *Id.*

[526] *Id.* at 77-78 (citing Operating Agreement, Schedule 1, § 1.11.4(C).

[527] *Id.* at 78 (citing Operating Agreement, Schedule 1, §§ 1.10.1A(j), 3.2.3A.01).

[528] *Id.* (citing Operating Agreement, Schedule 1, § 3.2.3A.01(h)). PJM sets out the rules for penalizing the resources in sections 3.2.3A.01(h)(i)-(ii).

[529] *Id.* at 83 (citing Operating Agreement, Schedule 1, § 1.10.1A(m)(i)(3)).

[530] *Id.* at 80 (citing Operating Agreement, Schedule 1, §§ 1.10.1A(j)(i)(1), 1.10.1A(m)(i)(1)).

[531] *Id.* at 80-81.

ii. Comments and Protests

249. In addition to parties that support the Reserve Market Proposal in its entirety, Dominion, EPSA, ETI, and FirstEnergy express support specifically for the proposed day-ahead and real-time market alignment.[532]

250. Noting that there is no NERC requirement to maintain 30-minute Reserves, the IMM argues that PJM provides no operational justification for its proposed Secondary Reserve product.[533] The IMM also argues that PJM's proposal for Secondary Reserves does not treat all resources equally. The IMM explains that the proposed Secondary Reserve product fails to include any of the 5,044 MW of pre-emergency and emergency demand response available to the market in 30 minutes.[534] On the other hand, the IMM states, PJM allows any generator submitting start and notification times less than 30 minutes to participate, even though some of these generating units do not maintain staff at the unit that would allow them to start within 30 minutes.

251. CEA similarly argues that PJM's proposal for Secondary Reserves is not just and reasonable and is unduly discriminatory because it fails to recognize the capability of demand response resources and unduly blocks this technology from serving as reserves.[535] CEA states that PJM's proposal fails to satisfy Order No. 719's criteria that shortage pricing be designed to facilitate robust demand response and to ensure comparability in treatment of all resources.[536] CEA argues that PJM's proposal discriminatorily ignores the reserve capability that capacity demand response resources—the majority of demand response resources within PJM—are already obligated to provide within 30 minutes during pre-emergency and emergency conditions, which CEA argues is the functional equivalent of the proposed Secondary Reserve product.[537] CEA argues that by ignoring the capability of capacity demand response resources, PJM's proposal

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[532] Dominion Comments at 8 (citing PJM Transmittal at 73-74); EPSA Comments at 22-23; ETI Comments at 6-7; FirstEnergy Comments at 3.

[533] IMM Protest at 55 (citing PJM Transmittal at 14, 76).

[534] *Id.* (citing Monitoring Analytics, LLC, *2019 State of the Market Report for PJM: January through March*, Vol. II, Section 6: Demand Response at tbl.6-20 (2020)).

[535] CEA Protest at 17.

[536] *Id.* at 17-20.

[537] *Id.* at 20-21.

will lead to false scarcity events, which are costly to customers.[538] CEA states that PJM could have readily accounted for the capability of capacity demand response resources by factoring them into the ORDC for Secondary Reserves, or by treating them as supply.

252. The IMM argues that PJM's proposed penalty for when a resource fails to provide Secondary Reserves is insufficient. The IMM states that the proposed penalty only applies when PJM dispatches an offline unit during a period for which it has cleared Secondary Reserves.[539] The IMM contends that the situation that would invoke the penalty is not likely to occur because PJM dispatchers call the resource before issuing a dispatch instruction. The IMM claims that if the resource is not able to start, the dispatchers' usual practice is to dispatch a different resource. Therefore, the IMM states, the resource that cannot start receives no dispatch instruction and may continue to clear reserves. In sum, the IMM states that PJM's proposal for Secondary Reserves does not include adequate performance incentives.[540]

iii. <u>Answers</u>

253. PJM responds to CEA's protest by arguing that capacity-only demand response resources registered in PJM's emergency load and pre-emergency programs should not be allowed to provide Secondary Reserves.[541] PJM notes that under the Tariff and the Reliability Assurance Agreement, such demand response resources are only "available for dispatch during PJM-declared pre-emergency events and emergency events."[542] PJM explains that pre-emergency and emergency events may only be called in specific circumstances, and PJM does not intend to alter those triggers in this proceeding. PJM states that such resources are therefore treated comparably to maximum emergency generation, which also is not eligible to provide reserves under the current or proposed

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[538] *Id.* at 24-25 (noting that capacity demand response resources could easily make the difference between Secondary Reserves clearing near zero and clearing at the Penalty Factor).

[539] IMM Protest at 55 (citing PJM Transmittal at 78).

[540] *Id.* at 55-56.

[541] PJM Answer at 67-68 (citing CEA Protest at 20-25).

[542] *Id.* at 68 (citing Reliability Assurance Agreement Among Load-Serving Entities in the PJM Region, Schedule 6, § A.6; PJM Tariff, Attach. DD-1, § A.6).

rules.[543] PJM states that given the limitation on when all the resources listed above are required to respond, it would not be good utility practice to rely on them to maintain reserves. PJM notes that load response resource sellers that desire to participate in the energy and ancillary services markets may register their resources as economic load response participants, under both the current and proposed market rules.[544]

iv. Commission Determination

254. We adopt as part of the just and reasonable replacement rate PJM's proposal to align its day-ahead and real-time reserve markets. We agree with PJM that the alignment should lead to lower procurement costs while providing incentives for resources to perform in real time. We also agree with PJM that the new 30-minute Secondary Reserve product will better allow PJM system operators to respond to forecast errors, backfill the 10-minute Reserve Requirement, and recover from pipeline contingencies. We thus disagree with the IMM that PJM provides no operational justification for it proposed Secondary Reserve product.

255. We also disagree with the IMM's and CEA's arguments regarding pre-emergency and emergency demand resources. As PJM notes in its answer, these demand resources are available for dispatch only during PJM-declared pre-emergency events and emergency events. PJM therefore cannot rely on these resources to maintain reserves outside of these events. We therefore decline CEA's request that we require that PJM treat pre-emergency and emergency demand response as uncertainty-mitigating factors in constructing its ORDCs. As PJM notes, sellers of demand resources that wish to participate in reserves markets can do so through PJM's economic program.

256. The IMM claims that some generating units offering 30-minute Reserves do not maintain enough staff to allow the units to start within 30 minutes. The IMM also claims that PJM dispatchers typically ask resources whether they can perform before dispatching them, allowing resources that cannot perform to continue to clear reserves. The IMM provides no evidentiary support for these assertions. These concerns are also beyond the scope of this proceeding. PJM's existing rules include a 30-minute Reserve product in

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[543] *Id.* (citing Operating Agreement, Schedule 1, § 1.7.19A(a) ("Synchronized Reserve can be supplied from non-emergency generation resources and/or Demand Resources located within the metered boundaries of the PJM Region."); Operating Agreement, Schedule 1, § 1.7.19A.01(a) ("Non-Synchronized Reserve shall be supplied from generation resources located within the metered boundaries of the PJM Region. Resources, the entire output of which has been designated as emergency energy, and resources that aren't available to provide energy, are not eligible to provide Non-Synchronized Reserve.")).

[544] *Id.* (citing Operating Agreement, Schedule 1, § 1.5A.3).

the day-ahead market, so any claims of lack of preparation or accountability for resource performance do not arise from the alignment of day-ahead and real-time reserve products that we adopt here. We are therefore not persuaded that the IMM's concerns render the market alignment change unjust and unreasonable.

e. Resource Eligibility and Reserve Capability

i. PJM's Proposal

257. PJM proposes a must-offer requirement for reserves to avoid potential withholding concerns; however, it notes that not all resource types are capable of providing reserves and are therefore exempt from the must-offer requirement. PJM states that these resource types, including nuclear, wind, and solar, are currently automatically not considered for reserves, but may notify PJM if the resource is capable of reliably providing reserves.[545]

258. PJM proposes to utilize its current practice of determining each resource's available capability to provide Tier 1 reserves based on the resource's energy offer parameters and extend the practice to all reserve products in both the day-ahead and real-time markets, for both Generation Capacity Resources and non-capacity resources.[546] PJM argues that using separate data for energy and reserve offers is superfluous. For Synchronized Reserve, PJM proposes that the reserve capability be determined based on the resource's current performance and initial energy output, its ramp rate, and the lesser of the Economic Maximum and Synchronized Reserve maximum.[547] Because some resources, such as those with duct burners, have operating configurations that may prevent them from reliably providing additional Synchronized Reserve, PJM proposes to allow Market Sellers to justify and set a maximum Synchronized Reserve offer parameter that is lower than their Economic Maximum.[548] For Non-Synchronized Reserves, PJM proposes to base the reserve capability on the start-up and notification time, in addition to the ramp rate and Economic Maximum.[549] For Secondary Reserves, PJM proposes to follow a similar approach to that of Synchronized Reserve for online resources and Non-Synchronized Reserves for offline resources. However, PJM will consider condense-to-

[545] *Id.* at 80-82.

[546] *Id.* at 88.

[547] *Id.* at 88-89.

[548] *Id.* at 89.

[549] *Id.*

generation time constraints and will use the lesser of the Economic Maximum and the Secondary Reserve maximum MW values in its determination.[550]

259. PJM proposes to strengthen its market rules to require Market Sellers to specify, in their offer data, ramping rates that accurately represent the resource's capabilities and accommodate the limitations of PJM's software, which does not allow the ramping capability of combined-cycle units and units with duct firing ranges, among other configurations, to be perfectly modeled. PJM states that its proposal allows resources to make modifications to ensure that they offer all their available ramping capability and prevents withholding through the submission of inaccurate ramp rates.[551]

260. PJM states that its current market rules provide each load-serving entity with an obligation for Synchronized Reserve and Non-Synchronized Reserve for each hour based on its total real-time load in each Reserve Zone or Reserve Sub-Zone. PJM explains that these entities are allocated a share of the cost of reserves based on their obligation.[552] PJM proposes to apply the same practice to Secondary Reserve and establish an obligation for each load-serving entity based on each load-serving entity's total load in each Reserve Zone or Reserve Sub-Zone.[553]

261. Finally, PJM proposes to increase from 33% to 50% the limit on the amount of demand resources that can be counted towards the Synchronized Reserve Requirement and the 30-minute Reserve Requirement.[554]

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[550] *Id.* at 89-90.

[551] *Id.* at 90-91. PJM will also allow Market Sellers to make updates to reserve offers, including ramping rates, each hour up to 65 minutes before the applicable clock hour and allow Market Sellers to submit offers that vary by hour. *Id.* at 91.

[552] *Id.* at 106. PJM explains that this obligation is further offset by any self-scheduled Synchronized Reserve MW.

[553] *Id.* at 106-07. PJM also explains that the obligation can be adjusted through bilateral contracts.

[554] *Id.* at 95-96. PJM notes that the current demand response limit for Synchronized Reserve is not stated in the tariff, but rather in PJM Manual 11, Section 4.2.8. PJM proposes to include it in the tariff as part of its proposal. *Id.* at n.228.

ii. Comments and Protests

262. IPI argues that the Commission should require PJM to implement a process for establishing eligibility to participate in the reserve market.[555] IPI states that PJM's Reserve Market Proposal does not clearly permit a number of resource types that are technically capable of providing reserves to do so.[556] IPI explains that neither PJM's current Operating Agreement nor the Reserve Market Proposal specifies the types of resources that are eligible to participate as reserves; rather, Synchronized, Non-Synchronized, and Secondary Reserve are defined to include those resources that are "capab[le] . . . of be[ing] converted fully into energy" within the required timeframe specific to that reserve type.[557] IPI argues that these definitions depend on a judgment about what resources are deemed capable of providing energy when called upon, yet PJM does not identify any particular criteria by which it will make such an evaluation.[558] IPI goes on to explain that PJM's filing states that wind, solar, and nuclear units would not automatically be deemed eligible, but that these resources can request an exception from PJM.[559] However, IPI explains, neither PJM's business practice manuals nor the form instructing resources to request an exception by email specifies any criteria by which PJM will evaluate a resource's request.[560] IPI argues that the lack of clarity surrounding which resources qualify for reserves serves as a barrier to reserve market participation and leaves too much discretion to PJM.[561] To ameliorate this issue, IPI requests that the Commission require PJM to include in any replacement rate a transparent process by which all resources—including wind, solar, and nuclear resources—may demonstrate that they are technically capable of providing reserves, and the criteria by which PJM will evaluate such requests.[562]

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[555] IPI Comments at 14-17.

[556] *Id.* at 14.

[557] *Id.* (citing PJM Transmittal, Attach. A).

[558] *Id.* at 14.

[559] *Id.* at 15-16 (citing PJM Transmittal at 81-82).

[560] *Id.* at 16.

[561] *Id.* at 16-17.

[562] *Id.* at 17.

263. Vistra seeks clarification on how reserve capability and performance will be measured. Vistra argues that accurate ramp rates can be challenging for certain resources, such as combined cycles and resources with duct burning capabilities. Vistra requests that PJM's proposed rules provide additional flexibility with respect to ramping rates.[563] Vistra explains that Market Sellers are permitted to provide only a single daily ramp rate curve. Because ramp rates are dependent on ambient air temperature and humidity, Vistra argues that a resource may need to update its ramp rate during the day when weather forecasts differ. Vistra also explains that a resource's ramp rate can change when it is moving between dispatch set points, since the output-segment ramp rates may not match with the output segments for a resource's offer curve.[564] Vistra requests that the Commission clarify that the requirement to submit accurate ramp rates should not be read outside the context of PJM's concern related to intentional withholding of reserve capability. Vistra notes that frequent ramp rate updates increase the likelihood of unintentional error, especially in light of PJM's market software limitation.[565]

264. The IMM argues that PJM's current process of deselecting resources for Synchronized Reserve and lowering resource ramp rates using the Degree of Generator Performance (i.e., operator interventions to alter resource offers in the IT SCED engine) are not just and reasonable and should be disallowed.[566]

265. UCS advocates that PJM should develop accurate data on reserves, even when generators omit reserve capability in their offer parameters.[567] UCS argues that under-reporting of reserve capability by PJM generators is widespread and that it reduces reserves available in cold weather.[568] Specifically, UCS points to the fact that thermal generation in PJM has a higher power rating for the same equipment when operated in lower ambient temperatures. UCS argues that a fully accurate inventory of winter and summer generating reserve capability would reflect generators' performance across the range of ambient temperatures. UCS asserts that PJM should not be denied access to

[563] Vistra Comments at 5-6.

[564] *Id.* at 12-13.

[565] *Id.* at 13-14.

[566] *Id.*

[567] UCS Protest at 4.

[568] *Id.* at 5.

available reserves as a result of generator under-reporting, given the critical importance of maintaining adequate reserves.[569] UCS states that there is a lack of incentive in PJM's markets for resources to offer increased output in colder weather, but that this capability ought to be visible to PJM. Finally, UCS explains that PJM's practices should properly reflect the level of reserves in a way that is transparent and consistent with the market; for example, generator capability (specifically the Economic Maximum), as a market parameter, could be raised when PJM issues a Cold Weather Alert.[570]

266. Calpine and LS Power argue that PJM's proposal to allocate the cost of reserves only to load is potentially unjust, unreasonable, and unduly preferential and discriminatory because it allows some generation resources, like a nuclear plant incapable of providing reserves, to benefit from higher energy and ancillary services prices while excusing those same resources from any performance obligations and from having to bear a share of the cost of procuring reserves.[571]

267. CEA and the IMM argue that PJM should eliminate the cap on demand resources' participation in the reserves market.[572] CEA argues that the proposed limits on demand resource participation in reserve markets (no more than 50 of MRRs) have no reliability basis and are thus unduly discriminatory.[573] CEA explains that the proposed caps derive from existing caps on demand resources in reserve markets, which the Commission should not rely on to determine whether the new proposed caps are reasonable or discriminatory, particularly when Synchronized Reserve performance data over the past four years shows almost identical response rates from demand resources and generation resources.[574] CEA states that demand resources are a powerful tool to mitigate the

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[569] *Id.* at 7.

[570] *Id.* at 8.

[571] Calpine and LS Power Comments at 7-8.

[572] CEA Protest at 25-26; IMM Protest at 74.

[573] CEA Protest at 25.

[574] *Id*. at 26.

projected cost impact of PJM's proposed market reforms.[575] Similarly, the IMM argues that there should be no cap on demand resource participation in the reserve markets.[576]

iii. Answers

268. PSEG agrees with certain commenters' proposed modifications to the Reserve Market Proposal and states these modifications would provide confidence to consumers that outcomes will be fair without sacrificing appropriate market design.[577] Specifically, PSEG states it would support greater participation by demand resources, provided these resources were also subject to a must-offer requirement in the energy market.[578]

269. PJM states that, upon review of the comments raised, it acknowledges that it would be just and reasonable for the Commission, in the context of a comprehensive order addressing the reserve pricing issues raised by PJM in this proceeding, to lift the cap on demand resource participation and allow demand resources to compete to provide reserves without limit.[579] PJM states that, because demand resources historically have never come close to approaching even the existing reserve participation limits, PJM does not at this time see a present reliability reason to maintain the caps.[580]

270. PJM notes that the Degree of Generator Performance adjustment is applied to a resource's ramp rate that provides Tier 1 reserves because it is only an estimate of what the resource is capable of doing. Conversely, PJM states that Tier 2 reserves is not an estimate, but an assignment based on submitted offer data. PJM explains that the Degree of Generator Performance adjustment is employed to ensure that the PJM dispatcher has the best reasonable estimate of the response it can expect from resources, should reserves need to be deployed. PJM notes that the consolidation of the Tier 1 and Tier 2 reserve products into a single product eliminates the need to adjust market data.[581]

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[575] *Id.*

[576] IMM Protest at 74.

[577] PSEG Answer at 27.

[578] *Id.*

[579] PJM Answer at 67.

[580] *Id.*

[581] *Id.*, Pilong Reply Aff. ¶¶ 3-6.

iv. Commission Determination

271. We largely adopt as part of the just and reasonable replacement rate PJM's proposal to impose on some resource types a must-offer requirement for reserves, and to determine resources' eligibility for providing reserves in a manner similar to PJM's current practice with regard to Tier 1 reserves. We also adopt PJM's requirement for Market Seller's to submit offer data to PJM that is an accurate representation of the resource's capabilities given the confines of the PJM software.[582] However, we find that certain protestors' arguments have merit and that additional clarity on how PJM's eligibility determinations will be made is necessary. We therefore direct modifications to PJM's proposal, as discussed below.

272. IPI raises concerns over the lack of a transparent process or outline of criteria in how PJM determines eligibility for resources providing reserves. We agree with IPI that PJM's tariff should contain clear provisions on: (1) resource classes that PJM has designated as incapable of providing reserves, for each reserve product; (2) the exemption process PJM will use to determine reserve eligibility if a resource is automatically deselected from providing reserves; and (3) the process by which PJM will communicate this information and determination to the Market Seller. Accordingly, we direct PJM to include in its compliance filing within 45 days of the date of this order revisions to its Tariff and Operating Agreement to clarify the process through which PJM will determine resource eligibility to provide reserves.

273. Vistra raises concerns over how reserve capability and performance will be measured, given the difficulties associated with predicting capability for certain resource types, based on configurations or whether they contain duct burners. PJM agrees with the inherent difficulty of this task and has provided an option for Market Sellers to submit a Synchronized Reserve maximum figure, which is submitted in the day-ahead market and updated in real time, and against which PJM will measure performance. We note that the PJM Tariff already provides guidance on ramp-limited MW values and whether they fall within permissible bandwidths by determining differences between the UDS Basepoint and the actual amount MW produced.[583] However, we agree that Market Sellers should work with PJM to determine how these values should be submitted, given current software limitations. We find that PJM should provide a mechanism, within the Tariff, to help guide the determination of reserve capability that PJM will use as an input when determining the Synchronized Reserve maximum. Accordingly, we direct PJM to

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[582] *See* proposed Operating Agreement, Schedule 1, § 1.7.19. We note that subsequent to the instant filing PJM has proposed additional amendments regarding ramp rate flexibility in Docket No. ER20-1414-000.

[583] *See* Operating Agreement, Schedule 1, § 3.2.3(o).

include in its compliance filing within 45 days of the date of this order revisions to its Tariff and Operating Agreement to provide for a process whereby Market Sellers can work with PJM to establish reserve capability for resources of this type.

274. Vistra requests clarification that the ramp-rate values submitted to PJM should not be interpreted as withholding, given the limitations with PJM's modeling. As explained above, Market Sellers can submit the Synchronized Reserve maximum to denote any limitations on output. PJM will then use this figure in conjunction with the ramp rates to determine reserve capabilities. Because the Tariff revisions we adopt herein require that the ramp-rate information that Market Sellers submit be an accurate representation of a resource's capabilities, we do not view this as creating a withholding concern.[584] We encourage Market Sellers to work with PJM to discuss any concerns over submitted offer parameters.

275. The IMM argues that PJM should not be allowed discretion to adjust resource ramp rates in the IT SCED engine using the Degree of Generator Performance adjustment. PJM notes that the consolidation of the Tier 1 and Tier 2 reserve products into a single product eliminates the need to adjust market data. Based on the record, and our acceptance of PJM's proposed replacement rate noted above, we reject the IMM's concern as moot.

276. Similarly, UCS argues that a fully accurate inventory of winter and summer generating reserve capability would reflect generators' performance across the range of ambient temperatures, but that generators' greater thermal efficiency in colder temperatures, and thus higher potential output of energy or provision of reserves, is not reflected in PJM's assessments of energy and reserves that could be available to PJM operators in the winter period. While there may be merit in UCS's contention regarding generators' varying output potential depending on ambient temperature, we do not find that it is necessary for PJM's assessment of reserve capability to account for that variability in order to be just and reasonable. We therefore decline to direct such changes to PJM's existing practice at this time.

277. Calpine and LS Power argue that PJM's decision to allocate the cost of reserves only to load is potentially unjust and unreasonable because it allows some resources to benefit from higher prices while not having to provide reserves or pay for reserves. We disagree. This concern appears to stem from PJM's eligibility rules for providing reserves. However, what PJM proposes here is merely an extension of its current practice in assessing Tier 1 reserve capability, a practice that reflects PJM's assessment of the operational capabilities of various technology types. To the extent certain technology types are incapable of meeting the eligibility standard for providing reserves due to

[584] *See* proposed Operating Agreement, Schedule 1, § 1.7.19.

operating limitations, it is reasonable for PJM to prohibit those technology types from providing reserves. In addition, while we acknowledge reserve prices will often be reflected in energy prices that resources of the cited technology types will receive if they are in merit for providing energy, these resources will not receive reserve revenue due to their ineligibility to provide reserves. We therefore disagree with Calpine and LS Power's characterization that these resources will benefit from higher prices despite not providing reserves. On the contrary, they will simply receive energy revenue for their provision of energy—a logical and appropriate result.

278. We agree with PJM, CEA, and the IMM that it is reasonable to remove the existing cap on demand resource participation in the reserve markets as part of the replacement rate we adopt here. With both protestors and PJM agreeing that removal of the cap presents no reliability concerns, and CEA pointing to nearly identical Synchronized Reserve response rates from demand resources and generation resources during Synchronized Reserve events over the past four years, we see no justification for continuing to restrict the degree to which demand resources can contribute to meeting the MRRs. Thus, we require PJM to submit as part of its compliance filing within 45 days of the date of this order Tariff and Operating Agreement revisions removing the cap on the percentage of MRRs that can be met by demand resources.

f. <u>Other Concerns</u>

i. <u>PJM's Proposal</u>

279. PJM proposes to discontinue its current practice of including opportunity costs for offline resources and synchronous condensers in reserve market pricing and settlements. PJM argues that these resources do not have opportunity costs because they would not have been dispatched in economic merit order to provide energy regardless of whether they were needed for reserves. PJM adds that these resources cannot start quickly enough to capture profit within the five-minute LMP, which is the basis for opportunity costs.[585]

ii. <u>Comments and Protests</u>

280. Dominion argues that the Commission should reject PJM's proposal to set the energy opportunity costs for offline resources to zero for settlement purposes.[586] Dominion disagrees with PJM's argument that offline resources are often offline and available for reserves rather than online and providing energy because it is not economic for them to provide energy once the resource's fixed costs (e.g. start-up and no-load

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[585] PJM Transmittal at 84-85.

[586] Dominion Comments at 8-9.

costs) are taken into account along with the effect on energy prices when the resource is committed.[587] Dominion argues that a resource that receives a Non-Synchronized Reserve commitment is agreeing to provide offline reserves and is foregoing revenues that it could otherwise receive in the energy market.[588] Specifically, Dominion explains that a quick-start offline resource that is providing Non-Synchronized Reserve may decide it is more economic to go online when energy prices spike if it is already scheduled to start later in the day, and thus will not incur additional start-up costs or has very low start-up costs.[589] Dominion contends that taking the assurance of energy margins away from a resource providing Non-Synchronized Reserve removes the incentive to follow PJM dispatch, treats offline resources differently from other resources, and is not sound market design.[590]

iii. Commission Determination

281. Dominion does not provide sufficient information for us to conclude that the replacement rate we adopt here is not just and reasonable in the absence of its requested change. PJM asserts that a resource that is offline and available for reserves is often in that state because the resource is not in economic merit order to provide energy once its startup and no-load costs and the effect of the its commitment on production cost and prices are considered. Put more simply, starting the resource to provide energy is not the economic decision at the time. Dominion states that there are situations where an offline resource in that situation may see a high energy price and wish to come online to provide energy to capture that price despite not having been committed by PJM. Dominion states that this may occur particularly if the resource anticipates the high prices to continue for a sustained period, such as an hour or longer. But in such a situation, the resource is making a self-commitment decision based on its own speculation about energy prices during future intervals. It is not clear based on the record before us whether PJM's settlement methodology can or should account for such subjective decision-making on the part of the resource in determining an appropriate opportunity cost. In the absence of additional information on which to evaluate the legitimacy of Dominion's claim, we are not persuaded that PJM's proposal to set the opportunity cost of offline resources to zero is inappropriate.

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[587] *Id.* at 9.

[588] *Id.*

[589] *Id.*

[590] *Id.*

3. E&AS Offset

a. PJM's Proposal

282. PJM recognizes the interaction between the energy and ancillary services markets and the capacity market and states that these markets were designed to work together to ensure that competitive resources have the opportunity to earn revenues sufficient at least to cover their total costs.[591] PJM explains that pursuant to its existing Tariff provisions, any additional energy and ancillary services revenues resulting from its Reserve Market Proposal will impact *future* capacity market prices via the E&AS Offset and its impact on Net CONE, which is used to set the capacity market demand curve, the VRR curve.[592]

283. PJM states that the E&AS Offset was designed with a historical estimating approach to ensure that actual revenues received in the energy and ancillary services markets offset capacity revenues in future years, such that over the long term, the combination of all revenues from all markets is recognized, and not to "predict with certainty" the actual revenues received by a given resource in the energy and ancillary services markets in a specific delivery year.[593] PJM explains that this approach was consciously chosen "with the knowledge that any predictions of actual future year energy and ancillary services revenues will be inherently wrong," but as the best solution, "even given the timing mismatch between the years when the actual energy and ancillary services revenues are received and the future capacity revenues are realized."[594] PJM explains that any changes to energy and ancillary services revenues from the Reserve Market Proposal will be reflected in the historic data as those changes actually occur in the energy and ancillary services markets, and argues that this is precisely the manner in which the E&AS Offset was designed to work.[595] Therefore, PJM does not propose any

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[591] PJM Transmittal at 68 ("The PJM markets are designed to work in tandem to ensure that competitive resources have the opportunity to earn revenues sufficient to cover at least their total costs through the combination of revenue streams available given the various products.").

[592] *Id.* at 68-69 (noting that whether and to what extent a lower Net CONE will actually reduce capacity auction clearing prices depends on a variety of factors).

[593] *Id.* at 69 (noting that Capacity Resources are typically long-term assets).

[594] *Id.* at 69-70.

[595] PJM estimates that its Reserve Market Proposal will increase energy and ancillary services billing by approximately $556 million. *Id.* at 69-70, 114.

changes to the E&AS Offset, or any other aspects of the capacity market, as part of its Reserve Market Proposal.

b. Comments and Protests

284. The Maryland Commission, IPI, the Ohio Commission, ODEC, OPSI, the PJM Load Coalition, CEA, and the IMM all argue that without an adjustment to the E&AS Offset, PJM's Reserve Market Proposal should be rejected as unjust and unreasonable.[596]

285. The Maryland Commission, IPI, the Ohio Commission, ODEC, OPSI, the PJM Load Coalition, CEA and the IMM argue that without changes to the E&AS Offset, PJM's Reserve Market Proposal will lead to unjust and unreasonable capacity market outcomes, because without a transition mechanism, billions of dollars of capacity over-payments will result immediately.[597] The Maryland Commission, IPI, OPSI, the PJM Load Coalition, CEA, and the IMM argue that failing to adjust the E&AS Offset will distort capacity prices and market entry and exit signals, because a failure to reflect the changes resulting from PJM's proposal in the E&AS Offset will lead to an overestimate of Net CONE, which in turn affects the VRR curve, minimum capacity offer prices, and capacity market offer caps.[598] IPI argues that an overestimate of Net CONE will cause inefficient capacity market outcomes, including an inappropriate over-procurement of

[596] Maryland Commission Protest at 12-15, IPI Comments at 17-23, Ohio Commission Protest at 3-6, ODEC Protest at 12-13, OPSI Protest at 5-17, the PJM Load Coalition Protest at 44-48, 55-60; CEA Protest at 7-17, and the IMM Protest at 28, 51-55.

[597] Maryland Commission Protest at 12; IPI Comments at 17; Ohio Commission Protest at 3-4; ODEC Protest at 12; OPSI Protest at 5, 8, 13-15; PJM Load Coalition Protest at 45-48, 57-58 (estimating $10 billion in over-recovery); CEA Protest at 3, 7, 10 (noting that without a transition mechanism, the E&AS Offset will not fully reflect PJM's proposed changes to the reserve market for seven years); IMM Protest at 51-53 (arguing that scarcity pricing in the energy and ancillary services market is equivalent to—i.e., a substitute for—capacity market revenue; thus, an increase in revenues from one of these should lead to a decrease in the other).

[598] Maryland Commission Protest at 13; IPI Comments at 17-19; OPSI Protest at 8-10; PJM Load Coalition Protest at 45, 57 (stating that PJM's proposal will result in material reductions to Net CONE of 15-30%); CEA Protest at 10, 14-15 ("artificially high capacity market prices during the seven-year lag will continue to send signals that additional build is needed, while also ensuring at least some capacity resources that might otherwise retire stay online"); IMM Protest at 54.

capacity;[599] high, uncompetitive prices;[600] and potential market power concerns.[601] Further, IPI and CEA argue that inefficiencies in the capacity market will in turn yield unjust and unreasonable energy and ancillary services rates, as capacity market outcomes produce the resource mix that is available to supply energy and reserve demand, and that underestimating Net CONE and over-procuring capacity will dampen energy and ancillary services price signals needed to encourage the entry and operation of flexible resources.[602]

286. IPI, OPSI, the PJM Load Coalition, CEA, and the IMM also argue that without an update to the E&AS Offset, PJM's Reserve Market Proposal will result in double-recovery, and therefore customers being overcharged, due to the overlap between the capacity market and shortage pricing revenues in the energy and reserve markets.[603] CEA argues that it is not reasonable to rely on potentially lower capacity seller offers in the next three BRAs to mitigate the double-recovery.[604]

[599] IPI Comments at 18 (citing *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029, at P 1 (2019) (Glick, Comm'r *dissenting*); *PJM Interconnection, L.L.C.*, 147 FERC ¶ 61,108, at P 68 (2014)).

[600] *Id.* at 18-19 (citations omitted)

[601] *Id.* at 19 (citations omitted).

[602] *Id.* at 20; CEA Protest at 10, 14-15.

[603] IPI Comments at 20-21; OPSI Protest at 15 (noting that FERC has previously ordered PJM to modify proposals based on concerns about double-recovery) (citing *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,030 at P 21); PJM Load Coalition Protest at 46-47 ("Under PJM's proposal, consumers will unnecessarily be subjected to double charges that will produce false price signals and artificially inflate the costs to load of ensuring reliable power."); CEA Protest at 10-12 (stating that the Commission has long recognized that failing to adjust for rising energy and ancillary services revenues in the capacity market threatens excessive costs to customers); IMM Protest at 28, 51-52, 54-55 ("proposal to include scarcity rents in the energy market under normal operating conditions without an offset for the collection of the same scarcity rents through the capacity market is not just and reasonable").

[604] CEA Protest at 8-13 (arguing that failing to address overpayments is inconsistent with the Commission's duty to protect customers from excessive rates).

287. IPI, ODEC, OPSI, the PJM Load Coalition, CEA, and the IMM reject PJM's argument that no change to the E&AS Offset is needed because it is based on historical data and thus will eventually incorporate the additional energy and ancillary services revenues expected from the PJM proposal.[605] IPI and OPSI explain that when FERC accepted use of a historical average approach, it did so based on reasoning that it was appropriate because "cyclical changes in net revenue are likely to average out;" but, the reserve market changes PJM proposes represent a systematic change explicitly designed to result in higher energy and ancillary services revenues, rather than a cyclical change that will average out.[606] IPI argues that since approving PJM's historical method, FERC has expressed reservations about the accuracy of an E&AS Offset based on historic prices, and that previous acceptance of the historical approach in a FPA section 205 proceeding does not serve as precedent here, where the Commission has responsibility to fix a just and reasonable rate.[607] ODEC argues that an update to the E&AS Offset is necessary, even if it cannot be determined to what extent the Reserve Market Proposal will increase energy and ancillary services revenues.[608] Similarly, OPSI argues that the purpose of the E&AS Offset was never to create certainty, but rather to estimate energy and ancillary services revenues, and here PJM has provided a simulation comparison that provides its best estimate of revenue impacts of the proposal.[609]

[605] IPI Comments at 21 (citing *PJM Interconnection, L.L.C.*, 135 FERC ¶ 61,022, at P 48 (2011)); ODEC Protest at 13 (stating that a "phased-in impact of market redesign may be reasonable for other initiatives, but not here"); OPSI Protest at 8-10; PJM Load Coalition Protest at 47 ("[t]he current approach of relying on a historical three-year average E&AS [O]ffset calculation is only reasonable when historical performance reflects future outcomes."); CEA Protest at 9-12 (arguing that because the ORDCs will be updated over time, the E&AS Offset will never catch-up with increasing revenues); IMM Protest at 54.

[606] IPI Comments at 21 (citing *PJM Interconnection, L.L.C.*, 135 FERC ¶ 61,022 at P 48); OPSI Protest at 9-10; *see also* CEA Protest at 13 (stating that is a "massive overhaul of the energy and ancillary services market," as compared to a "*routine* fluctuation in energy and ancillary services costs").

[607] IPI Comments at 22 (citing *PJM Interconnection, L.L.C.*, 137 FERC ¶ 61,145 (2011); *PJM Interconnection, L.L.C.*, 143 FERC ¶ 61,090, at P 181 (2013)).

[608] ODEC Protest at 13.

[609] OPSI Protest at 12-13.

288. OPSI, CEA, and the IMM argue that the E&AS Offset is not outside the scope of this proceeding, because the over-recovery in the capacity market is a direct product of PJM's administratively determined, ministerial proposal, and a proposal that leads to a double-payment for services cannot be just and reasonable.[610]

289. IPI and OPSI state that the Commission should require PJM to adopt a forward-looking E&AS Offset as the just and reasonable replacement rate, or some other transition mechanism.[611] OPSI argues that a forward-looking E&AS Offset "would recognize . . . market design change and be more responsive to changes in energy price inputs and other relevant factors."[612] The Ohio Commission argues that a transition mechanism that reflects changes to the E&AS Offset for all capacity auctions held after Commission approval of PJM's proposal would be appropriate.[613] ODEC and the PJM Load Coalition argue that the Commission should delay implementation of PJM's proposed Tariff revisions until the next BRA where the E&AS Offset can reflect the increased energy and ancillary services revenues and include an estimate of the energy and ancillary services revenues rather than phasing in the increased revenues over three years.[614] CEA and the IMM argue that multiple just and reasonable transition

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[610] *Id.* at 16; CEA Protest at 13-14; IMM Protest at 52 ("[PJM's proposal] is about the entire PJM market design, including the reserve markets, the energy market and the capacity market and the interactions among them.").

[611] IPI Comments at 22-23 (noting that the Commission has approved the use of a forward-looking E&AS Offset in other RTO capacity markets); OPSI Protest at 10-11, 18-23 (arguing that moving to a forward-looking E&AS Offset is appropriate because PJM's proposed reserve market changes "represent an administrative change in the underlying price-setting algorithm").

[612] OPSI Protest at 23.

[613] Ohio Commission Protest at 4-5 (explaining that PJM introduced an appropriate transition mechanism during stakeholder discussions).

[614] ODEC Protest at 13; PJM Load Coalition Protest at 58-59 (arguing that no changes should be made to reserve market until PJM has accurate reserve market data that it can align with the capacity construct; then a transition mechanism should be implemented). Alternatively, the PJM Load Coalition argues that the Commission could truncate the ORDC during the transition years to minimize the over-recovery and double payments. PJM Load Coalition Protest at 60.

mechanisms exist, including adopting a forward-looking E&AS Offset.[615] If a forward-looking E&AS Offset is adopted, the IMM states that it should "use energy prices from West Hub forward curves with basis differentials to CONE locations based on history; use fuel costs from forward markets with basis differentials to locations based on history; correctly account for the dispatch costs and dispatch parameters of the reference unit."[616]

290. OPSI and the IMM argue that PJM should also make adjustments for BRAs that have already been held, through some sort of true-up mechanism or delay/phase-in of implementation of PJM's proposal.[617] The IMM also argues that PJM should change its capacity market rules so that the maximum price in the capacity market is simply 1.5 times Net CONE, and not the higher of Gross CONE or 1.5 times Net CONE, to allow capacity market prices to fall in response to additional scarcity revenues in the other markets.[618]

291. Dominion and EPSA argue that the Commission should reject the requests to modify the E&AS Offset calculation to include forecasted revenues that could potentially accrue from the proposal.[619] Dominion and EPSA argue that a proactive adjustment to the E&AS Offset is not necessary, because the offset was not intended to match actual revenues received by a resource in the energy and ancillary services markets in the specific delivery year, and any changes in revenues will naturally be accounted for in future E&AS Offsets.[620] Further, EPSA states that the Commission recently found PJM's backward-looking E&AS Offset methodology to be just and reasonable.[621]

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[615] CEA Protest at 16-17 (stating that other RTOs use a forward-looking E&AS Offset and that doing so has the benefit of ensuring all future market changes are reflected more rapidly in RPM outcomes; but, a forward-looking offset only addresses excess payments in delivery years beginning in 2024); IMM Protest at 68.

[616] IMM Protest at 68.

[617] OPSI Protest at 11, 23-28; IMM Protest at 53-54, 67.

[618] IMM Protest at 68-71.

[619] Dominion Comments at 7-8; EPSA Comments at 20-21.

[620] Dominion Comments at 8 (arguing that an adjustment to the E&AS Offset using forecasted revenues would exchange a correction to price signals in the reserve market for poor prices signals in the capacity market); EPSA Comments at 20-21.

[621] EPSA Comments at 21 (citing *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029 at P 119).

292. EPSA states that the Commission has previously rejected requests for out-of-cycle adjustments to the capacity market demand curves, finding that such adjustments cannot be made without considering all the cost and revenue components of the curves and that such adjustments promote uncertainty in the market.[622] EPSA also argues that any proposed change to the E&AS Offset is beyond the scope of this proceeding, because PJM proposed no changes to its capacity market rules.[623] EPSA asserts that requiring a forward-looking, out-of-cycle adjustment to the E&AS Offset in this proceeding would establish "dangerous precedent" and "invite requests for similar adjustments in the future based on market rule changes and other unforeseen developments."[624]

c. <u>Answers</u>

293. PJM reasserts that its Reserve Market Proposal warrants no changes to the capacity market, noting that there have been numerous energy and reserve market reforms which did not prompt a wholesale review of the capacity market, a restructuring of the VRR curve, or a change to the E&AS Offset.[625] PJM argues that the impact of the proposal on energy and reserve market revenues will be *de minimis*, and will have no material effect on the capacity market.[626] PJM also explains that Capacity Resources are typically long-term assets, and that the E&AS Offset was never intended to precisely match the actual revenues received by a given resource in the E&AS markets in the relevant delivery year.[627] Further, PJM argues that because it did not propose any

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[622] *Id.* at 20 (citing *Indep. Power Producers of N.Y., Inc. v. N.Y. Indep. Sys. Operator, Inc.*, 125 FERC ¶ 61,311, at PP 33, 35 (2008)).

[623] *Id.* at 21.

[624] *Id.*

[625] PJM Answer at 60-61 (citing Order No. 719 Compliance Order, 139 FERC ¶ 61,057 at P 226 (rejecting requests to change the E&AS Offset to reflect possibly higher energy prices resulting from shortage pricing reform)). PJM acknowledges that the proposed reforms may, over time, reduce reliance on the capacity market. *Id.* at 60.

[626] *Id*. at 61-62 (noting that the energy and reserve markets settle for over $25 billion per year; compared to the potential $556 million per year increase in energy and reserve revenues resulting from its proposal).

[627] *Id.* at 64 ("this approach was 'consciously chosen' with the knowledge that any prediction of actual future year energy and ancillary services revenues will likely be incorrect, and therefore using actual historic revenues received is a more rational solution, given the fundamental timing mismatch between the years

changes to the E&AS Offset in the FPA section 205 portion of its initial filing, any arguments related to the E&AS Offset are beyond the scope of this proceeding.[628]

294. PJM rejects the IMM's argument that point A on the VRR curve should be changed to equal 1.5 times Net CONE only (rather than the "higher of" 1.5 Net CONE or Gross CONE). PJM states that the IMM's contention is based on the "belief that if [energy and ancillary services] revenues are sufficiently high such that the Net CONE is less than or equal to zero, that the VRR curve should be flat, which fails to recognize that energy and ancillary services revenues could be very high at times when PJM is not meeting its Installed Reserve Margin, and in these instances the markets should send a signal to attract new capacity despite the high energy and ancillary services revenues."[629]

295. PJM argues that commenters overlook numerous factors in arguing for E&AS Offset changes, including that: (1) simulating energy market revenues based on forecasts will result in Capacity Market Sellers trading known future capacity revenues for speculative, possible future energy and ancillary services revenues; (2) Net CONE is one of many assumptions embedded in the VRR curve, and that most capacity market clearing price changes will be due to Capacity Market Sellers changing offer behavior; (3) the magnitude of the energy and ancillary services revenue changes is likely to be well within the margin of error for the E&AS Offset, but forecasts of future energy prices are inherently uncertain and could be off by a substantial margin; (4) a short-term change to the E&AS Offset based on the perceived impacts of a market rule change would set bad precedent and increase inconsistency in E&AS Offset estimates over time, causing volatility in the capacity market; (5) even if PJM did propose a transition mechanism, LMP changes will be small and will make no difference in the VRR curve.[630]

296. PJM asserts that if the Commission does find a transition mechanism is necessary—which it should not—it should not reopen already run BRAs or attempt to take back revenues, as business decisions have been made with respect to those auctions and changes would result in inequities.[631] Further, PJM asserts that any transition

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when actual energy and ancillary services revenues are received and when future capacity revenues are realized").

[628] *Id.* at 63.

[629] *Id.* at 62. Additionally, PJM argues that no set of simulations indicated that PJM's proposal will cause energy and ancillary services revenues to reach such high levels that Net CONE could possibly reach zero. *Id.*

[630] *Id.* at 65-66.

[631] *Id.* at 66.

mechanism should be limited in scope and narrowly tailored. PJM states that that one measured approach to changing the E&AS Offset would be to weight the most recent year of energy and ancillary services revenues more heavily, on a prospective basis, to update the offset more quickly.[632]

297. The IMM, CEA, OPSI, and the PJM Load Coalition argue that PJM's market design requires tight coordination of the energy and capacity markets, and that not addressing the impact of the Reserve Market Proposal on the capacity market and the E&AS Offset leads to over-recovery and double-recovery, as well as distorted capacity market prices, and is not just and reasonable.[633] CEA and the PJM Load Coalition argue that Commission precedent establishes that a transition mechanism is necessary to avoid double-recovery and ensure just and reasonable rates.[634] CEA argues that PJM's proposal is a significant market design change that alters the fundamental premise of the Commission's prior determinations that a historic method for calculating the E&AS Offset yields "a reasonably accurate forecast."[635] Further, CEA states that the Commission has previously required system operators to institute measures to protect against over-recovery of revenues when making significant market design changes.[636]

298. CEA and OPSI argue that unlike weather or fuel price uncertainties that could drive energy and ancillary services revenues higher or lower from one year to the next, which market participants can account for in the regular course of business, the Reserve Market Proposal is a systematic increase of revenues that is foreseen and quantifiable.[637]

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[632] *Id*.

[633] IMM First Answer at 14-16; CEA Answer at 2-5 (noting broad support in the record for an E&AS Offset transition mechanism); OPSI Answer at 3, 5-6; PJM Load Coalition Answer at 4-7.

[634] CEA Answer at 5-7; PJM Load Coalition Protest at 6 (arguing that it would be reversible error for the Commission to accept a proposal that causes customers to pay twice for a service) (citing *NorAm Gas Transmission Co. v. FERC*, 148 F.3d 1158, 1165 (D.C. Cir. 1998) (citations omitted)).

[635] CEA Answer at 5-6 (citing *PJM Interconnection, L.L.C.*, 137 FERC ¶ 61,145 at P 28).

[636] *Id.* at 6 (citing *ISO New England Inc.*, 118 FERC ¶ 61,163 (2007); *ISO New England Inc.*, 133 FERC ¶ 61,013, at P 18 (2010); *ISO New England Inc.*, 130 FERC ¶ 61,005, at P 8 (2010); *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,030 at P 44).

[637] *Id.* at 16-18; OPSI Answer at 8-10 (citing P3 Answer at 6-8); *see also* PJM Load Coalition Answer at 3-7.

Further, OPSI and the IMM disagree with the contentions of PJM and Calpine and LS Power that a $556 million over-recovery is *de minimis*, especially from the ratepayer's perspective.[638]

299. OPSI, the IMM, and the PJM Load Coalition reject PJM and EPSA's arguments regarding the capacity market being beyond the scope of this proceeding, stating that the AEMA[639] case PJM cites actually upholds the proposition that the Commission can act under section 206 of the FPA to make changes to a market after finding that changes in another market render its rules unjust and unreasonable.[640] The PJM Load Coalition states that under a section 206 complaint, the Commission has the broad authority and obligation to fashion a just and reasonable replacement rate, which includes fixing the E&AS Offset, and argues that EPSA's reliance on *NRG Power Marketing, L.L.C. v. FERC*, 862 F.3d 108 (D.C. Cir. 2017) (*NRG*), which addresses filings pursuant to section 205 of the FPA, is misplaced.[641]

300. CEA and OPSI argue that proposals to delay implementation of the reforms and/or to weight historical years unequally are only partial solutions to the E&AS Offset concern.[642] Further, OPSI states that maintaining the historical E&AS Offset calculation without reflecting the known increase in revenue that will result from PJM's proposal would be inappropriate, as the E&AS Offset should reflect the "best estimate possible of the energy and ancillary services expected to be earned during the delivery year relevant for the auction, and, at a minimum, must be just and reasonable."[643] OPSI disagrees with Vistra and Calpine and LS Power that changes to the capacity market supply curve, through suppliers adjusting their capacity auction offers to reflect the anticipated reserve market design changes, is sufficient, arguing that it is equally important to have a just and

[638] OPSI Answer at 7-8; IMM Second Answer at 24 ("If PJM believes that the change to the energy and reserve market revenues is de minimis, it is not clear why they made this filing.").

[639] *Advanced Energy Mgmt. All. v. FERC*, 860 F.3d 656 (D.C. Cir. 2017) (*AEMA*).

[640] OPSI Answer at 4-5 (citing *AEMA*, 860 F.3d at 663-64; *Pub. Serv. Comm'n of N.Y. v. FERC*, 866 F.2d 487, 491 (D.C. Cir. 1986)); IMM Second Answer at 26-27.

[641] PJM Load Coalition Answer at 3-6; *see also* OPSI Answer at 5-7.

[642] CEA Answer at 12; OPSI Answer at 10-11, 15-16.

[643] OPSI Answer at 9-10 (responding to P3's argument that PJM should retain the historical E&AS Offset calculation); *see also id.* at 11-12 (arguing that ignoring seven years of over-recovery would not be just and reasonable).

reasonable capacity demand curve.[644] Further, CEA states that PJM plans to review and update the ORDCs annually, which without a change to the methodology of the E&AS Offset, means systematic bias towards excessive capacity prices.[645]

301. CEA states that commenters proposed numerous workable transition methods for both the BRAs that have already been run and those that have not yet been run, including true-ups, offsets, or feedback mechanisms; however, these proposals are all "solution concepts" that would require further development by stakeholders, which could occur at the direction of the Commission.[646] CEA argues that the simplest approach to the E&AS Offset issue is to shift to a forward-looking methodology, and that such an option is not precluded by the Commission's prior approval of the backward-looking offset methodology.[647] The IMM also supports a forward-looking offset, pointing out that PJM has consistently argued for a forward-looking E&AS Offset in the past and that it is illogical for PJM to argue against a forward-looking calculation because it may not be 100% accurate, when it admits that the backward-looking calculation was consciously chosen with the knowledge that the estimates would likely be incorrect.[648] CEA argues that commenters incorrectly state that adjusting the VRR curve will set dangerous precedent and will invite requests for similar adjustments in the future; rather, CEA states that moving to a forward-looking offset methodology will actually improve the accuracy of the VRR curve in light of future market rule changes or declining energy costs.[649]

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[644] *Id.* at 12-13.

[645] CEA Answer at 13.

[646] *Id.* at 7-16.

[647] *Id.* at 14-16 (arguing that to develop a forward-looking E&AS Offset, the Commission should order PJM to conduct a stakeholder process, or initiate settlement proceedings to determine the price indices and other elements of the calculation methodology).

[648] IMM Second Answer at 24-25 (citations omitted).

[649] CEA Answer at 19; *see also* OPSI Answer at 13-15 (rejecting arguments that changing the E&AS Offset in response to PJM's proposal would be dangerous precedent, because unlike routine market events, PJM's proposal represents a scope change in energy and reserve market design).

302. Calpine and LS Power and EPSA state that PJM proposed no capacity market rule changes, and therefore the Commission does not have the authority under the FPA to require modifications to any capacity market rules, including the E&AS Offset.[650]

303. Exelon and P3 argue that numerous changes occur in the energy market during the three-year period between a capacity auction and a delivery year, sometimes increasing revenue and sometimes decreasing revenue, and the Commission has generally rejected requests to require PJM to make corresponding adjustments to capacity prices after the fact.[651] Exelon and P3 argue that these changes are an inherent part of PJM's three-year forward auction structure and do not justify departing from the Commission's well-established policy of not disrupting capacity market results after an auction has run.[652] P3 states that the backward-looking E&AS Offset calculation was developed after significant PJM stakeholder deliberations and multiple FERC proceedings, and should be left unaltered as it yields sound results over time.[653]

304. Exelon argues that an adjustment to the E&AS Offset is also unnecessary because the offset has little impact on capacity prices given that capacity auctions have historically cleared well below the default offer cap.[654] Similarly, Vistra states that arguments for a forward-looking E&AS Offset or other changes are based on "the faulty premise that a simulated increase in E&AS revenues will translate one-to-one into a reduction in capacity payments."[655] Further, Calpine and LS Power and EPSA state that

[650] Calpine and LS Power Answer at 3-5 (citing *NRG*, 862 F.3d at 114-15); EPSA Answer at 5-6 (citing *NRG*, 862 F.3d at 110). Calpine and LS Power argue that challenges to the E&AS Offset need to be made in separate complaints pursuant to section 206 of the FPA, rather than as comments or protests in this proceeding. Calpine and LS Power Answer at 4 (citations omitted).

[651] Exelon Answer at 3, 22, 26 (citing recent price formation proceedings; market fundamental changes, including changes in natural gas prices; and weather pattern changes); P3 Answer at 7-8; *see also* EPSA Answer at 6-7.

[652] Exelon Answer at 22; P3 Answer at 7-8.

[653] P3 Answer at 6-8; *see also* Calpine and LS Power Answer at 10 (citing *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029 at PP 114-17).

[654] Exelon Answer at 27.

[655] Vistra Answer at 9-10 (arguing that in the first auction following implementation, capacity prices will naturally adjust based on market participants' business judgments regarding the effect of PJM's proposal); *see also* PSEG Answer at 28 (stating that there is no way to reflect how individual bidding and operating behavior

the actual impact of PJM's proposal is far from clear, particularly depending on the type of resource.[656]

305. Exelon states that if the Commission were to consider updating the E&AS Offset, it would be arbitrary to consider only potential upward adjustments; rather, the Commission would have to consider recent downward pressure on energy prices such that the historical averages are well above current prices.[657] Vistra states that the IMM and others' suggestion of a true-up mechanism raises the question of whether a true-up would provide additional money to generators if other factors result in lower than expected energy and ancillary services revenues.[658] Calpine and LS Power argue that changing the E&AS Offset methodology would establish precedent for adjustments whenever future changes are anticipated in the energy or ancillary services markets, which would be highly burdensome and make it difficult for suppliers to make investment decisions.[659] EPSA argues that selective, out-of-cycle adjustments to demand curves are manifestly unjust and unreasonable and have been rejected by the Commission.[660]

306. Exelon, Vistra, P3, and Calpine and LS Power argue that the Commission should reject a forward-looking offset, noting that forecasts are inherently assumption driven and prone to miss important fundamental changes.[661] Calpine and LS Power state that The Brattle Group (Brattle) has found that a forward-looking approach does not work well

will change in response to new price signals); *see also* P3 Answer at 8 (arguing that simulating the market response to rule changes is difficult).

[656] Calpine and LS Power Answer at 11-13; EPSA Answer at 8-9.

[657] Exelon Answer at 23-26.

[658] Vistra Answer at 11-12.

[659] Calpine and LS Power Answer at 13.

[660] EPSA Answer at 8-10 (citations omitted).

[661] Exelon Answer at 28 (stating that the fact that ISO-NE uses future prices to calculate its offset is not sufficient evidence to require PJM to do so); Vistra Answer at 10-11 ("simulations . . . cannot be relied upon to settle markets"); P3 Answer at 7-8; Calpine and LS Power Answer at 10-11; *see also* EPSA Answer at 8 (arguing that parties that are interested in a forward-looking E&AS Offset are free to pursue those issues in the PJM stakeholder process) (citing *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029).

when a combustion turbine is the reference resource, as it is in PJM.[662] PSEG supports a quicker phase-in of the energy and ancillary service revenue changes by weighting recent years in the E&AS Offset calculation, but emphasizes that any adjustment should be based on actual observed market data, not simulations or estimates.[663]

307. PSEG and EPSA argue that any adjustment to the E&AS Offset for already cleared auctions would be inappropriate, because the Commission has repeatedly refused to disturb the outcomes of past auctions, and those cleared auctions are final rates protected by the filed-rate doctrine.[664] Exelon also argues that it would be inappropriate to do a retroactive adjustment for already run BRAs, because this would conflict with the actual behavior of market participants, who generally hedge their future energy revenues (and therefore will not benefit from increased energy prices).[665]

d. Commission Determination

308. We find, pursuant to section 206 of the FPA, that the reserve market changes implemented herein have rendered PJM's methodology for calculating the E&AS Offset used in its capacity market unjust and unreasonable.[666] We find that the just and reasonable replacement rate is adoption of a forward-looking E&AS Offset, as discussed

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[662] Calpine and LS Power Answer at 11 (citing The Brattle Grp., *Periodic Review of Variable Resource Requirement Curve Shape & Key Parameters*, Attachment G, Ex. 2, at 25 (2018) (filed in Docket No. ER19-105-000 on Oct. 12, 2018)).

[663] PSEG Answer at 28 ("simulations or estimates for this purpose as some commentators have suggested could not be legally justified nor would they yield valid outcomes").

[664] PSEG Answer at 27-28 (citing *Ark. La. Gas Co. v. Hall*, 453 U.S. 571, 578 (1981); *Towns of Concord, Norwood & Wellesley v. FERC*, 955 F.2d 67, 71-72, 74 (D.C. Cir. 1992)); EPSA Answer at 10-11 (noting that no party has alleged that PJM failed to conduct past RPM auctions in accordance with the applicable market rules) (citations omitted).

[665] Exelon Answer at 26-27.

[666] 16 U.S.C. § 824e(a) (authorizing the Commission to investigate existing rates on a complaint or its own initiative); *see also PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208 at P 400 (recognizing that changes in one market can render aspects of another market unjust and unreasonable); *AEMA*, 860 F.3d at 663-64 (affirming the Commission's authority to act pursuant to section 206 to modify market provisions rendered unjust and unreasonable by the implementation of changes in other markets).

below. We therefore order PJM to submit a compliance filing to revise its Tariff[667] to implement a forward-looking E&AS Offset within 45 days of the date of this order, consistent with the discussion herein.

309. The energy and capacity markets are designed to work together to ensure that PJM can meet its reserve targets in each delivery year and that competitive resources have an opportunity to earn sufficient revenues to cover their costs.[668] Recognizing the interactions between the two markets, the E&AS Offset estimates the energy and ancillary services revenues that a reference resource will receive in a given delivery year in those markets. This E&AS Offset estimate is then used to calculate Net CONE, which impacts the capacity market demand curve, offer caps, and minimum offer price floors.[669]

310. We find that the significant reserve market reforms adopted herein, and in particular the changes to the shape of the ORDCs and the increase to the Reserve Penalty Factors that anchor those ORDCs, have fundamentally changed the design of the PJM reserve market in a way that will impact the amount of reserves procured, the price paid for those reserves, related energy prices, and energy and ancillary services revenues received by resources participating in those markets. These changes will be particularly pronounced during times of shortage. The impact of these changes must be recognized in the E&AS Offset estimate—a variable that is fundamental in determining the amount of capacity procured by the PJM capacity market and the prices paid to resources that supply capacity.

311. In general, a backward-looking E&AS Offset can be viewed as an assumption that, by and large, market conditions in the relevant delivery year will be about the same as the average of the delivery years before the auction. When the Commission approved PJM's backward-looking E&AS Offset, it was on the basis that it provided a reasonable means of estimating the net energy and ancillary services revenues a resource could expect to earn in the future delivery year, taking into consideration that "energy and fuel prices can change significantly—both upward and downward—from year to year."[670] The Commission concluded at the time that although the offset was an attempt to estimate

[667] PJM Tariff, Attach. DD, §§ 5.10(a)(v)-(vi), 6.

[668] PJM Transmittal at 68.

[669] PJM Tariff, Attach. DD, § 5.10; *Calpine Corp. v. PJM Interconnection, L.L.C.*, 169 FERC ¶ 61,239 at P 138 ("We adopt PJM's proposal to set the default offer price floor for certain resources . . . at Net CONE . . . ."), *reh'g and clarification*, 171 FERC ¶ 61,035 (2020).

[670] *PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,331 at P 118, *reh'g on other grounds*, 119 FERC ¶ 61,318.

future revenues, the historical approach was reasonable because "cyclical changes in net revenues" were "likely to average out."[671] PJM's Reserve Market Proposal, on the other hand, is not the type of proposal for which a historic average reasonably will reflect future prices. Rather, these reforms represent a major, systematic change in market design that significantly alters expectations about future energy and ancillary services revenues and involves adjustments to various parameters over time. Therefore, it is appropriate in establishing the just and reasonable replacement rate in this proceeding to find that this change warrants a re-evaluation of the E&AS Offset methodology.

312. Pursuant to its current E&AS Offset methodology, which uses three years of historical data to estimate revenues for the delivery year three years in the future, the impact of PJM's Reserve Market Proposal would not be realized in the E&AS Offset for three years or more.[672] During this period of time, calculations of Net CONE would be based on an inherently inaccurate, and likely significantly under-estimated, E&AS Offset, which may lead to unjust and unreasonable capacity market prices. We agree with the IMM and others that such a potentially inaccurate estimate of Net CONE can distort capacity market prices, which in turn could distort the price signals sent to generation contemplating entry into the market, as well as generation contemplating market exit.[673] Sending incorrect price signals could result in over-procurement of capacity with higher prices passed through to load.[674]

313. In addition, PJM has also committed to reviewing and updating the ORDCs periodically going forward, which means that a historic-looking E&AS Offset may never fully incorporate the impacts of these reserve market reforms. Further, an E&AS Offset based on three years of historical data is easily distorted by anomalous market conditions in one year that are not representative of what market participants can expect in future delivery years. Specifically, the replacement rate adopted herein increases the Reserve Penalty Factors more than two-fold and removes the cap on the additivity of Reserve Penalty Factors, while simultaneously adding a new reserve product (with its own Reserve Penalty Factor). While these changes are just and reasonable, as discussed

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[671] *PJM Interconnection, L.L.C.*, 126 FERC ¶ 61,275, P 44 (2009).

[672] ODEC Protest at 13.

[673] IMM Protest at 54; Maryland Commission Protest at 13; IPI Comments at 17-19; OPSI Protest at 8-10; PJM Load Coalition Protest at 45, 57; CEA Protest at 10, 14-15 ("artificially high capacity market prices during the seven-year lag will continue to send signals that additional build is needed, while also ensuring at least some capacity resources that might otherwise retire stay online").

[674] The PJM Load Coalition estimates over $10 billion in over-recovery during this time. PJM Load Coalition Protest at 45-48, 57-58. *See also* IPI Comments at 18.

above, by design they increase the potential for very high prices during extreme shortage conditions. If such conditions were to occur, the energy and ancillary services revenues received during that shortage period would not necessarily be representative of the revenues a generation developer could expect to earn in the future, and thus a backward-looking offset could be inappropriately distorted. It is for this very reason that Brattle has long urged PJM to move away from a backward-looking E&AS Offset methodology.[675] Brattle argues that a backward-looking E&AS Offset creates uneconomic and inaccurate price signals and leads to substantial price volatility that can undermine investment incentives, amongst other concerns.[676] Similarly, the IMM has consistently argued that PJM should move away from a backward-looking E&AS Offset.[677] As the IMM observes, historic revenue is always wrong. This is particularly true during the current period, where the industry is undergoing a significant change to its resource mix and market design.

314. We recognize, as commenters point out,[678] that the Commission has previously accepted PJM's existing backward-looking E&AS Offset methodology. However, such prior decisions do not preclude us from finding herein, based on the record before us, that this methodology is no longer just and reasonable as a result of the significant revisions directed in this order. While other energy market changes may have been made over the years without a reevaluation of the E&AS Offset methodology, the nature of the changes herein and the magnitude of the expected impact they will have on reserve procurement and energy and ancillary services revenues sets this case apart and leads to our finding

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[675] *See*, *e.g.*, The Brattle Grp., *Fourth Review of PJM's Variable Resource Requirement Curve* (2018), https://www.pjm.com/-/media/library/reports-notices/special-reports/2018/20180420-pjm-2018-variable-resource-requirement-curve-study.ashx?la=en (Brattle Fourth VRR Curve Review); The Brattle Grp., *Third Triennial Review of PJM's Variable Resource Requirement Curve* (2014), https://www.pjm.com/-/media/library/reports-notices/reliability-pricing-model/20140515-brattle-2014-pjm-vrr-curve-report.ashx?la=en; The Brattle Grp., *Second Performance Assessment of PJM's Reliability Pricing Model* (2011), https://brattlefiles.blob.core.windows.net/files/7932_second_performance_assessment_of_pjm's_reliability_pricing_model_pfeifenberger_et_al_aug_26_2011.pdf.

[676] *PJM Interconnection, L.L.C.*, 124 FERC ¶ 61,272, at P 14 (2008); *see* note 675 *supra*.

[677] *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029 at P 116, *reh'g denied*, 171 FERC ¶ 61,040 (2020).

[678] *See*, *e.g.*, EPSA Comments at 21 (citing *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029 at P 119).

that the E&AS Offset is no longer just and reasonable. We reject the contentions of PJM that the changes effected herein are *de minimis*.[679] First, it is inconsistent for PJM to argue on one hand that its reserve market is producing manifestly unjust and unreasonable rates and procuring insufficient reserve quantities that endanger reliability, and that this major reform package is necessary to address the issue, while at the same time arguing that this reform package has a *de minimis* effect on its markets. Second, we note that the energy and ancillary service markets make up a disproportionately large amount of total wholesale market revenues in PJM, so what may look small in the context of the energy and ancillary services markets can still have a large impact in the context of the PJM capacity market.[680] Furthermore, one of the projected effects of PJM's proposal is to provide additional revenues to flexible resources, such as the theoretical combustion turbine used to anchor the capacity market VRR curve.[681] This may mean that the additional revenues resulting from these reforms will have an even larger effect in the capacity market than other energy and ancillary service market changes.

315. Some parties argue that the major changes effected by these filings reflect only a temporary change, because the changes will over time be included in the historic-looking E&AS Offset. They maintain that as a result, the Commission should make no changes to the capacity market. We disagree. Even if the impact of the market rule changes directed herein were only temporary, the Commission would be responsible for setting the just and reasonable rate during the up to five-year interim period. However, we do not agree these changes are only temporary. In supporting the instant proposal, PJM has taken the position that wind, solar, and battery resources will make up a greater part of PJM's resource mix going forward, and that these resources will fundamentally change how PJM expects to operate its system.[682] Given these developments and the major

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[679] PJM Answer at 61-62

[680] The PJM Load Coalition estimates that PJM's proposal, when reflected in the E&AS Offset, will result in material reductions to Net CONE of 15 to 30 percent. PJM Load Coalition Protest at 45, 57.

[681] PJM Transmittal at 71-72 ("[T]he unified Synchronized Reserve product [will] . . . enhance[e] the price signal for developers to invest in resources that are flexible to compete in the new combined reserve market."); PJM Answer at 5, 36-37 ("As a threshold matter, reserve is inherently a ramping product, which values and rewards resources with the ability to quickly change output. On this basis alone, PJM's proposal incentivizes the development of flexible resources by ensuring that the PJM reserve market correctly values the ability to quickly change output, which it currently does not.").

[682] *See* PJM Transmittal at 3, 7-8, Keech Aff. ¶ 47-48.

market rule changes directed herein, use of a historic-looking E&AS Offset in PJM is not reasonable as it will not reflect projected changes in the resource mix and these market rule changes. Combined with arguments by both the IMM and Brattle to move to a prospective E&AS Offset in this and other proceedings,[683] we find that this is not just a temporary problem, but a sustained issue going forward.

316. PJM and other commenters argue that because PJM did not propose any changes to the E&AS Offset (or the capacity market generally) in its filings, any arguments related to the E&AS Offset are beyond the scope of this proceeding.[684] We disagree. PJM made its primary filing to implement its Reserve Market Proposal pursuant to section 206 of the FPA.[685] Pursuant to section 206, "once the Commission finds that a rate is unjust and unreasonable, the Commission bears the burden of determining a new just and reasonable rate."[686] Thus, having found PJM met its burden to show that its current reserve market construct is unjust and unreasonable, it is our statutory duty to determine the new just and reasonable rate. We agree with OPSI, CEA, and the IMM that this reserve market reform directly implicates PJM's E&AS Offset calculation.[687] Therefore, we find that the E&AS Offset is within the scope of this proceeding, and a just and reasonable replacement rate must address it.

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[683] In its report on resetting PJM's VRR curve, Brattle points to the outsized effects of anomalous years such as the Polar Vortex in driving up the E&AS Offset. Brattle Fourth VRR Curve Review at 33 ("However, forward-looking E&AS offsets for CCs avoid the volatility seen in historically-based E&AS offsets for CTs when anomalies such as the Polar Vortex occur.") Under the replacement rate adopted herein, the highest market prices during such periods of system stress can be three to four times higher than prices during prior shortage periods, only deepening this problem.

[684] PJM Answer at 63; EPSA Comments at 21.

[685] PJM Transmittal at 1. PJM's section 205 filing was merely to update identical provisions in its Tariff consistent with the changes it proposed to its Operating Agreement pursuant to section 206. *Id.* at 1 n.1.

[686] *New England Power Generators Ass'n, Inc. v. FERC*, 879 F.3d 1192, 1200 (D.C. Cir. 2018); *see also TranSource, LLC v. PJM Interconnection, L.L.C.*, 168 FERC ¶ 61,119, at P 44 (2019).

[687] OPSI Protest at 16; CEA Protest at 13-14; IMM Protest at 52 ("[PJM's proposal] is about the entire PJM market design, including the reserve markets, the energy market and the capacity market and the interactions among them.").

317. Further, even assuming *arguendo* the E&AS Offset is beyond the scope of the replacement rate in this case, the Commission can always act pursuant to section 206 to find that changes in one market have rendered aspects of another, related market unjust and unreasonable, as recently confirmed by the D.C. Circuit.[688] The court in *AEMA* noted examples of where the Commission has done just this, including *PJM Interconnection, L.LC.*,[689] in which the Commission found certain pre-existing energy market price adders had been rendered unjust and unreasonable by developments in the capacity market.[690] Similarly, in a different PJM matter,[691] the Commission found that acceptance of certain proposed changes to PJM's capacity market provisions rendered its existing energy market rules with respect to operating parameters, force majeure, and generator outages unjust and unreasonable.[692] Finally, we note that EPSA's reliance on *NRG*, which addresses filings pursuant to section 205 of the FPA, is misplaced.[693] *NRG* does not limit the Commission's broad authorities and duties pursuant to section 206.

318. Certain commenters argue that it is sufficient to rely on capacity resources responding to the reserve market reforms by submitting lower capacity offers to mitigate potential over-procurement and over-recovery in the capacity market. We disagree. First, without changes to the E&AS Offset methodology, the determination of the VRR curve would still be based on a Net CONE based on the historic three-year average, such that any increase in energy and ancillary services revenues will not be reflected in Net CONE. This would result in a demand curve that reflects higher prices for the same quantity of capacity and therefore could lead, all other things being equal, to procurement of more capacity than is needed, at higher prices. Second, if the default offer cap is also not adjusted in response to an increase in energy and ancillary services revenues, then resources may be able to exercise market power.

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[688] *AEMA*, 860 F.3d at 663-64; *Pub. Serv. Comm'n of N.Y. v. FERC*, 866 F.2d at 491.

[689] 149 FERC ¶ 61,091 (2014).

[690] *AEMA*, 860 F.3d at 664 (citing *PJM Interconnection, L.L.C.*, 149 FERC ¶ 61,091 at P 30).

[691] *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208.

[692] *Id.* P 400.

[693] EPSA Answer at 5-6 (citing *NRG*, 862 F.3d 108).

319. Finally, we disagree with arguments that finding the E&AS Offset unjust and unreasonable and requiring changes creates a slippery slope ("dangerous" precedent[694]), such that every time PJM makes a change to the energy or ancillary services markets, the E&AS Offset will need to be changed, causing uncertainty in the capacity market. Moving to a forward-looking offset, as we direct herein as the just and reasonable replacement rate, will better reflect changing market conditions and rules, and thus will reduce the need to modify the E&AS Offset going forward. As noted earlier, previous energy market changes that the Commission accepted without requiring concomitant capacity market changes did not involve such a fundamental, extensive change to the energy and ancillary services markets. The Commission makes these decisions on a case-by-case basis, taking into account the magnitude of the particular market reform and the impact it will have on the capacity market.

320. Having found pursuant to a section 206 that PJM's methodology for calculating the E&AS Offset is unjust and unreasonable, the burden falls on the Commission to determine the just and reasonable replacement rate.[695] We find that a forward-looking methodology for determining the E&AS Offset will allow changes to energy and ancillary services revenues stemming from energy market design modifications to be more readily incorporated into capacity market parameters and prices. Further, a forward-looking methodology is consistent with project valuation methods used by market participants. Therefore, we order PJM to make a compliance filing within 45 days of the date of this order proposing modifications to its Tariff to implement a forward-looking E&AS Offset that reasonably estimates expected future energy and ancillary services revenues for all Tariff provisions that rely on a determination of the E&AS Offset (e.g., Net CONE).

321. We reject certain parties' concerns that a forward-looking E&AS Offset is infeasible. Brattle, the IMM, and others have long supported implementation of a forward-looking E&AS Offset and have proposed viable means for implementing one.[696]

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[694] EPSA Comments at 21.

[695] 16 U.S.C. § 824e(a).

[696] IMM Second Answer at 23 ("Calculating a forward looking [E&AS] offset is not difficult. Actual developers and generation owners use forward looking calculations of energy market revenues. Actual generation offers are based on forward looking calculations."); *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029 at P 114 ("Brattle . . . states that [changing to a forward-looking offset] would 'provide a better representation of a developers' expectations for net energy revenues' and has recommended in all four of its Triennial/Quadrennial Review reports that PJM explore the use of a forward-looking [E&AS] Offset.") (citations omitted).

Further, other RTOs/ISOs have successfully implemented forward-looking offsets in their capacity markets.[697]

322. We reject requests to change the E&AS Offset retroactively to address the BRAs that have already occurred based on the historic-looking methodology for calculating energy and ancillary services revenues. Nothing in this record indicates that the previously cleared capacity auctions were not conducted in accordance with the then-effective Tariff. We agree with Exelon, P3, PSEG, and EPSA[698] that intervening changes to the market are an inherent part of PJM's three-year forward auction structure and do not justify departing from the Commission's well-established policy of not disrupting the results of cleared capacity auctions.[699] In *PJM Interconnection, L.L.C.*[700], we explained:

> The Commission generally does not order a remedy that requires rerunning a market because market participants participate in the market with the expectation that the rules in place and the outcomes will not change after the results are set. Rerunning past auctions creates two different types of risk: (1) capital risks for resources that made investments based on auction results, and (2) regulatory risk going forward (i.e., investors would be unlikely to want to invest capital in a market if the results were subject to change at a later date . . . .

Retroactively adjusting already run BRAs would inequitably upset settled expectations of market participants who relied on the results of those auctions to make business decisions. In addition, as Exelon points out, many market participants hedge their future

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[697] *See, e.g.*, *ISO New England Inc.*, 170 FERC ¶ 61,052, at PP 41-45 (2020).

[698] Exelon Answer at 22; P3 Answer at 7-8; PSEG Answer at 27-28; EPSA Answer at 10-11.

[699] *See Md. Pub. Serv. Comm'n v. PJM Interconnection, L.L.C.*, 123 FERC ¶ 61,169, at P 49, *order on reh'g*, 125 FERC ¶ 61,340 (2008) ("In a case involving changes in market design, we generally exercise our discretion over remedies and do not order refunds that require rerunning a market."); *see also Bangor HydroElec. Co. v. ISO New England Inc.*, 97 FERC ¶ 61,339 (2001) (finding that rerunning markets, even when a software error results in clearing prices that are inconsistent with the market rules, would do more harm to electric markets than is justifiable), *reh'g denied*, 98 FERC ¶ 61,298 (2002); *Cal. Indep. Sys. Operator*, 120 FERC ¶ 61,271, at P 25 (2007) (identifying market reruns as the exception, not the rule).

[700] 161 FERC ¶ 61,252 (2017).

energy revenues well in advance of the relevant delivery year,[701] and any change in prices will upset those hedges. Moreover, even if we were to re-calculate the VRR curve and other capacity auction parameters based on a new E&AS Offset, there is no way to accurately determine how market participants would have offered in those BRAs based on the new parameters.

323. We disagree with EPSA that it is inappropriate to make an "out-of-cycle adjustment" to the E&AS Offset in this proceeding, without evaluating and potentially adjusting all the other cost and revenue components of the VRR curve.[702] The Commission just recently approved an update to the VRR curve as part of the quadrennial review process.[703] The Commission is not aware of any material intervening change that merits reopening the other cost and revenue components that make up the VRR curve.

324. We agree with all parties arguing that an E&AS Offset is not designed, nor should it be required, to match actual revenues received by a given resource in the E&AS markets in the relevant delivery year. We disagree that this renders a prospective E&AS Offset inappropriate. A forward-looking E&AS Offset is the best expectation of energy and ancillary services revenues in the given delivery year and should therefore include the effects of any large market changes that are expected to be in place in the given delivery year. We do not expect these numbers to line up precisely.

4. Other Proposed Changes to the Capacity Market

325. The IMM argues that continuing to set the VRR curve maximum price at the higher of Gross CONE or 1.5 times Net CONE after implementation of PJM's proposed ORDC changes is unjust and unreasonable because it may artificially increase the capacity market price if Net CONE decreases significantly.[704] The IMM proposes that

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[701] Exelon Answer at 26-27.

[702] EPSA Comments at 20 (citing *Indep. Power Producers of N.Y., Inc. v. N.Y. Indep. Sys. Operator, Inc.*, 125 FERC ¶ 61,311 at PP 33, 35).

[703] *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029, *reh'g denied*, 171 FERC ¶ 61,040 (2020).

[704] IMM Protest at 68-69 ("Thus, under PJM's proposal, even if the [energy and ancillary services revenues] were to increase enough to fully reflect the ORDC scarcity revenues, the maximum capacity market price would never fall below Gross CONE. That rule, is inappropriate, given that PJM's ORDC proposal is intended to shift significant revenue from the capacity market to the energy market. If this evolution is ever to lead to the effective elimination of the capacity market, the capacity market price must be allowed to fall, consistent with actual net revenues.").

if PJM's ORDC changes are adopted, the maximum price on the VRR curve going forward should be set strictly to 1.5 times Net CONE. We do not find that the existing VRR curve maximum price is rendered unjust and unreasonable by the replacement rate we adopt here.

326. As the IMM explains in its pleading and as provided in the Tariff, the VRR curve is constructed by connecting four anchor points: (1) a starting point priced at the VRR curve maximum price and at a quantity of zero; (2) the first inflection point, point A, also priced at the VRR curve maximum price but at a quantity equal to the Installed Reserve Margin minus 0.2%; (3) the second inflection point, point B, priced at roughly 75% of Net CONE and at a quantity equal to the Installed Reserve Margin plus 2.9%; and (4) the end point, point C, priced at zero and at a quantity equal to the Installed Reserve Margin plus 8.8%.[705] Thus, the starting point and point A are functions of the VRR curve maximum price; points B and C are not—point B is a function of Net CONE, and point C is set at a price of zero.[706]

327. Given the nature of this construction, the VRR curve maximum price affects only two segments of the VRR curve: it determines the price associated with the long initial horizontal segment that begins at a quantity of zero and extends out nearly to the Installed Reserve Margin; and it affects the slope of the initial downward-sloping segment of the curve between points A and B. Notably, it does not affect the placement of points B and C and therefore does not affect the slope of the segment connecting those two points.

328. The IMM's protest focuses on a scenario where Net CONE has decreased sufficiently, due to the ORDC changes we adopt here, such that Gross CONE—that is, the cost of new entry for a reference combustion turbine technology before accounting for anticipated energy and ancillary services revenues—becomes greater than 1.5 times Net CONE. In this scenario, the differences between the resulting VRR curve under existing rules and that under the IMM's alternative are, again, twofold: the horizontal segment will be lower (i.e., will reflect a lower price), and the slope of the segment from point A to point B will be less.

[705] PJM Tariff, Attach. DD, § 5.10(a)(i) (26.1.0); *see also* IMM Protest at 70-71.

[706] Point B is also a function of the pool-wide equivalent forced outage rate, or "EFORd," but we ignore that detail here as it is not critical to this discussion.

329. The IMM essentially argues that under the existing VRR curve maximum price, the VRR curve may not, under certain circumstances, be sufficiently responsive to a reduction in the Net CONE value. While, as a general matter, we agree that the VRR curve should be responsive to changes in Net CONE, the two segments of the VRR curve that the IMM argues will be insufficiently responsive are the segments that reflect quantities of capacity either below or approaching the Installed Reserve Margin. More specifically, those segments determine capacity clearing prices only at quantities up to 2.9% greater than the Installed Reserve Margin. The IMM asks us to declare as unjust and unreasonable PJM's current practice of valuing capacity at those levels at prices up to and including Gross CONE. We decline to make such a finding. In so doing, we are particularly mindful of pricing on the horizontal segment of the VRR curve. Were the capacity market to clear on this segment, PJM would be below the Installed Reserve Margin. Therefore, in this scenario, we find that it is appropriate for PJM to pay up to Gross CONE for additional capacity.

330. We acknowledge that in the extreme scenario the IMM references, where Net CONE decreases to zero, the theory tells us that energy and ancillary services revenues should be sufficient to retain and attract capacity to ensure resource adequacy. However, the Net CONE calculation involves myriad assumptions. Should actual values deviate from those assumptions to an extent that energy and ancillary services revenues alone are insufficient to retain and attract adequate capacity despite Net CONE falling to zero, we find it just and reasonable for PJM to retain a VRR curve with the existing maximum price to serve as a final backstop to avoid resource inadequacy.

331. We note that for all points on the VRR curve at quantities greater than the Installed Reserve Margin plus 2.9%, the curve is fully responsive to any decrease in Net CONE. Should Net CONE decrease dramatically, or even as far as to zero, as a result of the ORDC changes, the capacity clearing price will accordingly be low, or even zero, so long as the supply-demand intersection point is on the segment between points B and C.

<u>The Commission orders</u>:

(A) PJM's filings in Docket Nos. EL19-58-000 and ER19-1486-000 are granted in part, subject to the further compliance filing, as discussed in the body of this order.

(B) PJM is hereby directed to submit a compliance filing, within 45 days of the date of this order, as discussed in the body of this order.

(C) As part of its further compliance filing, PJM is hereby directed to propose an effective date for the Operating Agreement and Tariff revisions, and related compliance filing, as discussed in the body of this order.

By the Commission. Commissioner Glick is dissenting with a separate statement attached.

(S E A L)

Nathaniel J. Davis, Sr.,
Deputy Secretary.

Appendix A

Tariff Records Accepted
PJM Interconnection, L.L.C.
Intra-PJM Tariffs

Docket No. EL19-58-000

OA Definitions A - B, 7.0.0
OA Definitions C - D, 21.0.0
OA Definitions E - F, 15.0.0
OA Definitions I - L, 15.0.0
OA Definitions M - N, 13.0.0
OA Definitions O - P, 18.0.0
OA Definitions Q - R, 12.0.0
OA Definitions S – T, 15.0.0
OA Schedule 1 Sec 1.5A Economic Load Response Participant, 10.0.0
OA Schedule 1 Sec 1.7 General., 20.0.0
OA Schedule 1 Sec 1.10 - Scheduling, 35.0.0
OA Schedule 1 Sec 1.11 - Dispatch, 5.0.0
OA Schedule 1 Sec 2.2 General., 10.0.0
OA Schedule 1 Sec 2.5 Calculation of Real-time Prices., 7.0.0
OA Schedule 1 Sec 2.6 Calculation of Day-ahead Prices., 3.0.0
OA Schedule 1 Sec 3.2 - Market Buyers, 44.0.0

Docket No. ER19-1486-000

OATT Definitions – A - B, 14.0.0
OATT Definitions – C-D, 19.0.0
OATT Definitions – E - F, 23.0.0
OATT Definitions – L – M - N, 22.0.0
OATT Definitions – O – P - Q, 22.1.0
OATT Definitions – R - S, OATT Definitions – R - S, 19.0.0
OATT Attachment K Appendix Sec 1.5A Economic Load Resp, 10.0.0
OATT Attachment K Appendix Sec 1.7 General, 20.0.0
OATT Attachment K Appendix Sec 1.10 - Scheduling, 35.0.0
OATT Attachment K Appendix Sec 1.11 - Dispatch, 5.0.0
OATT Attachment K Appendix Sec 2.2 General, 10.0.0
OATT Attachment K Appendix Sec 2.5 Calculation of Real-time, 7.0.0
OATT Attachment K Appendix Sec 2.6 Calculation of Day-ahead, 3.0.0
OATT Attachment K Appendix Sec 3.2 - Market Buyers, 46.0.0

Appendix B

Docket No. EL19-58-000
List of Intervenors

Advanced Energy Economy
Advanced Energy Management Alliance
American Electric Power Service Corporation
American Municipal Power, Inc.
American Petroleum Institute
American Public Power Association
American Wind Capital Company, LLC
American Wind Energy Association**
Calpine Corporation
Delaware Division of the Public Advocate
Delaware Municipal Electric Corporation, Inc.
Direct Energy Business Marketing LLC and Direct Energy Business, LLC
Dominion Energy Services Company, Inc.
Duke Energy Corporation
East Kentucky Power Cooperative, Inc.
EDP Renewables North America LLC
Electric Power Supply Association
Enel X North America, Inc.
Energy Trading Institute
Exelon Corporation
FirstEnergy Solutions Corp.
Illinois Commerce Commission
Illinois Municipal Electric Agency
Indiana Office of Utility Consumer Counselor
Indiana Utility Regulatory Commission
Institute for Policy Integrity, New York University School of Law
Kentucky Attorney General
Long Island Power Authority and Long Island Lighting Company
LS Power Associates, L.P.
Maryland Office of People's Counsel
Maryland Public Service Commission
Mercuria Energy America, Inc.
Monitoring Analytics, LLC
National Rural Electric Cooperative Association
New Jersey Board of Public Utilities
New Jersey Division of Rate Counsel
NRDC/FERC Project
NRG Power Marketing LLC

North Carolina Electric Membership Corporation*
Nuclear Energy Institute
Office of the People's Counsel for the District of Columbia
Ohio Consumers' Counsel
Old Dominion Electric Cooperative
Organization of PJM States, Inc.
Panda Power Funds
Pennsylvania Office of Consumer Advocate
Pennsylvania Public Utility Commission
PJM Load/Customer Coalition
PJM Power Providers Group
Public Power Association of New Jersey
PSEG Companies (PSEG Power LLC; PSEG Energy Resources & Trade LLC; Public Service Electric and Gas Company)
Public Citizen, Inc.
Public Service Commission of the District of Columbia
Public Utilities Commission of Ohio
R Street Institute
Rockland Electric Company
Sierra Club
Solar Energy Industries Association
Southern Maryland Electric Cooperative, Inc.
Steel Producers
Talen Energy Marketing, LLC
The Dayton Power and Light Company
The FirstEnergy Utility Companies
Tilton Energy, LLC
Union of Concerned Scientists
Virginia Municipal Electric Association No. 1
Vistra Energy Corp. and Dynegy Marketing and Trade, LLC
West Virginia Consumer Advocate

*motion to intervene out-of-time
**late-filed motion to intervene

Docket No. ER19-1486-000
List of Intervenors

Advanced Energy Management Alliance
American Electric Power Service Corporation
American Municipal Power, Inc.
American Public Power Association
American Wind Energy Association
Appian Way Energy Partners
Calpine Corporation
Delaware Division of the Public Advocate
Delaware Municipal Electric Corporation, Inc.
Dominion Energy Services Company, Inc.
Duke Energy Corporation
East Kentucky Power Cooperative, Inc.
Electric Power Supply Association
Enel X North America, Inc.
Energy Trading Institute
Exelon Corporation
FirstEnergy Solutions Corp.
Illinois Commerce Commission
Indiana Office of Utility Consumer Counselor
Institute for Policy Integrity, New York University School of Law
Kentucky Attorney General
LS Power Associates, L.P.
Maryland Office of People's Counsel
Maryland Public Service Commission
Monitoring Analytics, LLC
National Rural Electric Cooperative Association
New Jersey Board of Public Utilities
New Jersey Division of Rate Counsel
NRDC/FERC Project
NRG Power Marketing LLC
North Carolina Electric Membership Corporation*
Nuclear Energy Institute
Office of the People’s Counsel for the District of Columbia
Old Dominion Electric Cooperative
Organization of PJM States, Inc.
Panda Power Funds
Pennsylvania Office of Consumer Advocate
Pennsylvania Public Utility Commission
PJM Load/Customer Coalition
PJM Power Providers Group

Public Power Association of New Jersey
PSEG Companies (PSEG Power LLC; PSEG Energy Resources & Trade LLC; Public Service Electric and Gas Company)
Public Citizen, Inc.
Public Service Commission of the District of Columbia
Public Utilities Commission of Ohio
R Street Institute
Rockland Electric Company
Shell Energy North America (US), L.P.
Sierra Club
Solar Energy Industries Association
Southern Maryland Electric Cooperative, Inc.
Steel Producers
Talen Energy Marketing, LLC
The Dayton Power and Light Company
The FirstEnergy Utility Companies
Virginia Municipal Electric Association No. 1
Vistra Energy Corp. and Dynegy Marketing and Trade, LLC
West Virginia Consumer Advocate

*motion to intervene out-of-time

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C. Docket Nos. EL19-58-000
ER19-1486-000

(Issued May 21, 2020)

GLICK, Commissioner, *dissenting*:

1. Today's order grants PJM's complaint seeking to significantly overhaul its markets for energy and ancillary services. It does not, however, meet either of the conditions precedent for approving that sweeping overhaul: It fails to show that the existing rate is unjust and unreasonable or that the replacement is just and reasonable. Instead, the Commission unquestioningly defers to PJM's contested assertions while casually dismissing the detailed and well-reasoned protests. In so doing, the Commission approves a proposal that will impose billions of dollars of additional costs on consumers. That is yet another abdication of our responsibility to protect consumers and to comply with the requirements of the Federal Power Act (FPA).

2. Although I am obviously disappointed in this outcome, I cannot say that I am surprised. It is just the latest in a series of PJM proceedings that have gone against consumers as the Commission has prioritized high prices over efficient markets. In its order accepting PJM's Variable Resource Requirement Curve (VRR Curve), the Commission approved a proposal to establish a "demand curve" for the capacity market that will systematically over-procure capacity, significantly raising rates for customers.[1] Similarly, in its order radically expanding PJM's Minimum Offer Price Rule (MOPR), the Commission effectively modified the "supply curve" for the capacity market by prohibiting some resources that receive state support from participating in the market while forcing others to bid above administratively determined levels[2]—again all at

[1] *PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,040 (2020) (Glick, Comm'r, dissenting at P 21) (explaining that capacity "oversupply hurts customers directly—because they are paying too high a price for too much capacity—and indirectly insofar as it dulls the price signals in the energy and ancillary service markets that should, in theory, drive the efficiency of those markets").

[2] *PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,035 (2020) (Glick, Comm'r, dissenting at PP 85-88) (observing that the order "creates a byzantine administrative pricing scheme that bears all the hallmarks of cost-of-service regulation, without any of the benefits"); *id.* (Glick, Comm'r, dissenting at n.218) (observing "the Commission is willing to set price floors that ensure . . . that those resource can never clear the capacity

customers' expense. Today's order is just more of the same. It will further distort PJM's markets—this time the energy and ancillary service markets—handing yet another windfall to generators and leaving customers to pick up the tab. That is not just and reasonable.

I. The Commission Fails to Show that the Existing Tariff Is Unjust and Unreasonable

3. Reserves play a critical role in our electricity system as they, quite literally, help keep the lights on. As a result, properly valuing reserves is an integral part of ensuring reliable electricity service at just and reasonable rates. Shortage pricing helps to achieve that by providing efficient price signals when the system is short on reserves. During a reserve shortage, the energy price is increased by the administratively determined cost of falling below the reserve requirement. And this upward administrative adjustment sends a strong price signal to both load and supply to respond to the shortage condition. Those basic principles are, for all intents and purposes, beyond dispute.

4. What is in dispute is whether PJM must effectively impose shortage pricing when there is no shortage. The essence of PJM's argument in this proceeding is that, without shortage pricing in non-shortage periods, its Tariff is unjust and unreasonable because it does not sufficiently compensate generators. PJM argues that, instead of paying the marginal cost of providing the reserves in question, it must[3] pay all generators an administratively determined price above marginal cost even when there is no shortage. That theory finds no support in Commission precedent or common sense and it should have been easily rejected.

5. The same goes for the various purported problems to which PJM points in support of its complaint. Simply put, none of the record evidence regarding low prices, uplift, market actions, or the growth of renewable resources shows that the existing energy and reserve market is unjust and unreasonable. The only thing revealed by a careful review of the record, is that PJM has failed to satisfy its burden of proof to show that the existing rate is unjust and unreasonable.[4]

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market, no matter how serious the reliability need and even if that resource is the only that can meet it").

[3] Because this proceeding involves a complaint under section 206 of the FPA, the Commission is finding that the failure impose these prices is unjust and unreasonable a far more sweeping conclusion than finding that the proposed scheme is within the range of just and reasonable results contemplated by the FPA. *Cf. Emera Maine v. FERC*, 854 F.3d 9, 27 (D.C. Cir. 2017).

[4] *Id.* The Commission also accepts PJM's argument that the two-tiered approach

6. PJM principally contends that its Tariff is unjust and unreasonable because it does not price reserves in a manner that reflects the operational value of the flexibility that they provide.[5] But that argument overlooks—or ignores—that an efficient market prices a service at, or at least near, the marginal cost of producing it.[6] As the Independent Market Monitor explained, the marginal cost of providing reserves will often be zero. For example, when a resource is online and operating below its maximum output, it will be providing cost-free reserves equal to the MW difference between its current operating level and its maximum output. That is common because, as the Independent Market Monitor explains, "zero cost reserves often exceed the reserve requirement because some

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to pricing reserves has been shown to be unjust and unreasonable. *PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,153, at P 84 (2020) (Order). As an initial matter, Tier 1 reserves are made up of resources that are operating with headroom (*i.e.*, below their maximum capacity) and do not face any opportunity cost associated with providing reserves. PJM Transmittal at 15. Providing reserves should increase their revenue, since they would not otherwise be paid for that headroom. *See* PJM Load Coalition Protest at 22. Tier 2 resources, by contrast, are those that are dispatched below their profit-maximizing levels in order to provide reserves, meaning that they do face an opportunity cost of providing reserves. PJM Transmittal at 15-16. As they are not similarly situated, the different treatment between these resources does not constitute undue discrimination. PJM also argues that the two-tiered distinction is unjust and unreasonable because it impedes price transparency due to what PJM describes as sub-par performance of Tier 1 resources. *Id.* at 22-23. The record, however, is not so clear on that point. For example, the Independent Market Monitor disputes PJM's analysis, arguing that Tier 1 resources provide greater response to spinning events than PJM calculates and that they frequently exceed PJM's Tier 1 estimate. Independent Market Monitor Protest at 20. The Commission fails to address any of that evidence directly and just summarily states that agrees with PJM. Order, 171 FERC ¶ 61,153 at P 90 (noting the presence of a factual dispute between PJM and the Independent Market Monitor, but then crediting PJM's "overarching argument' without at all wrestling with that factual dispute). That is a far cry from a reasoned explanation of why the existing Tariff is unjust and unreasonable.

[5] PJM Transmittal at 7 ("Current reserve market clearing prices—zero in about 60 percent of all hours for Synchronized reserve and in about 98 percent of all hours for Non-Synchronized Reserve—do not reflect the operational value of resource flexibility.").

[6] *See* Order, 171 FERC ¶ 61,153 at P 81 (noting that PJM's market design should "reflect the marginal cost of providing reliable service—including reserves necessary to address legitimate non-contingency operational uncertainties"); *id.* P 83 ("We agree with PJM that the existing market design is consistently failing to produce prices reflecting the marginal cost of procuring necessary reserves.").

generating units are inflexible and must be scheduled for hours ahead of and beyond the time at which they are needed to produce energy."[7]

7. Those reserves surely have value. If a resource trips offline or if demand unexpectedly surges, they could help pick up the slack. But the fact that those costless reserves provide value to the system does not mean that PJM's market is sending inefficient price signals just because it is not paying high prices to a resource that is providing reserves by operating at a profit-maximizing level that happens to be below its maximum output. The Commission itself repeatedly explains that reserve prices should reflect the marginal cost of providing reserves,[8] but then utterly fails to square its finding that PJM's Tariff is unjust and unreasonable because reserves prices are too low with the fact that the marginal cost of providing reserves will often be at or near zero.[9]

8. In an effort to illustrate what it sees as the problem with PJM's current Tariff, the Commission points to a stretch of cold weather in January 2019.[10] It suggests that there must be a design flaw because the reserve prices were low during those frigid conditions.[11] But the record suggests that, from the perspective of the grid, the conditions were not actually that challenging: PJM was operating with a reserve margin above 25 percent during the peak hour of that cold snap.[12] Nothing in PJM's complaint—or today's order—provides any reason to believe that the low reserve prices during that period were due to anything other than market fundamentals or that there is something amiss with those fundamentals. Although the Commission suggests that the healthy

[7] Independent Market Monitor Protest at 13-14 ("Coal and combined cycle gas units comprise most of PJM's excess online capacity that is not providing energy at full output levels. Both have inflexibility in starting and shutting down, but provide a relatively large range of dispatchable capacity once online. . . . 60 percent of PJM's energy is provided by resources that create large quantities of zero cost synchronized reserves.").

[8] *See, e.g.*, Order, 171 FERC ¶ 61,153 at PP 81, 83.

[9] *See, e.g.*, Independent Market Monitor Protest at 13 ("Zero cost reserves often exceed the reserve requirement because some generating units are inflexible and must be scheduled for hours ahead of and beyond the time at which they are needed to produce energy.").

[10] Order, 171 FERC ¶ 61,153 at P 78.

[11] *Id.* P 91.

[12] PJM Load Coalition Protest at 19.

reserve margin may have been due to the operator bias to commit additional reserves,[13] it fails to address the evidence provided by the Independent Market Monitor refuting that argument and explaining that the low prices were the result of an excess supply of resources self-scheduling into the market.[14] If anything, the evidence on this cold snap seems to show that the existing Tariff is more than up to the job, not that it is unjust and unreasonable.

9. Next, the Commission points to PJM's contention that the tariff is unjust and unreasonable in part because of uplift payments caused by PJM's operators taking out-of-market actions to dispatch resources.[15] No one can argue with the general goal of reducing uplift payments. But, even so, it is not true that any existing tariff provision is unjust and unreasonable just because a change could be made that would conceivably reduce uplift payments.

10. Instead, the Commission must show that there is something about these uplift payments in particular that renders PJM's Tariff unjust and unreasonable—a showing it fails to make in this order. The Commission points to the Independent Market Monitor's 2018 State of the Market Report, suggesting that the fact that nearly half of the revenue for synchronized reserves was paid outside the market shows that there is an uplift problem that makes the Tariff unjust and unreasonable.[16] But, as the Independent Market Monitor asserts in disputing that characterization of his report, those uplift costs appear to be the result of issues with the settlements process that are outside the scope of PJM's complaint.[17] The Commission, however, simply ignores the contrary evidence in the record and claims that the presence of these uplift payments shows that there must be a

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[13] Order, 171 FERC ¶ 61,153 at P 91.

[14] The Independent Market Monitor explains that several large units self-scheduled or came online several hours prior to their commitment period in the early morning hours, increasing the available tier 1 synchronized reserves. As a result, for almost all intervals between 2:00 AM and 6:00 AM, zero-cost reserves fully satisfied the synchronized reserve requirement. Independent Market Monitor Protest, Attachment A at 12-13 (Winter Peak Price and Uplift Analysis: January 2019).

[15] Order, 171 FERC ¶ 61,153 at PP 81-83.

[16] *Id.* P 82. PJM makes a similar point, noting that in 2018, it paid 46.2 percent of the costs of Tier 2 reserves through uplift, which covered only 36.1 percent of production costs. PJM Answer at 28.

[17] Independent Market Monitor Second Answer at 9 (noting that the uplift payments were, in significant part, the result of "incorrect settlements calculations, and a mismatch between the dispatch interval and the pricing interval").

problem with the market for reserves. Such conclusory assertions that ignore contrary evidence are not reasoned decisionmaking.[18]

11. In addition, both the Commission and PJM suggest that the replacement rate will help lower uplift costs. Maybe, but that certainly does not show that the existing Tariff is unjust and unreasonable or that there is a problem with the current uplift payments. After all, uplift payments to eligible resources (such as those committed out of merit for an unexpected reliability need) are based on the difference between their cost and the revenue they receive from the market.[19] Higher energy market prices would, all else equal, likely reduce that difference, thereby decreasing uplift payments. But the fact that we could increase energy prices in order to decrease uplift does not necessarily mean that it would be just and reasonable to do so or, as relevant here, that PJM's tariff is unjust and unreasonable because the market is yielding low prices, which themselves increase uplift payments.

12. PJM and the Commission also argue that the mere presence of out-of-market operator actions is also a reason to find the Tariff unjust and unreasonable. As with uplift, the goal of minimizing out-of-market actions, and instead pricing the steps operators take to maintain reliability, is a laudable one. PJM and the Commission contend that, as a result of operator actions, PJM is procuring reserves well in excess of the minimum NERC standards: In 2018, it carried 34 percent more Synchronized Reserves than the system requirement and 43 percent more Primary Reserves.[20] These out of market actions to procure additional reserves should be transparent and understood

[18] *Genuine Parts Co. v. EPA*, 890 F.3d 304, 312 (D.C. Cir. 2018) ("[A]n agency cannot ignore evidence that undercuts its judgment; and it may not minimize such evidence without adequate explanation."); *id.* ("'Conclusory explanations for matters involving a central factual dispute where there is considerable evidence in conflict do not suffice to meet the deferential standards of our review.'" (quoting *Int'l Union, United Mine Workers v. Mine Safety & Health Admin.*, 626 F.3d 84, 94 (D.C. Cir. 2010)); *see also Lakeland Bus Lines, Inc. v. NLRB*, 347 F.3d 955, 962 (D.C. Cir. 2003) (explaining that a court "may not find substantial evidence 'merely on the basis of evidence which in and of itself justified [the agency's conclusion], without taking into account contradictory evidence or evidence from which conflicting inferences could be drawn'" (quoting *Universal Camera Corp. v. NLRB,* 340 U.S. 474, 487 (1951)).

[19] *See, e.g.*, Federal Energy Regulatory Commission, *Staff Analysis of Uplift in RTO and ISO Markets* 4 (2014), *available at* https://www.ferc.gov/legal/staff-reports/2014/08-13-14-uplift.pdf ("Uplift credits are payments made to resources whose commitment and dispatch by an RTO or ISO result in a shortfall between the resource's offer and the revenue earned through market clearing prices.").

[20] PJM Load Coalition Protest, Attachment A at P 8 (Ali Al-Jabir Affidavit).

and PJM should endeavor to improve its markets' design to incorporate those actions, at least to the extent justifiable.

13. But, again, as with uplift, the fact that the underlying goal is laudable does not show that the existing Tariff is unjust and unreasonable. Indeed, some out-of-market actions are inevitable, and, accordingly, proving that a Tariff is unjust and unreasonable requires reasoning quite a bit more thorough than simply pointing out that operator actions occur.[21] In addition, where the record contains conflicting evidence—as this one certainly does—section 206 requires the Commission to wrestle with the contrary evidence, not simply defer to PJM's contentions, as today's order does.[22] And while it may be just and reasonable for regions to take different approaches to procuring reserves beyond the NERC requirement, the Commission should not be so quick to find that procuring reserves consistent with that requirement is itself unjust and unreasonable.[23]

14. Moreover, PJM's existing Tariff permits it to take additional actions to address these very issues, suggesting that wholesale revisions to the Tariff may not be necessary. For example, its current Operating Reserve Demand Curve (ORDC) has a two-step design with a "Step 2B" that allows PJM "to extend the reserve requirement when PJM operators [take] actions to schedule additional reserves during conservative operations."[24] PJM explains that this authority to extend the reserve requirement has never been deployed, but fails to adequately explain why greater use of its existing authority could not go a long way toward remedying the problems that purportedly render the existing Tariff unjust and unreasonable.[25] It stands to reason that an RTO cannot decline to

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[21] And yet that is the primary argument on which the Commission relies to demonstrate the alleged shortcomings in PJM's Tariff. *See* Order, 171 FERC ¶ 61,153 at PP 77-78.

[22] *See supra* note 18.

[23] The Commission points to the many individual uncertainties related to the forecast of load, generator availability and performance, and interchange—uncertainties that all RTOs and ISOs as well as other Transmission Operators share—and contends that the sum of those uncertainties render the NERC-mandated quantity of reserves insufficient. *See* Order, 171 FERC ¶ 61,153 at P 75.

[24] PJM, Manual 13: Emergency Operations § 3.2.

[25] PJM claims that limitations in the guidance on how to use the Step 2B extension in its Business Practices Manual prevent this option from being effective solution. Even assuming that is correct, the more obvious solution would be to revise the Business Practices Manual—a guidance document that is not on file with the Commission—rather finding that the Tariff is unjust and unreasonable. *See* PJM Load Coalition Answer at 7-8. Today's order suggests that Step 2B is too narrow a measure as evidenced by the fact

exercise its existing authority and then use that decision to explain why its existing Tariff is unjust and unreasonable.

15. Finally, PJM contends that the Tariff is unjust and unreasonable because it will need additional reserves to provide the flexibility required to address the growth of variable resources, such as wind and solar.[26] As an initial matter, PJM has some of the lowest levels of variable resources of any RTO in the country—yet those other RTOs have managed to address the changing needs of their systems without filing complaints against their own tariffs—and, in any case, the Commission's recent orders are doing plenty to slow down that transition.[27] SPP and CAISO, for example, routinely manage renewable generation levels well above 50 percent of total load without the type of reforms PJM claims it needs.[28] Moreover, with over 40 GW of new, highly efficient, and flexible combined-cycle natural gas turbines PJM has a resource mix that should easily accommodate its relatively slow growth in variable resources.[29]

16. The bottom line is that none of PJM's arguments provide a compelling case that its existing Tariff is unjust and unreasonable. And the analysis, such as it is, in today's order equally fails to meet that burden. Most of the Commission's determination section consists of parroting PJM's points and then asserting that the Commission disagrees with protestors, without a real explanation why. Simply put, the Commission's willingness to uncritically accept the representations in PJM's complaint makes a mockery out of the

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that it has not prevented the use of out-of-market operator commitments. Order, 171 FERC ¶ 61,153 at P 94. That does not, however, respond to the argument that the appropriate response is for PJM to change its guidance on how to use Step 2B before claiming that the Tariff is simply unjust and unreasonable.

[26] PJM Transmittal at 7.

[27] *See PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,035 (Glick, Comm'r, dissenting at PP 90-97).

[28] *See* California ISO, *Monthly Renewables Performance Report* (Mar. 2020), http://www.caiso.com/Documents/MonthlyRenewablesPerformanceReport-Mar2020.html (stating that CAISO's maximum renewable penetration in March was just over 80 percent); Tom Kleckner, RTO Insider, *SPP Sets 71.3% Wind Penetration Mark* (Feb. 6, 2020), *available at* https://rtoinsider.com/spp-sets-wind-penetration-mark-154435/ (reporting that SPP experienced energy penetration levels of 71.3 percent on February 3, 2020).

[29] *See* Independent Market Monitor Protest at 19.

well-established proposition that "Section 206's procedures are 'entirely different' and 'stricter' than those of section 205."[30]

II. The Commission Fails to Demonstrate that Its Replacement Rate Is Just and Reasonable

17. In setting a replacement rate, today's order largely rubber stamps PJM's proposal to impose a complex and opaque administrative pricing scheme, which is expected to increase prices by between $500 million and $2 billion *per year*.[31] That replacement rate will result in pervasive scarcity pricing, even when reserves are plentiful.[32] That result is inconsistent with basic economic theory and, taken seriously, would appear to raise serious questions about how locational marginal prices are formulated in all other RTOs. Suffice it to say, forcing customers to pay outrageous costs for reserves substantially in excess of the reserve requirements established by NERC and without any evidence of additional benefits commensurate with that additional cost is about unjust and unreasonable as you can get.

18. As noted, scarcity pricing is an essential element of any market-based approach to managing an electricity system. It provides an economic incentive for resources to provide services that are in short supply, thereby providing more of those essential services. But the logic of shortage pricing presupposes that there is a shortage. Imposing scarcity pricing in the absence of a shortage is a way to generate windfalls for generators, not a just and reasonable response to market conditions.

19. Imagine if ride-sharing companies, such as Uber or Lyft, all suddenly began doubling or tripling the cost of rides when there were far more cars on the road than customers using those apps. Now imagine that those companies had a monopoly on transportation and you had to use those services to get where you want to go. That would look a lot more like price gouging than a reasonable response to market fundamentals. And yet, that is distressingly similar to the pricing regime that the Commission is

[30] *Emera Maine*, 854 F.3d at 24.

[31] The Independent Market Monitor estimates PJM's proposal will result in an increase in payments by load to generators of at least $1.7 billion per year. Independent Market Monitor Protest at 53. PJM estimates the increase in energy and reserve market billing from its proposal will be approximately $556 million. PJM Transmittal, Attachment D at 46 (Affidavit of Adam Keech).

[32] *See* Independent Market Monitor Protest at 7 (explaining that the result of PJM's proposed replacement rate "is scarcity pricing all the time, all hours of the day, all days of the year, regardless of actual shortage conditions.").

imposing today. That is a sad state of affairs for an agency whose primary purpose is supposed to be customer protection.[33]

20. To appreciate the implications of today's order, we need to start with the shape of the ORDC and what it means both in terms of pricing and price signals. Today's order approves a transition from a vertical stepped demand curve for reserves, to a downward-sloping ORDC. That downward slope supposedly reflects a probabilistic distribution of the likelihood that PJM would fail to meet its minimum reserve requirement for a reserve product when varying amounts of reserves in excess of the minimum reserve requirement are available to the system.[34] As a result, the downward-sloping ORDC extends far beyond the minimum reserve requirement and assigns a positive value to acquiring operating reserves well in excess of that requirement.[35] In particular, this positive value assigns every MW of load served a cost associated with failure to satisfy the reserve requirement. That cost is the scarcity component that is added to the energy price.

21. And therein lies the problem. Today's order approves PJM's proposal to procure reserves in excess of the reserve requirement as if it were facing a reserve shortage when it is not. As the Independent Market Monitor explains, the extended slope of the new ORDCs creates "scarcity pricing at all times rather than when there is an actual shortage."[36] The record suggests that this permanent shortage approach to pricing reserves will raise energy prices in 85 percent of the hours of the year.[37] The idea that PJM, out of all the RTOs, is facing a near-constant reserve shortage is frankly ludicrous.

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[33] *California ex rel. Lockyer v. FERC*, 383 F.3d 1006, 1017 (9th Cir. 2004) (rejecting "an interpretation [that] comports neither with the statutory text nor with the Act's 'primary purpose' of protecting consumers"); *City of Chicago, Ill. v. FPC*, 458 F.2d 731, 751 (D.C. Cir. 1971) ("[T]he primary purpose of the Natural Gas Act is to protect consumers." (citing, *inter alia*, *City of Detroit v. FPC*, 230 F.2d 810, 815 (D.C Cir. 1955)).

[34] PJM Transmittal at 58-59; *see also id.*, Attachment F at 6 (Affidavit of Dr. Patricio Rocha Garrido) ("[T]he proposed ORDC is composed of an [Minimum Reserve Requirement segment and a downward-sloping segment whose shape is determined by the declining probability of failing to meet the MRR as the magnitude of total forecast error (and available reserves) increases.").

[35] Independent Market Monitor Protest at 22 ("PJM's current calculations for its proposed ORDC define a positive marginal value for reserves up to nearly twice the current reserve requirements.").

[36] *Id.* at 23.

[37] *Id.* at 24. As noted, the total costs of those price increases is forecasted to run

22. In addition, the record suggests that applying constant scarcity pricing regardless of system conditions can threaten reliability. As Direct Energy observed, it could be particularly problematic during minimum generation events, when PJM needs to remove excess generation from the system to manage reliability. With the new downward-sloping ORDC, PJM's pricing mechanism will incentivize generation to come on to the system (and for load to come off), even as PJM is trying to get resources offline. This dynamic can threaten reliability as it undermines PJM's ability to manage a minimum generation event. And that is particularly concerning here because, as the Independent Market Monitor points out, the extended reserve requirements created by the long slope of the new ORDC increases the likelihood of minimum generation events in the future.[38]

23. In fairness, a sloped ORDC would not be inherently unjust and unreasonable. A sloped curve that reflected a realistic risk assessment could well be an appropriate approach to pricing excess reserves. But that is not what we have here. The downward sloping portion of the ORDC has no zero crossing point and can be more than twice as much as the reserve requirement.[39] That will result in the procurement of unneeded reserves and could result in prices as high as $12,000/MWh which appears far in excess of the value of lost load.[40] Neither PJM nor the Commission explain how the sloped curve in this order will provide reliability benefits anywhere near the roughly $500 million to $2 billion in annual costs that it will impose on customers.[41]

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between $500 million and $2 billion. *See supra* n.31. And that is just the beginning. As the Independent Market Monitor explains, applying PJM's method for calculating the proposed ORDCs based on wind and solar forecast error to PJM's prediction of the growth in wind and solar in the coming years would increase the scarcity price adder by $500 per MW for the first 1,000 MW of reserves beyond the reserve requirement. *See* Independent Market Monitor Protest at 50.

[38] Independent Market Monitor First Answer at 21 ("The extended reserve requirements created by the extended sloping ORDC increase the likelihood of PJM having excess online capacity such that it dispatches all resources down to their physical limits.").

[39] Compare that to the downward sloping portion the VRR curve, which can procure up to about five percent more MW than the target reserve margin. Independent Market Monitor Protest at 17.

[40] *Cf.* MISO FERC Electric Tariff Schedule 28 40.0.0 ("The Value of Lost Load (VOLL) shall be equal to $3,500 per MWh").

[41] *See supra* n.31.

24. In addition, by more than doubling the Reserve Penalty Factor from $850/MWh to $2,000/MWh, today's order also permits PJM to charge far too much for the reserves it procures.[42] PJM's argument, which the Commission again uncritically accepts, is that the reserve penalty factor should be the same as the maximum price-setting energy offer cap, which, in Order No. 831, the Commission increased to $2,000.[43] But that argument overlooks the fact that offers cannot exceed $1,000/MWh without prior PJM approval of a cost-based offer[44] and the Independent Market Monitor contends that the short-run marginal cost rarely exceeds the current $850/MWh penalty factor.[45] The Commission's statement that $2,000 is a just and reasonable Reserve Penalty Factor because generation resources *can*, under certain circumstances, submit cost-verified incremental energy offers up to $2,000/MWh ignores the fact that such prices are unlikely to occur[46] and makes no effort to wrestle with whether customers derive a benefit even remotely close to the incremental cost of such sky-high penalty factors.[47]

25. Using a $2,000/MWh penalty factor is likely an overstated value for the highest marginal cost resource on the system in all but the rarest of circumstances, but the impact of this is most severe when considering how the multiple products are designed to work together. The Commission approves PJM's proposal to make the reserve penalty factors additive across the different products and locational reserve.[48] In English, that means that

[42] Order, 171 FERC ¶ 61,153 at PP 34, 153.

[43] *Offer Caps in Mkts. Operated by Reg'l Transmission Orgs. & Indep. Sys. Operators*, Order No. 831, 157 FERC ¶ 61,115 (2016), *order on reh'g & clarification*, Order No. 831-A, 161 FERC ¶ 61,156 (2017), *amended by* 165 FERC ¶ 61,136 (2018).

[44] *Id.* P 1 ("[W]e require, pursuant to section 206 of the Federal Power Act, that each RTO/ISO: (1) cap each resource's incremental energy offer at the higher of $1,000/megawatt-hour (MWh) or that resource's verified cost-based incremental energy offer; and (2) cap verified cost-based incremental energy offers at $2,000/MWh when calculating locational marginal prices").

[45] Independent Market Monitor Protest at 32.

[46] As the Load Coalition points out, price-setting energy market offers did not exceed $1,000/MWh between 2015 and 2018 and, even in 2014, only went up $1,850/MWh. PJM Load Coalition Protest at 52.

[47] Order, 171 FERC ¶ 61,153 at P 153.

[48] *Id*. P 157.

total Reserve Penalty Factors could rise up to $12,000/MWh.[49] That is almost four times what other RTOs, such as MISO estimate as the Value of Lost Load[50] and even higher than the $9,000/MWh value used in the Electric Reliability Council of Texas's (ERCOT) energy only market.[51] That $9,000/MWh figure in ERCOT is supposed to raise energy prices above marginal cost as an alternative to a capacity market. Unlike ERCOT, PJM has a capacity market, albeit a troubled one, which would seem to undermine any justification for cumulative Reserve Penalty Factor thousands of dollars above ERCOT's figures.[52]

26. Given the enormous costs imposed by today's order, I am pleased to see that the Commission is at least requiring PJM to implement a forward-looking energy and ancillary services offset (E&AS Offset). In theory, that should mitigate some of the enormous costs imposed by this proposal by reducing capacity market prices accordingly.[53] But getting a forward looking E&AS Offset right is no mean feat. And getting it right is critical to properly establishing the Net CONE value that is used to

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[49] PJM Transmittal at 11-12.

[50] MISO FERC Electric Tariff Schedule 28 40.0.0 ("The Value of Lost Load (VOLL) shall be equal to $3,500 per MWh").

[51] Independent Market Monitor Protest at 27 (citing William W. Hogan & Susan L. Pope, FTI Consulting, *Priorities for the Evolution of an Energy-Only Electricity Market Design in ERCOT* (2017)).

[52] The Commission also relies on PJM's claim that these reforms will incentivize the development of flexible resources as a justification for the replacement rate. Order, 171 FERC ¶ 61,153 at P 230. If only. The record instead reflects that the new ORDC's principal effect will be to convey a windfall to inflexible generators. Independent Market Monitor Protest at 47- 49, tbl. 3 (showing that nuclear resources would receive the largest increase in energy revenue from PJM's proposal at $15,345/MW-year for the simulated year 2018 while combustion turbines and steam coal units would receive an increase of $5,910 and $6,952/MW-year in energy and reserve revenues). That will presumably help keep them online and slow their replacement by more flexible resources. Instead of helping the transition to the flexible resources needed in the future, this proposal seems more likely to slow—or even reverse—that trend by creating a new source of revenue for inflexible capacity.

[53] To that end, I have previously urged PJM and its stakeholders to work on developing such an approach, as I agree with the Brattle Group's repeated recommendations along these lines as a forward-looking approach to calculating E&AS would better align with a forward looking auction such as PJM's capacity auction. *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029 (Glick, Comm'r, dissenting at P 12).

anchor the VRR Curve[54] and that plays a central role in the sweeping administrative scheme imposed by the Commission's recent MOPR Order.[55] I strongly urge PJM to consider multiple options for developing this forward-looking offset and provide the relevant details to the PJM stakeholders as transparently as possible. Any proposal PJM makes on compliance must be properly vetted by PJM's stakeholders.

27. Finally, I note that the implication of the Commission's adoption of an E&AS offset is that, without such an offset reflecting the changes imposed by today's order, capacity market inputs that depend on E&AS, including Net CONE, could well be unjust and unreasonable. Accordingly, it would seem that any offset would have to be in place before the next capacity auction if the results are to be deemed just and reasonable under the Commission's own reasoning.

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28. I support changes to more accurately price operating reserves, which, when done well, should reward flexibility and ensure that both demand and supply receive accurate price signals to respond to changing system conditions. I also support efforts to better define energy market needs that would increase the ability of resources to earn revenues in the energy and ancillary services markets based on the services they provide rather than through the slush fund that has become the PJM capacity market. I remain open to proposals to improve PJM's markets along those lines.

29. Today's order does not do that. The record in this proceeding simply does not support a finding that the current market is unjust and unreasonable. To be sure, the market is not perfect, but showing that an existing rate is unjust and unreasonable requires more than suggesting that there may be something better.[56] In any case, the replacement rate set by today's order clearly is not a better approach. Instead of incentivizing resources to respond to system conditions or improving price formation, it replaces the locational marginal price with an administrative construct that implements scarcity pricing even when there is no shortage. This is an indefensible rate hike for consumers, not a just and reasonable solution.

30. In closing, I am also deeply disappointed by the failure of leadership on the parts of both PJM and the Commission in how they appear to be approaching the changing needs of the grid. Instead of using the coming growth of variable resources as a

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[54] *PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,040 (Glick, Comm'r, dissenting at P 2).

[55] *PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,035.

[56] *Emera Maine*, 854 F.3d at 27.

scapegoat to justify imposing excessive rates on consumers (and handing yet another windfall to generators), we should be considering how to best incentivize the resources that will provide the services needed to operate the grid reliably in the years to come. There are many ways that PJM could do that; this just is not one of them.

For these reasons, I respectfully dissent.

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Richard Glick
Commissioner

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