167 FERC ¶ 61,029
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Neil Chatterjee, Chairman;
Cheryl A. LaFleur, Richard Glick,
and Bernard L. McNamee.

PJM Interconnection, L.L.C. Docket Nos. ER19-105-001
ER19-105-002

ORDER ACCEPTING PROPOSED TARIFF REVISIONS

(Issued April 15, 2019)

1. On October 12, 2018, as amended on October 26, 2018, pursuant to section 205 of the Federal Power Act (FPA),[1] PJM Interconnection, L.L.C. (PJM) filed its quadrennial revision of its Variable Resource Requirement (VRR) Curve used in the Reliability Pricing Model (RPM). In this order we accept the proposed VRR Curve revisions, effective January 17, 2019, subject to condition, as discussed below.

I. Background and the PJM Filing

2. PJM explains that its VRR Curve is an administratively-determined demand curve that is used, in combination with the supply curve formed from capacity supplier sell offers, to clear the RPM Auctions.[2] PJM states that the PJM Open Access Transmission Tariff (Tariff) defines the VRR Curve as a set of lines connecting several price-quantity points that are stated as multiples or fractions of the Net Cost of New Entry (Net CONE)[3] reflected as $/MW-day (on the price axis) and the target reliability requirement (on the megawatt quantity axis). PJM indicates that the current VRR Curve is composed of three linear segments, each extending down and/or to the right from the point where the

[1] 16 U.S.C. § 824d (2012).

[2] PJM Transmittal at 4.

[3] Net CONE is calculated by subtracting the Net Energy and Ancillary Services (EAS) revenues (the net revenues such a plant could be expected to earn in the PJM energy and ancillary services markets) from CONE (which represents the levelized capital costs and fixed operations and maintenance (O&M) expenses of a new plant). *See* PJM Tariff, § 1 (Definitions-L-M-N), PJM Transmittal at 4.

immediately preceding segment ends.[4] PJM adds that the Commission has repeatedly accepted downward-sloping, administratively determined demand curves for capacity markets, citing the advantages of such curves.[5]

3. The Tariff requires PJM and its stakeholders to review every four years both the shape of the VRR Curve used to clear the RPM Auctions and the inputs to that curve.[6] These inputs include the Cost of New Entry (CONE) established by a representative, theoretical new power plant (Reference Resource) and the expected Net EAS revenues that a plant participating in the Capacity Market would earn in PJM's other markets.

4. PJM explains that higher prices (above Net CONE) are associated with capacity shortage conditions (generally below the target reliability requirement) and lower prices are associated with excess capacity conditions. PJM concludes that the current VRR Curve produces the highest price when capacity is 0.2 percentage points below the approved Installed Reserve Margin (IRM) or lower. PJM states that the current effective Tariff sets that price as 1.5 times the Net CONE.[7]

5. Based on the analyses produced by PJM's independent expert, the Brattle Group (Brattle), PJM proposed several changes for implementation in connection with the 2019 base residual auction for the 2022/2023 Delivery Year. As described in more detail below, these changes include adjusting the VRR Curve shape, redefining the CONE values, and updating the Net EAS revenue offset methodology. First, PJM proposes to shift the downward-sloping VRR Curve to the left by one percent, since the market and supply uncertainties present in the 2014 RPM parameter review that warranted a one percent rightward shift have been resolved.[8] Second, PJM proposes to update the

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[4] PJM Transmittal at 5. PJM explains: the price cap forms a horizontal segment at 1.5 times Net CONE, applying whenever cleared capacity is 0.2 percent or more below the IRM target; the second line segment slopes down and to the right, ending at the point where price is 0.75 times Net CONE and the cleared quantity of capacity is at IRM plus 2.9 percent; and the third segment slopes down more gradually, ending at the point where price equals zero and the cleared capacity exceeds the IRM by 8.8 percent.

[5] *Id.*

[6] PJM Tariff, Attachment DD, § 5.10(a)(i)-(iii).

[7] PJM Transmittal at 4.

[8] PJM states that the shift in 2014 was to address large scale generation retirements resulting from both the Environmental Protection Agency's (EPA) Mercury and Air Toxics Standards rule and fuel pricing changes due to the emergence of low-priced shale

estimate of the Gross CONE, reducing that estimate by over 20 percent in all areas of the PJM Region, based on a detailed analysis of the construction, operation, and capital costs of the combustion turbine (CT) peaking plant selected as the Reference Resource.[9] Third, PJM proposes to update the definition of the Reference Resource CT Plant from the F-class turbine to the newer H-class turbine.[10] Fourth, PJM proposes to revise the escalation rate used to adjust the Gross CONE estimate annually in the years between quadrennial reviews.[11] Finally, PJM proposes to include a 10 percent cost adder in the Net EAS Offsets calculation, consistent with the 10 percent margin sellers may include in their cost-based energy market offers.[12] PJM requests an effective date of December 12, 2018.

6. PJM notes that the Gross CONE values proposed in this filing assume that generators recover certain major maintenance costs as variable O&M costs through energy market offers.[13] While PJM's current Tariff precludes CTs and combined cycles (CC) units from including these expenses in their energy market offers, PJM proposes to eliminate this restriction in its Variable O&M (VOM) filing.[14]

II. Notice of Filings and Responsive Pleadings

7. Notice of the October 12, 2018 filing was published in the *Federal Register*, 83 Fed. Reg. 53,053 (2018), with interventions or protests due on or before November 2, 2018. Timely motions to intervene were filed by: the AES Corporation; American Municipal Power, Inc. (AMP); the American Public Power Association (APPA); Calpine Corporation, the Delaware Division of the Public Advocate, Direct Energy Business Marketing, L.L.C.; Dominion Energy Services, Inc.; East Kentucky Power Cooperative; EDF Trading North America; the Electric Power Supply Association (EPSA); Exelon

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gas; heightened competition from the increasing efficiency of gas combined-cycle technology; the D.C. Circuit court's vacatur of Order No. 745; and uncertainty in the manner in which states would implement the EPA's greenhouse gas rule.

[9] PJM Transmittal at 2.

[10] *Id.* at 2, 17.

[11] *Id.* at 2.

[12] *Id.*

[13] *Id.* at 19.

[14] We are accepting PJM's proposal to eliminate this restriction in our order in Docket Nos. ER19-210 et al., which is being issued concurrently with this order.

Corporation; First Energy Service Company; the FirstEnergy Utility Companies (FirstEnergy); LS Power Associates, L.P. (LS Power); the Maryland Office of People's Counsel; the Maryland Public Service Commission; Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor (IMM); the New Jersey Board of Public Utilities; the New Jersey Division of Rate Counsel; NRG Power Marketing; the North Carolina Electric Membership Corporation; the Office of the People's Counsel of the District of Columbia; Old Dominion Electric Cooperative; the PJM Industrial Customer Coalition (PJM ICC); the PJM Power Providers Group (P3); PSEG Companies; the Public Power Association of New Jersey; Rockland Electric Company; Talen Energy Marketing, L.L.C.; the Sierra Club; Southern Maryland Electric Cooperative, Inc.; and Wabash Valley Power Association. Out-of-time motions to intervene were filed by the Illinois Commerce Commission and the Public Service Commission of West Virginia.

8. On October 26, 2018, PJM filed an Amendment to Extend Time for Action, consisting of a non-substantive amendment to the October 12, 2018 filing with a new proposed effective date of January 17, 2019, solely for the purpose of extending the time for Commission action.

9. Comments and Limited Protests were filed by the EPSA, LS Power, P3, and the Public Interest Entities.[15] A Protest and Request for Evidentiary Hearing was filed by the PSEG Companies. Protests were filed by AMP and the PJM ICC (the Joint Protestors), the IMM, and FirstEnergy.

10. P3, the Joint Protestors, PJM, LS Power, and PSEG Companies filed answers.

11. On January 15, 2019, Commission staff issued a deficiency letter (Deficiency Letter) requesting additional information regarding PJM's filing.

12. PJM submitted its response on February 14, 2019 (Deficiency Letter Response). Notice of the Deficiency Letter Response was published in the *Federal Register*, 84 Fed. Reg. 5,999, with interventions and protests due on or before March 7, 2019. The Public Interest Entities, PSEG Companies, and LS Power each filed comments on the Deficiency Letter Response.

[15] The Public Interests Entities consists of: the Office of the People's Counsel of the District of Columbia, the Delaware Division of the Public Advocate, the Illinois Citizens Utility Board, the New Jersey Board of Public Utilities, the Maryland Office of the People's Counsel, the Sierra Club, and the West Virginia Consumer Advocate Division.

III. Discussion

A. Procedural Matters

13. Pursuant to Rule 214 of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214 (2018), the timely, unopposed motions to intervene serve to make the entities that filed them parties to this proceeding.

14. Pursuant to Rule 214(d) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214(d), we grant the late-filed motions to intervene of the Public Service Commission of West Virginia, and the Illinois Commerce Commission, given the parties' interest in the proceeding, the early stage of the proceeding, and the absence of undue prejudice or delay.

15. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.213(a)(2) (2018), prohibits an answer to a protest or answer unless otherwise ordered by the decisional authority. We accept the answers of PJM, P3, the Joint Protestors, LS Power, and PSEG Companies because they provided information that assisted us in our decision-making process.

B. Substantive Matters

16. As discussed below, we find that PJM's proposed quadrennial revisions are a just and reasonable and not unduly discriminatory or preferential modification to PJM's existing VRR Curve. We find that PJM's proposed changes result in a curve that meets PJM's reliability needs at a reasonable total cost to load. We also find that the curve will produce accurate market signals that will encourage appropriate capacity investment and achieve an adequate level of reliability.[16] Accordingly, we accept the proposed revisions to become effective on January 17, 2019, as requested, as discussed below. We require PJM to submit a compliance filing within 30 days of the date of this order to revise the effective date of the eTariff record submitted in Docket No. ER19-105-002 to January 17, 2019.[17]

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[16] *See PJM Interconnection, L.L.C.*, 149 FERC ¶ 61,183, at P 52 (2014) (2014 VRR Order).

[17] The eTariff record submitted in Docket No. ER19-105-002 includes an effective date of December 12, 2018, the originally requested effective date, which was amended to January 17, 2019, in PJM's Amendment to Extend Time for Action filed on October 12, 2018.

1. Assessment of the Current VRR Curve

a. Filing

17. PJM proposes adjustments to the existing VRR Curve, which it states will have the effect of significantly lowering prices on that curve at all capacity levels, compared to the VRR Curve used in the May 2018 RPM capacity auction.[18] PJM explains that its probabilistic simulation modeling, required by the Tariff for PJM's quadrennial RPM reviews, estimates that the proposed curve will result in continued satisfaction of resource adequacy standards at a lower cost compared to retention of the current VRR Curve.[19] PJM states that for this latest review and update to the VRR Curve, PJM followed the same historical-based Monte Carlo simulation analysis that the Commission has previously accepted for PJM, New York Independent System Operator (NYISO), and ISO New England Inc. (ISO-NE).[20] PJM asserts that its independent consultants have consistently used market simulation methods to assess the probabilities that various alternative curve designs will meet applicable reliability requirements. As a result of the Brattle modeling, PJM states that the current VRR Curve achieves the reliability goals for which it was designed. PJM further explains that the total annual customer costs were slightly higher for the current VRR Curve than for any of the proposed replacement curves that were evaluated during this review, but all of the annual cost projections were clustered fairly close together, with the total customer cost difference over all curves ranging only a few percent.[21]

b. Comments and Protests

18. The Public Interest Entities argue that the current shape of the VRR Curve leads to over-procurement and market-power abuses. The Public Interest Entities argue that PJM's failure to reevaluate the shape of the VRR Curve violates its own Tariff.[22] The Public Interest Entities assert that this omission is contrary to every prior Triennial or Quadrennial Review of the VRR Curve where alternative shapes were offered and considered. Furthermore, the Public Interest Entities state that the current curve, which is very steep at high prices, is open to market power abuses as demonstrated by the price

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[18] PJM Transmittal at 1.

[19] *Id.*

[20] *Id.* at 7.

[21] *Id.* at 8.

[22] Public Interest Entities Comments at 36.

spikes well above true Net CONE, particularly in small zones where a single participant owns a significant portion of the generation.[23] The Public Interest Entities conclude that, if PJM is not willing to thoroughly reevaluate the shape of its VRR Curve, the Commission should do so.

19. The Public Interest Entities also broadly explain the need for accurate market signals and conclude that an over-reliance on the capacity market has dulled the energy and ancillary services markets' abilities to provide those needed signals.[24] The Public Interest Entities conclude that the proposed curve has failed to "reasonably balance[] multiple considerations … including reducing price volatility, susceptibility to the exercise of market power, frequency of low reliability events, and avoiding falling below" a loss-of-load event (LOLE) threshold and, accordingly, that it should be rejected by the Commission.[25] The Public Interest Entities list several perceived shortcomings with the overall impact of PJM's VRR Curve. The Public Interest Entities characterize these shortcomings as resulting in a chronic capacity oversupply and pricing issue in the PJM market.[26] The Public Interest Entities represent that these issues must be addressed because the VRR Curve has consistently procured capacity beyond its target reserve margin. The Public Interest Entities argue that the resulting over-supply of capacity resources harms customers, who pay more for capacity costs in the capacity market and as excess capacity depresses prices and earnings in PJM's energy and ancillary services markets, shifts revenue recovery from the "real" markets to the administrative capacity market.[27]

c. Commission Determination

20. In response to assertions that PJM has not adequately reviewed its existing VRR Curve shape, we find that PJM has complied with its Tariff, which requires that PJM's review of the VRR Curve "shall be based on a simulation of market conditions to quantify the ability of the market to invest in new Capacity Resources and to meet the

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[23] *Id.* at 37 (citing Attachment A, Affidavit of James F. Wilson at P 50 (Wilson Aff.)).

[24] *Id.* at 3.

[25] *Id.* at 6 (citing *ISO New England Inc.,* 147 FERC ¶ 61,173, at P 29 (2014)).

[26] *Id.*

[27] *Id.* at 11.

applicable reliability requirements on a probabilistic basis."[28] PJM has followed the same historical-based Monte Carlo simulation analysis that the Commission has previously approved,[29] including for the last VRR Curve review filing, consistent with the PJM Tariff.[30] The Public Interest Entities have not presented evidence to demonstrate that this method is no longer justified nor that PJM has not properly followed its Tariff. We find that PJM's analysis was sufficient to meet the requirements of its Tariff, which is designed to ensure that the proposed VRR Curve meets PJM's reliability needs at a reasonable total cost to load.

2. VRR Curve Shift

a. Filing

21. PJM proposes to shift the VRR Curve one percent to the left in this VRR Curve update.[31] PJM states that during the 2014 VRR Curve review, it proposed a shift of the recommended curve one percent to the right, as a conservative approach to address "anticipated changes to PJM's resource base that could not be modeled using historical data."[32] These anticipated changes included: the Environmental Protection Agency's Mercury and Air Toxics Standards and fuel pricing changes due to the emergence of low-priced shale gas; heightened competition from the increasing efficiency of gas combined-cycle technology; the D.C. Circuit's vacatur of Order No. 745; and uncertainty in the manner in which states would implement the EPA's greenhouse gas rule.[33]

22. PJM proposes to undo that one percent shift to the right in this filing because the reasons for the prior shift in 2014 have been resolved or are much less of a concern.[34] PJM states that, although there is a potential for a significant amount of near-term

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[28] PJM Tariff, Attachment DD, § 5.10(a)(iii).

[29] 2014 VRR Order, at PP 52-58 (2014); *ISO-NE Demand Curve Order*, 147 FERC ¶ 61,173, at P 29 (2014); *N.Y. Indep. Sys. Operator, Inc.*, 103 FERC ¶ 61,201, at P 13 (2003).

[30] PJM Tariff, Attachment DD, § 5.10(a).

[31] PJM Transmittal at 8.

[32] *Id.* at 8-9 (citing 2014 VRR Order, at P 52 (2014)).

[33] *Id.* at 9.

[34] *Id.*

economic retirements, these retirement risks do not pose the same resource adequacy challenges as the risks cited in 2014, and therefore the one percent rightward shift that was warranted in 2014 is no longer required.[35]

b. Comments and Protests

23. The Joint Protestors, the Public Interest Entities, and the IMM generally support PJM's curve shift proposal, each agreeing that the market uncertainties that supported the rightward shift in 2014 have been resolved.[36] The IMM argues that PJM's earlier rightward shift contributed to PJM's over procurement of capacity and exacerbated the impacts of PJM's systematic over forecasting of load in the capacity market.[37] The Public Interest Entities argue that PJM's proposal to undo the one percent right shift would result in significant ratepayer savings and mitigate higher capacity prices that signal to capacity resources that excessive new entry is needed.[38] The Public Interest Entities argue that PJM may be over-procuring capacity, and PJM should consider moving the curve further to the left to align the reliability requirement with Net CONE.[39]

24. P3, EPSA, and LS Power oppose PJM's curve shift proposal.[40] They argue that the uncertainties that justified the shift in 2014 have been replaced with new uncertainties that merit the continued approach to setting the demand curve. These parties argue that the 2014 concerns about the implementation of the Mercury and Air Toxics Standards rule and the vacatur of Order No. 745 on demand response have been replaced with new issues. P3 argues that these new issues create similar uncertainties to those that existed in 2014, which could spur generation retirement, and potentially reliability issues.[41] LS Power argues that, though not related to the Mercury and Air Toxics Standards rule, there has been an acceleration of generation requirements, and the leftward shift would

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[35] *Id.* at 9-10 (citing Attachment C, Affidavit of Adam J. Keech ¶ 15 (Keech Aff.)).

[36] IMM Comments at 18; AMP and Industrial Coalition Comments at 2; Public Interest Entities Limited Protest at 20-22.

[37] *Id.* at 19.

[38] Public Interest Entities Limited Protest at 21-22.

[39] *Id.* at 22.

[40] LS Power Protest at 3, 24-26; P3 Comments at 13-15; EPSA Comments at 4.

[41] P3 Comments at 15.

jeopardize reliability by producing RPM clearing prices that fail to properly incentivize continued investment in the PJM region.[42] LS Power argues that initiatives by states to regulate emissions and subsidize resources create regulatory uncertainty that raise doubts about investing in generation in PJM, which would be compounded by shifting the VRR curve to the left.[43] Both LS Power and P3 note that PJM and the Commission are contemplating, but have not yet instituted, changes to the PJM capacity market that would resolve this uncertainty.[44]

c. Answers

25. In response to LS Power, P3, and FirstEnergy, the Joint Protestors argue that the requests for rejection of the leftward shift are unsupported attempts to artificially inflate the price PJM pays for capacity procured in PJM's RPM auctions.[45] The Joint Protestors claim that neither P3 nor LS Power have identified and quantified the new market uncertainties that would justify maintaining the rightward shift in the VRR Curve.[46] The Joint Protestors claim that, unlike LS Power's, P3's, and FirstEnergy's claims, PJM's proposal is supported by, and consistent with, Brattle's recommendation.[47]

26. Similarly, PJM argues that the concerns and criticisms raised by P3 and LS Power do not warrant a change in the proposed VRR Curve. PJM first argues that, contrary to the protestors' arguments, Brattle's simulations of the VRR Curve confirm that no rightward shift is needed to address reliability concerns because the left-shifted curve provides a greater margin of safety than the 2014 curve. PJM further argues that it is not facing the same circumstances of multiple regulatory mandates as it did in 2014.[48] Although PJM agrees that state and federal resource policies pose challenges for the capacity markets, it states the appropriate place to address that is in the Docket No.

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[42] LS Power Protest at 25, 3.

[43] *Id.* at 25-26.

[44] LS Power Protest at 26; P3 Comments at 14.

[45] Joint Protestors Answer at 1.

[46] *Id.* at 3-4.

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

[48] PJM Answer at 5.

EL16-49 et al. proceeding.[49] PJM argues that shifting the VRR Curve to the right is not an answer to those concerns.[50]

d. Commission Determination

27. We accept PJM's proposal to undo the previous one percent shift to the right, finding that the specific concerns justifying the 2014 shift largely have been resolved. The EPA Mercury and Air Toxics Standards rule has been implemented and upheld.[51] Order No. 745 has been upheld.[52] The greenhouse gas rule was not implemented.

28. When PJM requested the one percent shift to the right in 2014, PJM claimed that the shift served as a proxy for changes and uncertainty that would be happening in the future.[53] Because Brattle's model was based on historic data, it could not account for such future uncertainty.[54] In its 2014 filing, PJM argued that this shift was necessary to meet its capacity margin.[55] The referenced events occurred following the 2014 model, and we find that no basis remains for maintaining the one percent shift to the right.

29. Further, the remaining concerns about retirements from fuel-pricing changes due to the emergence of low-priced shale gas and heightened competition from the increasing efficiency of gas combined-cycle technology can be addressed by Brattle's model. Brattle's simulations are designed to take account of potential supply fluctuations, even

[49] *Id.* at 6.

[50] *Id.*

[51] *See Michigan v. EPA*, 135 S. Ct. 2,699 (2015).

[52] *See FERC v. Electric Power Supply Association*, 136 S. Ct. 760 (2016).

[53] PJM Interconnection, L.L.C., Revisions to OATT re: VRR Curve Triennial Review, Docket No. ER14-2940, Attachment C, Affidavit of Dr. Paul M. Sotkiewicz, at P 11.

[54] *Id.* P 10.

[55] PJM Interconnection, L.L.C., Revisions to OATT re: VRR Curve Triennial Review, Docket No. ER14-2940, at 18 (filed Sept. 25, 2014).

large fluctuations.[56] We find that there is no longer a need to maintain the one percent shift to the right because these fluctuations are already accounted for in the model.

30. We find that concerns tied to uncertainty in "regulation of carbon by either state or federal policymakers,"[57] and "increasing efforts by the states to subsidize large amounts of resources,"[58] are more appropriately addressed in the ongoing proceeding in Docket No. EL16-49 et al.

3. Reference Resource

a. Filing

31. PJM proposes to update the Tariff definition of the Reference Resource CT plant.[59] PJM states that it is not changing the Tariff's current designation of a CT plant as the basis for the CONE used in the VRR Curve, but that it proposes to update the turbine model assumed for the new entry CT plant to reflect the improved heat rate and turbine cooling technology provided by newer models.[60]

32. While PJM declined to adopt Brattle's proposed CC-based VRR Curve,[61] PJM defends the appropriateness of selecting a CT plant by citing Brattle's 2018 VRR Report, which explains that "any technology that is economically viable in the long run could be selected for determining Net CONE."[62] PJM supports its conclusion that a CT plant is a viable Reference Resource by noting that over 1600 MW of new CT plants have been

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[56] *See* PJM December 7 Answer at 5 ("Brattle's simulations are designed to take account of potential supply fluctuations, even large fluctuations, like retirements that could result from the financial stresses and other factors cited by intervenors.").

[57] P3 Protest at 14.

[58] LS Power Protest at 25.

[59] PJM Transmittal at 2; PJM Tariff, Attachment DD, Definitions R-S.

[60] PJM Transmittal at 10.

[61] *Id.* at 12.

[62] *Id.* at 10 (citing Attachment G, Exhibit 2, 2018 VRR Curve Report at 33 n.42 (2018 VRR Curve Report)).

added to PJM since RPM was adopted, including two CT plants that have been added since 2014.[63]

33. PJM also provides several reasons why its retention of a CT plant as its Reference Resource is appropriate at the time of this quadrennial filing. First, PJM explains that CT plants "represent the cheapest and fastest generation technology that could be brought to market, should market signals indicate the need for new capacity."[64] Second, PJM asserts that "there is a greater risk of misestimating a CC Net CONE than there is of misestimating a CT Net CONE because a CC Plant depends far more on energy market revenues … and thus is more susceptible to misestimation than a CT Plant in calculating the Net EAS Offset and ultimately the Net CONE."[65] PJM adds that long-run simulations provided in the Brattle report quantify certain reliability risks that may emerge if RPM is switched to a CC-based Net CONE, because of the potential for energy market revenues, which comprise a larger share of the total revenues for CC plants as compared to CT plants, to be misestimated and result in undervaluing Net CONE.[66] PJM explains that if a CC-based Net CONE is underestimated by 20 percent, the VRR Curve would fail the 1-in-10 LOLE standard, instead resulting in an expected 1.6 loss of load events every 10 years.[67] PJM concludes that the greater reliability risk arising from the inherent uncertainty of a Net CONE calculation that relies to a greater extent on estimates of energy market revenues supports PJM's retention of a CT plant as the Reference Resource. Third, PJM concludes that its selection of a CT plant as the Reference Resource is justified because both the NYISO and ISO-NE, which PJM states have comparable capacity auctions with downward-sloping demand curves, use a CT plant for the Reference Resource.[68]

34. PJM's current Tariff defines the Reference Resource as a CT power plant "configured with two General Electric ("GE") Frame 7FA turbines."[69] PJM proposes to

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[63] *Id.* at 10; Keech Aff. at ¶ 7 (citing Attachment E, 2018 CONE Study at 5, Figure 2 (2018 CONE Study)).

[64] PJM Transmittal at 11 (citing Keech Aff. at ¶ 8).

[65] *Id.*at 11 (citing Keech Aff. at ¶ 9).

[66] *Id.* at 12 (citing Keech Aff. at ¶ 10 and 2018 VRR Curve Report).

[67] *Id.* (citing Keech Aff. at ¶ 12).

[68] *Id.* at 13.

[69] *Id.* at 17 (citing PJM Tariff, § 1 (Definitions-R-S)).

update the definition to reflect the more recent version of GE's CT, i.e., the 7HA turbine, due to project development trends, as well as the improved efficiency and lower costs of the H-class turbine. PJM states that since 2014, over 12,000 MWs of H- and J-class turbines either have been installed, or are under construction, in the PJM region, albeit in CC configurations.[70] PJM also states that Brattle's review of recent orders for GE turbines shows that future CCs are almost exclusively using the H-class turbine.[71] PJM adds that a 7HA-based plant in CT configuration is also under construction in ISO-NE.[72] PJM explains that the 7HA is larger than the 7FA such that a plant with one 7HA will have a capacity not far below the capacity of two 7FAs. Accordingly, PJM asserts that the resulting 7HA plant is more cost-effective and efficient than the 7FA plant, indicating that a 7HA plant is a reasonable choice for the CT Reference Resource in PJM.[73]

35. PJM states it made a further change from Brattle's CONE estimates and requested that Brattle include selective catalytic reduction (SCR) and carbon monoxide catalyst environmental controls for air emissions. PJM states that even if a plant was not compelled by law to install these technologies, it would have an economic incentive to do so because it may otherwise face several runtime restrictions, impeding the plant's ability to run at peak times and increasing the likelihood that the plant would incur performance penalties.[74]

b. Comments and Protests

36. The IMM, EPSA, LS Power, P3 and the PSEG Companies support PJM's decision to continue to use a CT in the simple-cycle configuration as its Reference Resource, which is used to estimate the CONE.[75] The IMM advocates, however, for a careful reevaluation of the complete basis for the definition of the reference unit for the next Quadrennial Review. The IMM explains that while a baseload CC is not the correct reference unit, a natural gas-fired internal combustion engine (diesel) plant may be more

[70] *Id.* (citing 2018 CONE Study at 14-15 & Table 6).

[71] *Id.* (citing 2018 CONE Study at 14-15 & Table 6).

[72] *Id.* (citing 2018 CONE Study at 17).

[73] *Id.*

[74] *Id.* at 18.

[75] LS Power Protest at 2.

representative of an actual peaking plant at that future time.[76] LS Power supports PJM's proposal because the CT has been the Reference Resource since the inception of RPM, and that there is no evidence demonstrating that it is necessary to use another plant configuration.[77] LS Power further argues that a CT is the most appropriate choice for the Reference Resource because it better reflects the revenue requirement of a resource addition that is underwritten based on capacity revenues, and, correspondingly, the cost to bring online the last increment of capacity needed to satisfy the region's (or Locational Deliverability Area's) reliability needs.[78] P3 lists several reasons why the CT remains the most appropriate reference unit in PJM, including that CTs are smaller, more agile units that may be brought online more quickly and for lower costs; the fact that CTs' relying more heavily on capacity market revenues leads to a more accurate valuation of their Net CONE; the use of the CT as a reference unit in both New England and New York; and the risk that switching between the CT and CC technology inserts more risk into estimates of capacity market revenues.[79] Finally, P3 also asserts that switching to use of the CC technology as the Reference Resource could lead to high-priced bids and confusion in the market.[80]

37. Conversely, the Public Interest Entities argue that PJM should use a CC plant as the Reference Resource because they are uncertain that CTs will remain a part of the supply mix. The Public Interest Entities explain that this is because CC plants are the resources that have overwhelmingly been deployed in recent years in PJM and argue that CC plants are the most economically viable resources in the PJM region.[81] The Public Interest Entities also argue that PJM's stated concern that using a CC-based VRR Curve would underestimate Net CONE is a remote prospect.[82] Further, the Public Interest Entities assert that there is no material impact on reliability from using a CC as a Reference Resource, as well as that concerns about switching the Reference Resource are unfounded, as the Commission has largely granted deference to RTOs/ISOs in the

[76] IMM Protest at 4.

[77] LS Power Protest at 14-15.

[78] LS Power Protest at 16 (citing LS Group Aff. at ¶ 6).

[79] P3 Protest at 11-12.

[80] *Id.* at 12.

[81] Public Interest Entities Protest at 23-24.

[82] *Id.* at 29-30.

selection of their capacity market reference unit.[83] Finally, the Public Interest Entities refute the claims of other intervenors that a CT is the appropriate Reference Resource for PJM because it serves as the Reference Resource for both ISO-NE and NYISO; the Public Interest Entities instead point to the variation among regions of the economic viability of CTs, noting the differences between markets highlighted in the Brattle report.[84]

38. The IMM also agrees with PJM that the Reference Resource should be a 7HA CT. While the Public Interest Entities disagree that the Reference Resource should be a CT at all, they state that if a CT is retained as the Reference Resource, PJM's proposal to update the definition to use the H-class turbine, which reflects the greater efficiency, lower costs, and growing popularity of the newer design, should be accepted.[85] The Public Interest Entities suggest that the recommendations of PJM and Brattle to use the newer, lower cost model should be accepted both on the model's merits and to ensure that more reasonable Net CONE values will result.[86]

39. EPSA, LS Power, P3 and the PSEG Companies disagree with PJM's choice of turbine technology, even though they agree with PJM's choice of a CT for the Reference Resource. P3 and PSEG Companies argue that PJM's selection of the H-class technology over the F-class technology is inconsistent with the actual development of peaking units that is occurring in PJM and other places.[87] EPSA references P3's reasoning, stating that the Commission should approve the 7FA CT as the appropriate reference unit and technology, as it is consistent with current market development. PSEG Companies also assert that PJM should instead use the F-class turbine because no stand-alone CT generation units utilizing the H-class technology have been built in, or are planned for, the PJM region.[88]

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[83] *Id.* at 30.

[84] *Id.* at 30-32 (citing 2018 VRR Curve Report at 34).

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

[86] *Id.* at 66.

[87] P3 Protest at 4; PSEG Companies Protest at 10.

[88] PSEG Companies Protest at 9.

40. In addition to stating that the 7HA CT is not in development in the PJM queue, EPSA asserts that the H-class turbine presents other flexibility and cost challenges.[89] LS Power echoes these sentiments, arguing that PJM has chosen to configure its Reference Resource with an unproven turbine technology, which is at its nascent state of commercial application and has not yet been used widely by developers.[90] Similarly, P3 argues that the technology is unproven, making cost and revenue estimates difficult to ascertain. P3 also argues that there is virtually no experience with an H-class turbine in a peaking configuration. Further, P3 argues that the technology suffers from a lack of commercial experience in ramping and availability, decreased efficiency with partials loads, unproven flexibility, and uncertainty surrounding how often the technology can cycle during the day.[91] LS Power also argues that the H-class technology is a poor choice when SCR is required and that there are currently no 7HA CTs with SCR in operation.[92] Finally, the PSEG Companies assert that if the 7HA becomes the reference unit, based on the PSEG Companies' experience with this technology, the 2018 CONE Study assumptions underestimate the cost to construct a 7HA, both in CT and in CC configurations.[93]

c. Answers

41. In its answer, PJM reiterates the prudency of the decision not to change from the CT-based Reference Resource. First, PJM states that as compared to CC plants, CT plants remain an attractive option for developers given that they inherently have lower project costs and can be brought to market quicker. Second, PJM states that estimating a CC-based Net CONE is much more difficult than a CT-based Net CONE due to the former's stronger reliance on energy market revenues and because three-year forward energy revenues are harder to estimate than plant fixed costs. Lastly, PJM states, as demonstrated by Brattle's long-term simulations, switching to a CC-based Net CONE entails a specific added reliability risk that is exacerbated by the greater vulnerability of a CC-based Net CONE to misestimation.[94]

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[89] EPSA Protest at 4.

[90] LS Power Protest at 2.

[91] P3 Protest at 13.

[92] LS Power Protest at 18.

[93] PSEG Companies Protest at 10.

[94] PJM Answer at 8-9.

42. PJM argues that the Public Interest Entities ignore Brattle's acknowledgments that they "see an argument that a CT-based curve would more strongly guarantee resource adequacy under all conditions, at a cost that is modest when put in context" and that overall "PJM's market-based resource adequacy construct appears to have saved much more than that [modest cost] by attracting and retaining a wide range of resources at competitive market prices well below the estimated cost of new plants."[95] PJM further argues that the Public Interest Entities minimize the risks of misestimation of a CC-based Net CONE. According to PJM, while PJM can make refinements to improve the overall accuracy of its EAS estimates, there is no avoiding the inherent difficulty of estimating energy market revenues that will be experienced three or four years later, resulting in a high risk of substantial variance between estimated EAS and actual EAS.

43. PJM also notes that its Tariff has provided for a CT-based Net CONE since the RPM's inception in 2007 and that the only change PJM is proposing is to reflect the latest iteration of the General Electric turbine that has long been used in the Reference Resource. PJM asserts that parties advocating for a wholesale change to a CC plant type thus are challenging the status quo in the Tariff, which would require action under FPA section 206.[96]

44. With respect to arguments about the choice of turbine, PJM states that Brattle and Sargent & Lundy (S&L) experts show in their accompanying affidavit that "merchant generators are currently choosing to install the 7HA turbine in PJM and across the country in [CC] configurations…with over 4,000 MW of new CCs under construction in PJM with 7HAs and an additional 3,000 MW in other markets."[97] PJM states that the H-class turbine has important attributes that should appeal to developers.[98] Lastly, PJM states that Brattle and S&L gave weight to the fact that the IMM has used an H-class turbine in its own analysis of net revenues for new resources in the annual State of the Market report since 2014.[99]

45. PJM disagrees with the intervenors' arguments that there is no experience with how the H-class turbines ramp and operate at partial load. According to PJM, Brattle and

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[95] *Id.* at 9 (citing PJM Transmittal at 15; 2018 VRR Curve Report at 69).

[96] *Id.* at 10.

[97] *Id.* at 11 (citing PJM Answer, Attachment B, Answering Affidavit of Samuel A. Newell at ¶ 10 (CONE Answering Aff.)).

[98] *Id.* at 12.

[99] *Id.*

S&L note, "as of December 10, 2018, [H-class] gas turbines have operated for over 200,000 hours with 2,600 starts," and "the [H-class] turbine has a faster ramp rate than the [F-class],…slightly faster start up time in peaking mode[,]… the same [startup time] in conventional mode, and lower turndown minimum load."[100] Further, PJM argues that LS Power's claim that H-class turbines are not suited for use with an SCR unit is mis-stated.[101] PJM states that simple-cycle plants with H-class turbines can accommodate SCR technology similar to the SCR design used for F-class turbine.[102] Lastly, while LS Power and P3 argue that merchant generators will be hesitant to adopt the H-class turbine because it is a new technology and has had a notable blade failure at one of the first plants in the United States at which it was installed, PJM states that following the blade problem, GE adjusted its blade manufacturing process and installed new blades to the satisfaction of the plant owner.[103] Furthermore, PJM adds that GE has received 83 7HA turbine orders, with 30 facilities using the 7HA being in commercial operation.[104] Consistent with this, PJM states that Brattle's and S&L's review of the market, conducted after the aforementioned blade issues occurred, leads PJM to believe that "all plants that previously planned on installing 7HA turbines are still doing so.[105]

46. P3 reiterates it support of PJM's Reference Resource selection and argues that PJM missed the mark on the configuration by choosing the H-class turbine.[106] PSEG asserts that PJM picked a Reference Resource that has been constructed as a stand-alone unit only once in the U.S (but not within PJM).[107]

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[100] *Id.* at 12-13 (citing CONE Answering Aff. at ¶ 13).

[101] *Id.* at 13.

[102] *Id.* (citing CONE Answering Aff. at ¶ 14 (clarifying that footnote 43 of the 2018 CONE Study should have indicated that CTs, not CCs, with H-class turbines will use an SCR design similar to the F-class turbines.)).

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

[104] *Id.* at 14.

[105] *Id.* (citing CONE Answering Aff. at ¶ 15).

[106] P3 Answer at 5-6.

[107] PSEG Companies Answer at 2.

d. Deficiency Letter Response and Comments

47. In its Deficiency Letter, Commission staff requested that PJM explain why it chose the H-class turbine instead of the F-class turbine as the Reference Resource. In its response, PJM states that its experts developed the CONE value for PJM's proposed Reference Resource – the GE 7HA turbine – using industry data in the same manner and with the same vigor that was previously employed to develop the CONE for the Reference Resource in PJM over the last decade. PJM explains that all equipment and material costs are estimated by S&L using proprietary data, vendor catalogs, or publications, and that for inputs such as labor costs specific to the simple-cycle configuration, S&L developed the costs based on its experience with similarly-sized and -configured facilities.[108]

48. In support of its turbine choice, PJM states that the 7HA has been in commercial operation since 2008 and that GE in 2014 introduced the latest generation of the 7HA CT. PJM notes that the IMM began using the 7HA in 2014 to determine the net revenues for a new CT in the State of the Market Report. PJM states that all of the CC plants that cleared the most recent three capacity auctions were based on the 7HA CT technology.[109]

49. PJM also asserts that the H-class turbine provides a reasonable representation of the Reference Resource in PJM primarily due to the superior efficiencies of the model. First, PJM states that the H-class turbine is more efficient than the F-class turbine and thus more attractive to investors and developers. PJM contends that this supports PJM's reasonable expectation that the H-class turbine will be utilized in development of both simple- and combined-cycle plants in the future. PJM further states that H-class turbines have faster start times, faster ramp rates, larger turn down, and higher efficiency compared with the F-class turbines.[110] Additionally, PJM states that the increased turbine size and modularity results in significantly shorter installation times. Finally, PJM states that the cost of the H-class CT is 14 percent less expensive than that of the F-class.[111] Accordingly, PJM argues that the superior economics of the H-class over the F-class technology support the reasonable conclusion that this model or others with similar costs and performance are likely to be built in PJM in the future. PJM also argues that ignoring the fact that a more efficient, cost-effective CT unit is commercially available in PJM

[108] PJM Deficiency Letter Response at 2-3.

[109] PJM Deficiency Letter Response at 3.

[110] *Id.* at 3.

[111] *Id.* at 4.

than the F-class, could result in an over-procurement of capacity, unnecessarily increasing costs.[112]

50. PJM anticipates that the modularity, flexibility, and economics of the 7HA turbine is expected to become increasingly important with the growth of intermittent resources. PJM states that renewable resources are expected to generate approximately 30 terawatt hours more in 2022 than they do today, and that the 7HA CT specifications are better suited to respond to the increase in intermittent resources than the smaller, slower-responding F-class technology.[113]

51. LS Power, PSEG Companies, and the Public Interest Entities argue that PJM does not adequately address or provide any supporting data necessary to respond to the Deficiency Letter questions.[114] LS Power reiterates its earlier argument that PJM has failed to demonstrate that the proposal to configure the Reference Resource with the 7HA turbine is just and reasonable. PSEG Companies argues that rather than providing meaningful cost estimate data or data to substantiate its selection of a 7HA CT, PJM reiterates the scant information provided in its original filing.

52. The Public Interest Entities argue that PJM's choice of Reference Resource is an unsupported departure from the recommendation made by Brattle. The Public Interest Entities argue that PJM's consultants relied on information for CC resources in developing costs for the CT Reference Resource, likely due to the paucity of CT resources from which to draw information. Furthermore, the Public Interest Entities argue that PJM has provided no support for the claim that the CC resources that have cleared the last three base residual auctions were based on CT technology. Rather, the Public Interest Entities contend that PJM conflates two resources with very different operating characteristics.[115]

53. The Public Interest Entities argue that Commission staff's concerns from the Deficiency Letter would be addressed using the readily deployed CC as a Reference Resource. The Public Interest Entities further argue that Brattle demonstrates why a CC is the correct Reference Resource, optimally balancing the need for reliability and predictability with the requirement that market actions be just and reasonable. According

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[112] *Id.* at 5.

[113] *Id.*

[114] LS Power Deficiency Letter Comments at 3, PSEG Companies Deficiency Letter Comments at 1, Public Interest Entities Deficiency Letter Comments at 3.

[115] Public Interest Entities Deficiency Letter Comments at 3-5.

to the Public Interest Entities, CCs reduce excess capacity procurement costs and would provide certainty to cost estimates.[116]

54. Lastly, the Public Interest Entities argue that PJM's Deficiency Letter Response takes the Commission's holding in ISO New England's triennial review proceeding out of context. According to the Public Interest Entities, the Commission makes clear in its order on ISO New England's triennial review that it endorsed the choice of Reference Resource because "it is a technology that appears likely to be developed in New England and because [ISO New England] can develop cost and revenue estimates for this technology with confidence.[117] The Public Interest Entities argue that the record in this proceeding demonstrates that the same, or even similar, conditions do not exist with respect to CT resources in the PJM market. Despite concerns with the selection of a CT unit, the Public Interest Entities reiterate support for PJM's proposal to update the definition to the newer H-class technology.

55. According to LS Power, PJM's Deficiency Letter Response only reinforces the fact that PJM's proposal is premature. LS Power asserts that with no 7HA CT in commercial operation at this time, there is no ability to calculate the true costs of the 7HA Reference Resource. Furthermore, while PJM claims that 7HA turbines have cleared in recent PJM capacity auctions, LS Power argues PJM does not demonstrate that such CC plants provide any kind of reference point for developing the costs of a Reference Resource, which is a CT.

56. LS Power also reiterates its earlier arguments that it is very difficult to determine costs associated with the H-class turbine at this time, particularly with the discounts GE provided to establish the technology and the uncertainty surrounding the turbine blade fix. LS Power states that merchant generators do not have any guarantees of cost recovery and are therefore particularly concerned with the predictability and reliability of this new technology. Finally, LS Power clarifies that it would not necessarily oppose using the H-class turbine to configure the Reference Resource in the future once there is sufficient cost and operational data available to support such a decision.[118]

57. PSEG Companies argue that PJM's expectation that the H-class technology will be used to develop CTs and CCs in the future is speculative. Furthermore, PSEG

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

[117] *Id.* at 8 (citing *ISO New England Inc.*, 147 FERC ¶ 61,173, at P 32 (2014)).

[118] LS Power Deficiency Letter Comments at 3-6.

Companies argue the Commission should not be asked to make a determination on anything short of substantial evidence.[119]

e. Commission Determination

58. We accept PJM's Tariff revisions to define the Reference Resource as a CT plant with the H-class turbine configuration, as discussed below. As a threshold matter, PJM's Tariff is not prescriptive as to how PJM will choose the Reference Resource, and we find that PJM has supported its selection as just and reasonable.

59. As PJM states, the Reference Resource has been a CT plant since the inception of the RPM in 2007, and we find that PJM continues to support its resource selection. We agree that CT plants typically are built at a lower total cost than CC plants, and as a result, CTs typically can be deployed quickly to address any potential resource adequacy or reliability concerns. Furthermore, as PJM states, CT plants represent the generation technology that is most dependent on capacity market revenue due to their high marginal operating costs and low capacity factors. For these reasons, we support PJM's selection of a CT plant as the Reference Resource.

60. With respect to the H-class turbine selection, we find that PJM has justified this configuration based on project development trends, lower costs, and improved efficiency. On the record before us, PJM states that the 7HA has been in commercial operation since 2008 and that all of the CC plants that have cleared in the most recent three capacity auctions were based on the 7HA CT technology. PJM also explains that the H-class technology is 14 percent less expensive than the F-class and much more efficient with faster start times, faster ramp rates, and larger turn down, when compared with the F-class turbines, making the 7HA more attractive to investors and developers. We further note that the IMM has used the 7HA in its own analysis of net revenues for new resources in the annual State of the Market report since 2014. Therefore, we find that PJM's selection of a CT with the H-class turbine configuration as its Reference Resource is reasonable.

61. We are not persuaded by the Public Interest Entities' arguments that PJM should instead use a CC plant as the Reference Resource. The Public Interest Entities have not provided evidence that the CT selection, which the Commission has approved as the Reference Resource since the RPM's inception and which PJM does not seek to change here, is unjust and unreasonable. As PJM states, CTs continue to be deployed in the region, with over 1600 MW of new CT plants having been added since the RPM was

[119] PSEG Companies Deficiency Letter Comments at 4 (citing *Fla. Gas Transmission Co. v. FERC,* 604 F.3d 636, 641 (D.C. Cir. 2010)).

adopted, including two CT plants added since 2014.[120] Furthermore, we acknowledge PJM's concerns that there is greater risk of misestimating a CC Net CONE given the unit's larger dependence on energy market revenues. As PJM explains, such a misestimation could result in the curve failing to meet the required reliability standards. Lastly, the Commission has previously held that the most frequent new entrant into the RPM need not be the reference technology.[121]

62. We also disagree with arguments that PJM should instead use a CT with F-class turbine technology. With respect to concerns regarding the H-class turbine's operational experience, we address those arguments above. Furthermore, PJM states that all CC plants that cleared the most recent three auctions were based on the 7HA CT technology.[122] Although the 7HA CT may not be in operation in PJM at this time, PJM has supported its reasonable conclusion that the unit will likely be built in the future, due to the favorable economics and greater efficiency of the H-class turbine. The use of a future-looking reference technology is consistent with Commission precedent in other regions.[123] Similarly, the Commission has declined to require a minimum amount of operational experience to determine whether a technology is considered viable and thus appropriate for selection as a reference technology.[124]

4. CONE Estimate

a. Filing

63. PJM explains that the proposed Gross CONE values were determined from a "bottom-up" estimate of capital costs and ongoing fixed O&M costs of a representative new entry project.[125] Such costs include major materials, land, equipment, buildings, gas pipeline and electric transmission infrastructure, emissions control equipment, permitting costs, contingency, labor, property taxes, insurance, overheads, and regulatory expenses. Consistent with prior Quadrennial Reviews, the cost estimates for these components were

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[120] PJM Transmittal at 10.

[121] *PJM Interconnection, L.L.C.*, 126 FERC ¶ 61,275, at P 39 (2009), *order on reh'g and clarification*, 128 FERC ¶ 61,157, at P 40 (2009).

[122] PJM Deficiency Letter Response at 3.

[123] *See ISO New England Inc.*, 147 FERC ¶ 61,173, at P 32 (2014).

[124] *See New York Independent System Operator, Inc.*, 146 FERC ¶ 61,043 at P 58.

[125] PJM Transmittal at 15.

calculated by independent expert consultants, in this case Brattle.[126] In its 2018 CONE Study, Brattle clarifies the components that comprise the labor cost estimate, including the cost of constructing the generation facility itself, engineering, procurement, project services, construction management, field engineering, start-up and commissioning services.[127] For labor rates, Brattle uses S&L survey data on prevalent wages in the PJM region.[128] For the calculation of labor hours, Brattle uses S&L data and experience from similarly sized and configured CT and CC plants.[129] Brattle states that the percentages of project direct costs used for engineering, procurement, project services, construction management, field engineering, start-up, and commissioning were used in the 2014 PJM CONE Study and align with S&L experience with recent projects.[130]

64. PJM states that its current Tariff uses a composite index of generation plant capital costs to adjust Gross CONE annually between quadrennial reviews. The composite weights cost indices published by the United States Department of Commerce's Bureau of Labor Statistics for labor, turbines, and materials are – 20 percent, 30 percent, and 50 percent, respectively. Consistent with the findings in the Brattle CONE Report, PJM proposes to adjust the weightings to 20 percent, 25 percent, and 55 percent, respectively.[131] Under its proposed new composite index, PJM will escalate generation plant capital costs for the subsequent three years, until its next Quadrennial Review.

65. As a result of Brattle's 2018 CONE Study, PJM proposes the following Gross CONE values for the four CONE areas in the 2022/2023 Delivery Year: $108,000/MW-year in CONE Area 1, $109,700/MW-year in CONE Area 2, $105,500/MW-year in CONE Area 3, and $105,500/MW-year in CONE Area 4.[132]

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[126] *Id.*

[127] 2018 CONE Study at 24.

[128] *Id.* at 59.

[129] *Id.* at 21.

[130] *Id.*at 59.

[131] PJM Transmittal at 21.

[132] *Id.* at 16.

b. Comments and Protests

66. PSEG Companies argue that Brattle's 2018 CONE Study used by PJM greatly understates the cost components of Gross CONE, rendering it unrepresentative of reasonably expected costs to construct the Reference Resource. First, PSEG Companies contest Brattle's decision to exclude northern New Jersey from CONE Area 1 for being too high cost or not widely available for developers to consider. PSEG Companies argue that there have been more interconnection requests from gas-fired generators and higher average day-ahead LMPs in Northern New Jersey than in other areas included in CONE Area 1, indicating both active development in the area and a need for further development.[133] Second, PSEG Companies assert that Brattle significantly understates the construction labor costs for CONE Area 1 by underestimating the labor hours needed to construct the Reference Resource.[134] Lastly, PSEG Companies state that the equipment, material, land, dual fuel capability, and Host Community Benefit Agreement costs used in the Brattle study are significantly less than PSEG's estimate based on experience with similar projects.[135] Ultimately, PSEG Companies estimate that the correct Gross Cone would raise the VRR Curve by approximately 30 percent.[136] PSEG Companies assert that the cost estimates PJM used to calculate Gross CONE are not supported by the evidence and are insufficiently documented in the record, and so requests that the Commission set the Gross CONE estimates for evidentiary hearing. [137]

67. In contrast, the PJM IMM argues that PJM's Gross CONE estimate is overstated. The IMM claims PJM's estimate of pipeline interconnection costs incorrectly assumes using a pipeline and metering station sized for two units rather than for the reference unit, thereby overestimating the interconnection costs by $11.6 million.[138] The IMM also opposes PJM's calculation of the Engineering, Procurement, and Construction (EPC) contingency cost, which "covers undefined variables in both scope definition and pricing that are encountered during project implementation."[139] Specifically, the IMM asserts

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[133] PSEG Companies Protest at 5-8.

[134] *Id.* at 11-14.

[135] *Id.* at 14-17.

[136] *Id.* at 19.

[137] *Id.* at 14.

[138] IMM Protest at 4.

[139] 2018 CONE Study at 18.

that "PJM applies the contingency rate to both the profit and to PJM's initial overstated state taxes. Neither is correct and the result is an overstatement of contingency costs. It is not appropriate nor standard business practice to charge a contingency on profits."[140] The IMM also disagrees with PJM's practice of using escalation rates to determine Gross CONE in the years between quadrennial reviews because such rates do not capture a decrease in Gross CONE. The IMM suggests that PJM instead calculate Gross CONE every year.[141] The IMM also opposes PJM's choice of pricing hub for calculating gas costs, asserting that neither PJM nor Brattle defined the criteria used to choose the hubs.[142] The IMM also claims that PJM's estimate of the Reference Resource's start-up costs are overstated because PJM overestimated the amount of fuel needed.[143]

68. FirstEnergy and P3 argue that the proposed VRR Curve is too low and will not sufficiently compensate baseload generators, thereby threatening reliability in PJM. FirstEnergy states that lower capacity prices from PJM's proposed revisions to its VRR Curve may benefit some customers in the short-term, but that the proposed VRR Curve shift will reduce capacity prices substantially in the long term, which FirstEnergy argues will result in the further loss of fuel-secure and resilient baseload generation needed for grid stability and reliability.[144] P3 asserts that PJM's proposal, even if modified as suggested by P3, will represent a significant and unprecedented drop in CONE in PJM. P3 argues that capacity revenues to new and existing facilities in PJM are likely to decline, as a result, "at a time when uncertainty in the market is high and most generators are struggling to maintain economic viability."[145]

c. Answers

69. PJM counters PSEG Companies' argument that the Net CONE estimates are too low by noting that the 2018 BRA cleared 893 MW of new capacity despite clearing prices less than half of the Net CONE that PSEG seeks.[146] PJM defends its decision to

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[140] IMM Protest at 6.

[141] *Id.*

[142] *Id.* at 14.

[143] *Id.* at 15.

[144] FirstEnergy Protest at 1, 4.

[145] P3 Comments at 4.

[146] PJM Answer at 15.

exclude Northern New Jersey from CONE Area 1 by asserting that southern Eastern Mid-Atlantic Area Council (EMAAC) has seen more MWs of recent development, has lower labor costs, and has higher energy margins than northern EMAAC and so is a reasonable location to develop a project like the Reference Resource.[147]

70. PJM also defends its calculation of labor hours and material and equipment costs, stating that PSEG Companies' calculation of these components is not directly comparable to the Reference Resource, a standalone CT plant.[148] PJM explains that there are significant differences between constructing a standalone CT with an H-frame turbine versus a CC plant or a CT plant with several much smaller turbines.[149] PJM asserts that a "bottom-up" estimate of labor hours is specific to the particular plant design embodied in the Reference Resource, while PSEG Companies use an overly simplistic approach starting with the total CC plant labor hours and then removing hours attributable to the steam section overstates the estimates.[150] Similarly, PJM argues PSEG Companies does not account for the differences in installing one 7HA turbine versus six LM6000 turbines. PJM explains it would expect the labor hours for constructing a larger turbine to be more than a smaller one, but not so much greater than that the labor hours would be nearly six times higher.[151] Furthermore, PJM argues that PSEG Companies does not provide any information on how they translated the labor hours for their projects into their specific alternative labor hour estimate for the Reference Resource.[152]

71. PJM defends its own material and equipment cost estimates as reasonable.[153] Finally, PJM asserts that PSEG Companies' criticism of the land cost estimate is unjustified given that PJM's estimates are based on publicly-available listings of industrial land in the counties screened.[154]

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[147] *Id.* at 16.

[148] *Id.* at 17.

[149] *Id.* at 18.

[150] *Id.* (citing CONE Answering Aff. at ¶ 19).

[151] *Id.*

[152] *Id.* at 17 (citing CONE Answering Aff. at ¶ 19).

[153] *Id.* at 19.

[154] *Id.* at 20.

72. PJM rejects the IMM's critique of the gas interconnection cost estimate, stating that although PJM and the IMM used different methodologies, the IMM did not demonstrate that PJM's methodology was unjust and unreasonable.[155] PJM also challenges the IMM's critique of the EPC contingency costs, noting that contingency estimates are inherently judgment-based and that S&L's judgment of the appropriate EPC contingency rate produces a reliable cost estimate.[156]

73. In response to PJM's answer, PSEG Companies argue that PJM still does not sufficiently justify its cost estimates for construction labor, equipment and materials, land, dual fuel capability, and Host Community Benefit Agreement costs. PSEG Companies also question PJM's reference to similarly sized and configured facilities for the CT Reference Resource since only one has been constructed in the United States.[157] PSEG Companies maintain that their own cost estimates of these components are significantly higher based on their experience with similar projects, and that PJM's cost estimates are both too low and insufficiently supported by the evidence in the record.[158] PSEG Companies repeat their request that the Gross CONE estimate be set for evidentiary hearing.[159]

74. P3 in its answer reiterates that PJM's proposal to use a reduced Net CONE will materially reduce the capacity values of new and existing capacity resources in PJM. P3 characterizes the instant filing as determining how great that decrease will be, asserting that PJM's proposal would result in a 25-30 percent reduction in capacity prices while the IMM's alternative proposal would result in a nearly 50 percent reduction in capacity prices on top of PJM's proposed reduction.[160] P3 argues that although PJM "admittedly has reserve capacity above requirements, those reserves could quickly evaporate in the face of such dramatic declines in capacity revenues.[161]

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[155] *Id.*

[156] *Id.* at 22.

[157] PSEG Companies Deficiency Letter Comments at 3.

[158] PSEG Companies Answer at 2-8 and PSEG Companies Deficiency Letter Comments at 2-4.

[159] PSEG Companies Answer at 10.

[160] P3 Answer at 5.

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

d. Commission Determination

75. We accept PJM's CONE estimates and annual adjustments as just and reasonable. PJM's estimate of land costs and gas interconnection costs use and closely track publicly-available data, and have the benefit of being transparent. With regard to labor, equipment, material, and other costs, we find PJM's estimates to be well supported and reasonable. We agree with PJM's arguments that the alternative evidence of labor costs and equipment costs presented by PSEG Companies do not demonstrate that PJM's estimates are unjust and unreasonable. The PSEG Companies' evidence does not fully and properly account for differences to the standalone CT Reference Resource, such as constructing on existing power plant sites, the greater complexity of building the steam section of a CC compared to a CT, or the difference in installing a single large turbine compared to multiple small turbines. Therefore, PSEG Companies' cost estimates are not directly comparable to PJM's cost estimates.

76. For example, PSEG Companies argue that locating the Reference Resource in the southern area of CONE Area 1, as opposed to Northern New Jersey, is unjust and unreasonable. We disagree. First, as noted by both Brattle and S&L, at the time of the 2018 CONE Study, 2,919 MW of new gas-fired generation resources had begun operation or were under construction in southern EMAAC since 2014, compared to 2,102 MW in northern EMAAC over the same time frame. Second, labor costs are approximately 20 percent higher, on average, in northern EMAAC than southern EMAAC. Finally, based on both IMM and PJM data, average CT energy margins are 14 percent to 29 percent higher, respectively, in southern EMAAC than northern EMAAC.[162] Indeed, this is borne out in the market data that shows more development has occurred in southern EMAAC than in northern EMAAC. Accordingly, we find PJM's assumption that a Reference Resource would be developed in southern EMAAC to be just and reasonable.

77. We also disagree with PSEG Companies' assertion that PJM's labor cost estimate is understated. PSEG Companies assumes that its experience constructing the Sewaren 7 CC plant (a 1x1 GE 7HA.02 plant) and the Kearny 13 and 14 CT plant (a bank of six 60 MW LM6000 turbines) is directly comparable to the labor hours required to build a standalone Reference Resource. However, PSEG Companies' selected plants were built at existing power plant sites and use different turbine technologies.[163] As Brattle and S&L explain, "there are significant differences between constructing a standalone CT plant with a 7HA turbine versus either a CC plant or a CT plant with several much

[162] PJM Answer, Attachment B, Aff. of Samuel A. Newell, John M. Hagerty, and Sang H. Gang at ¶ 18.

[163] *Id.* at ¶ 19.

smaller turbines."[164] We concur with the Brattle and S&L assessment that PSEG's approach is overly simplistic.[165] Starting with a specific CC plant and simply removing select labor hours is not likely to provide a reasonable "bottom-up" estimate of labor hours specific to the particular plant design embodied in the Reference Resource. Accordingly, we do not agree with PSEG's assertions that PJM's assumptions are not just and reasonable. However, noting concerns raised about the cost components of Gross CONE, we require PJM to submit to the Commission an informational filing two years from the date of this order that: (1) reports the cost components of Gross CONE – specifically, labor, equipment, and material costs – as updated with available S&L data; (2) compares those updated cost components to the cost components used to calculate the Reference Resource here; and (3) includes, to the extent possible, actual costs observed during the construction of any standalone CT plant with a 7HA turbine in PJM or other regions.

78. The Commission also agrees with PJM that the IMM did provide persuasive arguments that PJM's cost estimate associated with the EPC contingency cost is unjust and unreasonable. Brattle's approach for estimating the EPC contingency cost in the 2018 CONE Study is the same as the previous Quadrennial Review, and the Commission continues to find this approach just and reasonable.[166] The EPC contingency is intended to produce a reliable estimate, and is necessarily a matter of judgment. The Commission agrees that, based on S&L's judgment, an EPC contingency rate of 10 percent applied to the total EPC costs, including the EPC contractor fee, is reasonable.

79. Further, the Commission agrees with PJM that it is just and reasonable to rely on the actual costs of recently constructed gas pipelines instead of the projected costs of future construction, as PJM did in the previous CONE study.[167] The Commission also agrees with PJM that cost estimates based on the Mid-Atlantic region and a 16" diameter pipe, rather than the lowest cost region in the PJM footprint and a 12" diameter pipe, are reasonable for the Reference Resource. Regarding the IMM's protest of PJM's use of escalation rates to determine Gross CONE in the years between Quadrennial Reviews, we find that in doing so PJM is properly implementing its Tariff, which requires the use of such escalation rates. Lastly, PJM's method to determine the CONE cost components

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[164] *Id*.

[165] PJM Answer at 18 (citing PSEG Protest at 13, n.24).

[166] PJM Interconnection, L.L.C., Revisions to OATT re: VRR Curve Triennial Review, Docket No. ER14-2940, Attachment E, CONE Study at 18 (filed Sept. 25, 2014).

[167] *Id.* at 20.

protested by PSEG Companies and the IMM is substantially similar to the method in the prior Quadrennial Review, which the Commission previously accepted.[168] Therefore, the Commission is not convinced by the arguments raised by PSEG Companies and the IMM, and finds PJM's CONE estimate and annual adjustments just and reasonable.

5. Depreciation

a. Filing

80. PJM proposes to further modify the annual adjustment of CONE, starting in the 2023/2024 Delivery Year. PJM notes that the Tax Cuts and Jobs Act of 2017[169] temporarily increased bonus depreciation to 100 percent, but then phases it down in subsequent years.[170] PJM explains that bonus depreciation is a form of highly accelerated tax depreciation immediately upon in-service of the depreciable asset. Under the 2017 tax law, this is allowed for merchant generators, and therefore reduces the Gross CONE of a new entry plant entering service on June 1, 2022. However, subsequent years will have less favorable tax treatment as the 100 percent bonus depreciation phases down by 20 percent each year. The 2018 CONE Report calculates that this will increase CONE each year by 2.2 percent. Accordingly, PJM proposes to apply a 1.022 gross-up factor to CONE each year as the bonus depreciation phases out.

b. Comments and Protests

81. LS Power filed a protest regarding PJM's treatment of bonus depreciation. As LS Power argues, "Brattle's assumptions ignore the fact that the Reference Resource will simply not have adequate tax liabilities to fully utilize the 100 percent bonus depreciation."[171] LS Power argues that peaking generation assets are usually depreciated over a 15 year period. LS Power adds that bonus depreciation does not provide any direct payments; it merely reduces the income tax liabilities. LS Power states that in order to fully use the bonus depreciation, the Reference Resource would need to have at least $54 million in federal tax liabilities, which LS Power regards as inconceivable. LS Power argues that in response, PJM may attempt to argue that bonus depreciation can be claimed by the corporate parent of the Reference Resource. LS Power states that PJM's assumptions are contrary to the stand-alone nature of the Reference Resource. LS Power avers that private equity firms develop and own new generation capacity, and that such

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[168] *PJM Interconnection, L.L.C.*, 149 FERC ¶ 61,183 at PP 76, 105.

[169] Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2054 (2017).

[170] PJM Transmittal at 21 (citing Internal Revenue Code § 168(k)(6)).

[171] LS Power Protest at 5.

firms are pass-through entities without the income-tax liabilities assumed by PJM. LS Power argues that even large, publicly-traded independent power producers (IPPs) would have difficulty absorbing the tax benefit associated with 100 percent bonus depreciation. LS Power maintains that there is therefore no basis for imputing substantial tax benefits to the Reference Resource, when its owners will only be able to enjoy a fraction of such benefits for the foreseeable future. LS Power concludes that the Commission should reject the 100 percent bonus depreciation used in PJM's CONE calculations, and instead recalculate CONE using a 15-year Modified Accelerated Cost Recovery System.

c. Answers

82. PJM reiterates that its Gross CONE estimate reasonably accounts for the bonus tax depreciation made available from recent federal corporate tax reform. PJM states that its CONE estimates assume that generation investment is taxed at the full corporate and state tax rate, without accounting for the various tax planning strategies that individual companies may use. PJM argues that if bonus depreciation were to be removed from the CONE estimate, then so should the full tax allowance.[172]

83. PJM also argues that "generation developers and their investors are sophisticated in financial engineering and tax planning, and therefore can be expected to find means to take full advantage of tax benefits where they exist."[173] PJM provides several examples in support of this argument. PJM states that financial engineering can be used to monetize bonus depreciation by transferring its tax benefit to outside investors. PJM notes that tax equity investors have done so with renewable energy projects, and that tax benefits from bonus depreciation can be carried forward and used in subsequent years. PJM concludes that its proposed assumptions surrounding bonus depreciation are just and reasonable.

84. LS Power replies that the PJM Answer does not dispute that the Reference Resource and IPPs lack the tax liability required to take advantage of the full 100 percent bonus depreciation.[174] LS Power alleges that there is no basis for PJM's suggestion that bonus depreciation can be readily monetized. With respect to investors that have monetized tax credits in renewable energy projects, LS Power avers that the Reference Resource in PJM is fundamentally different. LS Power states that the latter is a fossil-fuel fired merchant generator that relies on uncertain PJM market revenues, whereas renewable facilities benefit from state initiatives and have long-term contracts. LS Power

[172] PJM Answer at 34-35.

[173] *Id.* at 35.

[174] LS Power Answer at 3.

argues that to its knowledge, tax equity investors are uninterested in generation facilities such as the Reference Resource.[175]

d. Commission Determination

85. We accept PJM's incorporating into CONE the corporate tax rate and bonus depreciation reflected in the Tax Cuts and Jobs Act of 2017. Since the Act's passage, the Commission has issued numerous orders to ensure that public utilities appropriately reflect lower federal taxes in customers' rates.[176] We find reasonable PJM's application of the lower federal tax rate to calculate the CONE Reference Resource as it reflects the cost of service for that unit when organized as a taxable entity.

86. One aspect of the new law is that it temporarily increased bonus depreciation for certain entities. As PJM explains, "[b]onus depreciation is a form of highly accelerated tax depreciation immediately upon in-service of a depreciable asset."[177] LS Power does not dispute this fact, but instead argues that merchant generators are organized as pass-through entities for the purpose of income taxes in order to be "tax efficient" and "minimize their tax liability."[178] According to LS Power, merchant generators will be unable to take advantage of the increased bonus depreciation, and it proposes that PJM use a 15-year Modified Accelerated Cost Recovery System in its CONE assumption. We disagree. Because corporate structures and tax planning strategies can vary, we find that PJM reasonably assumes that generation investment is taxed at the full corporate and state tax rate without considering tax planning strategies that companies can use to lower or eliminate their income tax liability. Moreover, we agree that it is reasonable to assume that entities will attempt to minimize their income tax liability through the use of tax benefits, such as increased bonus depreciation. Accordingly, we are not persuaded by LS Power's arguments that PJM has failed to meet its burden that its treatment of bonus depreciation is just and reasonable.

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[175] *Id.* at 4.

[176] *See, e.g., Alcoa Power Generating Inc.*, 165 FERC ¶ 61,094 (2018).

[177] PJM Transmittal at 21.

[178] LS Power Protest at 7.

6. Cost of Capital

a. Filing

87. PJM states that one critical component of Gross CONE is the after-tax weighted average cost of capital (Cost of Capital), which is the discount rate to annualize new entry investment costs.[179] PJM states that Brattle followed nearly the same approach used in the 2014 CONE Review. PJM notes that the Commission found that methodology to be transparent, with well-supported assumptions, and results in a just and reasonable Cost of Capital.[180]

88. Consistent with the 2014 CONE Review, Brattle examined a sample of United States IPPs, and Cost of Capital-based discount rates used by financial analysts in evaluating merchant generation merger and acquisition (M&A) transactions. In early 2018, Brattle analyzed the effects of major federal corporate tax reform. In August 2018, Brattle identified increases in the United States risk-free rate and the cost of debt that occurred since its early-2018 analysis, resulting in a Cost of Capital that was slightly higher than what Brattle originally identified. Brattle estimates a Cost of Capital of 8 percent, including a debt-equity ratio of 55 percent-45 percent, respectively, with cost of BB-rated debt of 5.5 percent and a return on equity (ROE) of 13 percent.[181]

89. In the instant filing, PJM updates Brattle's analysis, based on additional data. PJM states that merchant generators would likely have a credit rating somewhere between B and BB, as opposed to BB alone. PJM states that this reflects the credit ratings of merchant generators Brattle analyzed from when they were stand-alone companies. Due to the mix of B and BB ratings, PJM argues a 6 percent cost of debt is more appropriate, resulting in an 8.2 percent Cost of Capital.[182] Examining PJM's adjustment, Brattle notes that while it is slightly higher that Brattle's original analysis, it is within the range of

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[179] PJM notes that the Cost of Capital helps determine Gross CONE but does not set, prescribe, limit, or define investment returns for any PJM capacity market seller. PJM Transmittal at 18.

[180] *Id.*

[181] Brattle determined the cost of equity using the capital asset pricing model (CAPM), which is based on the risk-free rate plus a risk premium given by the expected risk premium of the overall market (i.e., the S&P 500 Index), multiplied by the company's "beta." The beta describes each company's five-year historical correlation with the overall market. 2018 CONE Study at 38.

[182] PJM Transmittal at 19.

available market evidence for merchant generation. Brattle supports PJM's proposed Cost of Capital of 8.2 percent.

b. Comments and Protests

90. LS Power argues that PJM's Cost of Capital assumptions are flawed because they presume the Reference Resource will be financed on terms more favorable than normally available.[183] LS Power states that there is no reason for PJM to focus solely on publicly-traded IPPs and how they are financed. Instead, LS Power argues that it is more appropriate to assume that the Reference Resource would be developed on a stand-alone basis using non-recourse financing.[184] LS Power states that the Reference Resource is riskier as it does not have a long-term contract in place.[185] LS Power also argues that PJM's proposed debt-equity ratio is unreasonably high, and that a 30 percent debt ratio is much more appropriate. LS Power also maintains that PJM's proposed cost of debt is understated, as there have been substantial increases in interest rates over the past year. LS Power avers that the Reference Resource would more likely be financed through a project finance bank or institutional loan market, as opposed to the bond market, and that a 6.75 percent cost of debt is more reasonable than the 6 percent proposed by PJM.[186]

91. LS Power also argues that the proposed ROE, as determined by Brattle's CAPM, is understated.[187] In particular, LS Power alleges that the beta implied by PJM ignores the fact that risks for merchant generators in PJM have increased due to volatile commodity prices, the proliferation of renewable generation, and state subsidies. LS Power concludes that a beta at or near 1.0 would be more appropriate. As proof, LS Power points to a recent Commission order capping the ROE of the New England Transmission Owners at 13.08 percent, which equates to a beta of 0.87. LS Power adds that a beta near 1.0 is consistent with the ROEs observed in the overall market, which

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[183] The Electric Power Supply Association (EPSA) also argues that PJM's financing assumptions are flawed, but does not support this assertion with additional argument. EPSA Protest at 4.

[184] LS Power Protest at 9-10. LS Power explains that under "non-recourse financing," the generation resource would be secured by a pledge of the project assets and based on the cash flows of the project on a standalone basis, with no recourse to the sponsor's balance sheet, other holdings, or the owner's corporate portfolio. *Id*. at 10.

[185] LS Power Protest, Attachment A, Joseph D. Esteves Aff. at ¶¶ 11-12.

[186] LS Power Protest at 12.

[187] *Id.*

were 15.82 in 2018. In conclusion, LS Power states that its overall Cost of Capital recommendation is 10.2 percent.[188]

92. Similar to LS Power, P3 argues that PJM's proposed Cost of Capital is too low. P3 states that private equity investors are the principal financiers of generation in PJM, and that their financing approaches are different than those of the publicly-traded IPPs relied upon by PJM. P3 argues that the companies[189] examined by Brattle in its Cost of Capital study were under financial distress, and that the fairness opinions during their M&A transactions should be ignored.[190] P3 also notes that Trans-Alta, noted in the Brattle study, is a Canadian company that operates in an entirely different market. P3 concludes that Brattle's proxy group of comparable companies does not represent investors financing peaking resources in PJM, and includes companies in unique situations that should be ignored.

93. P3 argues that PJM's presumed costs of debt and equity are too low. P3 avers that the rates for B and BB rated companies have been 7 percent – 7.5 percent over the past year – much higher than PJM's proposed 6 percent cost of debt. P3 also states that PJM's cost of debt does not take into account signals from the Federal Reserve that interest rates are going to rise. P3 concludes that a 7.5 percent cost of debt is reasonable.[191]

94. P3 states that PJM's proposed 13.0 percent cost of equity is "out of touch with reality."[192] P3 argues that this is "below the recently-approved FERC cap of 13.08 for New England regulated transmission owners."[193] P3 explains that by stripping away assumptions regarding debt levels (i.e., leverage), risk free rates and market premiums yields the "asset beta," which is the true indicator of an asset's assumed risk.[194] Based on

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[188] *Id.* at 14. LS Power's proposed Cost of Capital consists of a debt-equity ratio of 30 percent-70 percent, respectively; a cost of debt of 6.75 percent; and, a cost of equity of 12.6 percent.

[189] The companies in the Brattle study were: NRG Energy, Inc. (NRG), Calpine Corp. (Calpine), Dynegy Inc. (Dynegy), and Talen Energy Corp. (Talen).

[190] P3 Protest at 5-6.

[191] P3 supports PJM's debt-equity ratio of 55 percent – 45 percent.

[192] P3 Protest at 8.

[193] *Id.* (citing *Coakley Mass. Attorney Gen. v. Bangor Hydro-Elec. Co.*, 165 FERC ¶ 61,030 (2018) (Coakley Briefing Order)).

[194] *Id.* at 8-9. P3 explains that the beta of the market as a whole is 1.0.

its calculations, P3 states that PJM's implied asset beta is 0.73. P3 argues that this is below the "asset beta of 0.85 that FERC implicitly approved for PJM in 2014,"[195] and below the asset beta range in the Coakley Briefing Order (between 0.67 and 0.93). P3 states that merchant generation is riskier than both utility transmission investment and the market as a whole. P3 argues that an asset beta of at least 0.84 is appropriate, which translates to an ROE of 15 percent, and a 9.8 percent Cost of Capital.

c. Answers

95. In its answer to protests, PJM argues that unlike the Brattle study, LS Power and P3 have no public or transparent data to support their assertions about the Cost of Capital, so instead rely on derivations and comparisons of asset betas. PJM states that their application of asset betas are subjective perceptions of risk and, in any event, their calculations are flawed.[196]

96. PJM notes that P3 is incorrect in its assertion that its Cost of Capital is downward-biased due to reliance on publicly-traded IPPs. PJM notes that the Cost of Capital of NRG, Calpine and Dynegy ranged from 5.4 percent – 6.5 percent. PJM argues that these figures are below Brattle's proposed 8.0 percent Cost of Capital, demonstrating that Brattle did not simply rely on the sample company results.[197] Regarding the inclusion of IPPs facing financial distress in the Brattle study, PJM argues that professional financial advisors concluded in their fairness opinions that Cost of Capital ranges of 4.7 percent – 7.7 percent were sufficient to fairly compensate investors for the systematic risks associated with these M&A transactions. In any event, PJM argues, protesters simply ignore Commission precedent accepting the use of fairness opinions.[198]

97. PJM disputes protesters' objections to its reliance on data from publicly-traded IPPs, rather than private equity companies. PJM states that this runs counter to the

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Accordingly, an investment that is less risky than the market as a whole has a beta below 1.0, whereas one that is more risky has a beta above 1.0. *Id*. at 9.

[195] P3 Protest at 9.

[196] PJM Answer at 24.

[197] *Id.* at 25. With respect to Brattle's use of Canadian generation companies in its study, PJM used them only as a reference point, and did not rely upon them to develop their Cost of Capital. *Id*.

[198] *Id.* at 26-27 (citing *PJM Interconnection, L.L.C.*, 153 FERC ¶ 61,035, at P 57 (2015)).

Commission's prior conclusion that PJM adequately explained why it did not include private equity companies in its Cost of Capital study.[199] In any event, PJM argues, the Cost of Capital depends on the uses of capital, not its source. PJM also argues that protesters provide no evidence to support their assertion that long-term contracts are prevalent in IPPs' portfolios. PJM adds that although its capacity market is not akin to a long-term contract, it substantially reduces near-term risk by allowing generators to forward contract capacity payments for four years.

98. Turning to P3's arguments about Brattle's methodology, PJM reiterates that it used the same approach for its 2018 CONE Study as it did in 2014, and that approach, which the Commission accepted, is based on long-accepted financial theory. In any event, PJM states that contrary to P3's assertions, Brattle did consider how PJM-specific generation investment risk differs from the average risk of the sample companies, and that Brattle's analysis led to its Cost of Capital recommendation in the upper end of the range of reasonable returns.[200]

99. Next, PJM turns to protesters' arguments about PJM investment risk, and inferences of an asset beta and its relation to the Cost of Capital. PJM argues that P3 provided no empirical evidence to support the claim that merchant generation investment risk has climbed since 2014. PJM responds that financing costs have decreased since then. PJM notes that Cost of Capital for United States IPPs in the 2014 CONE Report ranged from 6.1 percent to 7.8 percent, whereas those in the 2018 CONE Report declined to between 5.4 percent and 6.5 percent. PJM adds that the discount rates used in fairness opinions showed a similar decline.[201] PJM argues that P3 has misapplied the asset beta formula, rendering the results meaningless. PJM argues that asset betas can be compared relative to one another only if tax rates – one variable in the formula – are the same, but that is not the case here, due to corporate tax cuts recently enacted by Congress. PJM notes that if P3's mathematical errors are corrected, its 2014 asset beta of 0.85 becomes 0.77. PJM states that this is nearly identical to the 2018 asset beta of 0.73 that P3 calculated. PJM argues that P3's attempts to derive and compare asset betas between merchant generation in PJM and transmission in ISO-NE is misleading. PJM adds that the ROE's addressed in the Coakley Briefing Order are applicable only from October 2012 through March 2013, a decade before the 2022/2023 Delivery Year in the instant filing. PJM concludes that P3's and LS Power's decision not to use market data renders their arguments unreliable.

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[199] *Id.* at 27 (citing 2014 VRR Order, at P 91 (2014)).

[200] *Id.* at 29-30.

[201] *Id.* at 31.

100. In LS Power's reply to the PJM Answer, it argues that PJM misunderstands how LS Power calculated the debt ratio. LS Power states that the availability of debt for merchant generation assets is mainly based on PJM capacity market revenues, where project lenders determine the debt capacity of a facility not necessarily by some standard debt-to-capital ratio, but rather by the cash flow projected to be earned by the project.[202]

d. Commission Determination

101. We find PJM's proposed 8.2 percent Cost of Capital to be just and reasonable. In the instant filing, PJM relied upon the same methodology that the Commission accepted in the 2014 Quadrennial Review Order. The United States Court of Appeals for the District of Columbia recently upheld the Commission's acceptance of that methodology and resulting Cost of Capital.[203] Protesters in the instant filing generally repeat the same arguments as the protesters in 2014, but have provided neither a compelling justification to depart from this precedent nor any rational basis to conclude that the Cost of Capital has materially increased since 2014.[204]

102. As it did previously, Brattle used publicly-available market data from a sample of United States IPPs and discount rates used by financial analysts in evaluating M&A transactions. The former showed a Cost of Capital range of 5.4 percent to 6.5 percent. The latter ranged from 5.75 percent to 7.3 percent.[205] For example, the fairness opinion for Calpine Corp. provided a Cost of Capital range from 5.75 percent to 6.25 percent.[206] Protesters argue that we should ignore this market data despite the fact that, as LS Power admits, "Calpine was acquired by a private equity firm in 2017[.]"[207] We find this

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[202] LS Power Reply to Answers at 4-5.

[203] *PJM Power Providers Group v. FERC*, 880 F.3d 559 (D.C. Cir. 2018).

[204] We note that PJM's proposal is a 20 basis point increase from the 8.0 Cost of Capital approved in the 2014 Quadrennial Review Order. *See PJM Interconnection L.L.C.*, 149 FERC ¶ 61,183, at P 76 (2014).

[205] 2018 CONE Study at 40-41.

[206] 2018 CONE Study at 41, citing Definitive Proxy Statement, Schedule 14A, filed by Calpine Corporation with the Securities and Exchange Commission on November 14, 2017, https://www.sec.gov/Archives/edgar/data/916457/000119312517341396/d476502ddefm14a.htm.

[207] LS Power Protest, Attachment A, Joseph D. Esteves Aff. at ¶ 8.

market data relevant and that it demonstrates a reasonable range of returns that sufficiently compensate investors for the systematic risks associated with such transactions. Moreover, the prevalence of private equity investments in PJM new merchant generation entry over the last several years, combined with the fact that actual entry from new generating plants in PJM has occurred at market clearing prices below Net CONE, indicates that market entrants—including private equity investors—are receiving adequate returns.

103. Evidence presented by LS Power, in fact, underscores this point. LS Power states that Brattle's financing assumptions are "unrealistic" and have a downward bias.[208] LS Power argues instead that "non-recourse project financing" is the best representation of borrowing capacity, capital structure, and cost of debt to be used for the CONE of the Reference Resource.[209] It adds, "[b]ased on public sources, LS Power estimates that in the last five years alone, nearly $8 billion of non-recourse project financing has been raised for new power plant construction in PJM."[210] For four of the five years of LS Power's investment study period (2014-2018), the PJM Tariff assumed an 8 percent Cost of Capital.[211] Market conduct under these assumptions—regardless of the financing options available to investors—belies LS Power's insistence that a materially higher Cost of Capital than 8.2 percent is required to induce investment in PJM.[212]

104. Based on the data from Brattle's initial proxy group, Brattle makes an upward adjustment to the Cost of Capital based on assumptions that a stand-alone merchant project would be riskier than the average portfolio of IPPs that have some long-term

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[208] LS Power Protest at 8.

[209] LS Power Protest, Attachment A, Joseph D. Esteves Aff. at ¶ 12.

[210] *Id.* at 13.

[211] That 8 percent Cost of Capital included a 60 percent-40 percent debt-to-equity ratio, a 7 percent cost of debt, and a 13.8 percent return on equity. *See generally*, 2014 VRR Order, at PP 76-94 (2014).

[212] We also note that LS Power's arguments about financing and the Cost of Capital run counter to the basic economic principle that the cost of capital depends on its use, not its source. To that end, we agree with Brattle's assessment that LS Power and P3 "fail to provide any rationale and evidence for why private equity investors' cost of capital for the purpose of merchant generation investments would be different from the cost of capital of publicly-traded merchant generation companies making the same investments." PJM Answer, Attachment C, Answering Aff. of Johannes P. Pfeifenberger and Bin Zhou at P 4.

contracts in place, and that the Tax Cuts and Jobs Act of 2017 would modestly increase the Cost of Capital.[213] Brattle also identified interest rate increases following its April 2018 CONE Study.[214] No party disputes these facts, and we find them a reliable basis for determining that an 8.2 percent Cost of Capital is just and reasonable. We next address the three components embedded in PJM's Cost of Capital calculation: ROE, the cost of debt, and the capital structure.

i. Return on Equity

105. In its Cost of Capital study, Brattle performed a capital asset pricing model (CAPM) analysis on a variety of publicly-traded IPPs, and determined ROE ranges between 8.5 percent and 12.8 percent. Brattle revisited its Cost of Capital estimate in August 2018 after it identified increases in the risk-free rate, one of the components of a CAPM study, which increased the high end of the range of reasonable ROEs to 13 percent.[215] We find reasonable Brattle's conclusion that stand-alone merchant generation assets in PJM would be riskier than the publicly-traded IPPs because the latter would have a proportion of their generation assets under long-term contracts. We find that this greater level of risk supports the use of a 13 percent ROE, and we therefore find it to be just and reasonable.

106. We are not persuaded by protesters' arguments that PJM's proposed ROE is unjust and unreasonable. They point to no methodological flaws in either Brattle's CAPM analysis, or the upward adjustment it made due to certain risks faced by a typical merchant generator. Instead, LS Power and P3 extrapolate an asset beta and use it to compare ROEs for merchant generation in PJM for the 2022/2023 Delivery Year, with ROEs for electric transmission in ISO-NE a decade prior. There are numerous flaws with this argument. First, P3's reference to the "*recently-approved* FERC [ROE] cap of 13.08" is factually incorrect.[216] The Coakley Briefing Order was not a final Commission order approving an ROE (or an ROE cap); it was an order directing briefs on the

[213] Brattle notes that "a decrease in the federal corporate income tax rate reduces the tax advantage of debt relative to equity. One would thus expect investors to choose a higher equity ratio under the lower tax rate. Combined with a higher after-tax cost of debt, Cost of Capital will thus increase." 2018 CONE Study at 42.

[214] PJM Transmittal, Attachment F, Aff. of Johannes P. Pfeifenberger and Bin Zhou at ¶ 1-3.

[215] PJM Transmittal at 18-19.

[216] P3 Protest at 8 (citing Coakley Briefing Order, 165 FERC ¶ 61,030 (2018)) (emphasis added).

Commission's proposed ROE methodology.[217] Assuming, *arguendo*, that it was a final Commission order, protester's arguments still fail because that order proposed an ROE of 10.41 percent—well below the 13 percent ROE we are approving here.[218] Second, the 13.08 percent ROE cap that P3 references included a transmission incentive adder, which is not available for generation.[219] Third, the market data used in that proceeding was from October 2012 through March 2013. As PJM notes, this study period is a decade before the 2022/2023 Delivery Year. Fourth, P3's asset beta formula contained a mathematical error—a fact that P3 did not dispute in its reply. When Brattle corrected P3's error the resulting asset betas (0.73 and 0.77) were not materially different.

107. Finally, LS Power notes that the overall equity market earned a 15.82 percent ROE in 2018.[220] LS Power avers that such an ROE "is at the low end of the range of the ROEs expected by typical sponsors that invest in merchant construction in PJM."[221] We disagree. Historic, realized returns are not the same as the forward-looking cost of equity.[222] If these two concepts were synonymous, that would mean that any time market

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[217] Coakley Briefing Order, 165 FERC ¶ 61,030, at P 1 (2018) ("In this order, we propose a methodology for addressing the issues that were remanded to the Commission in *Emera Maine* and we establish a paper hearing on how this methodology should apply to the proceedings pending before the Commission involving NETOs' ROE."). *See also*, *Association of Businesses Advocating Tariff Equity v. MISO*, 165 FERC ¶ 61,118 at P 20 (2018) ("In this order, as in the *Coakley* Briefing Order, we do not make any final determinations with respect to the proposed new methodology for analyzing the base ROE component of rates under section 206 of the FPA. The scope of the paper hearing established in this order includes all aspects of this order's proposed methodology").

[218] *See* Coakley Briefing Order, 165 FERC ¶ 61,030, at P 18 (2018).

[219] *See generally*, P*romoting Transmission Investment through Pricing Reform*, Order No. 679, 116 FERC ¶ 61,057 (Order No. 679), *order on reh'g,* Order No. 679-A, 117 FERC ¶ 61,345 (2006), *order on reh'g,* 119 FERC ¶ 61,062 (2007).

[220] LS Power Protest at 14.

[221] LS Power Protest, Attachment A, Joseph D. Esteves Aff. at 24.

[222] *See, e.g.,* Roger A. Morin, New Regulatory Finance at 114 (Public Utilities Reports, Inc. 2006) (noting that "realized returns can be substantially different from prospective returns anticipated by investors, especially when measured over short time periods."); *see also, id.* at 114-115 ("Realized returns can be construed as the sum of an expected return plus a component of unanticipated return, *which will be positive or negative* depending on whether investors underestimated or overestimated expected

returns were negative (e.g., during the Great Recession) investors required a negative ROE in order to invest during that time period. This is illogical. Taken together, these flaws render unpersuasive any arguments that PJM's 13 percent ROE is not just and reasonable.

ii. Cost of Debt

108. PJM proposes a 6 percent cost of debt, based on the assumption that merchant generators would have a mix of B and BB credit ratings. PJM notes that this assessment follows from the 3-year average of ratings-based index interest rates of 5.1 percent for BB-rated and 6.5 percent for B-rated bonds.[223] PJM states that this also reflects the rising interest rate environment, confirmed by Federal Reserve Bank Chairman Jerome Powell in September 2018.[224] We find PJM's cost of debt of 6 percent to be just and reasonable, as the assumptions underpinning its proposed figure are all based on recent market data.

109. LS Power argues the private equity consortiums use non-recourse debt, which is more expensive than corporate debt, to finance merchant generation projects, and that a 6.75 cost of debt is more reasonable. However, as Brattle notes, this is because non-recourse debt holders have to bear more of the individual projects' default risks, which in turn reduces the default-related risks to equity holders.[225] This would lower the associated ROE. Such offsetting changes would mitigate any potential impact on the Cost of Capital.

110. P3 states that PJM's cost of debt does not take into account signals from the Federal Reserve that interest rates are going to rise. We disagree. As noted above, PJM explicitly incorporated Federal Reserve Bank Chairman Jerome Powell's statements about the rising interest rate environment into its cost of debt assumptions. P3 also states

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future returns.") (emphasis added).

[223] PJM Filing, Attachment D, Aff. of M. Gary Helm at P 10 (citing website of the St. Louis regional office of the United States Federal Reserve, illustrating BB bond yields, and illustrating B bond yields, https://fred.stlouisfed.org/series/BAMLH0A1HYBBEY).

[224] *Id.* at P 10 (citing Transcript of Chairman Powell's Press Conference, at 3 (Sept. 26, 2018), https://www.federalreserve.gov/mediacenter/files/FOMCpresconf20180926.pdf).

[225] *Id.* P 14.

that PJM's 6 percent "debt rate is too low."[226] For example, P3 argues that by November 2018, one month after PJM's filing, BB and B rated corporate bond yields rose to 5.7 percent and 7.34 percent, respectively.[227] While P3's assertions are correct, we note that 6 percent is still within this range. In addition, bond yields fluctuate and, as of April 2019, BB bond yields fell below 5 percent,[228] while those rated B fell below 7 percent.[229] We find that PJM's proposed 6 percent cost of debt falls within all of these ranges, and supports our conclusion that PJM's proposal is just and reasonable.

iii. Capital Structure

111. Finally, we address LS Power's argument that a debt-equity ratio of 55 percent-45 percent is not just and reasonable, and that the Commission should instead adopt a 30 percent-70 percent capital structure. First, Brattle's capital structure is supported by market data showing a range of debt-to-equity ratios from 73 percent-27 percent, to 46 percent-54 percent.[230] Second, we agree with Brattle that by "considering only project-specific debt, [LS Power] ignores any additional leverage that may be held by developers and investors, including 'back leverage' through which project equity is financed through debt at the parent company level."[231] Third, Brattle acknowledges that the "55 percent debt financing assumption employed in our final recommendation is consistent with the debt financing evidence provided by [P3]."[232] Finally, we agree with PJM that LS Power's proposed capital structure was based on an erroneous calculation. To determine a 30 percent debt level, LS Power divided the average project debt to finance *existing*

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[226] P3 Protest, Attachment A, Aff. of Tanya L. Bodell at P 46.

[227] *Id.* at PP 47-48.

[228] Data from website of the St. Louis regional office of the United States Federal Reserve, https://fred.stlouisfed.org/series/BAMLH0A1HYBBEY.

[229] Data from website of the St. Louis regional office of the United States Federal Reserve, https://fred.stlouisfed.org/series/BAMLH0A2HYBEY.

[230] *See* 2018 CONE Study at 40, Table 17.

[231] PJM Answer, Attachment C, Answering Aff. of Johannes P. Pfeifenberger and Bin Zhou at P 14.

[232] *Id.* P 16 (citation omitted).

plants by the cost of a new plant in 2023.[233] As PJM notes, this mismatches the numerator and the denominator and "[c]onsidering that the value of these older plants may be only half that of a new plant, the total value used for the denominator would only be half—which means [LS Power's] rough estimation method would indicate that the debt leverage of these older plants may be 60 percent (not 30 percent)."[234] We agree, and conclude that PJM's proposed capital structure, as supported by Brattle's and P3's evidence, is just and reasonable.

7. Net EAS Estimate

a. Filing

112. Discussing its net energy and ancillary services calculation methodology (EAS methodology), PJM explains that its Tariff directs PJM to estimate the energy revenues that the Reference Resource would have received based on actual Locational Marginal Pricing and fuel prices for the most recent three calendar years, the heat rate of the Reference Resource, and an assumption that the Reference Resource would be dispatched for both the day-ahead and real-time energy markets on a "Peak Hour Dispatch" basis.[235] PJM states that the Tariff directs PJM to then add ancillary service revenues of $2,199 per MW-year.[236]

113. PJM states that it carefully considered a number of changes to the EAS methodology during the Tariff-prescribed analysis and stakeholder process. However, based on the information, analysis, and stakeholder input gathered in that process, PJM indicates that the PJM Board chose to make no changes to the EAS methodology rules in the Tariff, with the single exception of a 10 percent adder, as discussed more in the following section.[237] PJM states that its proposed VRR Curve reflects an updated EAS Offset that reflects both the more efficient H-Frame technology and the introduction of

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[233] LS Power Protest, Attachment A, Joseph D. Esteves Aff. at 14, Table 4 (noting that the implied debt-to-equity ratio for existing plants is "based on Brattle's upfront cost for GE 7HA.02 CT.").

[234] PJM Answer, Attachment C, Answering Aff. of Johannes P. Pfeifenberger and Bin Zhou at P 15.

[235] PJM Transmittal at 22 (citing Tariff, Attachment DD, § 5.10(a)(v)(A)).

[236] *Id.*

[237] *Id.*

the 10 percent energy market offer cost adder.[238] PJM also states that the Gross CONE values proposed in its filing assume that certain major maintenance costs are recovered as Variable O&M through energy market offers.[239] PJM explains that its Tariff states an estimated value for Variable O&M to be used in determining the EAS Offset.

b. Comments and Protests

114. The Public Interest Entities suggest that Commission should also consider asking PJM and stakeholders to develop a forward-looking EAS Offset.[240] The Public Interest Entities state that PJM's current methodology for estimating the EAS Offset, which is designed to represent a generator's expectations of future earnings in the energy and ancillary services market, is flawed because it relies on past conditions and events – like excess capacity or a Polar Vortex – that may be very different from what market participants reasonably may expect going forward.[241] The Public Interest Entities note that even Brattle, which PJM retained to conduct an independent analysis of PJM's methodology for establishing its VRR Curve, states that such a change would "provide a better representation of developer's expectations for net energy revenues"[242] and has recommended in all four of its Triennial/Quadrennial Review reports that PJM explore the use of a forward-looking EAS Offset.[243]

115. The Joint Protestors and the Public Interest Entities argue that PJM should not calculate Net EAS based on historical prices because those prices may not accurately reflect future market conditions.[244] The Joint Protestors highlight that while PJM defines Gross CONE based on expected costs as of the Delivery Year corresponding with the relevant RPM auction, PJM determines Net EAS Revenue using data "from the PJM energy markets during a period of three consecutive calendar years preceding the time of

[238] *Id.* at 14.

[239] *Id.* at 19.

[240] Public Interest Entities Comments at 37.

[241] *Id.* at 38.

[242] *Id.* (citing 2018 VRR Curve Report at 25).

[243] *Id.*

[244] Joint Protestors Protest at 7.

the determination . . . ."[245] The Joint Protestors conclude that PJM mixes forward looking cost data with retrospective revenue data in determining the "price" component defining the VRR Curve.[246] The Joint Protestors cite similar conclusions presented in Brattle's 2018 VRR Curve Report to argue that PJM should adopt a forward-looking methodology, such as using futures prices.[247] The Joint Protestors suggest that instead of relying on forward-traded on-peak futures prices, PJM could use any of the commercially available electricity forecasting and analysis tools to develop price forecasts suitable for evaluating peaking CT energy market revenue.[248]

116. The IMM also addresses the backward-looking nature of PJM's proposed Net EAS Offset calculation, arguing that the net revenue offset should be forward-looking.[249] The IMM states that instead of using historical revenue from a dispatch based on specific power and gas prices that are unlikely to be repeated, energy revenues from a dispatch based on forward curves for power and gas are the best estimate of expected net revenue.[250] The IMM also states that using forward curves is consistent with project valuation methods used in practice by market participants. The IMM argues that even though there will be uncertainty in the forward curves for energy and gas on which forward looking net revenue offsets would be based, real developers of real power plants look forward and not backwards when evaluating a decision to invest in a new power plant.[251] Furthermore, the IMM argues that using forward curves to calculate net revenue would also allow the Net EAS Offset to adjust to any expected changes in energy prices based on market fundamentals or energy market design changes affecting future net revenues.[252] The IMM contends that the Commission should direct PJM to develop a

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[245] *Id.* (citing Tariff, Attachment DD, § 5.10(a)(v)).

[246] *Id.*

[247] *Id.* at 8 (citing 2018 VRR Curve Report at 25 (Apr. 19, 2018)).

[248] *Id.* at 8-9. The Joint Protestors also offer the example that the Commission recently approved AURORA for use by ISO New England Inc. in connection with energy price forecasts used to establish Net CONE for a CT reference resource in the New England market.

[249] IMM Protest at 16.

[250] *Id.*

[251] *Id.*

[252] *Id.* at 17.

forward looking method for calculating net revenues through a stakeholder process now rather than waiting until the next Quadrennial Review.[253]

117. Last, the IMM recommends that the net revenue calculation used by PJM to calculate the Net CONE VRR Curve parameter reflect the actual flexibility of units in responding to price signals rather than using assumed, fixed operating blocks that are not a result of actual unit limitations. The IMM argues that PJM's dispatch method does not correctly reflect the way in which the reference unit would actually be dispatched; the IMM asserts that PJM's dispatch method results in lower energy net revenues and a higher Net CONE than if the resource were optimally dispatched over all hours, subject to the unit's actual operating parameters.[254]

c. Answers

118. In its answer, PJM addresses concerns that its Net EAS Offset calculation ought to be forward-looking, stating that while PJM can make refinements to improve the overall accuracy of its EAS estimates, there is no avoiding the inherent difficulty of estimating energy market revenues that will be experienced three or four years later.[255] PJM asserts that there will always be a high risk of a substantial variance between estimated and actual EAS. In response to the IMM's assertion that PJM's existing dispatch methodology understates net energy revenues by assuming that a unit will be dispatched during certain non-profitable hours, PJM states that the IMM has failed to demonstrate that the dispatch methodology in the existing version of the Tariff is unjust and unreasonable.[256] PJM concludes that the IMM's criticism should be rejected as outside the scope of this case.

d. Commission Determination

119. As an initial matter, we find that PJM followed its currently-effective Tariff in calculating the EAS Offset component of the VRR Curve based on historic data. We reject the intervenors' requests that the Commission require PJM to revise its existing EAS offset methodology. We recognize PJM's concern regarding the inherent difficulty of estimating energy market revenues that will be realized in future years and the risk of variance between estimated and actual EAS revenues. We find that PJM's election to

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[253] *Id.*

[254] *Id.* at 9.

[255] PJM Answer at 10.

[256] *Id.* at 22.

continue using historic data to calculate the EAS Offset is a reasonable method by which to account for the EAS revenues earned by generators. Furthermore, the existing historic EAS Offset calculation methodology, which PJM does not propose to change, has previously been accepted as just and reasonable.[257]

120. We also disagree with the IMM's argument that the Net EAS Offset should be based on the revenues a resource would receive under the IMM's dispatch model. We find that a resource's revenues are a function of actual dispatch, and not a function of any other theoretical model that is neither used by PJM nor planned to be used by PJM in the future. Therefore, we agree with PJM that it is just and reasonable for PJM to calculate its Net EAS Offset consistent with its current dispatch methodology.

8. Ten Percent Adder

a. Filing

121. Cost-based offers into PJM's energy markets are currently allowed to include a 10 percent adder which PJM states accounts for uncertainties in the determination of energy market participation costs. PJM proposes to incorporate the 10 percent adder in the cost-based energy market offer assumed for the Reference Resource in the energy and ancillary service estimating method's Peak-Hour Dispatch rules. PJM states that the same uncertainties that underlie these offers, including assumptions regarding the applicable gas index hub, Day-ahead versus intra-day gas arrangements, and assigned Locational Marginal Pricing, would confront the Reference Resource if it were preparing an energy market offer.[258]

b. Comments and Protests

122. The Public Interest Entities argue that PJM did not provide any data or analysis to support the inclusion of a 10 percent adder in the calculation of Net EAS revenues. Pointing to the Wilson affidavit, the Public Interest Entities state that generators will generally not face the uncertainties outlined by PJM in support of the 10 percent adder, and to the extent that those uncertainties do arise, those uncertainties will only be faced during certain hours of the year. The Public Interest Entities argue that PJM has not justified the inclusion of the 10 percent adder for every single energy market offer.[259] The Public Interest Entities state that Brattle found only limited support for the inclusion

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[257] *See* 2014 VRR Order at P 140 (2014).

[258] PJM Transmittal at 23.

[259] Public Interest Entities Protest at 35 (citing Wilson Aff. at ¶ 61).

of the 10 percent adder because some generators could cost-effectively manage their gas needs without need for such an administrative fix. The Public Interest Entities cite Mr. Wilson in stating that the use of the 10 percent adder is irrational because including it reduces the Reference Resource's Net EAS revenues by 20 to 25 percent in most zones and by 32 percent in the entire RTO, thereby inflating Net CONE and leading to unjust and unreasonable ratepayer costs.[260]

123. The Joint Protesters argue that PJM's proposal to incorporate the full 10 percent adder into the Reference Resource offers used to determine Net EAS revenues is unsupported. The Joint Protesters assert that a competitive generator would instead only include the full 10 percent adder to the extent the resulting offer did not exceed its actual short-run marginal cost.[261] The Joint Protesters support this position by quoting the Commission's finding in its March 2016 order on a section 206 investigation regarding the expected revenue component of offer caps, which states, in relevant part, "Under conditions where sellers lack market power and a uniform market clearing price is paid to all suppliers, a competitive seller of energy maximizes its profits by offering energy at its short-run marginal cost."[262] The Joint Protesters state that this precedent is inconsistent with PJM's premise that incorporating the 10 percent adder is necessary to align predicted Net EAS values with lower observed values, since such a premise depends upon the resulting offers exceeding the generator's short-run marginal cost. The Joint Protesters state that the generators that would have an incentive to maximize the use of their offer cap flexibility are very likely to possess market power and that the generators' offers in excess of short-run marginal cost would yield greater EAS revenues because their units are likely to set price.[263] The Joint Protesters state that PJM's proposal may therefore reward generators with higher capacity market prices for actions that are consistent with the exercise of market power.[264]

124. The IMM states that a profit maximizing generator in a competitive market will base its offer only on short run marginal costs, and that the 10 percent adder is not a short run marginal cost. As an example, the IMM states that the owners of coal units and many gas and oil fired units, facing competition, typically exclude the additional 10 percent

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[260] *Id.* at 35-36 (citing Wilson Aff.at ¶¶ 59, 64).

[261] Joint Protestors at 3.

[262] *Id.* at 4 (citing *PJM Interconnection, L.L.C.*, 154 FERC ¶ 61,151, at P 53 (2016)).

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

[264] *Id.* at 3-5.

from their actual offers.[265] The IMM continues that the introduction of hourly offers and intraday offer updates allows gas and oil generators to directly incorporate the impact of ambient temperature changes in fuel consumption in offers. The IMM also points out that, in 2017, many units in the PJM market, including 28 percent of gas generators, offered in at a price below their cost-based offer.[266]

125. P3 supports PJM's proposal to include a 10 percent adder in the cost-based energy market offer assumed for the Reference Resource, citing to a Commission finding that, "an incremental cost rate that allows a fair recovery of the incremental cost of generating with a 10 percent adder to provide for a margin over incremental cost is reasonable. Incremental costs plus 10 percent represents a conservative proxy for a reasonable rate available in a competitive market."[267] EPSA supports PJM's proposal stating that the Commission has included some form of a 10 percent adder in other RTOs.[268]

c. Answers

126. PJM answers that the inclusion of the 10 percent adder is not designed to increase or decrease capacity prices, but rather to more reasonably estimate EAS revenues. PJM states that ignoring a permitted component of energy offers is not reasonable, and that taking account of a significant energy offer component that is ignored by the current estimate will improve the accuracy of the EAS estimate.[269]

127. In its Answer, P3 states that both the Public Interest Entities and the IMM have longstanding objections to the 10 percent adder, and that their arguments seek to re-litigate the issue. P3 points out that the Commission upheld the 10 percent adder in 2016, finding that the adder was an appropriate means to "account for uncertainty in the values

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[265] IMM Protest at 10 (citing 2015 State of the Market Report for PJM, Vol. 2, Section 3: Energy Market at 118).

[266] *Id.* The IMM also states that in 2017, 28 percent of gas generators offered their entire economic operating range at a price less than their cost-based offer (citing 2017 State of the Market Report for PJM, Vol. 2, Section 3: Energy Market, at 139).

[267] P3 Answer at 15 (citing *Market-Based Rates for Wholesale Sales of Electric Energy, Capacity and Ancillary Services by Public Utilities*, Order No. 697, 119 FERC ¶ 61,295, at P 350 (2007)).

[268] EPSA Protest at 4.

[269] PJM Answer at 6-7.

of the costs utilized in computing those cost-based offers before all costs are known."[270] P3 states that it is common sense to extend the adder since the Reference Resource could face significant uncertainty due to its limited and intermittent dispatch profile. P3 states that the Reference Resource is a hypothetical reference unit, and not the entire PJM generation fleet, so the IMM's argument that a number of natural gas resources do not avail themselves of the 10 percent adder rings hollow.[271]

d. Commission Determination

128. We accept PJM's Tariff revision to include the 10 percent adder when calculating the Net EAS Offset. We find that this revision would make the method of estimating Net EAS revenues for the Reference Resource consistent with existing energy market rules. The Commission previously found to be just and reasonable the inclusion of a 10 percent adder in cost-based incremental energy offers.[272] Therefore, we find that PJM's proposal, which will calculate the EAS offset based on offers that include this adder, more fully reflects all eligible offer cost components, for the purpose of increasing the overall accuracy of the Net EAS Offset.

129. We disagree with the IMM's argument that the presence of resources regularly offering below their cost-based offer means that the cost-based offer should not be used to calculate the offset. That some, or even many, units submit competitive offers below the cost-based offer does not render either the cost-based offer itself or PJM's use of the adder in calculating the costs of its Reference Resource unjust and unreasonable. Similarly, we disagree with Joint Protesters' argument that resources offering near their cost-based offer that include the 10 percent adder may be exerting market power. The inclusion of the 10 percent adder in cost-based energy market offers is not at issue in this proceeding, only PJM's decision to include it in the estimate of the Reference Resource's costs when calculating the net EAS revenue component of the EAS offset.

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[270] P3 Answer at 3 (citing *PJM Interconnection, L.L.C.* 153 FERC ¶ 61,289 at P 30).

[271] *Id.* at 3-4.

[272] *See PJM Interconnection, L.L.C.* 153 FERC ¶ 61,289 at P 30.

9. Variable O&M Costs

a. Filing

130. The Gross CONE values that PJM proposes assume that certain major maintenance costs are recovered as Variable O&M through energy market offers.[273] PJM explains that these costs therefore should not be embedded in the capacity market auction parameters or capacity bids.[274]

131. While other resource technologies may reflect major maintenance expenses in the Maintenance Adder component of their cost-based energy market offers,[275] PJM Manual 15 currently provides that CT and CC resources may not include "[p]lant major inspection and overhaul expenses" in their variable maintenance expenses.[276] The PJM Tariff currently provides that the avoided cost component of a generator's capacity market bid "shall exclude" variable costs recoverable in the energy market.[277] PJM's

[273] PJM Transmittal at 19.

[274] *Id.* PJM identifies the operating costs at issue as expenses related to consumable materials used during plant operations. It identifies the major maintenance costs at issue to be operating expenses related to consumable materials used during plant operations and maintenance expenses a Market Participant incurs as a result of electric production.

[275] The Maintenance Adder is "an adder that may be included to account for variable operation and maintenance expenses in a Market Seller's Fuel Cost Policy . . . and [that] may only include expenses incurred as a result of electric production." Operating Agreement § 1, Definitions M – N; Tariff § 1 Definitions L – M – N.

[276] PJM's Operating Agreement states that the details of the cost based energy bid will be provided in the Manuals. *See* PJM Operating Agreement Schedule 2, Section 1(a) (Such unit-specific Energy Market Opportunity Costs are calculated by forecasting Locational Marginal Prices based on future contract prices for electricity using PJM Western Hub forward prices, taking into account historical variability and basis differentials for the bus at which the generating unit is located for the prior three year period immediately preceding the relevant compliance period, and subtract therefrom the forecasted costs to generate energy at the bus at which the generating unit is located, as specified in more detail in PJM Manual 15.)

[277] PJM Tariff Attachment DD, § 6.8(c).

Operating Agreement outlines the costs recoverable in the energy market and incorporates by reference the prohibitions in Manual 15.[278]

132. PJM proposes to address this prohibition for CC and CT resources in its filings in Docket Nos. ER19-205 and EL19-8, which would require Market Participants to recover these usage-driven O&M costs solely through their cost-based offers in the PJM energy market.[279] PJM filed Gross CONE values that exclude these usage-driven operation and maintenance costs, in recognition that these costs are variable and should be recovered through energy market offers.[280]

b. Comments and Protests

133. The IMM protests PJM's proposal to include variable O&M costs associated with major maintenance in energy offers rather than in capacity market offers, arguing that these costs are not short-run marginal costs.[281] Instead, the IMM recommends including major maintenance costs in the Gross CONE and using short-run marginal cost as the competitive energy offer and the rate at which the unit would be dispatched.[282] The IMM further argues that PJM and Brattle made several mistakes in the calculation of net revenues when major maintenance is included in energy offers, such as using an unsupported assumption of number of hours per start as part of the equation to convert the start cost to a dollar per MWh rate and an over-estimation of short run marginal cost of variable O&M.[283]

c. Deficiency Letter Response

134. In its Deficiency Letter, Commission staff requested that PJM explain how Net CONE changes depending on whether variable O&M costs are recovered in the energy market or the capacity market. In its response, PJM states that the Net CONE does not materially change regardless of whether major maintenance costs are recovered in the

[278] PJM Operating Agreement Schedule 2, § 1.

[279] PJM Transmittal at 20.

[280] *Id.*

[281] IMM Protest at 11.

[282] *Id.* at 12.

[283] *Id.*

energy market or the capacity market.[284] PJM explains that the Net CONE would increase from $251.34 to $252.53 per MW-day if major maintenance expenses were recovered in the energy market instead of the capacity market.[285] According to PJM, the Gross CONE value is higher and the variable O&M value is lower when major maintenance costs are assumed to be included in the fixed costs in the capacity market. PJM also states that since variable O&M is included as part of the total cost-based offer used to determine the annual Net EAS revenues of the proposed Reference Resource, a lower variable O&M corresponds with higher Net EAS revenues. PJM further explains that this is because a resource with lower cost-based offers will be dispatched more often than one with higher offers, which results in higher Net EAS revenues when recovering major maintenance costs in the capacity market than the energy market. Because of this off-setting effect, PJM explains that the resultant Net CONE values are nearly identical regardless of the market in which the major maintenance costs are included.[286]

d. Commission Determination

135. We accept PJM's proposed Gross CONE Values, which reflect variable O&M costs being recovered in the energy market rather than the capacity market. As PJM states in its Deficiency Letter Response, the resultant Net CONE does not change materially whether PJM reflects the recovery of major maintenance costs in energy and ancillary services revenue or as recoverable in the capacity market, on account of the offsetting effect of the calculation of Net EAS revenues.[287] As PJM also notes in its Deficiency Letter Response, Net CONE would increase by $1.19 per MW-day if resources recover major maintenance costs in their energy market offers.[288] Furthermore, the proposed Gross CONE values are consistent with our decision in Docket Nos. ER19-210 et al., which accepts PJM's proposal to shift variable O&M costs associated with major maintenance to a resource's energy market offer.[289]

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[284] PJM Deficiency Letter Response at 7.

[285] *Id.*, Table 2.

[286] PJM Deficiency Letter Response at 8.

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

[288] *Id.* at 7.

[289] *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,030 (2019).

136. We find that the IMM's protest of the Gross CONE values raises issues that are beyond the scope of this proceeding and which are better addressed in Docket Nos. ER19-210 et al. Therefore, we will not address them here.

10. Additional Issues

137. If the instant filing is not rejected, PSEG Companies request that the Commission institute an evidentiary hearing to evaluate issues of material fact. Specifically, PSEG Companies indicate that a hearing, which should include with the ability of interested parties to review the S&L database upon which Brattle based the CONE calculations, will be necessary in order to resolve the parties' factual disagreements. PSEG Companies also contest the credibility of certain individuals providing opinions in the docket and suggest that a hearing is needed so that the expertise of each witness can be properly examined by the trier of fact.[290]

138. FirstEnergy argues that the revised VRR Curve not only will not solve the much bigger problems in PJM's markets, but also that it will make them far worse. FirstEnergy further argues that in reviewing PJM's filing, the Commission must look beyond the calculation of Net CONE and the like, to its broader implications and impacts, including not only to PJM's capacity market, but also to all of PJM's markets, with respect to their ability, collectively, to support reliability for the long term. As a result, FirstEnergy requests the Commission reject PJM's filing or, in the alternative, accept it subject to refund, consolidate the proceeding with that in Docket No. EL16-49-000 et al., and undertake a holistic review of PJM's energy, capacity and ancillary services markets.[291]

139. The PJM IMM proposes an alternative to PJM's proposed VRR Curve. The IMM states that each of the differences between the PJM position and the IMM position has the same directional impact on the Net CONE calculation. The IMM indicates that the IMM's proposal has a lower Gross CONE than PJM's and higher net energy revenues than PJM's. The IMM concludes that the combined effect of these differences results in a calculation of Net CONE that is lower than PJM's calculation of the same.[292] In a figure comparing the curves proposed by PJM and the IMM with that representing the 2021/2022 base residual auction VRR Curve for PJM, all cleared against the aggregate supply curve from the 2021/2022 base residual auction, the IMM demonstrates that use of its assumptions to set the VRR Curve would have resulted in an RTO-wide clearing price

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[290] PSEG Companies Protest at 20-21.

[291] FirstEnergy Protest at 1-2 (citing *Calpine Corp.* et al. *v. PJM Interconnection, L.L.C.* et al., 163 FERC ¶ 61,236, at P 6 (2018)).

[292] IMM Protest at 15.

of $120 per MW-day, as opposed to PJM's proposed VRR Curve, which would have resulted in an RTO-wide clearing price of $132 per MW-day.[293]

140. We reject PSEG Companies' request to institute an evidentiary hearing. For the reasons discussed above, we have found that PJM's proposal is just and reasonable and find no issues of material fact that necessitate a hearing. We also find that FirstEnergy's request to consolidate the proceeding with the issues addressed in Docket No. EL16-49, et al. to be beyond the scope of this proceeding.

141. Having found PJM's proposal to be just and reasonable, we need not consider the alternative VRR Curve design proposed by the IMM.[294]

The Commission orders:

(A) PJM's proposed Tariff revisions are hereby accepted, to become effective January 17, 2019, subject to conditions, as discussed in the body of this order.

(B) PJM is hereby directed to submit a compliance filing within 30 days of the date of issuance of this order, to revise the effective date of the eTariff record submitted in Docket No. ER19-105-002, as discussed in the body of this order.

(C) PJM is directed to submit an informational 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.

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

[294] *See Oxy USA, Inc. v. FERC*, 64 F.3d 679, 691 (D.C. Cir. 1995); *Cities of Bethany v. FERC*, 727 F.2d 1131, 1136 (D.C. Cir. 1984).

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C. Docket No. ER19-105-001
ER19-105-002

(Issued April 15, 2019)

GLICK, Commissioner, *dissenting*:

1. I dissent from today's order because PJM has failed to show that its proposal will produce just and reasonable rates. For many years now, the PJM capacity market has suffered from a chronic oversupply of generation resources. The primary factor driving that oversupply is PJM's excessively high Net Cost of New Entry[1] parameter (Net CONE), which has incentivized new resources to enter the market when they are not needed and caused PJM to procure far more resources than it should. Since the 2015/2016 Base Residual Auction, over 31,000 MW of new generation resources have cleared the PJM capacity market, despite the auctions clearing at prices that were on average 60 percent below Net CONE.[2] Those figures indicate that developers are willing to enter the market at a fraction of PJM's estimate of Net CONE.[3] An excessive Net CONE distorts the shape of the demand curve that PJM uses in its capacity market, causing PJM to procure too many resources at too high a price, with obvious detrimental consequences for consumers.

2. But the harm from an excessive Net CONE goes beyond its impact on consumers' bills. By retaining too many resources, PJM dulls the price signals in the markets for energy and ancillary services (E&AS), impairing their ability to incentivize the services we actually need to reliably operate the grid. A market is only as efficient as the price

[1] Net CONE is used to establish the administratively determined demand curve that—along with the supply curve formed from capacity supplier sell offers—is used to clear capacity auctions in PJM. The higher the Net CONE figure, the higher the market-clearing price and the higher the total capacity cleared.

[2] 2018 CONE Study at 4.

[3] "As the clearing prices reflect the offer price of the marginal unit clearing the market, new generation resources must have on average been submitting offers into the auction at even lower prices." *Id*.

signals it sends. So long as the flaws in PJM's capacity market distort the prices throughout the other PJM markets, consumers will pay excessive prices and get a suboptimal resource mix. Net CONE also sets the market seller offer cap, giving it a significant role in protecting against the exercise of market power in the capacity market.[4] As a result, an artificially high Net CONE increases the potential for market power abuse.[5]

3. Faced with mountains of evidence indicating that PJM's capacity market is over-procuring resources—harming customers and hindering price formation in its other markets—one might expect that PJM and the Commission would take a holistic review of the capacity market, starting with the VRR curve. Unfortunately, today's order does not give this matter the careful consideration it demands. Instead, the Commission uncritically accepts PJM's filing in the face of contrary Commission precedent, persuasive protestor arguments, and many unresolved questions of material fact. The record in this proceeding simply does not provide a basis for the Commission to make a reasoned finding that the proposed VRR curve is just and reasonable and not unduly discriminatory or preferential. Rather than summarily accepting PJM's filing in the face of these shortcomings, I would instead set the issues for hearing in order to develop the record needed to adequately address them.

4. Today's order approves the use of a combustion turbine power plant configured with one GE Frame 7HA turbine as the reference resource over considerable evidence (including from PJM's own consultant) indicating that it is unjust and unreasonable to make a combustion turbine the reference resource rather than a combined cycle unit. As PJM explains, the "well-accepted economic theory" of the capacity market is that, over time, the "cleared capacity [should] converge[] at the target Installed Reserve Margin and new economic generation—regardless of resource type—should converge at the same Net CONE."[6] For that to occur, "Net CONE must accurately reflect the price at which

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[4] This cap is calculated by multiplying Net CONE by the historical average of the Balancing Ratios experienced during Performance Assessment Intervals/Hours in the three most recent calendar years. PJM's tariff states that bids up to the market seller offer cap "shall not, in and of itself, be deemed an exercise of market power." PJM Tariff, Attachment DD § 6.4(a).

[5] This is not just theoretical. Recently, excessive Net CONE values have resulted in very high market seller offer caps. These market seller offer caps have elicited concerns from the Market Monitor that the exercise of market power caused the clearing price to exceed competitive levels. *See* Monitoring Analytics, Analysis of the 2021/2022 RPM Base Residual Auction 3 (Aug. 9, 2018).

[6] Keech Affidavit at P 7.

developers would actually be willing to enter the market."[7] A Net CONE value that is consistently above that price will frustrate the economic theory on which the PJM capacity market is based, calling into question whether the market produces just and reasonable results. The reference resource used to establish Net CONE is, therefore, critical to determining whether the VRR curve is just and reasonable.

5. As noted, the record in this proceeding indicates that resources are entering the PJM capacity market at a fraction of the current Net CONE, indicating that the current Net CONE is excessive. Although PJM's proposal would reduce Net CONE, PJM's own consultant finds that using a combustion turbine as the reference resource for the VRR curve will perpetuate the oversupply of capacity since new resources can continue to clear the capacity market at prices far below the administrative estimates of a combustion turbine's Net CONE.[8] Nevertheless, the Commission accepts PJM's proposal to select a combustion turbine as the reference resources, relying heavily on its previous approval of a combustion turbine as the reference resource.[9] But circumstances have changed. The additional four years of capacity auctions since the last VRR Curve filing in 2014 have seen even greater combined-cycle unit entry than previous years and little combustion turbine entry.[10] Those auctions have confirmed that combined-cycle units remain the dominant form of new entry, supporting Brattle's finding that the advantages of combined-cycle units reflect fundamental, long-term cost drivers. By ignoring Brattle's recommendation and insisting on using a combustion turbine as the reference resource, PJM's proposed VRR curve will continue incentivize new entry when it should no longer be profitable.

6. In addressing this issue under the analogous provision of ISO New England's tariff, the Commission considered (1) whether the reference resource is likely to be developed in the region, (2) whether cost and revenue estimates for that unit can be developed with confidence, and (3) whether the resulting curve produces "prices high enough to meet the reliability standard but not so high as to add unnecessary costs."[11]

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[7] 2018 CONE Study at 1.

[8] Nearly 27,000 MW (ICAP) of new combined-cycle units have cleared in the past several BRAs, with prices ranging from 50-80 percent below administrative estimates of Net CONE for a combustion turbine. 2018 VRR Curve Report at 32.

[9] *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,029, at PP 60, 62 (2019) (Order).

[10] 2018 VRR Curve Report at 41.

[11] *ISO New England, Inc.*, 161 FERC ¶ 61,035, at P 38 (2017).

The record does not indicate that PJM's choice of a 7HA combustion turbine as the reference resource is consistent with any of these principles.

7. First, the record does not show that a greenfield combustion turbine is economically viable or likely to be developed in PJM.[12] PJM argues generally, that a combustion turbine is economically viable based on two new merchant plants: The 340 MW Doswell Peaking Unit and the 141 MW Perryman Unit 6.[13] In both cases, however, those turbines were installed on the sites of existing plants.[14] Accordingly, these plants' costs are below the cost of greenfield combustion turbine and, thus, do not indicate that a greenfield standalone combustion turbine is economic, never mind likely to enter the PJM market. PJM also relies on Brattle and Sargent & Lundy to support its selection of the H-class in a combustion turbine configuration by showing that merchant generators are installing the 7HA turbine in over 4,000 MW of generators in PJM and another 3,000 MW in other markets. But those figures address the 7HA turbine in *combined-cycle configurations*, not as combustion turbines. Thus those figures do not support the proposition that there is likely to be 7HA combustion turbine development in PJM. Instead, those figures indicate that to the extent the 7HA turbine is entering the market, it is likely to be developed as a combined-cycle unit.

8. Second, PJM contends that estimating Net CONE for a combined-cycle unit is more difficult due to the significant revenue that it would likely earn in the energy market.[15] As an initial matter, PJM's own consultant refutes that point.[16] Brattle explains that revenues from E&AS "can be accurately approximated" using actual historical data for combined-cycle units, but that no such benchmark is available for combustion turbines.[17] In other words, calculating the E&AS revenue for combustion

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[12] A Net CONE analysis assumes the reference resource is a greenfield project.

[13] PJM Filing at 10 (citing 2018 CONE Study at 5).

[14] The Doswell Peaking Unit is on the site of the existing Doswell Energy Center and Exelon's Perryman Unit 6 is located at the existing Perryman Generating Station. Wilson Affidavit at P 39.

[15] Order, 167 FERC ¶ 61,029 at P 42.

[16] 2018 VRR Curve Report at 33 ("The conventional wisdom has always been that [combined-cycle units] are subject to more estimation error in E&AS offsets, since their E&AS offsets are larger. We disagree.").

[17] *Id.* ("No such benchmark is available for [combustion turbines], so we rely on historical estimates that may not be representative of the future deliver year due to historical anomalies and evolving market conditions. Finally, [combustion turbines] face

turbine will, in fact, be subject to greater estimation error than a combined-cycle unit. Putting aside the fact that PJM's assertion is unsupported by the record, it makes no sense to address the purported uncertainty associated with a combined-cycle unit's energy market revenue by selecting a reference resource that earns only negligible energy market revenues.[18] The solution to complexity is not to assume it out of existence.

9. It is also more difficult to calculate the expected costs of a combustion turbine unit and specifically the 7HA combustion turbine. In choosing a 7HA combustion turbine unit as the reference resource, PJM needed to develop the cost of constructing and financing a resource that no entity has experience building in PJM. Many of the issues raised by protestors in the record go to the establishment of CONE, which could be addressed largely by choosing a technology type that is in operation and where there is experience in the costs of constructing such units.[19] As PJM itself points out, there is significant experience with the 7HA in the combined cycle configuration.

10. Third, the record does not suggest that using a combustion turbine as the reference resource would incentivize new entry without unnecessary cost. As noted, the record indicates that new resources are entering the market at a fraction of the current Net CONE and still well below the Net CONE likely to be produced using a 7HA combustion turbine.[20] It is hard for me to understand how a Net CONE so substantially in excess of what is actually required to enter the capacity market does not impose unnecessary costs on consumers. PJM asserts that the "VRR Curve should not be designed to limit competition from a plant type available to developers that has all the essential features of

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less transparent gas procurement costs since they are committed and dispatched day-of.")

[18] Combustion turbines have capacity factors as low as 3 percent in recent years while combined-cycle units operate with 50 percent to 70 percent capacity factors. Wilson Affidavit at P 40 (citing Keech Affidavit).

[19] These issues include the construction and labor costs concerns raised by the PSEG Companies, PSEG Protest at 9-17, the gas interconnection costs raised by the IMM, IMM Protest at 4-6, and the arguments regarding the 10 percent adder—which Brattle found should only be considered for combustion turbine facilities, not combined-cycle units, VRR Curve Report at 23-24—raised by several parties, e.g., Public Interest Entities' Protest at 34; Joint Protesters' Protest at 2-5; IMM Protest at 10.

[20] Although PJM's proposal would lower Net CONE, PJM's consultant explains that the current Net CONE figure is roughly 2.5 times higher than its estimated Net CONE for a combined-cycle unit. 2018 VRR Curve Report at 55.

a peaking plant that is most reliant on capacity market revenues."[21] But the purpose of the VRR curve is not to ensure that all resource types can compete economically.[22] Instead, the VRR curve should procure enough capacity to meet, and not substantially exceed, PJM's resource adequacy requirements stating that "the curve must be anchored on the price at which investors are willing to add capacity."[23]

11. Rather than adopting PJM's cursory justification for selecting a combustion turbine as the reference resource, I would set these issues for hearing in order to develop a more complete record and permit the Commission to give these matters the careful consideration they demand.

12. I also want to respond to the significant concerns raised about PJM's use of a 3-year historical rolling average for the establishment of the E&AS offset. While PJM's current tariff requires this approach, the record here highlights its significant drawbacks. As the Market Monitor observes, historic revenue is always wrong.[24] This is particularly true during periods, like today, where the industry is undergoing a significant change to the resource mix and market design. Brattle has recommended that PJM explore the use of a forward-looking E&AS offset in each of its studies of the VRR Curve. In the 2018 review, as in past reviews, it concluded that forward-looking estimates of E&AS revenues would yield a VRR curve that meets reliability objectives more effectively than relying on historical estimates.[25] I encourage PJM and its stakeholders to initiate a process to develop a forward-looking methodology for determining E&AS revenue estimates. Utilizing forward curves for power and gas is consistent with project valuation methods used by market participants and allows energy market design changes to be more readily incorporated into the capacity market.

For these reasons, I respectfully dissent.

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Richard Glick

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[21] PJM Transmittal at 13.

[22] *See* Public Interest Entities' Protest at 31 ("What PJM's logic overlooks is that consumers are not obligated to pay prices set high enough to allow competition by a very expensive capacity-only resource when more than adequate capacity resources are available at significantly lower prices.").

[23] 2018 VRR Curve Report at iv.

[24] Monitoring Analytics Initial Protest at 18.

[25] 2018 VRR Curve Report at vi.

Commissioner