169 FERC ¶ 61,049
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

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

PJM Interconnection, L.L.C. Docket Nos. ER19-469-000
ER19-469-001
EL19-100-000

ORDER ON COMPLIANCE FILING, INSTITUTING SECTION 206 PROCEEDING, AND ESTABLISHING PAPER HEARING

(Issued October 17, 2019)

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1. On December 3, 2018, PJM Interconnection, L.L.C. (PJM) submitted proposed revisions to its Open Access Transmission Tariff (Tariff) and Amended and Restated Operating Agreement (Operating Agreement)[1] in compliance with the requirements of Order No. 841,[2] which removes barriers to the participation of electric storage resources in the capacity, energy, and ancillary service markets operated by Regional Transmission Organizations and Independent System Operators (RTO/ISO markets).

2. In this order, we accept PJM's proposed revisions, to become effective December 3, 2019, subject to a further compliance filing, to become effective on a date to be established by PJM, as discussed below. We also institute an investigation pursuant to section 206 of the Federal Power Act (FPA)[3] and establish paper hearing procedures regarding the justness and reasonableness of PJM's minimum run-time rules and procedures.

[1] In Docket No. ER19-462-000, PJM concurrently filed additional proposed Tariff and Operating Agreement revisions to comply with Order No. 841, requesting an effective date of February 3, 2019 (First Compliance Filing). Capitalized terms that are not defined in this order have the meaning specified in the Tariff.

[2] *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, Order No. 841, 162 FERC ¶ 61,127 (2018), *order on reh'g*, Order No. 841-A, 167 FERC ¶ 61,154 (2019).

[3] 16 U.S.C. § 824e (2018).

I. Background

3. In Order No. 841, the Commission adopted reforms to remove barriers to the participation of electric storage resources in RTO/ISO markets.[4] The Commission modified section 35.28 of its regulations[5] to require each RTO/ISO to revise its tariff to establish market rules that, recognizing the physical and operational characteristics of electric storage resources, facilitate their participation in the RTO/ISO markets. The Commission found that Order No. 841 will enhance competition and, in turn, help to ensure that the RTO/ISO markets produce just and reasonable rates, pursuant to the Commission's legal authority under Federal Power Act (FPA) section 206.[6]

4. Order No. 841 requires each RTO/ISO to revise its tariff to establish a participation model for electric storage resources consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, will help facilitate their participation in the RTO/ISO markets.[7] Specifically, for each RTO/ISO, the tariff provisions for the participation model for electric storage resources must: (1) ensure that a resource using the participation model is eligible to provide all capacity, energy, and ancillary services that it is technically capable of providing in the RTO/ISO markets; (2) ensure that a resource using the participation model can be dispatched and can set the wholesale market clearing price as both a wholesale seller and wholesale buyer consistent with existing market rules that govern when a resource can set the wholesale price; (3) account for the physical and operational characteristics of electric storage resources through bidding parameters or other means; and (4) establish a minimum size requirement for participation in the RTO/ISO markets that does not exceed 100 kW. Additionally, each RTO/ISO must specify that the sale of electric energy from the RTO/ISO markets to an electric storage resource that the resource then resells back to those markets must be at the wholesale locational marginal price (LMP).[8]

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[4] Order No. 841, 162 FERC ¶ 61,127 at P 1.

[5] 18 C.F.R. § 35.28 (2019).

[6] 16 U.S.C. § 824e.

[7] Order No. 841, 162 FERC ¶ 61,127 at P 3. In Order No. 841, the Commission referred to a set of tariff provisions that are created for a particular type of resource as a participation model. *Id.*

[8] *Id.* P 4.

II. Compliance Filings

5. PJM submitted two compliance filings in Docket Nos. ER19-462-000 and ER19-469-000 to establish a participation model that facilitates the participation of electric storage resources in the PJM capacity, energy, and ancillary services markets.[9] PJM explains that the First Compliance Filing requested definitional changes to be effective February 3, 2019 to allow PJM to develop and test its metering and accounting practices prior to implementing the Storage Participation Model. On February 1, 2019, the Commission accepted, in Docket No. ER19-462-000, PJM's First Compliance Filing to conform its definitions of Energy Storage Resource and Capacity Storage Resource to the Commission's definition of electric storage resource in Order No. 841.[10]

6. On December 3, 2018, PJM submitted its second Order No. 841 compliance filing, which we address in this order. PJM states that it evaluated each of its available market services to determine whether it needed to make changes to allow Energy Storage Resources to participate effectively.[11] PJM states that it also assessed how Energy Storage Resources should be treated to ensure their eligibility does not result in preferential treatment or undue discrimination. PJM states that, although Energy Storage Resources are currently eligible to provide services in its capacity, energy, and ancillary services markets, the Storage Participation Model explicitly addresses each available product to ensure that Energy Storage Resources are eligible to provide all services that they are technically capable of providing. PJM explains that it did not need to modify all aspects of its markets to implement the proposed Storage Participation Model. PJM states that it also will need to make changes to the PJM Manuals to implement the

[9] PJM proposes to define Energy Storage Resource Participation Model as the participation model accepted by the Commission in the instant docket. Compliance Filing, Tariff, Definitions – E – F. We hereinafter refer to it as the Storage Participation Model.

[10] *PJM Interconnection, L.L.C.*, 166 FERC ¶ 61,087 (2019) (First Compliance Order). PJM defines "Energy Storage Resource" as "a resource capable of receiving electric energy from the grid and storing it for later injection to the grid that participates in the PJM Energy, Capacity and/or Ancillary Services markets as a Market Participant" and defines a "Capacity Storage Resource" as "any Energy Storage Resource that participates in the Reliability Pricing Model or is otherwise treated as capacity in PJM's markets such as through a Fixed Resource Requirement Capacity Plan."

[11] Compliance Filing, Transmittal at 3.

Storage Participation Model through its stakeholder process prior to implementation on December 3, 2019.[12]

7. PJM proposes not to require resources currently operating in its markets under the optimized pumped-hydro participation model to instead utilize the Storage Participation Model. PJM states that such resources that satisfy the criteria for the Storage Participation Model will have the opportunity to select the model in which they would like to participate.[13]

8. PJM seeks an effective date for its compliance filing of December 3, 2019.

9. On April 1, 2019, Commission staff issued a letter informing PJM that additional information was necessary to process its compliance filing (Data Request). On May 1, 2019, PJM submitted a response to the Data Request, which amended its compliance filing (Data Request Response).

10. On October 8, 2019, PJM filed amended Tariff records to change the corresponding effective dates from 12/3/2019 to 12/31/9998 to provide for flexibility.[14]

III. Notice of Filing and Responsive Pleadings

11. Notice of PJM's December 3, 2018 filing was published in the *Federal Register*, 83 Fed. Reg. 63,852 (2018), with interventions and protests due on or before December 24, 2018. On December 14, 2018, the Commission extended the comment period until and including February 7, 2019.[15] Appendix A to this order lists the entities that filed notices of intervention and timely-filed motions to intervene.

12. Appendix B to this order lists the entities that filed protests and comments. Appendix C to this order lists the entities that filed answers.

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[12] *Id.* at 5.

[13] *Id.* at 6.

[14] PJM October 8, 2019 Filing at 2-3.

[15] Notice of Extension of Time, Docket Nos. ER19-460-000, ER19-462-000, ER19-465-000, ER19-467-000, ER19-468-000, ER19-469-000, and ER19-470-000 (December 14, 2018).

13. Notice of PJM's May 1, 2019 Data Request Response was published in the *Federal Register*, 84 Fed. Reg. 20,351 (2019), with interventions and protests due on or before May 22, 2019.

14. Advanced Energy Economy, AWEA and the RTO Council, and PJM's Market Monitor filed comments on PJM's Data Request Response.

15. Notice of PJM's October 8, 2019 filing was published in the *Federal Register*, 84 Fed. Reg. 55,308 (2019), with interventions and protests due on or before October 29, 2019. On October 10, 2019, the Commission shortened the comment period until and including October 11, 2019.[16]

IV. Discussion

A. Procedural Matters

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

17. Pursuant to Rule 214(d) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214(d) (2019), we grant Lockheed Martin's late-filed motion to intervene given its interest in the proceeding, the early stage of the proceeding, and the absence of undue prejudice or delay. The entities that filed protests or comments but did not file motions to intervene are not parties to the proceeding.[17]

18. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.213(a)(2) (2019), prohibits an answer to a protest or an answer unless otherwise ordered by the decisional authority. We accept the answers filed in this proceeding because they have provided information that assisted us in our decision-making process.

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[16] Errata Notice Shortening Comment Period, Docket No. ER19-469-002 (October 10, 2019).

[17] 18 C.F.R. § 385.211(a)(2). SEIA and Tesla filed comments but did not file motions to intervene. As part of Public Interest Organizations' protest, Earthjustice and Sierra Club filed protests but did not file motions to intervene. Although we do not grant party status to these entities, we address their comments and protests in this order.

B. Substantive Matters

19. We find that PJM's compliance filing, with certain modifications, complies with the requirements that the Commission adopted in Order No. 841.[18] Accordingly, we accept PJM's compliance filing to be effective December 3, 2019, subject to a further compliance filing as discussed below. We direct PJM to file the compliance filing within 60 days of the date of issuance of this order.

20. As a preliminary matter, we find that PJM has complied with the following requirements of Order No. 841: (1) ensure that a resource using the participation model for electric storage resources can be dispatched and can set the wholesale market clearing price as both a wholesale seller and wholesale buyer, consistent with rules that govern the conditions under which a resource can set the wholesale price;[19] (2) demonstrate that its market design will not allow for conflicting supply offers and demand bids from the same resource for the same market interval or modify its market rules to prevent conflicting supply offers and demand bids from the same resource for the same market interval;[20] and (3) ensure that resources available for manual dispatch as a wholesale buyer and wholesale seller under the participation model for electric storage resources are held harmless for manual dispatch by being eligible for make-whole payments.[21] PJM's compliance with these requirements is not contested in this proceeding. All remaining compliance requirements and all comments and protests are addressed below.

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[18] Below we do not discuss issues concerning compliance with Order No. 841 regarding the definition of electric storage resource because the Commission accepted PJM's compliance with that part of Order No. 841 in the First Compliance Order.

[19] Order No. 841, 162 FERC ¶ 61,127 at PP 142-150. *See* Compliance Filing, Transmittal at 12-13, 31-32, 36, 51-52 and Attachment A; Data Request Response at 15 – 17. *See also* Tariff, Attachment K-Appendix, §§ 1.7.2, 1.7.2B and Tariff, Attachment K, § 1.4A.

[20] Order No. 841, 162 FERC ¶ 61,127 at PP 162-165. *See* Compliance Filing, Transmittal at 49-50; Data Request Response at 18-19. *See also* Tariff, Attachment K-Appendix, § 1.4A.

[21] Order No. 841, 162 FERC ¶ 61,127 at PP 174-179. *See* Compliance Filing, Transmittal at 53 – 54 (citing Manual 28: Operating Agreement Accounting, §5); Data Request Response at 20-23. *See also* Tariff, Attachment K-Appendix, § 3.2.3.

1. Creation of a Participation Model

a. Participation Model

21. Order No. 841 adds section 35.28(g)(9)(i) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, facilitate their participation in the RTO/ISO markets.[22] Order No. 841 explains that establishing a participation model for electric storage resources does not preclude an RTO/ISO from structuring its markets based on the technical requirements that a resource must meet to provide needed services; it simply requires that each RTO/ISO establish a participation model that ensures eligibility to participate in the RTO/ISO markets in a way that recognizes the physical and operational characteristics of electric storage resources.[23] Order No. 841 requires that resources using the participation model for electric storage resources be compensated for the wholesale services they provide in the same manner as other resources that provide these services.

22. Separate participation models are not necessary for different types of electric storage resources (e.g., slower, faster, or aggregated), and to the extent an RTO/ISO seeks to include in its tariff additional market rules that accommodate electric storage resources with specific physical and operational characteristics, the RTO/ISO may propose such revisions to its tariff through a separate FPA section 205 filing.[24] However, Order No. 841 states that, where an RTO/ISO already has a separate participation model that electric storage resources may use (such as participation models for pumped-hydro resources or demand response), the RTO/ISO is not required to consolidate that participation model with the participation model for electric storage resources required by Order No. 841.[25] To the extent that an RTO/ISO modifies existing participation models to comply with Order No. 841, it must ensure that those resulting participation models are available for all types of electric storage resources and comply with all of the Order No. 841 requirements.

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[22] Order No. 841, 162 FERC ¶ 61,127 at P 51.

[23] *Id.* P 52.

[24] *Id.* P 54 (citing 16 U.S.C. § 824d). In Order No. 841-A, the Commission found that a single participation model can be designed to be flexible enough to accommodate any type of electric storage resource. Order No. 841-A, 167 FERC ¶ 61,154 at P 65.

[25] Order No. 841, 162 FERC ¶ 61,127 at P 55.

23. Lastly, Order No. 841 explains that, while the participation model for electric storage resources should be designed to facilitate the participation of all types of electric storage technologies, the Commission is not requiring all electric storage resources to use that participation model.[26] Under section 35.28(g)(9) of the Commission's regulations, section 35.28(g)(9)(i) applies to resources using the participation model for electric storage resources and section 35.28(g)(9)(ii) applies to all electric storage resources that fall under the definition of electric storage resources. Therefore, electric storage resources that elect not to use the participation model for electric storage resources are still able to pay the wholesale LMP for the electric energy they purchase from the RTO/ISO markets and then resell back to those markets. This issue is discussed further in the Energy Used to Charge Electric Storage Resources section below.

i. Filing

24. PJM explains that Energy Storage Resources are already eligible to and do participate in PJM's capacity, energy, and ancillary services markets.[27] PJM states that, for instance, pumped-hydro resources, which fall within PJM's definition of Energy Storage Resource, are active participants in PJM's markets.[28] However, PJM states that its current eligibility and market rules do not entirely meet the Commission's directive to remove barriers to entry for electric storage resources.[29] PJM asserts that it evaluated and proposes the necessary modifications to the capacity, energy, and ancillary services markets and associated support areas to ensure that its proposed Storage Participation Model recognizes the physical and operational characteristics of Energy Storage Resources and is consistent with all requirements of Order No. 841.

25. PJM asserts that, under the proposed Storage Participation Model, Energy Storage Resources will be eligible to provide all services that they are technically capable of providing in PJM's capacity, energy, and ancillary services markets.[30] PJM further states that Energy Storage Resources using the Storage Participation Model can be dispatched and will be able to set price while discharging and charging.[31] PJM explains that Energy

[26] *Id.* P 56.

[27] Compliance Filing, Transmittal at 7.

[28] *Id.* at 7 n.10.

[29] *Id.* at 7.

[30] *Id.*

[31] *Id.*

Storage Resources will participate in the energy market under three different modes of operation: (1) continuous mode; (2) charge mode; and (3) discharge mode.[32] PJM proposes to account for the physical and operational characteristics of Energy Storage Resources through bidding parameters in PJM Markets Gateway,[33] and explains that Energy Storage Resources will self-manage their State of Charge by updating their bidding parameters and operating mode as needed.[34] PJM explains that resources using the Storage Participation Model are allowed to participate in PJM's markets as a wholesale seller and wholesale buyer.[35] According to PJM, its current 100 kW participation threshold is consistent with the Commission's minimum size threshold requirement.[36] In addition to PJM's proposed tariff revisions, PJM states that it will need to make changes to its manuals to implement the Storage Participation Model and these changes will be developed and vetted through PJM's stakeholder process prior to implementation on December 3, 2019.[37]

26. PJM states that, under its preexisting rules, an Energy Storage Resource utilizing the pumped-hydro optimizer cannot set a negative dispatchable range or set price in the day-ahead or real-time markets.[38] PJM also states that an Energy Storage Resource self-scheduling or utilizing the pumped-hydro optimizer is assumed to have no costs associated with charging or discharging. Thus, in line with the Commission's acknowledgement that RTOs/ISOs are not required to consolidate existing electric storage resource models into those arising from Order No. 841 compliance, PJM states that it is not integrating the pumped-hydro optimizer with its proposed Storage Participation Model.[39] Instead, PJM explains that its proposed Storage Participation

[32] *Id.* at 33-36.

[33] PJM explains that its Markets Gateway is a tool that allows members to submit information and obtain data needed to conduct business in the day-ahead, regulation and synchronized reserve markets. *Id.* at 8 n.12 (citing *Markets Gateway*, PJM Interconnection, L.L.C., https://www.pjm.com/markets-and-operations/etools/markets-gateway.aspx).

[34] *Id.* at 32-33. State of Charge is discussed further in section 4 below.

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

[36] *Id.* at 8.

[37] *Id.* at 5.

[38] *Id.* at 30.

[39] *Id.* at n.84.

Model addresses these shortfalls by accounting for the unique operating characteristics of Energy Storage Resources and allowing them to set price.[40]

ii. Protests/Comments

27. Several commenters raise concerns with the compatibility of PJM's proposed Storage Participation Model and pumped-hydro resources. SEIA argues that the Commission should maximize the use of Energy Storage Resources and should not force them to use outdated participation models based on long-duration pumped-hydro models.[41] Dominion contests PJM's decision to continue to use its existing pumped-hydro optimizer without modifying it to comply with Order No. 841. More precisely, Dominion states that it has long advocated for PJM to make pumped-hydro resources eligible to set LMP when they are dispatchable in real-time because doing so would improve price transparency and market efficiency.[42] Dominion explains that pumped-hydro resources utilizing PJM's pumped-hydro optimizer are limited to self-scheduling as non-dispatchable resources in real-time and are unable to submit their dispatch costs in the form of real-time offers, and thus unable to set energy prices.[43] Dominion states that restricting pumped-hydro resources to self-scheduling in real-time results in detrimental market effects, such as the application of operating reserve deviation charges.[44]

28. While Dominion acknowledges that the Commission did not require RTOs/ISOs to extend the ability to set price to existing electric storage resource participation models, Dominion argues that the design of PJM's proposed Storage Participation Model is "largely incompatible" with pumped-hydro resources, and expresses concern that the market benefits associated with the Storage Participation Model may not be fully realized with respect to pumped-hydro resources.[45] Specifically, Dominion explains that PJM's proposed Storage Participation Model fails to consider a resource's economic minimum, start-up costs, and the binary nature of pump-mode for non-variable speed pumps.[46]

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[40] *Id.* at 30-31.

[41] SEIA Comments at 4-5.

[42] Dominion Comments at 3-4.

[43] *Id.* at 4.

[44] *Id.* at 5.

[45] *Id.* at 3.

[46] *Id.* at 4.

Additionally, Dominion asserts that there are size considerations in the case of large pumped-hydro resources that require notification to PJM prior to the startup or shutdown of a generator or pump.

29. Voith Hydro urges the Commission and the RTOs/ISOs to account for the technical capability of pumped-hydro resources in providing a number of services in the RTO/ISO markets. Voith Hydro states, for example, pumped-hydro resources have the ability to: (1) provide reliable, long duration generation capacity; (2) deliver energy from all sources (e.g., pumped-hydro resources can store excess energy generated by nuclear plants during off-peak hours and then release the energy back to the grid during peak hours); (3) provide spinning and non-spinning reserves; (4) provide black start capabilities; and (5) set the wholesale market clearing price.[47]

30. Energy Storage Association, NextEra, and Union of Concerned Scientists assert that PJM's filing does not address the ways in which Order No. 841 compliance impacts the market participation of hybrid resources, i.e., Energy Storage Resources co-located at the same point of interconnection with generation.[48] Union of Concerned Scientists states that there is no participation model available for hybrid resources and a growing number of hybrid resources in PJM's interconnection queue, and that the lack of clarity on market participation for hybrid generation resources is a barrier to participating in PJM's markets.[49] Union of Concerned Scientists adds that some of the barriers for hybrid resources are analogous to those that have been addressed for combined cycle plants or coal plants that have discontinuous operating modes and output ranges.[50] Union of Concerned Scientists notes that PJM has previously promoted hybrid resources as a means to meet the obligations of the new Capacity Performance construct.[51] However, Union of Concerned Scientists asserts that PJM has failed to provide the means for a project proponent to interconnect, register, and operate a hybrid resource in the capacity market as a single asset because the storage portion of a hybrid resource is required to

[47] Voith Hydro Comments at 2-7.

[48] *See* Energy Storage Association Comments at 16; NextEra Comments at 6-7; Union of Concerned Scientists Comments at 6.

[49] Union of Concerned Scientists Comments at 8-9.

[50] *Id.* at 11.

[51] *Id.* at 14. Capacity Performance is a capacity product that is used to ensure that PJM's capacity market provides adequate incentives for resource performance.

provide a unique interconnection request, interconnection agreement, and asset registration.[52]

31. Energy Storage Association similarly states that questions remain as to under which category hybrid resources could register; how they are parameterized in market software; their capacity value; how they interconnect; and other issues.[53] Given the lack of clarity on these issues, Energy Storage Association recommends the Commission open a new docket to address this matter, which will ensure that RTO/ISO tariffs keep pace with technological innovation that aims to reduce costs and increase competition in wholesale markets.[54]

iii. Answer

32. PJM states that several commenters identified and requested clarification on ancillary and other implementation details not specifically addressed in either Order No. 841 or its proposal.[55] PJM argues these details are best addressed through the stakeholder process and, to the extent they are beyond the scope of Order No. 841, through separate FPA section 205 filings outside the compliance process.

33. With respect to commenters' concerns that PJM's proposal does not address "hybrid resources," such as Energy Storage Resources co-located with natural gas-fired or renewable resources,[56] PJM states that the Commission does not utilize the term "hybrid" anywhere in Order No. 841, and that the Storage Participation Model outlined in PJM's proposal will be available to any Energy Storage Resource, regardless of whether or not it is co-located with another resource type.[57] PJM states that it is currently working both internally and with stakeholders to better clarify and define rules for hybrid resources to participate in PJM's capacity, energy, and ancillary services markets.[58]

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[52] Union of Concerned Scientists Comments at 16-17.

[53] Energy Storage Association Comments at 16.

[54] *Id.* at 2, 16.

[55] PJM March 5, 2019 Answer at 28.

[56] *Id.* at 30 (citing Energy Storage Association Comments at 16, Union of Concerned Scientists Comments at 14-15).

[57] *Id.* at 30-31.

[58] *Id.* at 31.

iv. Data Request Response

34. PJM states that, as applied to pumped-hydro resources, its proposed Storage Participation Model meets each of the requirements identified in the Commission's regulations.[59] PJM states that all Energy Storage Resources, including pumped-hydro resources, may elect to participate in its Storage Participation Model, and are eligible to set price and be dispatchable.[60] PJM states that its Storage Participation Model accounts for the physical and operational characteristics of pumped-hydro resources because: (1) it includes separate charge and discharge modes to accommodate resources that cannot transition seamlessly between charging and discharging, and (2) charge and discharge modes do not require an instantaneous ramp rate.

v. Commission Determination

35. We find that PJM's proposed tariff revisions partially comply with the requirement of Order No. 841 to create a participation model for electric storage resources that ensures the eligibility of such resources to participate in PJM's markets in a way that recognizes their physical and operational characteristics. Specifically, we accept PJM's proposal to allow Energy Storage Resources to be dispatched and to participate under three different modes of operation: (1) continuous mode; (2) charge mode; and (3) discharge mode. We find that this proposal will allow resources using the Storage Participation Model to be compensated for the wholesale services that they provide in the same manner as other resources that provide these services.

36. However, we find that PJM has failed to sufficiently specify the Storage Participation Model in its Tariff because its proposed Tariff language does not include the model's three modes of operation described in its filing and data request response. As explained above, Order No. 841 requires that each RTO/ISO have tariff provisions providing a participation model for electric storage resources consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, facilitate their participation in the RTO/ISO markets.[61] We find that the three modes of operation PJM proposes are fundamental components of PJM's Storage Participation Model, which significantly affect rates, terms, and conditions of service,[62] and therefore, are market rules that must be specified in PJM's tariff, as required by Order No. 841.

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[59] Data Request Response at 2-3.

[60] *Id.* at 3.

[61] Order No. 841, 162 FERC ¶ 61,127 at P 51.

[62] *See Energy Storage Ass'n v. PJM Interconnection, L.L.C.*, 162 FERC ¶ 61,296, at P 103 (2018) (*ESA v. PJM*).

Thus, we direct PJM to file, within 60 days of the date of issuance of this order, a further compliance filing proposing language describing the three modes of Energy Storage Resource participation in the energy market (i.e., continuous, charge, discharge) in PJM's Tariff.

37. Regarding the treatment of pumped-hydro resources, PJM has demonstrated that its proposed Storage Participation Model is available to all electric storage technologies, including pumped-hydro resources, and thus PJM's proposed model complies with Order No. 841. Further, PJM's Storage Participation Model allows all resources that are technically capable of simultaneously participating as supply and demand to do so. We note that PJM's existing pumped-hydro optimizer will continue to be available to pumped-hydro resources, and that these resources may choose to participate in PJM's markets using either the pumped-hydro optimizer or the Storage Participation Model. However, as PJM's existing pumped-hydro optimizer is not a part of PJM's proposal to comply with Order No. 841, and thus is outside the scope of this compliance proceeding, we will not address whether it complies with the requirements of Order No. 841.[63]

38. In response to Dominion, we note that Order No. 841 does not require RTOs/ISOs to consider a resource's economic minimum, start-up costs, or the binary nature of pump-mode for non-variable speed pumps. As discussed below under the section concerning Relationship Between Electric Storage Participation Model and Existing Market Rules, we find that PJM allows Energy Storage Resources to include relevant costs, including opportunity costs, in their energy market offers and bids, similar to other market participants, when appropriate. Therefore, while PJM's proposed model does not specify start-up or related commitment costs for these resources, we find that its proposed treatment of Energy Storage Resources is consistent with how it treats other generators with respect to allowable cost recovery.

39. We find commenters' concerns that PJM's Storage Participation Model does not fully recognize the physical and operational characteristics of co-located resources beyond the scope of compliance with Order No. 841. We note that in Order No. 841, the Commission did not address co-location of electric storage resources with other resources. As PJM explains, its proposed Storage Participation Model will be available to any Energy Storage Resource, regardless of whether or not it is co-located with another resource type.

[63] Order No. 841, 162 FERC ¶ 61,127 at P 55.

b. Qualification Criteria for the Participation Model

40. To ensure that the electric storage resource participation model will accommodate both existing and future technologies, and to implement the new requirement in section 35.28(g)(9)(i) of the Commission's regulations, Order No. 841 requires each RTO/ISO to define in its tariff the criteria that a resource must meet to use the participation model (i.e., qualification criteria).[64] These criteria must: (1) be based on the physical and operational characteristics of electric storage resources, such as their ability to both receive and inject electric energy; (2) not limit participation under the electric storage resource participation model to any particular type of electric storage resource or other technology; and (3) ensure that the RTO/ISO is able to dispatch a resource in a way that recognizes its physical and operational characteristics and optimizes its benefits to the RTO/ISO.

41. Order No. 841 provides each RTO/ISO with flexibility to propose qualification criteria that best suit its participation model for electric storage resources.[65] However, the qualification criteria should not create barriers to the participation of any electric storage resource in the RTO/ISO markets and should be inclusive of, at a minimum, those resources set forth under the definition of electric storage resources in Order No. 841.[66]

i. Filing

42. PJM states that its proposed qualification criteria are based on the ability of Energy Storage Resources to both receive and inject energy and allow any resource satisfying the definitions of Energy Storage Resource and/or Capacity Storage Resource to participate in the Storage Participation Model.[67] PJM states that, currently, an Energy Storage Resource may participate in PJM's markets only as a market seller, and that such resource's ability to both buy and sell at wholesale render them distinct from market buyers under the current Tariff rules.[68] Therefore, PJM proposes to expand its current

[64] Order No. 841, 162 FERC ¶ 61,127 at P 61.

[65] *Id.* P 63.

[66] *Id.*

[67] Compliance Filing, Transmittal at 16.

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

market rules to allow Energy Storage Resources to both buy and sell at wholesale and to adopt new rules regarding purchases and sales unique to Energy Storage Resources.[69]

43. PJM proposes to modify its tariff to allow Energy Storage Resources to purchase energy directly from PJM.[70] PJM states that the proposed revisions remove barriers to entry for Energy Storage Resources by eliminating the requirement that only "market buyers" can purchase energy. PJM explains that market buyers are subject to certain qualification criteria (such as obtaining transmission service) that may be inconsistent with the unique characteristics of Energy Storage Resources. Therefore, PJM proposes revisions to allow Energy Storage Resources to purchase from PJM without triggering all market buyer responsibilities as would be the case if PJM were to simply define them as market buyers.[71]

44. To ensure that an Energy Storage Resource can only purchase energy from PJM if it is a sale for resale in interstate commerce, PJM proposes to limit Energy Storage Resource purchases to purchases of energy that are stored for later resale to PJM.[72] PJM also proposes a new defined term, "Direct Charging Energy," to refer to energy that is purchased from PJM markets, stored, and returned to PJM's markets or lost to conversion inefficiencies.[73] To provide additional clarity regarding the criteria for purchases and sales under the Storage Participation Model, PJM proposes to define an Energy Storage Resource Model Participant (Storage Model Participant) as an Energy Storage Resource utilizing the Storage Participation Model.[74]

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[69] *Id.* at 13.

[70] *Id.* (citing proposed Tariff, Attachment K-Appendix, §§ 1.7.2, 1.7.2B).

[71] *Id.* at 13.

[72] *Id.* at 14 (citing proposed Tariff, Attachment K-Appendix, § 1.4A.1(a)).

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

[74] *Id.* at 15; proposed Tariff, Definitions – E – F.

45. PJM further proposes to set forth specific criteria for wholesale energy market purchases by Energy Storage Resources utilizing the Storage Participation Model.[75] These criteria are modeled after the purchasing limitations and transmission service requirements for market buyers.[76]

ii. Data Request Response

46. PJM submitted several revised tariff records to provide additional clarity in response to Commission staff's questions regarding the ability of an Energy Storage Resource to set prices in PJM's markets as either a wholesale seller or a wholesale buyer. Relevant here, PJM revised its proposed section 1.4A.1 (Qualification) to Schedule 1 of PJM's Operating Agreement, which specifies the qualification criteria for the Storage Participation Model.[77] The revisions include an option for Energy Storage Resources to opt into and out of the Storage Participation Model on an annual basis. The revisions specify that Storage Model Participants will be eligible to be dispatched for positive and negative megawatts (MW), to set price at positive and negative MW points on their offer curve, and to self-schedule positive and negative MW quantities, pursuant to the requirements of the PJM Manuals. The revisions require Energy Storage Resources in continuous mode to specify a single energy offer curve with monotonically increasing dollar values including both positive and negative MW quantities and require all Storage Model Participants to be responsible for their own State of Charge management. The revisions further specify that Storage Model Participants may offer quantities (including charging and discharging) equivalent to 0.1 MW or greater into all applicable PJM markets.[78]

iii. Commission Determination

47. We find that PJM complies with the requirement in Order No. 841 to define in its tariff the criteria that a resource must meet to use the Storage Participation Model (i.e., qualification criteria). We find that PJM's qualification criteria are based on the physical and operational characteristics of electric storage resources because they are based on the ability of such resources to both receive and inject electric energy and allow any resource satisfying the Energy Storage Resource definition to participate in the Storage Participation Model. We therefore find that PJM's qualification criteria are inclusive of

[75] Compliance Filing, Transmittal at 15 (citing proposed Tariff, Attachment K-Appendix, § 1.4A.1(b)).

[76] *Id.* (citing Tariff, Attachment K-Appendix, § 1.4).

[77] Data Request Response, Attachment A at 14.

[78] *Id.* at 15-16; proposed Tariff, Attachment K-Appendix, § 1.4A.1.

those resources set forth under the Commission's definition of an electric storage resource and do not limit participation under the Storage Participation Model to any particular type of electric storage resource or other technology. We also find that PJM's qualification criteria ensure that PJM is able to dispatch a Storage Model Participant in a way that recognizes its physical and operational characteristics and optimizes its benefits to PJM.

c. Relationship between Electric Storage Participation Model and Existing Market Rules

48. To provide certainty to resources using the electric storage resource participation model about the market rules that will govern their participation in each RTO/ISO market, and to implement the new requirement in section 35.28(g)(9)(i) of the Commission's regulations, Order No. 841 requires each RTO/ISO to propose any necessary additions or modifications to its existing tariff provisions to specify: (1) whether resources that qualify to use the participation model will participate in the RTO/ISO markets through existing or new market participation agreements; and (2) whether particular existing market rules apply to resources participating under the electric storage resource participation model.[79] Order No. 841 allows the use of one or more existing market participation agreements so long as the agreement(s) complies(y) with the terms of Order No. 841.[80]

i. Filing

49. PJM states that it was not necessary to modify some aspects of its market rules in order to implement the proposed Storage Participation Model, including the capacity must-offer requirement; determination of capacity value; the day-ahead market must-offer requirement; determining performance under Capacity Performance rules; providing a "non-energy" resource option in the frequency regulation market; rules governing reactive supply and reactive service; requirements for black start service; real-time telemetry requirements; and rules governing sales at LMP.[81] PJM further states, as noted above, that it will not require resources currently operating in its capacity, energy, and/or ancillary services markets utilizing PJM's pumped-hydro optimizer to instead utilize the Storage Participation Model.[82] PJM explains that such resources that satisfy the criteria

[79] Order No. 841, 162 FERC ¶ 61,127 at P 68.

[80] *Id.* P 69.

[81] Compliance Filing, Transmittal at 3-4.

[82] *Id.* at 6.

for the Storage Participation Model can select the model in which they would like to participate annually.[83]

50. PJM states that, with respect to existing rules, its current interconnection process supports the interconnection of Energy Storage Resources to participate in PJM's capacity, energy, and ancillary services markets, and therefore, PJM does not propose any revisions to the Tariff or Operating Agreement to facilitate interconnection for resources utilizing the Storage Participation Model.[84] PJM states that, whether interconnected at the transmission or distribution level or behind a customer meter, PJM treats Energy Storage Resources in the same manner it treats all other resources requesting to interconnect to participate in PJM's capacity, energy, and/or ancillary services markets.[85]

51. Specifically, PJM states that, as with all other generation interconnection customers seeking to interconnect, Energy Storage Resources will be required to provide information such as one-line diagrams, operating configurations, and operating parameters.[86] PJM states that, consistent with current practice, it will perform the appropriate studies for Energy Storage Resources based on their maximum facility output and requested Capacity Interconnection Rights.[87] PJM explains that, upon completion of the relevant studies, the Energy Storage Resource connecting at the transmission level or at a distribution point where a prior jurisdictional sale has occurred will execute an Interconnection Service Agreement.[88] Energy Storage Resources interconnecting at the

[83] *Id.* at 6, 18.

[84] *Id.* at 9-11 (citing Tariff, Parts IV (Interconnections with the Transmission System) & VI (Administration and Study of New Service Requests; Rights Associated with Customer – Funded Upgrades)).

[85] *Id.* at 9.

[86] *Id.* at 9-10 (citing Tariff, § 36.1.01).

[87] *Id.* at 10 (citing Tariff, §§ 36, 110). Capacity Interconnection Rights are the rights to participate as a Generation Capacity Resource and inject energy into the Transmission System and the Point of Interconnection where the generation interconnection facilities connect to the Transmission System. *Id.* (citing Tariff, § 1, Definitions – C-D).

[88] *Id.* (citing Tariff, § 110.5).

distribution level where no prior Commission-jurisdictional interconnection has occurred will execute a Wholesale Market Participation Agreement.[89]

52. PJM states that it does not need to modify the current requirements for quantifying Capacity Interconnection Rights.[90] PJM states that Energy Storage Resources entering the new services queue may request Capacity Interconnection Rights in the lesser of the amount of power discharge (in units of MW) that can be sustained for 10 continuous hours, or the size of the generator hardware.[91] PJM states that this requirement aligns with the treatment of Energy Storage Resources currently operating in PJM today (e.g., pumped-hydro facilities).[92]

53. PJM also proposes to continue to apply the same offer development rules under the Storage Participation Model that it currently applies to all generation resources submitting cost-based offers.[93] PJM states that all dispatchable resources participating in the energy markets are required to provide a cost-based offer to be eligible for economic dispatch. However, PJM states that, in order to specify the components of cost-based offers for Energy Storage Resources, it proposes to modify its Operating Agreement to clarify that their cost-based offers may include charging costs.[94] PJM also proposes to modify its Operating Agreement to clarify that the fuel costs of Energy Storage Resources shall include costs to charge for later injection onto the grid.[95] PJM recognizes that Energy Storage Resources should be able to document their incremental costs to provide energy and plans to engage stakeholders and PJM's Market Monitor to develop revisions to PJM Manual 15 (Cost Development Guidelines) to identify allowable costs

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[89] *Id.* (citing *PJM Manual 14A: New Services Request Process*, PJM Interconnection, L.L.C., § 5.7 (rev. 24, July 26, 2018), https://pjm.com/-/media/documents/manuals/m14a.ashx).

[90] *Id.* (citing Tariff, § 230).

[91] *Id.* at 10-11 (citing *PJM Manual 21: Rules and Procedures for Determination of Generating Capability*, PJM Interconnection, L.L.C., § 2.1(13) (rev. 12, Jan. 1, 2017), https://pjm.com/-/media/documents/manuals/m21.ashx).

[92] *Id.* at 11.

[93] *Id.* at 51.

[94] *Id.*; Compliance Filing, Operating Agreement, Schedule 2, § 1.1.

[95] Compliance Filing, Transmittal at 51-52; Compliance Filing, Operating Agreement, Schedule 2, § 2.5.

to be included in cost-based offers prior to the December 3, 2019 implementation date.[96] PJM explains that it will not permit Energy Storage Resources to submit Start-Up Costs and No-Load Costs because the resource owner will control commitment decisions through management of its State of Charge.

ii. Protests/Comments

54. Public Interest Organizations express concern that PJM's interconnection process could be a barrier to market access for Energy Storage Resources.[97] Public Interest Organizations state that PJM's proposal requires Energy Storage Resources located on a distribution system or behind the meter to go through the wholesale interconnection process prior to market participation, even if they are properly interconnected under their distribution authority. Public Interest Organizations add that, even if these resources are rejected by PJM's interconnection studies, they remain able to inject and withdraw power under their distribution tariffs, which renders PJM's studies moot for transmission impact purposes. Public Interest Organizations also argue that the fact that PJM does not require studies for distributed or behind-the-meter resources connected under net metering tariffs results in discriminatory treatment of resources that are physically identically situated based purely on their desired market participation.[98]

55. FirstEnergy Utilities/Dayton P&L/EKPC request that the Commission require that PJM ensure that an Energy Storage Resource interconnected at the distribution level has satisfied all electric distribution utility interconnection, operational, and metering requirements before allowing it to participate in PJM's wholesale markets.[99] FirstEnergy Utilities/Dayton P&L/EKPC request that the Commission direct PJM to defer to electric distribution utilities, in consultation with affected state commissions, on implementation and coordination issues at the electric distribution level. They argue that the electric distribution utilities, not PJM, should take the lead on implementing PJM's proposal for Energy Storage Resources that are interconnected at the distribution level. They assert that PJM's proposal fails to designate either a direct or indirect role for distribution utilities and state commissions in its implementation and does not acknowledge that distribution utilities and state commissions will need to revise and/or develop processes and standards to reliably and safely integrate large-scale Energy Storage Resources onto

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[96] Compliance Filing, Transmittal at 52.

[97] Public Interest Organizations Comments at 23.

[98] *Id.* at 23-24.

[99] FirstEnergy Utilities/Dayton P&L/EKPC Comments at 3.

the distribution system.[100] They contend that distribution utilities will need to work with affected state commissions to implement revised interconnection processes, including revised interconnection standards and technical requirements for Energy Storage Resources; develop or revise methodologies to study their potential impact on the distribution system; and establish processes, rates, and tariffs regarding cost allocation for upgrades or reinforcements to the distribution system that are required to maintain reliability and safety due to the interconnection of an Energy Storage Resource.[101]

56. FirstEnergy Utilities/Dayton P&L/EKPC further state that any necessary upgrades or reinforcements to the distribution system must be completed and paid for by an Energy Storage Resource before its interconnection can be finalized.[102] They assert that state commissions will need to hold proceedings to update or establish retail tariffs providing for interconnection fees and charges for Energy Storage Resources that desire to interconnect with and utilize the distribution system.[103] They request that the Commission consider, once appropriate retail tariffs are in place, whether to roll out PJM's proposal on a pilot basis while addressing overarching issues and developing "lessons learned" that can be applied during a wider rollout.[104]

57. FirstEnergy Utilities/Dayton P&L/EKPC also request that, to avoid disrupting the "cooperative federalism" that has existed between the Commission and the states, the Commission clarify that deployment of Energy Storage Resources on local distribution facilities must be subordinate to and not impinge on the operation and use of those facilities to provide service to retail customers.[105] They further request that the Commission clarify that, while Energy Storage Resources may procure transmission service over local distribution facilities, the procurer of such service is subject to paying any and all incremental costs that are or may be required in order to provide such service.[106] They state that, if Energy Storage Resources desire to procure "firm" transmission service over local distribution facilities, the Commission should affirm that such resources pay the costs

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

[101] *Id.* at 6-10.

[102] *Id.* at 9.

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

[104] *Id.* at 3.

[105] *Id.* at 12.

[106] *Id.* at 13.

to "enlarge" the local distribution facilities to accommodate such service, and in the event that these resources are not willing to pay for "firm" service, then they must be prepared for interruptions as needed by the distribution utility to deliver adequate and reliable retail service to end-use customers.

58. The New Jersey Commission points out that PJM's proposal would retain all existing interconnection procedures for Energy Storage Resources, including that distribution points where prior Commission-jurisdictional sales have occurred require an Interconnection Service Agreement, placing that interconnection request under the jurisdiction of PJM's Tariff.[107] The New Jersey Commission thus seeks to confirm the jurisdiction over the distribution lines interconnecting Energy Storage Resources after a wholesale sale has occurred.[108] The New Jersey Commission is concerned that, over time, much of the distribution system may be relinquished to PJM-jurisdictional interconnection procedures and that the effect could erode the protections envisioned by the Commission and contravene Order No. 841.[109] It therefore encourages the Commission to contemplate alternate methods for defining jurisdiction, rather than applying rigid methods, and to continue monitoring the jurisdictional issues as the Energy Storage Resource market reaches maturity.[110] Alternatively, the New Jersey Commission asks the Commission to place additional requirements on the coordination between wholesale market providers and distribution companies. Specifically, it argues that any Energy Storage Resource that chooses to participate in the wholesale markets should be required to receive an affirmation from the electric distribution company that such participation will not cause any issues on the distribution system and such affirmation should be state-jurisdictional.[111]

59. Advanced Energy Economy contends that, although PJM's Cost Development Guidelines allow the inclusion of opportunity costs in cost-based offers, PJM did not address how Energy Storage Resources would calculate their opportunity costs for cost-

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[107] New Jersey Commission Comments at 5 (citing Compliance Filing at section II.C, 10 n.19).

[108] *Id.* at 5.

[109] *Id.* (citing Order No. 841, 162 FERC ¶ 61,127 at P 33 ("the definition of an electric storage resource excludes a resource that is either (1) physically incapable of injecting electric energy back onto the grid due to its design or configuration or (2) contractually barred from injecting electric energy back onto the grid")).

[110] *Id.* at 6.

[111] *Id.* at 6-7.

based offers in its compliance filing.[112] Advanced Energy Economy asserts that calculation of an Energy Storage Resource's opportunity cost is a key component of its reference level, and proposes that accurate calculation of opportunity costs for Energy Storage Resources co-located with load should include foregone avoided retail bills associated with demand charge management.[113] Advanced Energy Economy states that PJM's current opportunity cost calculation, based on forecasted energy prices, may not accurately calculate an Energy Storage Resource's opportunity costs.[114] Advanced Energy Economy asserts that, while opportunity costs not defined in the Operating Agreement may be submitted to PJM and PJM's Market Monitor for approval pursuant to the Cost Methodology and Approval Process, such a process may be time consuming and the outcome is uncertain. Thus, Advanced Energy Economy requests the Commission direct PJM and PJM's Market Monitor to provide further clarity regarding inclusion of Energy Storage Resources' opportunity costs in cost-based energy offers over shorter time horizons and demand charge management.[115]

iii. Answers

60. PJM argues that, contrary to certain comments and protests, its current interconnection process is sufficient to accommodate all Energy Storage Resources seeking to participate in PJM's capacity, energy, and/or ancillary services markets.[116] PJM states that it treats them in the same manner as it treats all other resources requesting to interconnect, regardless of whether the resource is interconnected at the transmission level, distribution level, or behind a customer meter.[117] PJM states that, consistent with current practice, any behind-the-meter generation wishing to transact in PJM's energy markets may enter PJM's New Services Queue and complete the requisite study process in the same manner as all Generation Interconnection Customers.[118] PJM states that such

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[112] Advanced Energy Economy Comments at 9.

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

[114] *Id.* at 9.

[115] *Id.* at 10.

[116] PJM March 5, 2019 Answer at 26-27 (citing FirstEnergy Utilities/Dayton P&L/EKPC Comments at 4).

[117] *Id.* at 27.

[118] *Id.* at 28 (citing PJM Manual 14A, § 5.7). PJM Manual 14A classifies parties seeking to do the following as Generation Interconnection Customers: 1) interconnect a new generation facility to PJM's transmission system, 2) increase the capacity of an

a resource sells any "net excess" energy to PJM; i.e., any Energy Storage Resource discharging is first used to reduce on-site load, and only unused surplus power is injected onto the grid and sold at wholesale to PJM markets.[119]

61. FirstEnergy Utilities/Dayton P&L/EKPC filed an answer to PJM's answer asserting that PJM mischaracterizes their comments and conflates issues regarding distribution system operations and jurisdiction with the sufficiency of PJM's interconnection process.[120] According to FirstEnergy Utilities/Dayton P&L/EKPC, PJM's answer provides incomplete information when it claims "[Energy Storage Resources] connecting at the local distribution level where no prior Commission-jurisdictional interconnection has occurred will execute a Wholesale Market Participation Agreement."[121] They state that an interconnection under these circumstances falls under state jurisdiction and the resource must go through the state-regulated interconnection process.[122] They further state that PJM's answer fails to acknowledge that, although the interconnection process is conducted by PJM when there is a prior wholesale interconnection on a distribution line, the interconnection is studied and completed in accordance with standards and requirements established by the distribution utility.[123]

62. FirstEnergy Utilities/Dayton P&L/EKPC also claim that PJM's answer did not refute or address their concern that the large-scale integration of Energy Storage Resources interconnected at the distribution level with two-directional power flow could impact the ability of distribution utilities to fulfill their mandates under state law to provide reliable and safe retail electric service.[124]

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existing generation facility, 3) alter the fuel type of an existing facility or interconnection request, or 4) interconnect a generating unit to distribution facilities in the PJM footprint making wholesale sales using the output of the generating unit. PJM Manual 14A, §1.3, https://pjm.com/~/media/documents/manuals/m14a.ashx.

[119] PJM March 5, 2019 Answer at 28.

[120] FirstEnergy Utilities/Dayton P&L/EKPC Answer at 2.

[121] *Id.* at 4 (citing PJM March 5, 2019 Answer at 27).

[122] *Id.* at 4.

[123] *Id.* at 5.

[124] *Id.* at 6-7.

63. In response to Advanced Energy Economy's argument that PJM has not explained how Energy Storage Resources will be able to calculate opportunity costs in their cost-based offers, particularly opportunity costs associated with demand charge management, PJM states that it is working with stakeholders through special sessions of its Markets Implementation Committee to identify and account for allowable opportunity costs in Energy Storage Resources' cost-based offers.[125] PJM states that, consistent with the representations made in its proposal, this stakeholder process is intended to modify PJM Manual 15 (Cost Development Guidelines) prior to the December 3, 2019 Order No. 841 implementation date.[126]

iv. Data Request Response

64. In response to a question from Commission staff regarding make-whole payments, PJM explains that, in order to account for unforeseen possibilities for lost opportunity costs for specific Energy Storage Resources, especially with respect to manual curtailments of Energy Storage Resource charging, PJM proposes to add a new subsection to its Tariff, Attachment K-Appendix.[127] PJM's proposed new section provides that if an Energy Storage Resource using the Storage Participation Model believes that it is not accurately compensated for opportunity costs associated with following PJM manual dispatch instructions due to a transmission constraint or other reliability issue, then the Energy Storage Resource can receive a modified amount of opportunity cost compensation if it is mutually accepted by the resource, PJM and PJM's Market Monitor.[128]

v. Commission Determination

65. We find that PJM complies with the requirement of Order No. 841 to modify its Tariff to specify: (1) whether resources that qualify to use the participation model will participate in the RTO/ISO markets through existing or new market participation agreements and (2) whether particular existing market rules apply to resources participating under the Storage Participation Model. As PJM states, it is not necessary for PJM to modify all aspects of its market rules in order to implement the proposed Storage Participation Model. The market rules that do not need to be modified include the capacity must-offer requirement; determination of capacity value; the day-ahead

[125] PJM March 5, 2019 Answer at 31.

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

[127] PJM Data Request Response at 23; Tariff, Attachment K-Appendix, § 3.2.3.

[128] PJM Data Request Response at 23.

market must-offer requirement; determining performance under Capacity Performance rules; providing a "non-energy" resource option in the frequency regulation market; rules governing reactive supply and reactive service; requirements for black start service; real-time telemetry requirements; and rules governing sales at LMP.

66. As to commenters' concerns about PJM's existing interconnection process, we find these concerns to be outside the scope of compliance with Order No. 841, which does not reform or address any procedures pertaining to the interconnection of resources to transmission or distribution facilities.[129] As the Commission acknowledged in Order No. 841-A, states have jurisdiction over the interconnections of certain resources to the distribution system and the requirements reasonably related to those interconnections.[130] We reiterate that nothing in Order No. 841 preempts the states' right to regulate the safety and reliability of the distribution system and that all Energy Storage Resources must comply with any applicable interconnection and operating requirements.[131] We find that PJM complies with Order No. 841 by appropriately specifying that it will apply existing rules governing its interconnection process to resources participating under the Storage Participation Model.

67. In response to Advanced Energy Economy, we find that electric storage resources participating in RTO/ISO markets under the Storage Participation Model should be able to reflect relevant opportunity costs in their energy market offers and bids, similar to other market participants, when appropriate. For example, for electric storage resources to effectively self-manage their State of Charge, RTOs'/ISOs' electric storage resource participation models may need to allow electric storage resources to account for opportunity costs associated with services provided to another entity outside the RTO/ISO markets.[132] We note that determining whether a resource should be allowed to reflect opportunity costs and how such opportunity costs may be calculated can be complex and case specific. We find that PJM's proposal to apply its existing market rules, with certain clarifications, is appropriate because PJM has an existing process that allows market participants to seek revisions to reference levels to account for appropriate

[129] *See* Order No. 841-A, 167 FERC ¶ 61,154 at P 49.

[130] *Id.* P 42.

[131] *Id.* P 46.

[132] *See* Order No. 841, 162 FERC ¶ 61,127 at PP 251, 256-257. Order No. 841 recognizes that some RTOs/ISOs facilitate the participation of electric storage resources in the capacity market by relying on opportunity costs in incremental energy offer reference levels. Order No. 841 requires each RTO/ISO to demonstrate how such rules are applicable to resources using the participation model. *Id.* P 101.

opportunity costs in consultation with PJM and PJM's Market Monitor.[133] We further note PJM's intention to modify its cost development guidelines in its manuals to account for allowable opportunity costs in cost-based offers prior to the December 3, 2019 implementation date.

2. Eligibility of Electric Storage Resources to Participate in the RTO/ISO Markets

a. Eligibility to Provide all Capacity, Energy, and Ancillary Services

68. Order No. 841 adds section 35.28(g)(9)(i)(A) to the Commission's regulations to require that each RTO/ISO have tariff provisions allowing a resource using the participation model for electric storage resources to be eligible to provide all capacity, energy, and ancillary services that it is technically capable of providing, including services that the RTOs/ISOs do not procure through an organized market, such as blackstart, primary frequency response, and reactive power services.[134] Where an RTO/ISO has developed a standard set of technical requirements that all resources must meet to provide a given service, such requirements would also apply to a resource using the electric storage resource participation model if it wants to provide that service.[135]

69. A resource is "technically capable" of providing a service if the resource can meet all of the technical, operational, and/or performance requirements that are necessary to reliably provide that service, such as minimum run times to provide energy, or the ability to respond to automatic generation control to provide frequency regulation.[136] In Order No. 841, the Commission noted that it is not considering in this proceeding the requirements that determine whether resources are technically capable of providing individual wholesale services. To the extent that an RTO/ISO seeks to revise its tariff provisions setting forth the technical requirements for providing any specific wholesale service, the Commission stated that the RTO/ISO may propose such revisions to its tariff

[133] According to PJM's Cost Development Guidelines, opportunity costs not defined in the Operating Agreement may be submitted to PJM and PJM's Market Monitor for approval pursuant to the Cost Methodology and Approval Process. Manual 15, § 12.1.

[134] Order No. 841, 162 FERC ¶ 61,127 at PP 76, 80.

[135] *Id.* P 77.

[136] *Id.* P 78.

through a separate FPA section 205 filing.[137] The Commission further stated that each individual electric storage resource must still meet the technical requirements of providing any specific service, which would be determined by the RTO/ISO on a case-by-case basis.[138] In Order No. 841, the Commission encouraged each RTO/ISO to consider whether any modifications or additions to the existing technical requirements, testing protocols, or other qualification procedures are necessary to facilitate the participation of electric storage resources in its markets.[139]

i. Filing

70. PJM states that its three-year forward capacity market, the Reliability Pricing Model or RPM, is "resource agnostic," meaning the RPM clears offered resources not by resource type, but through an algorithm that matches offered MW to system demand in a least cost manner. Therefore, PJM states that its capacity requirements are met by utilizing all resources that are capable of meeting the operational and performance requirements of a Capacity Performance Resource, including Intermittent Resources (e.g., wind, solar, run-of-river hydroelectric), Energy Efficiency Resources, thermal generators, Demand Resources, and Capacity Storage Resources.

71. PJM states that, in compliance with Order No. 841, the Storage Participation Model includes a number of clarifications to PJM's status quo capacity market operation to facilitate participation of Energy Storage Resources in the RPM.[140] Specifically, PJM's revised definition of Capacity Storage Resource includes all Energy Storage Resources and thus all Energy Storage Resources utilizing the Storage Participation Model will be eligible to participate in the RPM.

72. PJM explains that it proposes to maintain the current provisions in its Tariff that: (1) exempt Capacity Storage Resources from the capacity must-offer requirement;[141] (2) require Capacity Storage Resources with a capacity obligation to offer into the day-

[137] *Id.* P 78 n.106.

[138] *Id.* P 79.

[139] *Id.* P 81.

[140] Compliance Filing, Transmittal at 19.

[141] *Id.*at 19 (citing Tariff, Attachment DD, § 6.6A).

ahead energy market;[142] and (3) define Capacity Storage Resources as eligible to participate as Capacity Performance Resources.[143] According to PJM, a resource with a capacity obligation must be available to inject unless it has been rendered unavailable by a Generator Planned Outage, a Generator Maintenance Outage, or a Generator Forced Outage.[144] PJM states that its Tariff currently allows a Capacity Storage Resource to self-schedule (with or without a dispatchable range) or offer its unit as a dispatchable resource to meet its day-ahead must-offer obligation.

73. To account for Energy Storage Resources' full range of operation and charge, PJM proposes to model their cost-based and market-based offer curves as continuous—with both positive and negative MW values.[145] Energy Storage Resources participating in PJM's markets would be allowed to enter a minimum and maximum operating range into PJM's Markets Gateway and update those parameters throughout the operating day in accordance with their State of Charge.[146]

74. With respect to operation in the day-ahead markets, PJM states that its market commitments are made on an hourly basis; as such, Energy Storage Resource participants in the day-ahead market would need to manage their State of Charge with the understanding that dispatch during the day-ahead market includes a duration of a minimum of one hour.[147] PJM would rely on each resource's operational mode and parameters to make dispatch decisions.[148]

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[142] *Id.* at 28 (citing Tariff, Attachment K-Appendix, § 1.10.1A(d); Operating Agreement, Schedule 1, § 1.10.1A(d)).

[143] *Id.* at 28-29 (citing Tariff, Attachment DD, § 5.5A).

[144] *Id.* at 28 (citing Tariff, Attachment K-Appendix, § 1.10.1A(d); Operating Agreement, Schedule 1, §1.10.1A(d)).

[145] *Id.* at 31.

[146] *Id.* at 32.

[147] *Id.* at 36 (citing PJM Manual 11, § 9.1).

[148] *Id.* at 36.

75. To participate in PJM's real-time market, an Energy Storage Resource's market seller would be required to update the availability status of the resource 20 minutes before the hour—a practice consistent with current standards for other resources.[149] With respect to the offers for a given hour, market sellers would be required to update their Energy Storage Resource's operating mode 65 minutes before the hour along with other offer parameters that can be updated based on intraday offer rules.[150] As in the day-ahead markets, participating Energy Storage Resources would be required to enter a ramp rate, Maximum Charge Limit, and Maximum Discharge Limit into the Markets Gateway, but would maintain the ability to edit these parameters intra-hour. PJM contends that it will not prohibit Energy Storage Resources from charging during peak periods, but as Energy Storage Resource installations increase, PJM intends to examine the impacts of charging times on system operations.[151]

76. PJM states that its current market rules allow Energy Storage Resources to participate in its ancillary services markets.[152] Specifically, PJM explains that they are eligible to provide Synchronized Reserves, Non-Synchronized Reserves, Day-Ahead Scheduling Reserves, Regulation, Reactive Supply, and Black Start Service.[153] PJM clarifies that it currently categorically excludes Energy Storage Resources from Tier 1 Synchronized Reserves, but that they can request an exception to have their available headroom counted as Tier 1 Synchronized Reserve by the Ancillary Service Optimizer.[154] PJM proposes to retain this exception process for purposes of the Storage Participation Model. PJM states an Energy Storage Resource can offer in as Tier 2 Synchronized Reserves, and PJM will use its energy offer (or lost opportunity cost equal to $0) and dispatched basepoint to determine if it should be assigned reserves, similar to the practice for non-Energy Storage Resource generation.[155] PJM clarifies that an Energy Storage Resource dispatched to zero MW will still be considered synchronized and able to offer Tier 2 in the Synchronized Reserve market, and that Energy Storage Resources may participate in the Synchronized Reserve market without an energy offer. Additionally,

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[149] *Id.* at 37 (citing PJM Manual 11, § 2.3.3).

[150] *Id.* at 37.

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

[152] *Id.* at 38.

[153] *Id.* at 38-45.

[154] *Id.* at 40.

[155] *Id.* at 41.

PJM clarifies that an Energy Storage Resource physically disconnected from the grid and capable of providing energy within 10 minutes shall be treated as Non-Synchronized Reserve.[156]

77. PJM explains that its current rules categorically exempt Energy Storage Resources from the Day-Ahead Scheduling Reserve process, but that they can participate voluntarily by seeking an exception. PJM proposes to maintain this process under the Storage Participation Model.[157] PJM states that an Energy Storage Resource that wishes to clear in the Day-Ahead Scheduling Reserve market would need to inform PJM that it would like to be considered and would require an energy schedule.

78. PJM states that, under the Storage Participation Model, the range of an Energy Storage Resource's Regulation offer will be a function of the operating limits specified for its continuous, charge, and discharge operating modes.[158] PJM states that, to provide energy and regulation concurrently, an Energy Storage Resource may operate in any of the continuous, charge, and discharge operating modes, and that the market participant will self-manage the Energy Storage Resource's State of Charge by adjusting its operating limits. PJM also proposes to continue to offer a non-energy resource option, allowing Energy Storage Resources to provide Regulation service without an energy offer. PJM states its proposal is consistent with its current treatment of Energy Storage Resources providing Regulation service and ensures these resources can continue to participate in the Regulation market in a manner consistent with all other Regulation resources.

79. PJM explains that its current market rules require Energy Storage Resources with an executed Interconnection Service Agreement to have reactive capability in order to provide Reactive Supply, and that cost recovery for Reactive Supply is governed by Schedule 2 of PJM's Tariff.[159] PJM further explains that an Energy Storage Resource with an energy schedule dispatched to provide Reactive Service in real-time for reliability may receive payment for lost opportunity costs based on its energy offer.[160]

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[156] *Id.* (citing PJM Manual, § 4b.2.1).

[157] *Id.* at 42.

[158] *Id.* at 43.

[159] *Id.* at 43-44 (citing PJM Operating Agreement, Schedule 2).

[160] *Id.* at 44 (citing Tariff, Attachment K-Appendix, § 3.2.2(i)).

80. PJM states that Energy Storage Resources are currently permitted to submit proposals in response to a PJM Black Start request for proposals if they meet all of the Black Start requirements, which include a minimum 16-hour duration or such other duration identified in the Transmission Owner's restoration plan.[161] PJM states that it does not propose any changes to this construct in the Storage Participation Model because PJM's Black Start Service rules expressly permit the submission of proposals by Energy Storage Resources.[162]

81. PJM proposes to utilize its current requirements for pumped-hydro resources in reporting outages under the Storage Participation Model.[163] PJM describes that, currently, market participants with pumped-hydro resources in PJM are required to report an outage when a unit's ability to meet its capacity obligation is limited by equipment. PJM explains that this requirement accounts for the fact that a pumped-hydro unit is not experiencing an "outage" every time the unit is unable to generate, such as when operating in pump mode. Thus, PJM explains that "out of charge" will not be considered an outage for the purposes of Equivalent Demand Forced Outage Rate (EFOR-d)[164] calculation, unless the Energy Storage Resource was explicitly directed to discharge and was unable to do so due to lack of stored charge.[165]

ii. Protests/Comments

82. Calpine argues that PJM's proposal inappropriately exempts Energy Storage Resources from certain capacity market operating requirements.[166] For example, Calpine points to PJM's proposal to not consider "out of charge" to be an outage for purposes of EFOR-d calculation.[167] According to Calpine, "out of charge" for a battery resource is the same as being "out of gas" or "out of coal" for a gas or coal generator, respectively; as such, Calpine argues that if a gas or coal generator takes a forced outage because it

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[161] *Id.* at 44-45 (citing PJM Manual 13, § 3.1).

[162] *Id.* at 45.

[163] *Id.* at 46.

[164] EFOR-d is defined in PJM's manuals as the portion of time a unit is in demand, but is unavailable due to forced outages or deratings. PJM Manual 22, § 3.1.

[165] Compliance Filing, Transmittal at 46.

[166] Calpine Comments at 3.

[167] *Id.* (citing Compliance Filing, Transmittal at 4).

runs out of fuel, its EFOR-d will be impacted, and there is no reason why an Energy Storage Resource should not receive the same treatment.[168] Calpine contends that disparate treatment of similarly situated capacity resources is unjust, unreasonable, and otherwise unlawful. Moreover, Calpine argues that failure to account for an outage in a resource's EFOR-d because the resource is "out of charge" will result in PJM incorrectly calculating the availability of capacity resources, which, in turn, will lead PJM to under-procure capacity resources and expose the system to potential reliability problems. Calpine further argues that a generator does not have the option to turn off after running for a certain number of hours unless mechanical failure necessitates a forced outage, and even then, a forced outage will impact the generator's EFOR-d rating.[169] Relatedly, PJM's Market Monitor asserts that an Energy Storage Resource that is "out of charge" should be required to inform PJM of its unavailability and take an outage analogous to a lack-of-fuel outage.[170]

83. Advanced Energy Economy argues that applying PJM's existing Capacity Performance rules to Energy Storage Resources is unjust, unreasonable, and unduly discriminatory because the Capacity Performance construct was designed to give generators the incentive to improve their performance and firm their fuel supplies.[171] Advanced Energy Economy states that PJM did not provide support for applying its existing Capacity Performance rules to Energy Storage Resources without modification.[172] Advanced Energy Economy claims the Capacity Performance rules could potentially punish Energy Storage Resources when they perform at their maximum capacity because, unlike generators, these resources do not have the ability to mitigate Non-Performance Charges through additional measures.

84. Similarly, Tesla argues that Capacity Performance charges that are not limited to the physical capability of an Energy Storage Resource unduly discriminate against such resources and create barriers to participation in the capacity market.[173] Tesla explains that PJM's Capacity Performance rules require resources to be able to respond to calls

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[168] *Id.* at 4.

[169] *Id.* at 5.

[170] PJM's Market Monitor Comments at 7.

[171] Advanced Energy Economy Comments at 12-13.

[172] *Id.* at 13.

[173] Tesla Comments at 11-12.

24 hours a day, 365 days a year, for an unlimited number of consecutive hours.[174] Tesla argues that, while this requirement may promote performance for traditional generators, it unduly discriminates and effectively blocks participation of Energy Storage Resources by not recognizing their physical attributes. Tesla further expands that Capacity Performance rules potentially subject Energy Storage Resources to penalties for not performing beyond the resource's physical capability, which creates a barrier to participation in PJM's capacity market because Energy Storage Resources cannot effectively manage this financial risk.[175]

85. Tesla also asserts that current frequency regulation rules in PJM do not allow behind-the-meter Energy Storage Resources to inject energy onto the grid during the provision of Regulation service and asks the Commission to require PJM to allow such resources to utilize their full capacity for the provision of Regulation service.[176]

iii. Answer

86. PJM disagrees with commenters' arguments that it is unjust and unreasonable to apply Capacity Performance penalties to Energy Storage Resources even if they are performing to the maximum extent of their physical and operational capacities.[177] PJM argues that its current Capacity Performance rules clearly define and contemplate Energy Storage Resource participation, and that the Commission accepted those rules as just and reasonable as applied to all Capacity Performance Resources, including Energy Storage Resources.[178]

iv. Data Request Response

87. PJM provides several clarifications regarding which sections of its Tariff make Energy Storage Resources eligible to provide certain ancillary services. PJM clarifies that, under Tariff Section 1.7.19A, Energy Storage Resources will be eligible to provide both Tier 1 and Tier 2 Synchronized Reserve: "Synchronized Reserve can be supplied from non-emergency generation resources and/or Demand Resources located within the

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

[175] *Id.* at 15.

[176] *Id.* at 21.

[177] PJM March 5, 2019 Answer at 24 (citing Advanced Energy Economy Comments at 12, Tesla Comments at 8).

[178] *Id.* at 24-25 (citing Tariff, Attachment DD, § 10A).

metered boundaries of the PJM Region."[179] Regarding their eligibility to provide Day-Ahead Scheduling Reserve, PJM cites to the Tariff definition of Day-Ahead Scheduling Reserve Resources as "synchronized and non-synchronized generation resources and Demand Resources electrically located within the PJM Region that are capable of providing Day-ahead Scheduling Reserves."[180] Additionally, PJM explains that Energy Storage Resources are eligible to provide Reactive Service by section 12.0 of the existing *pro forma* Interconnection Service Agreement in Tariff, Attachment O, which requires that resources interconnecting to the PJM system have the ability to maintain specific leading and lagging power factors.[181]

88. Regarding their eligibility to provide Non-Synchronized Reserve, PJM clarifies that a practical outcome of its Storage Participation Model is that it is technically infeasible for an Energy Storage Resource to provide Non-Synchronized Reserves.[182] However, Storage Model Participants can provide Synchronized Reserves to contribute to PJM's Synchronized Reserve Requirement or Primary Reserve Requirement, so PJM asserts that there is no barrier for Energy Storage Resources to provide and be compensated for contributing towards all PJM reserve requirements comparable to other resources.[183]

89. PJM explains that an Energy Storage Resource that is "out of charge" would not be considered an outage for purposes of EFOR-d calculations because the fact that it is "out of charge" does not mean that it is unavailable for providing a service to PJM, nor does it mean that it has malfunctioned or otherwise been taken out of service.[184] Additionally, PJM states that an Energy Storage Resource that is "out of charge" would not fall under the category of a Generator Forced Outage because it would not constitute "an Emergency or threatened Emergency, unanticipated failure, or other cause beyond the control of the owner or operator."[185] Likewise, PJM asserts that an Energy Storage

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[179] Data Request Response at 8-9.

[180] *Id.* at 7.

[181] *Id.* at 10.

[182] *Id.* at 6.

[183] *Id.* at 7.

[184] *Id.* at 13.

[185] PJM's Tariff defines Generator Forced Outage as an immediate reduction in output or capacity or removal from service, in whole or in part, of a generating unit by reason of an Emergency or threatened Emergency, unanticipated failure, or other cause

Resource that is "out of charge" does not meet the other Tariff definitions related to an outage.

v. Comments on Data Request Response

90. PJM's Market Monitor argues that PJM fails to identify the service that an Energy Storage Resource is available to provide if it is "out of charge."[186] PJM's Market Monitor further argues that PJM did not include a more detailed definition of a forced outage from the Tariff.[187] PJM's Market Monitor asserts that PJM's interpretation of the outage rules would allow a battery to discharge its entire 10-hour capacity in one hour, and in the following hour be unavailable to follow PJM's dispatch instruction due to lack of charge, and incur no impact on its EFOR-d.[188] PJM's Market Monitor explains that this is not consistent with PJM's treatment of units that are unavailable due to economic decisions, such as a lack of fuel, an interruption due to lack of gas supply, or that do not have staff available to start a unit at the time of a call.

91. PJM's Market Monitor states that PJM market rules currently require that generators submit forced outage tickets when they are not available and the outage (the lack of availability) is not due to a Generator Maintenance Outage or a Generator Planned Outage.[189] PJM's Market Monitor further states that outages caused by lack of fuel, whether they are outside management control or not, are included in the calculation of

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beyond the control of the owner or operator of the facility, as specified in the relevant portions of PJM's Manuals. A reduction in output or removal from service of a generating unit in response to changes in market conditions shall not constitute a Generator Forced Outage. *Id.* at 13-14 (citing Tariff, § 1, Definitions – G-H).

[186] PJM's Market Monitor Comments on Data Request Response at 2.

[187] A Generation Capacity Resource committed to PJM loads through an RPM Auction, FRR Capacity Plan, or by designation as a replacement resource under Attachment DD of PJM's Tariff, that does not deliver all or part of its scheduled energy shall be deemed to have experienced a Generator Forced Outage with respect to such undelivered energy, in accordance with standards and procedures for full and partial Generator Forced Outages specified in the Reliability Assurance Agreement (RAA), and PJM's Manuals. *Id.* (citing PJM Tariff, § 1.9.4).

[188] *Id.* at 2.

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

EFOR-d.[190] PJM's Market Monitor points to PJM's Manual 18, which states that "Effective with the 2018/2019 Delivery Year, the EFOR-d based on forced outage data from an October through September period prior to the Delivery Year will be based on all forced outage data and not exclude forced outage data for Outside Management Control events."[191] PJM's Market Monitor concludes that when an Energy Storage Resource is "out of charge" due to the resource owner's operating decisions, it should be considered on an outage if it is unavailable for PJM dispatch.

vi. Commission Determination

92. We find that PJM's proposed tariff revisions comply with the requirements of Order No. 841 because PJM ensures that Energy Storage Resources are eligible to provide all capacity, energy, and ancillary services that they are technically capable of providing.

93. We disagree with commenters' arguments that an Energy Storage Resource should be considered on an outage when it is "out of charge," for the purposes of calculating that resource's EFOR-d. We agree with PJM that an Energy Storage Resource that is "out of charge" would not fall under the category of a Generator Forced Outage because it would not constitute "an Emergency or threatened Emergency, unanticipated failure, or other cause beyond the control of the owner or operator."[192] Additionally, we agree with PJM that its proposal is also consistent with how PJM currently treats pumped-hydro resources. Therefore, we find that PJM's proposal not to consider an Energy Storage Resource that is "out of charge" as an outage for purposes of EFOR-d does not conflict with Order No. 841, and PJM appropriately explains how it intends to apply its existing market rules to Energy Storage Resources for the purposes of EFOR-d calculations.

94. We also accept PJM's proposal to apply its existing Capacity Performance rules to Energy Storage Resources. We reiterate our finding in Order No. 841 that Energy Storage Resources must still meet all of the technical, operational, and/or performance requirements that are necessary to reliably provide a service. Order No. 841 does not exempt an Energy Storage Resource that is participating in RTO/ISO capacity markets from any applicable penalties for non-performance.[193] We find that PJM has

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[190] *Id.* at 3.

[191] *Id.*

[192] *See* Data Request Response at 13-14 (citing Tariff, § 1, Definitions – G-H).

[193] Order No. 841, 162 FERC ¶ 61,127 at PP 78, 95.

appropriately clarified how it will apply its existing Capacity Performance penalties to Energy Storage Resources, as required by Order No. 841.

95. In response to Tesla's comment that the current PJM rules do not allow a behind-the-meter Energy Storage Resource to inject energy onto the grid during the provision of Frequency Regulation Service, we note that PJM clarifies in its answer that Energy Storage Resources that are co-located with load and share a single grid connection may provide Frequency Regulation between load reduction and injection, provided that they have an Interconnection Service Agreement or a Wholesale Market Participation Agreement.

b. Ability to De-Rate Capacity to Meet Minimum Run-Time Requirements

96. To implement section 35.28(g)(9)(i)(A) of the Commission's regulations, Order No. 841 requires that each RTO/ISO have tariff provisions providing that resources using the participation model for electric storage resources can de-rate their capacity to meet minimum run-time requirements.[194] Electric storage resources that participate in an RTO/ISO capacity market are not exempt from meeting the performance metrics and criteria that apply to all other resources that participate in that market and are not exempt from any applicable penalties for non-performance.[195]

97. Order No. 841 states that an electric storage resource de-rating its capacity to provide capacity or other services is not engaging in physical withholding if it is de-rating to meet minimum run-time requirements. However, each RTO/ISO may request that its market monitor verify whether an electric storage resource de-rated its capacity to meet a minimum run-time requirement to ensure that such resource is not engaging in physical withholding, as defined by the Commission.[196] Additionally, to the extent that market power concerns arise as a result of electric storage resources de-rating capacity to provide capacity or other services, each RTO/ISO may consider whether it is appropriate to update and/or apply existing market power mitigation processes to electric storage resources to alleviate market power concerns.[197] Further, electric storage resources may

[194] *Id.* P 94.

[195] *Id.* P 95.

[196] *Id.* P 96.

[197] *Id.* P 97.

provide services in RTO/ISO markets without de-rating so long as they meet the requirements to provide the particular service that they seek to provide.[198]

98. Order No. 841 provides each RTO/ISO with flexibility to either use its existing rules for must-offer quantities or to modify its existing rules as necessary to reflect the physical and operational characteristics of electric storage resources.[199] However, if an electric storage resource elects to de-rate its capacity, it must not de-rate its capacity below any capacity obligations that it has assumed, such as any applicable must-offer requirement. Also, the de-rated quantity should be based on the quantity of energy that an electric storage resource can discharge continuously over the minimum run-time set by the RTO/ISO.

99. Order No. 841 does not require RTOs/ISOs to make specific changes to minimum run-time or must-offer requirements associated with providing capacity.[200] However, each RTO/ISO must demonstrate on compliance that its market rules provide a means for electric storage resources to provide capacity, including how its capacity market rules are applicable to resources using the participation model.[201] Where an RTO/ISO does not have existing tariff provisions that enable electric storage resources to provide capacity, the RTO/ISO must propose such rules.[202]

i. Filing

100. PJM states that while there has been notable development of flywheel and battery storage in the PJM region in the last few years, those currently operating are short duration resources, and no such facilities have yet offered into the RPM on a stand-alone basis.[203] As such, PJM states that there is currently no stand-alone battery storage participation in PJM's capacity market. However, PJM states there has been substantial

[198] *Id.* P 98.

[199] *Id.* P 99.

[200] *Id.* P 100.

[201] *Id.* PP 100, 101.

[202] *Id.* P 100.

[203] Compliance Filing, Transmittal at 18-19.

(currently about 5,000 MW) Energy Storage Resource participation in the capacity market in the form of pumped-hydro resources.[204]

101. PJM also clarifies its requirements regarding the Installed Capacity (ICAP) MW value of Capacity Storage Resources to ensure they are treated in a manner comparable with other resources with similar operational characteristics.[205] PJM explains that it currently determines the capacity value (in installed capacity MW) of Capacity Storage Resources, under which PJM includes all types of Energy Storage Resources, based on their discharge/output capability over 10 hours of sustained continuous operation.[206] PJM states that setting an Energy Storage Resource's capacity value based on the level of continuous output that can be sustained for 10 hours ensures that PJM dispatchers can call upon such resources to manage loads in a typical summer peak day in a manner comparable to any other dispatchable resource.[207] PJM states that the Storage Participation Model retains the existing 10-hour minimum run-time requirement.[208] PJM elaborates that, as Order No. 841 requires, it has long used the approach of allowing resources to de-rate their capacity to meet output duration requirements.[209] Further, PJM states that this approach is how PJM determines the maximum capacity value of battery storage projects currently seeking interconnection, with Capacity Interconnection Rights, under PJM's interconnection rules. Thus, PJM proposes no changes to its governing documents related to this requirement.

102. PJM references the affidavit by Mr. Bastian and explains that he shows that under a typical PJM region summer weekday load shape, PJM loads are at or above 90 percent of the daily peak for a period of approximately 10 hours.[210] Mr. Bastian further explains that PJM relies on the ability of capacity resources to maintain output at their stated capability levels during such periods to manage the system's ability to meet those loads throughout the afternoon and evening. PJM concludes that the capacity value of a Capacity Storage Resource is reasonably based on the output level it can be expected to

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[204] *Id.* at 19.

[205] *Id.*

[206] *Id.* at 20.

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

[208] *Id.* at 21.

[209] *Id.* at 20.

[210] *Id.* at 22.

provide on a continuous basis because they are capable of sustained, continuous output and can be dispatched, unlike intermittent resources.[211]

ii. Protests/Comments

103. Exelon supports PJM's 10-hour minimum run-time requirement. Exelon agrees with PJM that requiring 10 hours of sustained continuous operation for Energy Storage Resources providing capacity is reasonable and appropriate for the PJM footprint.[212] Exelon states that 10 hours of sustained continuous operation is currently a Tariff requirement for other dispatchable resources and was adopted based on PJM's needs. Exelon further states that PJM should not be forced to change its current Tariff and rules to develop a participation model specific to Energy Storage Resources, and Order No. 841 does not require RTOs/ISOs do so.[213] Exelon further states that there are regional differences between and among the various RTOs/ISOs, which must be recognized and respected.[214]

104. Multiple commenters request that the Commission reject PJM's proposed 10-hour minimum run-time requirement.[215] They generally argue that this requirement creates a barrier for Energy Storage Resources to participate in PJM's capacity market, and therefore, is unjust and unreasonable.[216] EDF and Clean Energy Entities elaborate that PJM creates a financial barrier for battery storage to compete and will lead to unjustifiably low capacity values for Energy Storage Resources or result in hours of unnecessary capacity that will go unused by customers.[217] Joint Consumer Advocates

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[211] *Id.* at 27.

[212] Exelon Comments at 2.

[213] *Id.* at 3.

[214] *Id.* at 4.

[215] Advanced Energy Economy Comments at 12; Clean Energy Entities Comments at 3; EDF Comments at 5; Energy Storage Association Protest at 10; Joint Consumer Advocates Comments at 7, 8-9; Public Interest Organizations Comments at 8; SEIA Comments at 5-6.

[216] Advanced Energy Economy Comments at 12; Clean Energy Entities Comments at 2; EDF Comments at 2; Energy Storage Association Comments at 8-9; Joint Consumer Advocates Comments at 13-14; Public Interest Organizations Comments at 4, 10-11.

[217] EDF Comments at 2; Clean Energy Entities Comments at 2.

claim that PJM's proposal would also result in higher costs for ratepayers.[218] Advanced Energy Economy elaborates that PJM's proposal would inhibit competition and cause unjust and unreasonable rates.[219]

105. Multiple commenters contend that, although PJM currently uses a 10-hour minimum run-time requirement for pumped-hydro resources, Order No. 841 requires RTOs/ISOs to develop a participation model that provides a realistic opportunity for battery and other storage types to participate in wholesale electricity markets at just and reasonable rates that reflect the true value such resources provide.[220] Energy Storage Association argues that PJM's proposal creates arbitrary and undue burdens to non-pumped-hydro Energy Storage Resource participation in PJM's capacity market.[221] Clean Energy Entities and Joint Consumer Advocates claim that PJM has not explained why the 10-hour minimum run-time requirement is necessary for non-hydro Energy Storage Resources.[222] Public Interest Organizations further contend it is unclear how the 10-hour minimum run-time requirement has been applied to pumped-hydro resources based on the available data.[223]

106. Multiple commenters note that PJM does not use its 10-hour minimum run-time requirement for all resources. NextEra contends that, while it is true that the 10-hour minimum run-time requirement has been historically used for all dispatchable resources in PJM, PJM has a different procedure for calculating the minimum run-time requirement

[218] Joint Consumer Advocates Comments at 13.

[219] Advanced Energy Economy Comments at 12.

[220] *Id.* at 10-11; EDF Comments at 3-4 (citing Order No. 841, 162 FERC ¶ 61,127 at P 55); Energy Storage Association Comments at 1; Joint Consumer Advocates Comments at 7; Public Interest Organizations Comments at 10-11.

[221] Energy Storage Association Comments at 1.

[222] Clean Energy Entities Comments at 5.

[223] Public Interest Organizations Comments at 11-12. Public Interest Organizations point to data from Bath County Pumped-Hydro Station that implies the station can maintain full output for just under eight hours, Yards Creek Pumped-Hydro Station that implies the station can maintain its full capacity output for between seven and eight hours, and Seneca Pumped-Hydro Station that states the station would support output at the full capacity value for slightly more than eight hours. *Id.* at 12-13.

for intermittent solar and wind resources.[224] NextEra notes that capacity interconnection rights and Unforced Capacity values for intermittent resources are measured over only four hours. NextEra therefore contends that the use of a 10-hour minimum run-time requirement discriminates against Capacity Storage Resources compared to intermittent resources.[225] NextEra argues that Energy Storage Resources have the technical capability to reliably provide capacity at rates substantially greater than intermittent resources.[226] NextEra provides an example that shows PJM's methodology would restrict a Capacity Storage Resource to 20 MW even though it can, on average, provide approximately two to five times that much capacity during the identified Performance Hours – 40 MW in summer and 100 MW in the winter.[227]

107. Several commenters point out that no other RTO/ISO proposes as long of a minimum run-time requirement.[228] Clean Energy Entities point to the four-hour minimum run-time requirements proposed by NYISO, MISO, and CAISO as well as the two-hour minimum run-time requirement proposed by ISO-NE.[229] Advanced Energy Economy points to ISO-NE's and NYISO's compliance proposals, stating that these proposals better reflect both the unique physical and operational characteristics of Energy Storage Resources and their technical capabilities to provide energy and ancillary services during critical peak periods. Tesla states that PJM has not provided any rationale as to why system needs in its territory would differ so greatly from other regions as to require such a significant increase in required minimum run time.[230] Some commenters contend that PJM's proposed minimum run-time requirement would not properly account for the capacity of hybrid resources, and thus, would lead to unjust and unreasonable market outcomes.[231] Union of Concerned Scientists argues that a hybrid

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[224] NextEra Comments at 2, 4.

[225] *Id.* at 2.

[226] *Id.* at 11.

[227] *Id.* at 10.

[228] Clean Energy Entities Comments at 6-7; Advanced Energy Economy Comments at 11; Energy Storage Association Comments at 9-10; EDF Comments at 2-3.

[229] Clean Energy Entities Comments at 7.

[230] Tesla Comments at 14.

[231] Clean Energy Entities Comments at 3-4; Union of Concerned Scientists Comments at 12; Energy Storage Association Comments at 8.

resource will seek to avoid designation as an Energy Storage Resource if it carries with it the obligation to pass the 10-hour minimum run-time requirement.[232] NextEra argues that PJM's singular focus on dispatchability is irrational within the context of hybrid resources.[233] NextEra explains that if a hybrid resource – e.g., a project with a four-hour battery storage resource co-located with a solar resource – was measured according to PJM Manual 21, its Capacity Interconnection Rights would be significantly lower than those assigned to a solar resource with identical nameplate capacity because PJM Manual 21 measures the capacity value of dispatchable resources over a 10-hour period but measures the capacity value of intermittent resources over a four-hour period.[234]

108. Several commenters argue that PJM's 10-hour minimum run-time requirement is not based on a sound consideration of physical and operational characteristics of Energy Storage Resources.[235] Public Interest Organizations explain that duration is not a significant concern for a vast majority of traditional generators and, because a 10-hour minimum run-time requirement does not impose significant costs on them or reduce their capacity value, there was never a need to consider how to best make use of resources with shorter durations.[236] Joint Consumer Advocates explain that the unique "energy-limited nature" of Energy Storage Resources, which limits them to "only discharg[ing] as much energy as has previously been charged," separates them from traditional resources and thus PJM's capacity market rules should account for their "energy-limited nature."[237]

109. Commenters also take issue with the results of the studies PJM uses to support its 10-hour minimum run-time requirement.[238] Clean Energy Entities take issue with PJM's assumption that non-hydro Energy Storage Resources will account for 8.5 percent of peak load in the capacity market, and PJM's use of the 2018 Limited Energy Capability Resources report, which they state is not publicly available and does not analyze the

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[232] Union of Concerned Scientists Comments at 15-16.

[233] NextEra Comments at 6.

[234] *Id.* at 4-7.

[235] Public Interest Organizations Comments at 10, 15; Joint Consumer Advocates Comments at 7; Advanced Energy Economy Comments at 12.

[236] Public Interest Organizations Comments at 11.

[237] Joint Consumer Advocates Comments at 5-6.

[238] Advanced Energy Economy Comments at 11; Public Interest Organizations Comments at 11-12, 14-15; Joint Consumer Advocates Comments at 8, 21-22.

minimum run-time requirement.[239] Advanced Energy Economy, Clean Energy Entities, and Public Interest Organizations argue that the 2010 demand response study cited by PJM is out-of-date and does not provide persuasive evidence.[240] Tesla points to more recent studies by the National Renewable Energy Laboratory and ICF International, Inc. that find that a four-hour minimum run-time requirement is sufficient.[241] Public Interest Organizations argue that the results of the 2010 demand response study hinge on specific operational limitations of demand response that do not apply to Energy Storage Resources.[242] In contrast to demand response, Public Interest Organizations argue that an Energy Storage Resource is a nearly perfectly dispatchable resource and can be dispatched second-to-second to precisely fill in gaps between load and energy produced by other resources.[243] Tesla argues that, in order to ensure just and reasonable rates, any minimum run-time requirement above four hours for electric storage resources should be based upon appropriate studies of the ability of such resources to serve the specific system's forecasted load that demonstrate a specific duration is required to meet those system needs.[244] Specifically, Tesla recommends that RTOs/ISOs: (1) calculate the effective load carrying capability of electric storage resources with various run times at the forecasted level of system load, (2) establish the maximum quantity in MW of electric storage resources of a specific run time that can provide capacity service to the system based on forecasted load, and (3) limit performance penalties to the physical energy capacity in MW hours (MWh) committed to the capacity market by the electric storage resource.[245]

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[239] Clean Energy Entities Comments at 9-10.

[240] Advanced Energy Economy Comments at 11; Clean Energy Entities Comments at 9; Public Interest Organizations Comments at 13-15.

[241] Tesla Comments at 13 (citing P. Denholm and R. Margolis, *The Potential for Energy Storage to Provide Peaking Capacity in California under Increased Penetration of Solar Photovoltaics* (Mar. 2018), https://www.nrel.gov/docs/fy18osti/70905.pdf, and H. Johal et al., *Unlocking the Hidden (Capacity) Value in Energy Storage* (Nov. 2016), https://www.icf.com/resources/white-papers/2016/unlocking-the-hidden-capacity-value-in-energy-storage).

[242] Public Interest Organizations Comments at 11-12.

[243] *Id.* at 15.

[244] Tesla Comments at 8.

[245] *Id.* at 8-12.

110. Public Interest Organizations further state that setting electric storage resource requirements based on the duration of peak periods is equivalent to valuing an electric storage resource as if it were a non-dispatchable, block-loaded resource similar to demand response.[246] Joint Consumer Advocates also argue that PJM errs in proposing to base the Energy Storage Resource capacity rating on a typical peak summer weekday, rather than basing measurement on peak load conditions.[247] They explain that Energy Storage Resources have not penetrated PJM's markets enough that they would be called upon to ensure resource adequacy on a typical summer day and are not expected to reach such levels in the near future, but they can provide significant capacity value on peak days.[248] EDF further argues that establishing an Energy Storage Resource's capacity value based on sustained performance for at least 10 hours goes beyond the capacity market's purpose of covering peak demand during emergency conditions.[249]

111. Several commenters argue that PJM's proposal contradicts language in its own Tariff and manuals.[250] Energy Storage Association notes that PJM defines "Peak Hours" in several other locations in its manuals and that those other definitions do not exceed four consecutive hours, in contrast with PJM's 10-hour minimum run-time proposal.[251] Clean Energy Entities also state that PJM did not define "peak-hour period" for Energy Storage Resources, but the most logical interpretation of PJM's Tariff is that it is four hours.[252] Clean Energy Entities and Public Interest Organizations argue PJM would have to file an FPA section 205 filing to establish a prospective 10-hour minimum run-time requirement.[253] Public Interest Organizations and Energy Storage Association state that the Commission previously approved a less restrictive standard for determining the

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[246] Public Interest Organizations Comments at 15.

[247] Joint Consumer Advocates Comments at 8, 21-22.

[248] *Id.* at 8.

[249] EDF Comments at 4 (citing *PJM Interconnection, LLC*, 155 FERC ¶ 61,157, at P 112 (2016) ("[t]he purpose of the capacity market is to ensure PJM has adequate resources during an emergency")).

[250] Union of Concerned Scientist Comments at 17; Public Interest Organizations at 6-7; NextEra Comments at 7-8, 10; GlidePath Comments at 3.

[251] Energy Storage Association Comments at 6 (citing Bastian Affidavit).

[252] Clean Energy Entities Comment at 20.

[253] *Id.* at 6; Public Interest Organizations Comments at 7.

capacity value of a Capacity Storage Resource in the Capacity Performance proceeding.[254] NextEra asserts that section 5.6.1(h) of Attachment DD – which sets the rules by which seasonal capacity resources may aggregate sell offers in a capacity market auction – defines peak-hour periods differently than PJM's Manual 21.[255] Energy Storage Association explains that PJM's Tariff states that Capacity Storage Resources may offer to sell capacity in a quantity consistent with their average expected output during peak periods.[256]

112. Public Interest Organizations assert that PJM's citation to RAA, Schedule 9 and the associated Manual 21 is inapposite as Schedule 9 governs Generation Capacity Resources, which electric storage resources are not.[257] GlidePath does not object to PJM's proposed tariff revisions, but argues that, despite PJM's claim that its 10-hour minimum run-time requirement is a longstanding requirement, this requirement is not in the Tariff and PJM does not propose to incorporate this requirement into its Tariff as part of its compliance filing.[258] GlidePath concludes that the Commission should either clarify that the Tariff is inconsistent with PJM's description of the 10-hour minimum run-time requirement for Energy Storage Resources, or state that the Commission makes no determination with respect to PJM's position on the minimum run-time requirement for Energy Storage Resources.[259]

113. A number of comments offer alternative proposals, the most common of which is that the Commission should instruct PJM to use a four-hour minimum run-time

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[254] Public Interest Organizations Comments at 4-5; Energy Storage Association Comments at 5.

[255] NextEra Comments at 7-8 (Attachment DD defines peak-hour periods as "the hour ending 1500 local prevailing time through the hour ending 1900 local prevailing time on any day during the calendar months of June through August… and the hour ending 800 local prevailing time through the hour ending 900 local prevailing time and the hour ending 1900 local prevailing time through the hour ending 2000 local prevailing time on any day during the calendar months of January and February").

[256] Energy Storage Association Comments at 3 (citing PJM Tariff, Attachment DD, § 5.6.1(h)).

[257] Public Interest Organizations Comments at 6-7.

[258] GlidePath Comments at 4.

[259] *Id.* at 5.

requirement.[260] Alternatively, Clean Energy Entities request that the Commission instruct PJM to use a four-hour minimum run-time requirement for non-hydro Energy Storage Resources on an interim basis, so non-hydro Energy Storage Resources may offer capacity in the August 2019 Base Residual Auction.[261] Public Interest Organizations request that the Commission direct PJM to fulfill its 2015 commitment to incorporate a calculation for the capacity value of Capacity Storage Resources based on output during peak hour periods in its manuals.[262] Joint Consumer Advocates propose that PJM could define a lower minimum run-time requirement and review the requirement when Energy Storage Resources have a higher penetration level in PJM's market.[263]

114. In contrast, Calpine asks the Commission to consider whether Energy Storage Resources should be permitted to participate as capacity resources before they are able to fully provide the services needed by PJM to reliability operate the grid.[264] Calpine argues that the manner in which PJM proposes to apply the 10-hour minimum run-time requirement to Energy Storage Resources provides preferential treatment to Energy Storage Resources compared to thermal resources.[265] Specifically, Calpine points to PJM's statement that "the capacity value of a Capacity Storage Resource is based on the resource's MW output capability that can be maintained over a continuous ten-hour period when starting at a fully charged state *with an assumed ability to return to a fully charged state during the fourteen-hour period remaining until the start of the next ten-hour discharge period*."[266] According to Calpine, permitting a Capacity Storage Resource to be offline for 14 hours in between the 10-hour discharge periods is inconsistent with the requirements of thermal generation resources participating in the capacity market, which are instead expected to run when, and for as long as, PJM calls on them to do so.[267] Although Calpine recognizes that electric storage resources have

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[260] Clean Energy Entities Comments at 3; Energy Storage Association Comments Protest at 10; SEIA Comments at 5-6.

[261] Clean Energy Entities Comments at 3.

[262] Public Interest Organizations Comments at 17-18.

[263] Joint Consumer Advocates Comments at 9.

[264] Calpine Comments at 5.

[265] *Id.* at 4.

[266] *Id.* (quoting Compliance Filing, Transmittal Letter at 25) (emphasis added).

[267] *Id.* at 5.

operational limitations, it argues that the reliability requirements for capacity resources should not be degraded in an effort to encourage a particular resource type.

115. Several commenters also argue that the Commission should determine that PJM's 10-hour minimum run-time requirement is outside the scope of this compliance filing.[268] Public Interest Organizations argue that even if the minimum run-time requirements for Energy Storage Resources are in scope for the current proceeding, the lack of stakeholder process and insufficient record make an order on Energy Storage Resource duration inappropriate at this time.[269]

iii. Answers

116. PJM argues that its proposal is consistent with the requirements of Order No. 841 because it applies the same technical standards for determining capacity value that are currently applied to all other dispatchable resources.[270]

117. In response to commenters' arguments that PJM's proposed method to determine the installed capacity value of Energy Storage Resources presents a barrier to entry by creating an economic disincentive to their participation in the Reliability Pricing Model, PJM argues its proposal is a technical determination of the maximum value of Capacity Interconnection Rights a resource may have when it seeks to interconnect to the PJM grid, and that any Energy Storage Resource wishing to participate in the RPM has the ability to de-rate its capacity to satisfy the technical eligibility requirements.[271] PJM asserts that, while its approach may not provide the maximum potential economic value to all Energy Storage Resources wishing to participate in the RPM, its proposal does allow all Energy Storage Resources the opportunity to participate on a non-discriminatory basis.[272]

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[268] Public Interest Organizations Comments at 4, 8, 17-18; NextEra Limited Comments at 3; Energy Storage Association Comments at 9.

[269] Public Interest Organizations Comments at 15.

[270] PJM March 5, 2019 Answer at 9-10 (citing Clean Energy Entities Protest at 6-7, Energy Storage Association Protest at 2-10, Advanced Energy Economy Comments at 12-13).

[271] *Id.* at 12 (citing EDF Comments at 2).

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

118. In response to protestors' arguments that the Commission should require PJM to utilize a shorter minimum run-time requirement consistent with the requirements proposed by other RTOs/ISOs, PJM argues that simply substituting the requirements from other RTOs/ISOs would constitute arbitrary and capricious action.[273] PJM argues that the proposal from Energy Storage Association to impose a four-hour minimum run-time requirement as an interim solution has no evidentiary support for how it would meet PJM's reliability requirements.[274] PJM argues that protestors have not offered alternatives that are anchored in any analysis specific to PJM's load shape during peak periods or other analyses that their alternatives would better meet the PJM system's reliability needs.[275]

119. In response to protestors' arguments that the current Tariff language specifying capacity sell offer parameters for Energy Storage Resources[276] requires a four-hour duration, PJM argues that its Tariff clearly specifies that a capacity sell offer cannot exceed a resource's installed capacity as determined under the RAA.[277] PJM argues that the provision protestors cite must be read in conjunction with the Tariff's other provisions on sell offers, which make clear that a seller cannot offer more than its resource's installed capacity, which is determined under the RAA.[278] PJM states that RAA, Schedule 9 explicitly states that the specific rules and procedures for determining the capability of Generation Capacity Resources are maintained in PJM's Manuals.[279] PJM explains that the Tariff section cited by protestors permits an Energy Storage Resource to base its Capacity Performance offer on its average expected output during

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[273] *Id.* at 13 (citing Clean Energy Entities Protest at 21, Energy Storage Association Protest at 9-10).

[274] *Id.* at 13.

[275] *Id.* at 14.

[276] *See* PJM Tariff, Attachment DD, § 5.6.1(h) (7.0.0) (". . . a Capacity Market Seller that owns or controls one or more Capacity Storage Resources . . . may submit a Sell Offer as a Capacity Performance Resource in a MW quantity consistent with their average expected output during peak-hour periods").

[277] PJM March 5, 2019 Answer at 14-16 (citing Energy Storage Association Protest at 3-4, Clean Energy Entities Protest at 18-19, Public Interest Organizations Protest at 5).

[278] *Id.* at 16-17 (citing PJM OATT, Attachment DD, §§ 5.8(g), 5.8(f), 5.6.1(b)).

[279] *Id.* at 15.

peak-hour periods, so long as the offer does not exceed the installed capacity determined for that resource in accordance with the RAA.[280] Thus, PJM argues, its proposed method for establishing an Energy Storage Resource's installed capacity value is consistent with its Tariff, and accurately reflects PJM's longstanding requirements.[281]

120. PJM contends that protestors' criticisms of the analysis supporting its proposed method for determining the installed capacity value of Energy Storage Resources is misplaced.[282] In response to arguments by Clean Energy Entities' affiant Dr. Emma L. Nicholson and Energy Storage Association's affiant Mr. Kevin Carden that PJM should establish its minimum run-time requirements for Energy Storage Resources based on their penetration in the capacity market, PJM contends that adopting a maximum quantity limit or sliding-scale limit for short-duration storage to accommodate that resource would be unduly discriminatory and contrary to PJM's resource-agnostic evaluation of capacity resources.[283] PJM further argues that Dr. Nicholson and Mr. Carden err in their efforts to diminish the significance of PJM's 2010 study that found that Limited Demand Resources had to commit to interrupt for at least 10 hours per call, even if they were subject to an aggregate resource-class limit of 8.5 percent of load.[284] PJM clarifies that it did not base its proposal for valuing the installed capacity of Energy Storage Resources on the Limited Demand Resources analysis, but that the Limited Demand Resources analysis nonetheless supports its proposal.[285] PJM argues that the alleged differences between Limited Demand Resources and Energy Storage Resources that Dr. Nicholson and Mr. Carden cite provide no basis for affording Energy Storage Resources a much shorter minimum run-time requirement. PJM disputes Dr. Nicholson's assertion that the 2010 Limited Demand Resources analysis is based on inputs that are out-of-date, and argues that typical summer load shapes have not changed greatly since the study was conducted.[286] Finally, PJM disagrees with Dr. Nicholson and Mr. Carden's argument that there is not likely to be sufficient penetration of storage to cause a reliability

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[280] *Id.* at 17.

[281] *Id.* at 17-18.

[282] *Id.* at 18.

[283] *Id.* at 18-19 (citing Nicholson Affidavit at 3, Carden Affidavit at P 8).

[284] *Id.* at 19.

[285] *Id.* at 20.

[286] *Id.* at 21 (citing Nicholson Affidavit at 9).

problem.[287] PJM argues that if the system need on the peak day in question required capacity for a longer duration than the Energy Storage Resource could provide, PJM would *have* to find another resource to fill the gap in system need, and this shortcoming is incompatible with the fundamental obligations of a Capacity Resource.[288]

121. Energy Storage Association responds that Order No. 841 was never intended to be a vehicle for PJM to implement new tariff barriers to the participation of Capacity Storage Resources in PJM's market.[289] Energy Storage Association contends that Manual 21 is ambiguous on how Capacity Storage Resources will be treated, and that PJM chooses to assert an interpretation of Manual 21 that would unilaterally develop rules that supersede a Commission-approved tariff.[290] Energy Storage Association explains that at the time the Capacity Storage Resource asset type was first established in PJM's Capacity Performance Filing,[291] Capacity Storage Resources were repeatedly and exclusively discussed as part of a set of non-traditional resources.[292] Energy Storage Association states that a separate and explicit approach to installed capacity determination for Capacity Storage Resources was not in place at the time the Commission accepted the Capacity Performance Filing, and thus the Tariff language the Commission accepted in that filing expressly provides that capacity market participation would be based on a Capacity Storage Resource's average output during peak hours.[293] In response to PJM's argument that it can apply RAA, Schedule 9 to Capacity Storage Resources, Energy Storage Association contends that PJM's Capacity Performance Filing intentionally and repeatedly distinguishes Generation Capacity Resources from Capacity Storage Resources, indicating PJM's and the Commission's understanding that Capacity Storage Resources would be treated differently from the Generation Capacity Resources

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[287] *Id.* at 22-23 (citing Nicholson Affidavit at 10, Carden Affidavit at P 8).

[288] *Id.* at 24.

[289] Energy Storage Association Answer at 3.

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

[291] *See* PJM Interconnection, L.L.C., Filing, Docket No. ER15-623-000 (filed December 12, 2014) (Capacity Performance Filing).

[292] Energy Storage Association Answer at 4 (citing PJM Interconnection, L.L.C., Answer, Docket No. ER15-623-000, at 20 (filed February 13, 2015)).

[293] *Id.* at 4-5 (citing *PJM Interconnection, L.L.C.*, 151 FERC ¶ 61,208, at P 100 (2015)).

discussed in RAA, Schedule 9.[294] Thus, Energy Storage Association argues, while PJM contends that Capacity Storage Resources are dispatchable and therefore akin to Generation Capacity Resources, in numerous tariff provisions PJM clearly distinguishes the treatment of Capacity Storage Resources from Generation Capacity Storage, and it is immaterial that Capacity Storage Resources and generators are both dispatchable given the plain, unambiguous language in the tariff.[295]

122. Energy Storage Association argues that PJM's reliance on Manual 21 not only conflicts with the express intent of the Capacity Performance Filing, but also violates the Commission's rule of reason.[296] Energy Storage Association explains that provisions that significantly affect rates, terms, and conditions of service must be included in the tariff, and argues that PJM's proposed 10-hour minimum run-time requirement for Capacity Storage Resources affects rates, terms, and conditions of capacity market service, and thus the Commission cannot rely on Manual 21 to justify PJM's proposal.[297]

123. Energy Storage Association contends that publicly-available data disputes PJM's claim that its 10-hour minimum run-time requirement already applies to pumped-hydro resources.[298] Moreover, Energy Storage Association asserts that it is uncertain how long the claimed status-quo 10-hour duration requirement has been in effect.[299] Energy Storage Association explains that, as recently as 2013, Manual 21 referred to a 12-hour minimum run-time requirement, and that discussion of this history is notably absent from PJM's justification for the 10-hour minimum run-time requirement.

124. Further, Energy Storage Association argues that, to the extent that Capacity Storage Resources can provide full capacity value at less than 10-hours duration under significant penetrations in the market, PJM's proposed 10-hour minimum run-time requirement violates Order No. 841's directive that storage be allowed to provide all services for which it is technically capable. Energy Storage Association explains that it commissioned a reliability analysis that demonstrates that an incremental addition of 4,000 MW of four-hour storage and an incremental addition of over 10,000 MW

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[294] *Id.* at 5-6 (citing PJM Tariff, Attachment DD § 5.5A, 5.6.1).

[295] *Id.* at 6.

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

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

[298] *Id.* at 9 (citing Public Interest Organizations Comments at 12-15).

[299] *Id.* at 10.

of 6-hour storage would provide capacity value on par with Generation Capacity Resources.[300] Energy Storage Association explains that this finding is consistent with the IEEE Study cited by PJM in its answer.[301] Energy Storage Association explains that 10,000 MW represents over 40 percent of all storage resources (e.g., pumped-hydro and battery storage) installed on the U.S. electric grid today, and argues this level of deployment is unlikely to be achieved in PJM's footprint for many years to come.[302]

125. PJM's Market Monitor argues that, in order for the capacity market to function on a resource agnostic basis, every MW of capacity offered must be a substitute for every other MW, so that a capacity MW from a steam plant is a substitute for a battery or any other resource.[303] Thus, PJM's Market Monitor contends, despite Energy Storage Association's and Joint Consumer Advocates' argument that the energy-limited nature of Energy Storage Resources would not cause a problem until sometime in the future, problems would commence immediately in the form of suppressed capacity market prices and displaced resources with greater capabilities. Further, PJM's Market Monitor argues that the assertion that other RTO/ISO markets are using a four-hour minimum run-time requirement as the basis for capacity MW determinations does not justify using a four-hour minimum run-time requirement in PJM, and is not an indication that a four-hour minimum run-time requirement would be consistent with Order No. 841's requirements in PJM.[304] PJM's Market Monitor states there is no basis for the assertion by Energy Storage Association and Joint Consumer Advocates that any problems introduced by significant market penetration by Energy Storage Resources with a lesser minimum run-time requirement could be mitigated through exposure to Capacity Performance market penalties.[305]

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[300] *Id.* at 12 (citing Carden Affidavit at 16).

[301] *Id.* at 12 (citing PJM March 5, 2019 Answer at n.72; Aramazd Muzhikyan, Laura Walter, Scott Benner, and Anthony Giacomoni, *Limited Energy Capability Resource Duration Requirement for Participation in PJM Capacity Market* (2019), *available at* https://www.pjm.com/-/media/library/reportsnotices/special-reports/2019/esr-duration.ashx?la=en (IEEE Study)).

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

[303] PJM's Market Monitor Answer at 5.

[304] *Id.* at 6-7.

[305] *Id.* at 7 (citing Energy Storage Association Comments at 7; Joint Consumer Advocates Comments at 8).

126. PJM's Market Monitor contends that Energy Storage Association and Joint Consumer Advocates confuse economic barriers to Energy Storage Resource participation with technical barriers.[306] PJM's Market Monitor argues that Order No. 841 does not require PJM to provide a market participation model that will make Energy Storage Resources economic in PJM's market, regardless of merit or technical capability.[307]

127. PJM states that the Commission should reject Energy Storage Association's proposal for PJM to modify its current capacity construct to establish a new category of "energy-limited resources" that would only have to provide energy for four or six hours.[308] PJM asserts that Energy Storage Association's proposal runs counter to the Commission's finding that PJM's Capacity Performance rules are "appropriate, because [they] create[ ] the same expectations for all Capacity Performance Resources (i.e., the expectation that such resources will be available to provide energy and reserves when called upon), without regard to technology type."[309] PJM further states that in the Capacity Performance Order, the Commission found reasonable PJM's phased elimination of a Demand Resource product that, among its other limitations, had to be "available to PJM . . . for a maximum of 6 hours a day;" and that, like Energy Storage Association's present proposal, was subject to a maximum market penetration limit.[310] PJM explains that Energy Storage Association now proposes—contrary to the Capacity Performance Order—to reinstate a category of resources that would only have to provide capacity at their committed level for no more than six hours, even while Energy Storage Association acknowledges that such resources degrade reliability if they are committed at too high a level.[311]

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[306] *Id.* at 7.

[307] *Id.* at 7-8 (citing Energy Storage Association Comments at 4; Joint Consumer Advocates Comments at 2).

[308] PJM May 14, 2019 Answer at 2.

[309] *Id.* (citing *Capacity Performance Order*, 151 FERC ¶ 61,208 at P 99), *order on reh'g*, 155 FERC ¶ 61,157).

[310] *Id.* at 3 (citing *PJM Interconnection, L.L.C.*, 143 FERC ¶ 61,076, at P 59 (2013)), *Id*. at 6.

[311] *Id.* at 3.

128. Additionally, PJM states that Capacity Storage Resources are also subject to certain differing rules as expressly noted in PJM's governing documents.[312] PJM states that Capacity Storage Resources are also subject to differing rules on Sell Offers, but the Sell Offer rules do not substitute for, or displace, the installed capacity rules that are intended under the RAA to apply to every resource capable of injecting energy onto the grid.[313] Moreover, PJM explains that nothing in the instant filing or Manual 21 conflicts with the Tariff's Sell Offer rules.[314] PJM elaborates that under Tariff, Attachment DD, Section 5.6.1(h), Capacity Storage Resources are permitted to base Capacity Performance offers on their average expected output during peak-hour periods, provided, however, as explicitly prescribed by Tariff, Attachment DD, Section 5.8(g), PJM "shall accept a Sell Offer only up to the [MW] amount of installed capacity of Capacity Resources owned or controlled by such Capacity Market Seller that has not previously been committed for the applicable Delivery Year."[315]

129. PJM avers that including the technical details of installed capacity determination for Capacity Storage Resources in Manual 21 does not violate the Commission's "rule of reason" and states that as Energy Storage Association itself notes, none of the rules detailing installed capacity determination for any resource are found in the Tariff.[316] PJM states that Energy Storage Association is incorrect to suggest that the installed capacity of pumped-hydro resources is not based on the output level the resource can provide over
10 hours.[317] PJM elaborates that its intent, design and approach to determining installed capacity for pumped-hydro resources has always been 10 hours of sustained output for all units. PJM clarifies that it does not develop or track MWh estimates for pumped-hydro resources, but instead monitors and relies on reservoir data, and the exact number of available MWh from those reservoir levels can vary.[318] PJM clarifies that consistent with these reservoir considerations, the MW capacity levels from PJM's RPM Resource

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[312] *Id.* at 8.

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

[314] *Id.* at 9.

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

[316] *Id.* at 9.

[317] *Id.* at 11.

[318] *Id.* at 12.

Model were developed based on the level of output each unit could provide on a sustained basis for 10 hours, assuming efficient operations.

iv. Data Request Response

130. PJM clarifies that every Capacity Storage Resource is also considered a Generation Capacity Resource.[319] PJM explains that the RAA defines Capacity Resource as either a Generation Capacity Resource, Demand Resource, or Energy Efficiency Resource, and that PJM classifies all pumped-hydro resources and other Capacity Storage Resources as Generation Capacity Resources.[320] PJM clarifies that, because they are Generation Capacity Resources, Capacity Storage Resources must meet the capability and reliability requirements of RAA, Schedules 9 and 10, respectively.[321]

131. PJM states that its proposal recognizes "the relative ability of units to maintain output at stated capability over a specified period of time."[322] Specifically, an Energy Storage Resource that is capable of supplying energy at a higher discharge rate over a shorter period of time is technically and operationally capable, by reducing its discharge rate, of supplying energy over a longer period of time. PJM contends that parties have not presented evidence in this proceeding that Energy Storage Resources are technically or operationally incapable of discharging their batteries at a reduced rate in order to supply energy on a more sustained basis.

132. PJM asserts that arguments regarding PJM's determination of PJM's system reliability needs do not address "the relative ability of units to maintain output at stated capability over a specified period of time."[323] Furthermore, PJM explains that such arguments also seek to depart from the Commission's findings in the Capacity Performance Order that Capacity Resources are expected to perform on a sustained basis, and thus, seek special treatment for Capacity Storage Resources. Moreover, PJM avers that technical and operational requirements specific to Capacity Storage Resources do not

[319] Data Request Response at 3.

[320] *Id.* at 4 (citing RAA, art. 1).

[321] *Id.* (citing RAA, Schedule 9-10).

[322] *Id.* at 11.

[323] *Id.* at 12.

provide any justification for allowing them to base their capacity value on their output over a much shorter time period.[324]

133. PJM states that it currently uses received telemetric information to verify that any given pumped-hydro unit can produce at its full capacity for 10 hours or more.[325] PJM further states that it applies an analogous process for Energy Storage Resources, which consists of receiving information regarding capability and verifying the information received.

v. Comments on Data Request Response

134. Advanced Energy Economy and Clean Energy Entities object to PJM's characterization of their objections to the 10-hour minimum run-time requirement as "essentially economic," arguing instead that PJM's mischaracterization is misplaced and misleading.[326] Advanced Energy Economy states that its comments focused on ensuring that the rules recognize the physical and operational characteristics of Energy Storage Resources and PJM should allow these resources to provide all of the capacity they are technically capable of providing.[327]

135. Clean Energy Entities assert that PJM's reference to Dr. Nicholson's testimony is misleading.[328] First, Clean Energy Entities clarify that the majority of their arguments did not focus on a disagreement with PJM's determination of PJM's system's reliability needs, rather their arguments focused on other distinct issues.[329] Additionally, Clean Energy Entities explain that Dr. Nicholson's testimony demonstrated that the 2010 demand response studies, used by PJM in support of the 10-hour minimum run-time requirement, did not analyze the right question and were based on outdated information

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

[325] *Id.* at 13.

[326] Advanced Energy Economy Comments on Data Request Response at 3; Clean Energy Entities Comments on Data Request Response at 4 and 6 (citing Data Request Response at 11-12).

[327] Advanced Energy Economy Comments on Data Request Response at 3.

[328] Clean Energy Entities Comments on Data Request Response at 6.

[329] *Id.* at 6-7.

or unreasonable assumptions.[330] Clean Energy Entities also clarify that Dr. Nicholson did not take any position on how PJM should determine the system's reliability needs or on a specific minimum run-time requirement for non-hydro Energy Storage Resources.

136. Clean Energy Entities also point out that PJM did not meaningfully address their argument that PJM's proposal is not supported by the sole reference to a 10-hour minimum run-time requirement in PJM's governing documents or manuals.[331] Clean Energy Entities state that PJM's failure to respond to Clean Energy Entities' arguments highlights that PJM has failed to explain how the proposed 10-hour minimum run-time requirement ties to calculating non-hydro Energy Storage Resource capacity value.[332]

137. Advanced Energy Economy states that PJM failed to answer Question 3(b) of the Commission's Data Request and did not explain how its proposal recognizes the unique characteristics and capabilities of Capacity Storage Resources.[333] Advanced Energy Economy also contends that PJM's answer did not explain how its proposal accounts for the abilities of Energy Storage Resources compared to other resource types. Advanced Energy Economy states that PJM applies the same rules and procedures to Energy Storage Resources as it does to pumped-hydro resources, which does not align with the requirements of Schedule 9 of the RAA.[334] Advanced Energy Economy reiterates that because Energy Storage Resources are fundamentally different from pumped-hydro resources, it is not appropriate to apply the same capacity valuation procedures to both resource types. Advanced Energy Economy also argues that PJM's evidence to support the proposal was not applicable to Energy Storage Resources and the proposal differs from those provided by other regions. Advanced Energy Economy concludes that PJM's response does not demonstrate that the proposed minimum run-time requirement is just and reasonable or in compliance with Order No. 841.

vi. Commission Determination

138. We find that PJM's Tariff satisfies Order No. 841's general directive with respect to allowing electric storage resources to de-rate their capacity to meet minimum run-time requirements. However, we institute an FPA section 206 proceeding to direct PJM to

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[330] *Id.* at 7.

[331] *Id.* at 8.

[332] *Id.* at 9.

[333] Advanced Energy Economy Comments on Data Request Response at 2.

[334] *Id.* at 3.

include its rules and practices regarding minimum run-time requirements in its Tariff. In addition, in that same FPA section 206 proceeding, based on the comments submitted in this proceeding, we institute an investigation and establish paper hearing procedures regarding the justness and reasonableness of PJM's minimum run-time requirements as applied to Capacity Storage Resources.

139. Order No. 841 requires only that resources using the Storage Participation Model may de-rate their capacity to meet minimum run-time requirements.[335] RAA, Schedule 9, Procedures for Establishing the Capability of Generation Capacity Resources, provides: "Such rules and procedures as may be required to determine and demonstrate the capability of Generation Capacity Resources . . . shall be developed by the Office of Interconnection and maintained in the PJM Manuals. . . . The rules and procedures shall recognize the difference in types of generating units and the relative ability of units to maintain output at stated capability over a specified period of time."[336] Because this tariff provision requires PJM to maintain rules and procedures in its Manuals that allow Capacity Storage Resources to de-rate their capacity to meet minimum run-time requirements, we find that PJM's Tariff satisfies Order No. 841's general directive that resources using the Storage Participation Model may de-rate their capacity to meet minimum run-time requirements. In Order No. 841, the Commission did not require RTOs/ISOs to make specific changes to minimum run-time or must-offer requirements associated with providing capacity.[337] We find, therefore, that arguments concerning the specifics of PJM's minimum run-time rules and procedures, including application of PJM's 10-hour minimum run-time requirement to Capacity Storage Resources, are beyond the scope of PJM's Order No. 841 compliance filing.

140. Nevertheless, we agree with commenters that PJM's rules and procedures regarding minimum run-time requirements for every resource type, which currently are included only in PJM's Manual, must be included in the PJM Tariff. Decisions as to whether an item should be placed in a tariff or in a business practice manual are guided by the Commission's rule of reason policy,[338] under which provisions that "significantly

[335] *See supra* P 96.

[336] RAA, Schedule 9.

[337] Order No. 841, 162 FERC ¶ 61,127 at P 100.

[338] *See, e.g.*, *ESA v. PJM*, 162 FERC ¶ 61,296 at P 103 (citing *Midcontinent Indep. Sys. Operator, Inc.*, 158 FERC ¶ 61,003, at P 69 (2017) (citing *PacifiCorp*, 127 FERC ¶ 61,144, at P 11 (2009))); *City of Cleveland, Ohio v. FERC*, 773 F.2d 1368, 1376 (D.C. Cir. 1985) (finding that utilities must file "only those practices that affect rates and service *significantly*, that are reasonably *susceptible* of specification, and that are not so generally understood in any contractual arrangement as to render recitation superfluous");

affect rates, terms, and conditions" of service, are readily susceptible of specification, and are not generally understood in a contractual agreement must be included in the tariff, while items better classified as implementation details may be included only in a business practice manual.[339] Although PJM's minimum run-time rules and procedures applicable to all resource types significantly affect rates, terms, and conditions of service, its current Tariff does not include any minimum run-time requirements other than specifying that the Manual must allow resources to de-rate their capacity. Accordingly, we initiate a separate FPA section 206 proceeding in Docket No. EL19-100-000 to direct PJM to submit Tariff provisions reflecting the minimum run-time rules and procedures currently specified in its Manual for every resource.

141. Further, the record in this proceeding raises concerns that PJM's application of its minimum run-time rules and procedures to Capacity Storage Resources may be unjust, unreasonable, unduly discriminatory or preferential. For example, commenters argue that: (1) it is unduly discriminatory to apply a 10-hour minimum run-time requirement to Capacity Storage Resources, while only applying a 4-hour minimum run-time requirement to intermittent resources; (2) PJM's 10-hour minimum run-time requirement is not based on a sound consideration of physical and operational characteristics of Capacity Storage Resources; and (3) multiple PJM Tariff provisions differ in the treatment of Capacity Storage Resources and Generation Capacity Resources, even though PJM contends in its Data Request Response that Capacity Storage Resources are Generation Capacity Resources.

142. Accordingly, in the same FPA proceeding directed above in Docket No. EL19-100-000, we will initiate paper hearing procedures to investigate whether PJM's minimum run-time rules and procedures are unjust, unreasonable, unduly discriminatory or preferential as applied to Capacity Storage Resources. We find that a paper hearing is the appropriate procedure to determine whether PJM's minimum run-time requirements as applied to Capacity Storage Resources, which must be submitted as part of the filing directed below, are just and reasonable and not unduly discriminatory or preferential.

143. Accordingly, no later than 45 days after the publication of notice in the *Federal Register* of the Commission's initiation of this section 206 proceeding in Docket No. EL19-100-000, PJM must submit Tariff provisions reflecting its minimum run-time rules and procedures applicable to all resources. By the same date, PJM and other interested participants may file initial briefs addressing whether PJM's application of

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Public Serv. Comm'n of N.Y. v. FERC, 813 F.2d 448, 454 (D.C. Cir. 1987) (holding that the Commission properly excused utilities from filing policies or practices that dealt with only matters of "practical insignificance" to serving customers).

[339] *See, e.g.*, *ESA v. PJM*, 162 FERC ¶ 61,296 at P 103 (citing *Cal. Indep. Sys. Operator Corp.*, 122 FERC ¶ 61,271, at P 16 (2008)).

those rules and practices to Capacity Storage Resources is just and reasonable and not unduly discriminatory or preferential. Reply briefs may be filed within 30 days thereafter. Because we are instituting a separate FPA section 206 proceeding regarding PJM's minimum run-time requirements, PJM's relevant filing should be filed in the new Docket No. EL19-100-000 and all responsive pleadings should be filed only in that new docket.

144. In cases where, as here, the Commission institutes a section 206 investigation on its own motion, section 206(b) of the FPA requires that the Commission establish a refund effective date that is no earlier than the date of publication by the Commission of notice of its intention to initiate such proceeding nor later than five months after the publication date. In such cases, in order to give maximum protection to customers, and consistent with our precedent, we have historically tended to establish the section 206 refund effective date at the earliest date allowed by section 206, and we do so here as well.[340] That date is the date of publication of notice of initiation of the section 206 proceeding in Docket No. EL19-100-000 in the Federal Register.

145. Section 206(b) of the FPA also requires that, if no final decision is rendered by the conclusion of the 180-day period commencing upon initiation of the section 206 proceeding, the Commission shall state the reason why it has failed to render such a decision and state its best estimate as to when it reasonably expects to make such a decision. We expect to issue a final order in this proceeding within 12 months of receiving reply briefs.

3. Physical and Operational Characteristics of Electric Storage Resources

146. Order No. 841 adds section 35.28(g)(9)(i)(C) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources that accounts for the following physical and operational characteristics of electric storage resources through bidding parameters or other means: State of Charge, Maximum State of Charge, Minimum State of Charge, Maximum Charge Limit, Minimum Charge Limit, Maximum Discharge Limit, Minimum Discharge Limit, Maximum Charge Time, Minimum Charge Time, Maximum Run Time, Minimum Run Time, Discharge Ramp Rate, and Charge Ramp Rate.[341] Each RTO/ISO must demonstrate how its proposed or existing tariff provisions account for each of these specific physical and operational characteristics of electric storage resources, which are

[340] *See, e.g., Idaho Power Co*., 145 FERC ¶ 61,122 (2013); *Canal Electric Co*., 46 FERC ¶ 61,153, *order on reh'g*, 47 FERC ¶ 61,275 (1989).

[341] Order No. 841, 162 FERC ¶ 61,127 at P 191.

described further below. Order No. 841 provides that, to the extent that an RTO/ISO proposes to comply with the requirement to account for any of the physical and operational characteristics of electric storage resources enumerated herein through its existing bidding parameters or other existing market mechanisms, it must demonstrate in its compliance filing how its existing market rules already account for that particular physical and operational characteristic.[342] This requirement will improve the ability of electric storage resources to provide all of the services that they are technically capable of providing and allow RTOs/ISOs to procure these services more efficiently, which will enhance competition and, in turn, help to ensure that RTO/ISO markets produce just and reasonable rates.[343]

147. Order No. 841 does not require RTOs/ISOs to mandate that a resource owner/operator submit any information, but instead, provided flexibility to each RTO/ISO to determine whether resources using the participation model for electric storage resources are required to submit information regarding their physical and operational characteristics, or whether resources using the participation model should be allowed to submit such information at their discretion.[344] This flexibility may help prevent resources using the participation model for electric storage resources from having to submit information that is not applicable given their physical, operational, or commercial circumstances. If an RTO/ISO adopts bidding parameters to account for the physical and operational characteristics set forth in Order No. 841, as specified below, it must permit a resource using the participation model for electric storage resources to submit those bidding parameters in both the day-ahead and the real-time markets.[345]

148. Further, Order No. 841 allows each RTO/ISO to propose, in its compliance filing, bidding parameters or other means to account for physical and operational characteristics of electric storage resources besides those set forth in Order No. 841.[346] To the extent that an RTO/ISO includes such a proposal in its compliance filing, it must demonstrate that such bidding parameters or other mechanisms do not impose barriers to the participation of electric storage resources in its markets.

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[342] *Id.* PP 211, 220, 229.

[343] *Id.* PP 211, 220, 230.

[344] *Id.* P 192.

[345] *Id.* P 193.

[346] *Id.* P 235.

149. Order No. 841-A clarifies that the requirement that each RTO/ISO establish tariff provisions providing a participation model for electric storage resources that accounts for the physical and operational characteristics of electric storage resources through bidding parameters or other means allows for regional flexibility.[347]

State of Charge

150. Order No. 841 provides that State of Charge represents the amount of energy stored by an electric storage resource in proportion to the limit on the amount of energy that it can store, typically expressed as a percentage.[348] The State of Charge as a bidding parameter is the level of energy that an electric storage resource is anticipated to have available at the start of the market interval rather than the end. Order No. 841 provides each RTO/ISO the flexibility to propose telemetry requirements for such resources in its compliance filing and allows the RTOs/ISOs to implement the requirements of Order No. 841 consistent with the telemetry requirements for different services and other market participants in each RTO/ISO.[349]

Maximum State of Charge and Minimum State of Charge

151. Maximum State of Charge represents the State of Charge that should not be exceeded (i.e., gone above) when the electric storage resource is receiving electric energy from the grid.[350] This value may either be a static value based on manufacturer specifications or a dynamic value depending on the operational characteristics of the resource (e.g., if it is providing multiple services and needs to reserve part of its State of Charge for another service).

152. Minimum State of Charge represents the State of Charge that should not be exceeded (i.e., gone below) when an electric storage resource is injecting electric energy onto the grid.[351] This value may be either a static value based on manufacturer specifications or a dynamic value depending on the operational characteristics of the resource (e.g., if it is providing multiple services and needs to reserve part of its State of Charge for another service).

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[347] Order No. 841-A, 167 FERC ¶ 61,154 at P 93.

[348] Order No. 841, 162 FERC ¶ 61,127 at P 213.

[349] *Id.* P 214.

[350] *Id.* P 215.

[351] *Id.* P 215.

Maximum Charge Limit and Minimum Charge Limit

153. The Maximum Charge Limit for a resource using the electric storage resource participation model is the maximum MW quantity of electric energy that it can receive from the grid.[352] The Minimum Charge Limit represents the minimum MW level that the resource can receive from the grid.[353]

Maximum Discharge Limit and Minimum Discharge Limit

154. The Maximum Discharge Limit is the maximum MW quantity that the resource can inject onto the grid.[354] The Maximum Discharge Limit is analogous to, and could be represented by, the economic maximum that traditional generation resources can generally submit with their offers. The Minimum Discharge Limit represents the minimum MW output level that the resource can inject onto the grid.[355]

Maximum Charge Time and Minimum Charge Time

155. The Maximum Charge Time represents the maximum duration that a resource using the participation model for electric storage resources is able to be dispatched by the RTO/ISO to receive electric energy from the grid (e.g., for four hours).[356] If the RTO/ISO is not managing the State of Charge of the electric storage resource in real time, then the Maximum Charge Time will prevent it from dispatching the resource to charge for a duration that would exceed the resource's Maximum State of Charge.

156. The Minimum Charge Time represents the shortest duration that a resource using the participation model for electric storage resources is able to be dispatched by the RTO/ISO to receive electric energy from the grid.[357] Minimum Charge Time is similar to the Minimum Run Time for traditional generation resources but represents the minimum time the resource can receive electric energy from the grid, rather than provide electric energy to the grid.

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[352] *Id.* P 216.

[353] *Id.* P 231.

[354] *Id.* P 216.

[355] *Id.* P 231.

[356] *Id.* P 223.

[357] *Id.* P 222.

Maximum Run Time and Minimum Run Time

157. The Maximum Run Time reflects the maximum amount of time that a resource using the participation model for electric storage resources is able to inject electric energy to the grid due to physical or operational constraints, such as its State of Charge or potential obligations to provide other services.[358] The Minimum Run Time allows the resource to identify the minimum amount of time the resource is physically able to discharge electric energy onto the grid.

Discharge Ramp Rate and Charge Ramp Rate

158. The Discharge Ramp Rate represents the speed at which electric storage resources can move from zero output to full output, or Maximum Discharge Limit.[359] The Charge Ramp Rate represents the speed at which electric storage resources can move from zero output to fully charging, or the resource's Maximum Charge Limit.

a. Filing

159. To comply with Order No. 841's requirement that RTOs/ISOs account for specified physical and operational characteristics of electric storage resources in their participation models, PJM proposes to allow Energy Storage Resources using the Storage Participation Model to report certain data in PJM Markets Gateway for the day-ahead market and, in some instances, to update data for the real-time market.[360] The bidding parameters that PJM proposes for Energy Storage Resources to submit are: (1) Minimum and Maximum Charge Limit; (2) Minimum and Maximum Discharge Limit; and (3) Charge and Discharge Ramp Rate. [361] PJM states that these values are required for PJM to dispatch resources within their operational range. PJM proposes not to require Energy Storage Resources to submit other pieces of data, including: (1) Minimum and Maximum State of Charge; (2) Minimum and Maximum Charge Time; and (3) Minimum and Maximum Run Time, because the Energy Storage Resource will account for those characteristics in managing its State of Charge and these variables are not required for

[358] *Id.* P 224.

[359] *Id.* P 234.

[360] Compliance Filing, Transmittal at 47-48 (citing Order No. 841, 162 FERC ¶ 61,127 at PP 235-236).

[361] *Id.* at 48.

PJM to dispatch an Energy Storage Resource within its operational range.[362] Further, PJM explains that these values are commitment variables that Energy Storage Resources will make independent of PJM. PJM reiterates it is not making commitment decisions for Energy Storage Resources.[363]

160. For State of Charge, PJM proposes that Energy Storage Resources submit data to PJM via real-time telemetry, which PJM will use for the purposes of operational situational awareness in real-time.[364] PJM proposes to use the same telemetry requirements as it does for other generation resources to reflect State of Charge.[365]

b. Protests/Comments

161. Energy Storage Association, Union of Concerned Scientists, and SEIA assert that PJM's choice not to include State of Charge, Minimum State of Charge, and Maximum State of Charge as bidding parameters will cause several problems. Energy Storage Association argues that without bidding parameters for State of Charge and related characteristics, there is a greater chance of infeasible schedules, and thus, infeasible dispatch, poor performance, and imposition of penalties, all of which present barriers to the participation of Energy Storage Resources in RTO/ISO markets.[366] Union of Concerned Scientists adds that this lack this lack of bidding parameters may result in infeasible schedules may be created which will lead to both increased costs for consumers and unrealistic dispatch instructions that will cause deviation penalties for the Energy Storage Resource asset owner.[367] Energy Storage Association elaborates that, even if PJM were directed to include the three State of Charge parameters in its Tariff, it appears that PJM would not be able to utilize them because PJM considers the three State of Charge parameters to be commitment parameters and PJM will not be making commitment decisions for Energy Storage Resources.[368] Union of Concerned Scientists charges that PJM's proposal deprives PJM's market system, operators, and ongoing

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

[363] *Id.* at 49.

[364] *Id.* at 48.

[365] *Id.* at 46 (citing PJM Manual 14D, § 4.2.2).

[366] Energy Storage Association Comments at 14.

[367] Union of Concerned Scientists Comments at 3-4.

[368] Energy Storage Association Comments at 14-15.

reliability assessments from receiving information relevant to feasible schedules, operating levels, and capabilities available for the system.[369] SEIA argues the Commission should encourage PJM to incorporate State of Charge parameters into Energy Storage Resource offers for energy market dispatch.[370] SEIA asserts that this approach would yield substantial market efficiencies by reducing the potential for infeasible schedules and dispatch.[371]

162. Energy Storage Association argues that PJM's failure to include any of the three State of Charge parameters (i.e., State of Charge, Maximum State of Charge, and Minimum State of Charge) in either the day-ahead or real-time market design is inconsistent with Order No. 841.[372] Energy Storage Association argues that PJM's proposal to require Energy Storage Resources to use their real-time telemetry to report their State of Charge is misplaced because Energy Storage Resources cannot submit their State of Charge as defined by Order No. 841 in both the day-ahead and real-time markets by telemetering instantaneous State of Charge to PJM.[373] Energy Storage Association asserts that PJM's proposal to have Minimum and Maximum State of Charge parameters captured by other submitted bidding parameters reflects PJM's failure to demonstrate that other submitted bidding parameters will account for these unique parameters that represent the State of Charge that should not be gone above or gone below when the Energy Storage Resource is receiving electric energy from or injecting electric energy onto the grid.[374]

163. Energy Storage Association notes that CAISO proposes to have Energy Storage Resources submit the State of Charge as a part of a day-ahead offer, and suggests PJM use this as an example.[375] Alternatively, Energy Storage Association requests the Commission find that PJM's failure to include State of Charge and related parameters is non-compliant with Order No. 841 and direct PJM to initiate a stakeholder process to create a market design that (1) includes the three State of Charge parameters (State of

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[369] Union of Concerned Scientists Comments at 3.

[370] SEIA Comments at 6.

[371] *Id.* at 7.

[372] Energy Storage Association Comments at 10-11.

[373] *Id.* at 12.

[374] *Id.* at 13.

[375] *Id.*

Charge, Maximum State of Charge, and Minimum State of Charge) as defined by and required by Order No. 841 and (2) utilizes them properly.[376] SEIA recommends the Commission instruct PJM to facilitate additional stakeholder proceedings to determine whether the inclusion of State of Charge parameters enhances energy market dispatch to avoid infeasible schedules.[377]

164. Union of Concerned Scientists argues that PJM should adopt elements of its pumped-hydro optimizer for the Energy Storage Resources' State of Charge parameters. Union of Concerned Scientists asserts that PJM's choice not to include these characteristics contrasts with PJM's pumped-hydro optimizer, which optimizes the availability and performance for pumped-hydro resources to provide PJM dispatchers with information and control to reliably operate the system.[378] Union of Concerned Scientists argues the choice to decline information regarding State of Charge parameters seems incongruous and detrimental to reliability efforts give the heightened concern regarding grid operations in a changing supply mix.[379] Union of Concerned Scientists notes that the Commission, in Order No. 841, stated that RTOs/ISOs have gained experience from operating pumped-hydro resources and found ways to facilitate their market participation. Union of Concerned Scientists further notes that the Commission should "maintain this mindset" and require PJM to include State of Charge, Minimum State of Charge, and Maximum State of Charge as parameters in its markets and operating systems.[380]

165. Tesla requests that the Commission require RTOs/ISOs to allow electric storage resources to submit separate round-trip efficiency (i.e., the amount of energy lost from charge to discharge) parameters for summer and winter, for purposes of market registration or offers, because round-trip efficiency can be highly dependent on temperature.[381] Tesla states that seasonal round-trip efficiency levels are sufficient for all

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[376] *Id.* at 15.

[377] SEIA Comments at 1, 6.

[378] Union of Concerned Scientists Comments at 4.

[379] *Id.* at 4-5 (citing *PJM Interconnection, L.L.C.,* PJM's Evolving Resource Mix and System Reliability (2017); *PJM Interconnection, L.L.C.*, PJM's Fuel Security Analysis (2018)).

[380] *Id.* at 5.

[381] Tesla Comments at 23.

uses, including planning processes and determination of cost bases, so requiring more granular updates would not improve RTO/ISO processes.

c. Answer

166. PJM disagrees with Energy Storage Association's argument that PJM has failed to implement the three State of Charge bidding parameters defined in Order No. 841 (State of Charge, Minimum State of Charge, and Maximum State of Charge) in either the day-ahead or real-time market.[382] PJM argues that its proposal fully accounts for all physical and operational characteristics required by Order No. 841, and that PJM will account for State of Charge, Minimum State of Charge, and Maximum State of Charge by allowing electric storage resources to manage their own State of Charge and reflect the resource's capability through minimum and maximum MW operating range parameters.[383] PJM clarifies that it will modify Markets Gateway to accept hourly informational State of Charge and daily Minimum and Maximum State of Charge parameters for studies and analysis that could lead to further consideration.[384]

d. Data Request Response

167. PJM clarifies that its proposed participation model accounts for certain physical and operational characteristics of Energy Storage Resources in other bidding parameters that participants submit to PJM. For Minimum State of Charge and Maximum State of Charge limits, PJM clarifies that these are taken into account via the Maximum and Minimum Discharge and Maximum and Minimum Charge values along with the Energy Storage Resource's selection of different operating modes (i.e., continuous mode, charge mode, and discharge mode).[385] PJM adds, for example, if an Energy Storage Resource is charging and is nearing its Maximum State of Charge, the Energy Storage Resource may reduce the Maximum Charge to zero to cease charging. Alternatively, PJM offers, if an Energy Storage Resource is discharging and nearing the end of its normal discharge ability, the Energy Storage Resource may update its limits to ensure that discharging stops.

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[382] PJM March 5, 2019 Answer at 25 (citing Energy Storage Association Protest at 10-11).

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

[384] *Id.* at 26.

[385] Data Request Response at 24.

168. For the Minimum Charge Time, Maximum Charge Time, Minimum Run Time, and Maximum Run Time characteristics, PJM notes that Energy Storage Resource operators can control these through the choice of operating modes, updating the Maximum and Minimum Charge/Discharge parameters, and through priced-based bids or offer curves.[386] PJM clarifies that operating modes will be preset by the Energy Storage Resource for hourly intervals, however, the operating modes may be overwritten to zero MW in intraday to prevent Energy Storage Resources from violating Minimum/Maximum Charge/Run time. PJM offers the example of an Energy Storage Resource with a 7.5 hour Maximum Run Time or Maximum Charge Time. That resource may schedule itself in charge mode for eight hours in the day-ahead market. Then, as the resource approaches 7.5 hours of operations, the resource may adjust its Maximum Charge Limit to zero. Following the redispatch of the PJM system, PJM's dispatch of the resource will drop to zero. Therefore, PJM contends, the resource will not run longer than its Maximum Run Time or Maximum Charge Time.

169. PJM reiterates that it does not intend to manage the State of Charge on behalf of resources, and therefore, the parameters of Minimum State of Charge, Maximum State of Charge, Minimum Charge Time, and Maximum Charge Time would not constrain the output of PJM's dispatch and pricing engines.[387] Similarly, the parameters of Minimum Run Time and Maximum Run Time are restrictions on the commitment of an Energy Storage Resource, which PJM has indicated resource owners would manage by nominating non-zero Maximum Charge and Discharge Limits.

170. PJM clarifies that both historic and current State of Charge telemetry will be used for situational awareness in the day-ahead and real-time markets those markets, but not for optimization purposes.[388] PJM adds that, if one or more resources are critical to reliability, PJM operators will use the telemetered State of Charge values to confirm that an operating schedule is physically achievable and determine whether contingency plans are necessary to maintain reliability.

171. PJM also states the parameters discussed here are dynamic and are a function of the real-time State of Charge of the resource.[389] PJM argues that the communication of these parameters results in costs for market participants, who must calculate the appropriate values. PJM adds this also results in a cost for both PJM and the market

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[386] *Id.*

[387] *Id.* at 25.

[388] *Id.*

[389] *Id.* at 26.

participant, since both will need to establish and maintain communication to ensure that the salient operational data is available to PJM dispatchers while also avoiding overwhelming PJM dispatchers with irrelevant data. PJM notes that it plans to create new data entry pages in its Markets Gateway interface to collect the static Minimum State of Charge and Maximum State of Charge parameters as well as the hourly State of Charge.

172. PJM states that it will account for State of Charge at the start of a future market interval via the Maximum/Minimum Charge/Discharge values, the three available operating modes, and offers.[390] PJM provides the example of a resource targeting a lower State of Charge in a future interval, and explains that resource may choose discharge mode or continuous mode, adjust its discharge maximum to a positive value, and submit a supply offer that it believes will clear. PJM adds that if the resource clears the market to supply energy, its power output will be dispatched positive, and its State of Charge, in turn, will decline.[391]

e. Commission Determination

173. We find that PJM's proposed tariff revisions do not comply with the requirement of Order No. 841 to account for the State of Charge, Maximum State of Charge, and Minimum State of Charge of resources using the Storage Participation Model. PJM's Storage Participation Model fails to accurately represent the capabilities of Energy Storage Resources by only accounting for a small subset of the physical and operational characteristics that Order No. 841 required. PJM's proposal does not fully comply with Order No. 841 because the limited bidding parameters available to Energy Storage Resources means that PJM would "make assumptions about the state of charge of an electric storage resource."[392] Specifically, we find that PJM's proposal to account for Maximum State of Charge and Minimum State of Charge through a market participant's continuous updates to its Maximum/Minimum Charge Limit and Maximum/Minimum Discharge Limit bidding parameters fails to accurately represent the capabilities of Energy Storage Resources in its market clearing engine. Further, PJM's proposal to only collect State of Charge via real-time telemetry for situational awareness prevents market participants from accurately representing their physical and operational characteristics in the PJM markets.

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[390] *Id.*

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

[392] Order No. 841, 162 FERC ¶ 61,127 at P 213.

174. PJM argues that accounting for State of Charge, Maximum State of Charge, and Minimum State of Charge in its dispatch would be tantamount to managing resources' State of Charge. While Order No. 841 does not require that RTOs/ISOs *manage* resources' State of Charge (i.e., optimize Energy Storage Resources' charge and discharge schedules over time),[393] Order No. 841 does require RTOs/ISOs to *account* for State of Charge so that Energy Storage Resources can participate in the energy market without receiving dispatch points that violate their physical and operational limits.[394] We agree with protestors that failing to adequately account for Energy Storage Resources' State of Charge could result in Energy Storage Resources receiving infeasible energy schedules. Therefore, we direct PJM to file, within 60 days of the date of issuance of this order, a further compliance filing that modifies PJM's proposed Storage Participation Model to more appropriately account for an Energy Storage Resource's State of Charge, Maximum State of Charge, and Minimum State of Charge through bidding parameters or other means in both its day-ahead and real-time market dispatch, as required by Order No. 841.[395]

175. We agree with PJM's proposal for Energy Storage Resources to submit: (1) Minimum and Maximum Charge Limit; (2) Minimum and Maximum Discharge Limit; and (3) Charge and Discharge Ramp Rate bidding parameters in both the Day-ahead and Real-time markets. However, Order No. 841 requires that the Tariff provide for a participation model that accounts for each of the characteristics described in the rule.[396] PJM does not account for Minimum and Maximum Charge Limit, Minimum and Maximum Discharge Limit, and Charge and Discharge Ramp Rate in its Tariff. Accordingly, we direct PJM to file, within 60 days of the date of issuance of this order, a further compliance filing to include those bidding parameters in the Tariff. We find that those bidding parameters will account for those physical and operational characteristics of Energy Storage Resources, as required by Order No. 841.

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[393] *Id.* P 254.

[394] *See id.* P 189.

[395] *Id.* P 213 ("As noted above in the Requirement to Incorporate Bidding Parameters as Part of the Electric Storage Resource Participation Model section . . . we require each RTO/ISO to allow a resource using the participation model for electric storage resources to submit its State of Charge in both day-ahead and real-time markets.").

[396] *See id.* P 191 (requiring each RTO/ISO to demonstrate how its proposed or existing tariff provisions account for each of these specific physical and operational characteristics of electric storage resources, which are described further below).

176. We also accept PJM's proposal not to require Energy Storage Resources to submit Minimum and Maximum Charge Time and Minimum and Maximum Run Time. We find that this complies with Order No. 841 because, as PJM explains, Energy Storage Resources will account for these characteristics in selecting their operating mode (i.e., continuous, charge, or discharge).

177. We find Tesla's request that the Commission require PJM to allow electric storage resources to submit separate round-trip efficiency levels for summer and winter to be outside the scope of this compliance proceeding. Although Order No. 841 affords the RTOs/ISOs flexibility to propose additional bidding parameters to account for the physical and operational characteristics of electric storage resources, it does not require the RTOs/ISOs to account for any other physical and operational characteristics beyond those identified above.

4. State of Charge Management

178. Order No. 841 requires each RTO/ISO to allow resources using the participation model for electric storage resources to self-manage their State of Charge.[397] Order No. 841 provides that a resource using the participation model for electric storage resources that self-manages its State of Charge will be subject to any applicable penalties for deviating from a dispatch schedule to the extent that the resource deviates from the dispatch schedule in managing its State of Charge. Order No. 841 further provides that, to the extent that the provision of a particular wholesale service, such as frequency regulation, requires a resource providing that service to follow a dispatch signal that has the effect of maintaining the resource's ability to provide the service, an electric storage resource that is managing its own State of Charge would still be required to follow such a dispatch signal, just as all other resources providing that same service.

179. RTOs/ISOs are not required as part of Order No. 841 to manage the State of Charge for resources using the participation model for electric storage resources.[398] While RTOs/ISOs must permit resources to manage their own State of Charge, RTOs/ISOs may provide an option for the RTO/ISO to manage an electric storage resource's State of Charge for any particular service or circumstance as they deem appropriate in their markets with the consent of the electric storage resource.[399] If an RTO/ISO already has a mechanism to manage a resource's State of Charge, then the RTO/ISO must make it optional for the electric storage resource owner/operator to use such mechanism so that

[397] Order No. 841, 162 FERC ¶ 61,127 at P 253.

[398] *Id.* P 254.

[399] *Id.* n.300.

the electric storage resource is able to manage its own State of Charge if it elects to do so.[400] Order No. 841 further provides that, where an electric storage resource has the option to allow the RTO/ISO to manage its State of Charge, the electric storage resource is the default manager of the resource's State of Charge. Order No. 841 states that RTOs/ISOs should be able to dispatch resources using the participation model for electric storage resources in the same manner as any other market participant to address any reliability challenges and should know that the resources have an adequate State of Charge to perform the service to which they have committed.[401] RTOs/ISOs are not precluded from establishing telemetry or other communication requirements necessary to determine the capabilities of an electric storage resource in real time. Self-managing electric storage resources, just like all market participants, are subject to any non-performance penalties in the RTO/ISO tariff.

a. Filing

180. PJM states that Energy Storage Resources are in the best position to manage their own State of Charge.[402] PJM explains that it is not assuming the burden of managing Energy Storage Resources' state-of-charge or commitment decisions; rather, PJM intends to require Energy Storage Resources to decide when—based upon the self-management of their operation parameters—they participate in PJM's energy markets. PJM will then dispatch participating Energy Storage Resources based upon their most recently submitted parameters.[403] Because Energy Storage Resources will manage their State of Charge, PJM states that it will not make commitment decisions or permit Energy Storage Resources to submit start-up costs and no-load costs.[404]

181. As discussed above, PJM proposes three potential modes of operation for Energy Storage Resource participants in its real-time and day-ahead markets: (1) continuous mode, (2) charge mode, and (3) discharge mode.[405] PJM explains that, in continuous mode, a resource can be dispatched to either charge or discharge within its available operating range, as defined by the resource's specified Maximum Discharge Limit and

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[400] *Id.* P 254.

[401] *Id.* P 255.

[402] Compliance Filing, Transmittal at 48.

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

[404] *Id.* at 52.

[405] *Id.* at 33.

Maximum Charge Limit.[406] PJM also explains that resources operating in continuous mode would have no limitation on start-up, an assumed instantaneous ramp rate, and the ability to update their Maximum Discharge Limit and Maximum Charge Limit in real-time.

182. PJM asserts that, while continuous mode offers Energy Storage Resources operational flexibility, it does not guarantee each resource economically optimal operation across time; rather, PJM's goal remains the economic optimization of the market as a whole.[407] PJM explains that it currently uses an optimizer tool to establish the day-ahead energy market schedule for certain large pumped-hydro resources; this approach allows large pumped-hydro market participants to optimize their own pond levels and market participation, while giving PJM dispatchers the information and control necessary to reliably operate the system.[408] To optimize their own participation, Energy Storage Resources will retain the ability to switch to other modes of operation by altering relevant parameters in Markets Gateway throughout the operating day.[409]

183. Because continuous mode is not compatible with all types of electric storage resources (i.e., pumped-hydro), PJM proposes allowing charge and discharge modes as well.[410] Under charge mode, an Energy Storage Resource specifies a Minimum Charge Limit, Maximum Charge Limit, and ramp rate, and will only be dispatched to charge. Similarly, under discharge mode an Energy Storage Resource specifies a Minimum Discharge Limit, Maximum Discharge Limit, and ramp rate, and will only be dispatched to discharge.[411] In either mode, an Energy Storage Resource may also submit a non-dispatchable fixed MW schedule.

184. PJM proposes to apply its current telemetry requirements to resources participating in the Storage Participation Model. PJM currently requires real-time telemetry for resources that are larger than 10 MW, eligible to set prices in PJM's energy market, interconnected to the grid at voltages greater than 50 kV, capacity resources, or participating in ancillary services. PJM notes that Energy Storage Resources that do not

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[406] *Id.* at 33-34.

[407] *Id.* at 34.

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

[409] *Id.* at 34.

[410] *Id.* at 33.

[411] *Id.* at 35-36.

have current telemetry requirements will not be required to telemeter under the Storage Participation Model.[412] PJM states it will require real-time telemetry of the State of Charge from all telemetered Energy Storage Resources for operational situational awareness. However, PJM states the telemetered State of Charge will not be used to optimize Energy Storage Resources across intervals in energy markets. PJM adds that this State of Charge information will inform PJM dispatch about Energy Storage Resources that may be coming off their charge and allow PJM dispatch to anticipate and prepare for load or generation changes.[413]

185. PJM states that, like all other resources participating in PJM's day-ahead and real-time markets, Energy Storage Resources will be subject to deviation charges for failing to follow PJM dispatch.[414] PJM proposes that Energy Storage Resources will incur deviation charges in the same manner as other resources, and an Energy Storage Resource will incur deviation charges when it (1) does not have a dispatchable range and fails to match its real-time output to the day-ahead schedule; (2) is not dispatched below the economic maximum; or (3) does not follow within 10 percent of the dispatch signal and the calculated deviation for the hour is greater than or equal to 5 MWh.[415]

b. Protests/Comments

186. NextEra supports PJM's proposal to have Energy Storage Resource operators self-manage their State of Charge, and argues that PJM's proposal provides a good model for other regions to follow.[416] NextEra adds that this approach is appropriate because Energy Storage Resources, rather than RTOs/ISOs, are better equipped to evaluate the many physical and economic factors that influence the optimal modes of market participation from moment-to-moment. In short, NextEra asserts that PJM provides the adequate and appropriate tools for Energy Storage Resource operators to communicate through PJM's Markets Gateway on a timely real-time basis.[417]

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[412] *Id.* at 46-47 (citing Manual 14D, § 4.2.2).

[413] *Id.* at 47.

[414] *Id.* at 53.

[415] *Id.*; Manual 28: Operating Agreement Accounting, § 5 (Revision 81, October 25, 2018).

[416] NextEra Comments at 11.

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

187. Tesla states that it does not oppose the option to utilize energy neutral signals for frequency regulation, but requests that the Commission require that PJM and other RTOs/ISOs provide the option for electric storage resources to self-manage their State of Charge during the provision of frequency regulation and to submit asymmetrical offer curves for regulation up and regulation down service.[418] Tesla argues that energy neutral signals for the provision of frequency regulation represent RTO/ISO-management of an electric storage resource's State of Charge, and that Order No. 841 expressly requires that each RTO/ISO allow electric storage resources to self-manage their State of Charge.[419] Tesla argues that electric storage resources should have the option to self-manage their State of Charge when providing frequency regulation, and be allowed to provide an asymmetric offer curve for regulation up and regulation down. Tesla explains that an electric storage resource that is fully charged cannot offer its full capacity for frequency regulation with an energy neutral signal, but that it could provide its full capacity if it were allowed to bid only regulation up. Likewise, Tesla explains a fully discharged electric storage resource cannot provide frequency regulation based on an energy neutral signal, but could provide its full capacity for regulation down service.

188. SEIA asserts that, even though the Commission did not mandate that the RTOs/ISOs manage electric storage resources' State of Charge in Order No. 841, such an approach would create significant market efficiencies, especially with coming market changes as new electric storage resources enter the markets.[420]

189. Public Interest Organizations argue that under PJM's proposal, PJM will not optimally dispatch Energy Storage Resources in real-time and that PJM's proposal to permit Energy Storage Resources to self-manage their State of Charge severely limits their ability to utilize rapid response capabilities and manage the ebb and flow of energy real-time.[421] According to Public Interest Organizations, Energy Storage Resource owners have two methods to attempt to optimize their real-time participation, neither of which comes close to optimizing Energy Storage Resource participation in real-time: they may set static buy (charge) and sell (discharge) offers, and continuously update their Minimum and Maximum Charge Rates to reflect energy limits, or they may chase prices by monitoring LMPs and self-scheduling operations.[422] Public Interest Organizations

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[418] Tesla Comments at 22-23.

[419] *Id.*

[420] SEIA Comments at 6-7.

[421] Public Interest Organizations Comments at 19-20.

[422] *Id.* at 20.

state that an Energy Storage Resource owner who entered charge and discharge offers and relied on economic real-time scheduling would need a prescient knowledge of future real-time prices to make even approximately optimal offers. Similarly, Public Interest Organizations argue that monitoring real-time prices and self-scheduling fares no better. Public Interest Organizations argue that the delay inherent in this approach means that Energy Storage Resources will not be able to respond to rapid price movements, and the owner's lack of knowledge regarding the system outlook over the next hour or so would reduce them to little better than guessing if they should be charging or discharging during any interval.[423] Public Interest Organizations assert that storage offers potential benefits in real-time operations beyond managing price volatility and the simple Energy Storage Resource model proposed in the filing offers little opportunity to realize these benefits.[424]

c. Data Request Response

190. In response to a question as to whether resources using PJM's Storage Participation Model may self-manage their State of Charge, PJM clarifies that they may. PJM adds that the State of Charge is a consequence of the power output over time. Because resources control their power output via their choice of mode, Maximum and Minimum Charge/Discharge Limits, and offers by virtue of controlling their power output, resources can manage their State of Charge.[425] Additionally, PJM proposes to add language to its Tariff clarifying that resources will be responsible for their own State of Charge Management.

191. PJM also proposes to add the following definition of State of Charge Management to its Tariff: "the control of State of Charge of an [Energy Storage Resource] Market Participant using minimum and maximum charge and discharge limits, changes in operating mode, charge and discharging offer curves, and self-scheduling of non-dispatchable purchases and sales of energy in PJM's markets. State of Charge Management shall not interfere with an [Energy Storage Resource] Model Participant's obligation to follow PJM dispatch, consistent with all other resources."[426]

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

[424] *Id.* at 21. Public Interest Organizations state that storage may "help manage ramps, reduce the uplift associated with startup and shutdown of inflexible units, [and] rapidly shift between reserves, regulation and energy."

[425] Data Request Response at 28.

[426] *Id.* at 29.

d. Commission Determination

192. We find that PJM's proposed Storage Participation Model complies with Order No. 841 because it allows Energy Storage Resources to manage their State of Charge. While Public Interest Organizations argue that PJM's proposal to require Energy Storage Resources to self-manage their State of Charge severely limits their ability to utilize rapid response capabilities and manage the ebb and flow of energy in real-time, Order No. 841 explains that RTOs/ISOs are not required to manage an electric storage resource's State of Charge and that resources must be permitted to self-manage their own State of Charge. Thus, we find that PJM's proposal to require Energy Storage Resources to manage their State of Charge complies with Order No. 841.

193. We also find that PJM's proposal that Energy Storage Resources, like all other resources participating in PJM's day-ahead and real-time markets, will be subject to deviation charges for failing to follow PJM dispatch complies with Order No. 841. Order No. 841 provides that a resource using the participation model for electric storage resources that self-manages its State of Charge will be subject to any applicable penalties for deviating from its dispatch schedule in managing its State of Charge.

194. We further find that PJM's proposal to apply its current telemetry requirements to resources participating in the Storage Participation Model complies with Order No. 841. Order No. 841 does not preclude RTOs/ISOs from establishing telemetry or other communication requirements necessary to determine the capabilities of an electric storage resource in real-time.

195. In response to Tesla's comments regarding resources providing frequency regulation, we note that Order No. 841 addresses this issue by explaining that, to the extent that the provision of a particular wholesale service, such as frequency regulation, requires a resource providing that service to follow a dispatch signal that has the effect of maintaining the resource's ability to provide the service, an electric storage resource that is managing its own state of charge would still be required to follow such a dispatch signal, just as all other resources providing that same service.[427] We disagree with Tesla that the Commission must require PJM to allow Energy Storage Resources to submit asymmetrical offer curves for regulation up and regulation down service, as it was not a requirement in Order No. 841, and thus, is outside the scope of this proceeding. As explained above, we find that PJM's proposal complies with Order No. 841's requirement to allow resources to self-manage their State of Charge.

[427] Order No. 841, 162 FERC ¶ 61,127 at P 253.

5. Minimum Size Requirement

196. Order No. 841 adds section 35.28(g)(9)(i)(D) to the Commission's regulations to require that each RTO/ISO have tariff provisions providing a participation model for electric storage resources that establishes a minimum size requirement for participation in the RTO/ISO markets that does not exceed 100 kW.[428] This minimum size requirement includes all minimum capacity requirements, minimum offer to sell requirements, and minimum bid to buy requirements for resources participating in these markets under the participation model for electric storage resources. Under this requirement, an RTO/ISO may allow offer and/or bid quantities smaller than or equal to 100 kW, but an RTO/ISO may not require a resource using the electric storage resource participation model to submit offer and/or bid quantities larger than 100 kW.[429] The Commission found that minimum size requirements do not need to be resource specific or location-specific.[430]

197. Order No. 841-A denies requests for rehearing regarding the minimum size requirement,[431] including MISO's request for clarification or, in the alternative, rehearing to phase in the implementation of the minimum size requirement.[432] In response to MISO's request for clarification that the 100 kW limit does not apply to the Minimum Charge Limit or Minimum Discharge Limit, Order No. 841-A clarifies that the minimum size requirement does not prohibit an RTO/ISO from establishing a minimum size limit that is lower than 100 kW on any minimum capacity requirements, minimum offer to sell requirements, or minimum bid to buy requirements. Order No. 841-A clarifies further that it is possible that the quantities for the Minimum Charge Limit and Minimum Discharge Limit may be smaller than 100 kW for resources using the participation model for electric storage resources. However, Order No.841-A does not specify how the minimum size requirement may affect the quantities submitted for some of the physical and operational characteristics of electric storage resources, and stated that the Commission would not prejudge how the RTOs/ISOs may propose any such relationships

[428] *Id.* P 270.

[429] *Id.* P 276.

[430] *Id.* P 273.

[431] Order No. 841-A, 167 FERC ¶ 61,154 at PP 102-104.

[432] *Id.* P 105.

between the minimum size requirement and the physical and operational characteristics of resources using the participation model for electric storage resources.[433]

a. Filing

198. PJM states that its current 100 kW participation threshold is consistent with the Commission's minimum size threshold.[434]

b. Data Request Response

199. PJM states that 100 kW is the minimum offer threshold for all resources participating in all of its markets.[435] PJM states that, for example, its Tariff provides that "a Sell Offer shall state quantities in increments of 0.1 [MW]."[436] PJM also cites to Attachment K-Appendix section 1.10 which provides that Regulation and Synchronized Reserve offers "must equal or exceed 0.1 [MW]."[437] To ensure consistency, PJM proposes an additional revision to its Tariff, which states that "Energy Storage Resource Model Participants may offer quantities (including charging and discharging) equivalent to 0.1 MW or greater into all applicable PJM markets."[438] PJM further clarifies that all generating units, including Energy Storage Resources, that are smaller than 100 kW may be aggregated to meet PJM's 100 kW participation threshold. PJM states that its manuals provide that "[g]enerating units that are connected to the system at the same electrical location may be aggregated and offered into PJM's market as a single unit."[439]

c. Comments on Data Request Response

200. Advanced Energy Economy states that PJM has not demonstrated that limiting aggregations of Energy Storage Resources to a single electrical location to meet the 100 kW minimum size requirement is just and reasonable or in compliance with Order

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[433] *Id.* P 106.

[434] Compliance Filing, Transmittal at 11.

[435] Data Request Response at 30.

[436] *Id.* at 31 (quoting Tariff, Attachment DD, § 5.6).

[437] *Id.* at 31; Tariff, Attachment K-Appendix, § 1.10.

[438] Data Request Response at 31; Tariff, Attachment K-Appendix, § 1.4A(f).

[439] Data Request Response at 32 (citing Manual 11, § 2.3.3).

No. 841.[440] Rather, Advanced Energy Economy requests the Commission direct PJM to allow Energy Storage Resource aggregation across a broader area.[441]

d. Commission Determination

201. We find that the minimum size requirement for resources using the Storage Participation Model provided in PJM's Tariff complies with the requirements of Order No. 841 because PJM has established a minimum size requirement that does not exceed 100 kW, as required by Order No. 841. Additionally, we find Advanced Energy Economy's request that the Commission require PJM to allow Energy Storage Resource aggregation across a broader area to be outside the scope of this proceeding because Order No. 841 does not address the aggregation of Energy Storage Resources or other resources.[442]

6. Energy Used to Charge Electric Storage Resources

a. Price for Charging Energy

202. Order No. 841 adds section 35.28(g)(9)(ii) to the Commission's regulations to require that the sale of electric energy from the RTO/ISO markets to an electric storage resource that the resource then resells back to those markets be at the wholesale LMP.[443] This provision applies regardless of whether the electric storage resource is using the electric storage resource participation model or participates in RTO/ISO markets through other means, as long as the resource meets the definition of an electric storage resource set forth in Order No. 841. An electric storage resource's wholesale energy purchases should take place at the applicable nodal LMP, and not the zonal price.[444]

203. Order No. 841 finds that, when an electric storage resource is charging to resell energy at a later time, then its behavior is similar to other load and applicable transmission charges should apply.[445] However, Order No. 841 finds that electric storage

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[440] Advanced Energy Economy Comment on Data Request Response at 7.

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

[442] *See* Order No. 841-A, 167 FERC ¶ 61,154 at PP 30, 143, 155.

[443] Order No. 841, 162 FERC ¶ 61,127 at P 294.

[444] *Id.* P 296.

[445] *Id.* P 297. To the extent that load resources located at a single node pay different transmission charges than load resources located across multiple nodes, each

resources should not be charged transmission charges when they are dispatched by an RTO/ISO to provide a service (such as frequency regulation or a downward ramping service).[446] Order No. 841-A clarifies that the Commission's use of the phrase "applicable transmission charges" was intended to convey that an RTO/ISO may propose to apply its existing rate structure for transmission charges to an electric storage resource that is charging at wholesale but is not being dispatched by the RTO/ISO to provide a service in the RTO/ISO markets.[447] Order No. 841-A further clarifies that, on compliance, each RTO/ISO may propose that any electric storage resource that is charging for the purpose of participating in an RTO/ISO market but is not being dispatched by the RTO/ISO to provide a service should be assessed charges consistent with how the RTO/ISO assesses transmission charges to wholesale load under its existing rate structure. Order No. 841-A also states that if an RTO/ISO proposes not to apply transmission charges to an electric storage resource that is charging at wholesale but is not being dispatched by the RTO/ISO to provide a service, then the RTO/ISO must demonstrate that exempting such a resource from these charges is reasonable given its existing rate structure for transmission charges.

204. With respect to the meaning of a "service," Order No. 841-A acknowledges that the participation of electric storage resources in RTO/ISO markets may convey a range of benefits, particularly under certain system conditions, but declines to grant clarification that charging pursuant to economic dispatch always qualifies as a service.[448] However, Order No. 841-A does clarify that services do not need to be limited to ancillary services and that they can include any service defined in an RTO/ISO tariff. Order No. 841-A explains that to the extent that an RTO/ISO seeks to create a new service that would involve charging pursuant to economic dispatch under certain system conditions, the RTO/ISO may propose such revisions to its tariff through a separate FPA section 205 filing.

205. Order No. 841 does not require that electric storage resources purchase all electric energy for future use from RTO/ISO markets, and does not address whether they can pay

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RTO/ISO must apply those transmission charges for single-node resources to electric storage resources that are located at a single pricing node, as long as they are not being dispatched to provide an ancillary service by an RTO/ISO.

[446] *Id.* P 298.

[447] Order No. 841-A, 167 FERC ¶ 61,154 at P 121.

[448] *Id.* P 120.

some other rate, such as a retail rate, for charging of co-located generation.[449] Regarding electric storage resources' use of the distribution system, the Commission found that it may be appropriate, on a case-by-case basis, for distribution utilities to assess a wholesale distribution charge to an electric utility participating in the RTO/ISO markets.[450] Order No. 841-A clarifies that the Commission will consider any proposal to establish a rate for providing wholesale distribution service to an electric storage resource for its charging on a case-by-case basis (e.g., a facility-specific rate, a wholesale distribution service rate that applies to all or some subset of electric storage resources, a generally applicable wholesale distribution service tariff, or any other rate mechanism).[451]

206. Additionally, Order No. 841 finds that efficiency losses are charging energy and therefore not a component of station power load. Thus, charging energy lost to conversion inefficiencies should be settled at the LMP as long as those efficiency losses are an unavoidable component of the conversion, storage, and discharge process that is used to resell energy back to RTO/ISO markets and are not a component of what an RTO/ISO considers onsite load.[452] With respect to directly integrated and other ancillary loads, Order No. 841 provides RTOs/ISOs flexibility to determine whether they are a component of charging energy or a component of station power.

207. Order No. 841-A denies Pacific Gas and Electric's request to clarify that states have jurisdiction to determine how power flowing from the distribution grid into the electric storage resource located behind the customer meter is split between retail consumption and wholesale charging for later discharge into the wholesale markets. Order No. 841-A further reiterates that the Commission's finding regarding charging energy did not address payment of the retail rate for energy and therefore Order No. 841 does not authorize electric storage resources to bypass retail rates for its on-site electricity consumption, as Pacific Gas & Electric suggested.[453]

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[449] Order No. 841, 162 FERC ¶ 61,127 at P 299.

[450] *Id.* P 301.

[451] Order No. 841-A, 167 FERC ¶ 61,154 at P 123.

[452] Order No. 841, 162 FERC ¶ 61,127 at P 302.

[453] Order No. 841-A, 167 FERC ¶ 61,154 at P 119 (citing Order No. 841, 162 FERC ¶ 61,127 at PP 323-324).

i. Filing

208. PJM states that its Tariff currently applies the applicable interval LMP to energy bought and sold during the applicable market interval, so Energy Storage Resources can buy and sell energy at LMP without further revisions to PJM's Tariff or Operating Agreement.[454]

209. PJM proposes to adopt four new definitions to distinguish the unique behaviors of Energy Storage Resources purchasing charging energy from the grid: (1) Direct Charging Energy, (2) Dispatched Charging Energy, (3) Non-Dispatched Charging Energy, and (4) Load-Serving Charging Energy.[455]

210. PJM proposes to define Direct Charging Energy as the energy that an Energy Storage Resource purchases from the PJM Interchange Energy Market and (i) later resells to the PJM Interchange Energy Market; or (ii) is lost to conversion inefficiencies, provided that such inefficiencies are an unavoidable component of the conversion, storage, and discharge process that is used to resell energy back to the PJM Interchange Energy Market.[456] PJM explains that Direct Charging Energy is an umbrella term for all energy purchased by an Energy Storage Resource that is later resold back to PJM or lost to conversion inefficiencies and includes both Dispatched Charging Energy and Non-Dispatched Charging Energy as subcategories of Direct Charging Energy.[457]

211. PJM proposes to define Dispatched Charging Energy as "Direct Charging Energy that an [Energy Storage Resource] Model Participant receives from the electric grid pursuant to PJM dispatch while providing a service in PJM's markets."[458] Because Order No. 841 provides that transmission charges should not be assessed when an Energy Storage Resource is "dispatched to provide a service," PJM states that absent further clarification from the Commission as to what "services" are contemplated in this

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[454] Compliance Filing, Transmittal at 51 (citing Tariff, Attachment K-Appendix, § 1.7.7).

[455] *Id.* at 54.

[456] *Id.* at 54-55.

[457] *Id.* at 55.

[458] *Id.*

requirement, PJM will further define the services that constitute Dispatched Charging Energy prior to implementation of the Storage Participation Model.[459]

212. PJM proposes to define Non-Dispatched Charging Energy as "[a]ll Direct Charging Energy that an [Energy Storage Resource] Model Participant receives from the electric grid that is not otherwise Dispatched Charging Energy."[460] PJM explains that Non-Dispatched Charging Energy includes all charging energy purchased by an Energy Storage Resource when it does not notify PJM of the charging and does not schedule charging.

213. PJM proposes to define Load Serving Charging Energy as energy that is purchased from the PJM Interchange Energy Market and stored in an Energy Storage Resource for later resale to end-use load.[461] Load Serving Charging Energy is separate and distinct from Direct Charging Energy.[462] PJM explains that, according to its Tariff, only a Load Serving Entity may purchase energy that is physically withdrawn from the grid, stored in an Energy Storage Resource, and then provided to an end user.[463]

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[459] *Id.* at 55 n.135.

[460] *Id.* at 55.

[461] *Id.*; Tariff, Attachment K-Appendix, § 1.7.2.

[462] Compliance Filing, Transmittal at 56.

[463] *Id.* The RAA defines a Load Serving Entity as:

> any entity (or the duly designated agent of such an entity), including a load aggregator or power marketer, (i) serving end-users within the PJM Region, and (ii) that has been granted the authority or has an obligation pursuant to state or local law, regulation or franchise to sell electric energy to end-users located within the PJM Region. Load Serving Entity shall include any end-use customer that qualifies under state rules or a utility retail tariff to manage directly its own supply of electric power and energy and use of transmission and ancillary services.

RAA, Art. 1 (Definitions).

214. PJM proposes that Energy Storage Resources purchasing Non-Dispatched Charging Energy must be Transmission Customers paying for transmission service under either Part II or Part III of the Tariff.[464] PJM also proposes to adopt new PJM Tariff, Attachment F-2 (Form of Network Integration Transmission Service Agreement for Purchases of Non-Dispatched Charging Energy), which will allow Energy Storage Resources utilizing the Storage Participation Model to obtain Network Transmission Service for purchases of Non-Dispatched Charging Energy with detailed transparency regarding the charges and credits applied to such purchases.[465] PJM proposes that Network Transmission Service and Point-to-Point Transmission Service are not required for purchases of Dispatched Charging Energy.[466]

215. PJM proposes to exempt Direct Charging Energy from specific charges currently allocated to load, including charges related to Reactive Service as well as miscellaneous credits and charges allocated to load.[467] More specifically, PJM proposes to exempt Direct Charging Energy from Non-Deviation Uplift Charges;[468] Reactive Service Charges;[469] Control Area Service Charges;[470] Inadvertent Interchange and meter correction charge billing adjustments;[471] LMP surplus charges and credits;[472] and Auction Revenue Rights.[473]

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[464] Compliance Filing, Transmittal at 56-58 (citing Tariff, Attachment K-Appendix, § 1.4A.1).

[465] *Id.* at 57-58 (citing Tariff, Attachment F-2: Form of Network Integration Transmission Service Agreement for Purchases of Non-Dispatched Charging Energy).

[466] Compliance Filing, Tariff, Attachment K-Appendix, § 1.4A.1(b).

[467] Compliance Filing, Transmittal at 58-59.

[468] *Id.* at 59 (citing Tariff, Attachment K-Appendix, § 3.2.3).

[469] *Id.* at 59-60 (citing Tariff, Attachment K-Appendix, § 3.2.3B).

[470] *Id.* at 60 (citing Tariff, Schedule 9-1).

[471] *Id.* (citing Tariff, Attachment K-Appendix, §§ 3.7 and 3.6-3.6.4).

[472] *Id.* (citing Tariff, Attachment K-Appendix, § 5.5).

[473] *Id.* (citing revisions to Tariff, Attachment K-Appendix, § 7.4.2).

216. PJM also proposes to exempt Direct Charging Energy from charges allocated to Transmission Customers in the following PJM markets: Synchronized Reserves, Regulation, Capacity Market charges; Economic Demand Response in the Day-Ahead and Real-Time Markets; and Emergency Demand Response.[474]

ii. Protests/Comments

217. The New Jersey Commission supports PJM's enumeration of a Load Serving Charging Energy product because it will ensure that energy purchased for end-use will remain in the purview of a load serving entity under state jurisdiction.[475] However, the New Jersey Commission argues that providing load serving entities proper jurisdictional authority over Load Serving Charging Energy does not cure the potential jurisdictional issues raised in the implementation of interconnection requirements and the protections envisioned by Order No. 841.[476]

iii. Data Request Response

218. PJM explains that all purchases from PJM's energy market are at the applicable nodal LMP, including an Energy Storage Resource's wholesale energy purchases.[477] PJM states that its compliance filing proposes to establish the right of an Energy Storage Resource to purchase electric energy from PJM's markets.[478] According to PJM, because it is critical to ensure that PJM solely engages in sales for resale and does not inadvertently make end-use sales, PJM's proposed tariff revisions limit the right of

[474] *Id.* at 61.

[475] New Jersey Commission Comments at 5-6 (citing Compliance Filing, Transmittal at 55-56 ("Load Serving Charging Energy: 'Load Serving Charging Energy' is energy that is purchased from the PJM energy markets by an [Load Serving Entity] and stored in an [Energy Storage Resource] for later resale to end-use load.")).

[476] *Id.* at 6.

[477] Data Request Response at 32 (citing Tariff, Attachment K-Appendix, § 1.7.7 ("The price paid for energy bought and sold in the PJM Interchange Energy Market and for demand reductions will reflect the hourly [LMP] at each load and generation bus, determined by the Office of the Interconnection in accordance with this Agreement.")).

[478] *Id.* at 33 (citing Tariff, Attachment K-Appendix, § 1.7.2 ("Only Market Buyers and Energy Storage Resources shall be eligible to purchase energy or related services in the PJM Interchange Energy Market. Market Buyers shall comply with all requirements for making purchases from the PJM Interchange Energy Market.")).

Energy Storage Resources to make purchases from PJM to only those purchases that are stored for later resale to PJM markets. PJM states that resales to end-users must only be made by Load Serving Entities that have been authorized to do so under appropriate state or local law.[479]

iv. Commission Determination

219. We find that PJM's compliance filing complies with the requirements of Order No. 841 regarding the price paid for an electric storage resource's charging energy. Specifically, PJM's Tariff provides that the price paid for energy bought and sold in the PJM Interchange Energy Market and for demand reductions will reflect the hourly LMP at each load and generation bus.[480] PJM's proposed Tariff revisions also limit the right of Energy Storage Resources to make purchases from PJM to only those purchases that are stored for later resale to PJM markets. We also find that PJM complies with the requirement to settle charging energy lost to conversion inefficiencies at the wholesale LMP. Specifically, PJM's proposed definition of Direct Charging Energy includes energy purchased from PJM markets, stored, and returned to PJM's markets or lost to conversion inefficiencies.[481] Therefore, we find that the Tariff provides that sales of electric energy from PJM's markets to an Energy Storage Resource that the resource then resells back to those markets will be at the applicable nodal LMP, as required by Order No. 841.

220. We find that PJM partially complies with the requirement to not assess transmission charges to an Energy Storage Resource that is dispatched to withdraw energy to provide a service. PJM defines Dispatched Charging Energy as "Direct Charging Energy that an [Energy Storage Resource] Model Participant receives from the electric grid pursuant to PJM dispatch while providing a service in PJM's markets."[482] PJM's proposed Tariff provisions state that "Network Transmission Service and Point-to-Point Transmission Service are not required for purchases of Dispatched Charging Energy."[483] However, PJM has not defined the services that constitute Dispatched Charging Energy, stating that it will do so prior to implementation of the Storage Participation Model. Accordingly, we direct PJM to file, within 60 days of the date of

[479] *Id.* (citing Compliance Filing, Transmittal at 56).

[480] Tariff, Attachment K-Appendix, § 1.7.7.

[481] Compliance Filing, Attachment A (OATT Definitions C-D).

[482] *Id.*

[483] Tariff, Attachment K-Appendix, § 1.4A.1(b).

issuance of this order, a further compliance filing that provides Tariff provisions describing the services that constitute Dispatched Charging Energy.

b. Metering and Accounting Practices for Charging Energy

221. To help implement the new requirement in section 35.28(g)(9)(ii) of the Commission's regulations, Order No. 841 requires each RTO/ISO to implement metering and accounting practices as needed to address the complexities of implementing the requirement that the sale of electric energy from RTO/ISO markets to an electric storage resource that the resource then resells back to those markets be at the wholesale LMP.[484] Order No. 841 requires each RTO/ISO to directly meter electric storage resources,[485] but allows flexibility for each RTO/ISO to propose alternative approaches that may not entail direct metering but nonetheless address the complexities of implementing the requirement that the sale of electric energy from RTO/ISO markets to an electric storage resource that the resource then resells back to those markets be at the wholesale LMP.[486] Metering and accounting rules may need to differ based on whether the resource is located on the transmission system, the distribution system, or behind the meter.[487]

222. The Commission rejected the suggestion that electric storage resources must choose to participate in either wholesale or retail markets due to the complexity of the metering and accounting practices.[488] The Commission found that it is possible for electric storage resources that are selling retail services also to be technically capable of providing wholesale services, and it would adversely affect competition in the RTO/ISO markets if these technically capable resources were excluded from participation. In response to concerns that not requiring electric storage resources to choose to participate exclusively in either wholesale or retail markets will allow resources using the participation model for electric storage resources to evade the distribution utility's retail service or to simultaneously buy electricity at the retail rate and sell it at the wholesale LMP, Order No. 841-A states that each RTO/ISO can address these issues by developing its metering and accounting requirements in cooperation with the distribution utilities and

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[484] Order No. 841, 162 FERC ¶ 61,127 at P 322.

[485] Order No. 841-A clarifies that the RTO/ISO itself does not need to be the entity that directly meters electric storage resources. Order No. 841-A, 167 FERC ¶ 61,154 at P 138.

[486] Order No. 841, 162 FERC ¶ 61,127 at P 322.

[487] *Id.* P 324.

[488] *Id.* P 325.

relevant electric retail regulatory authorities in its footprint, as the Commission recognized in Order No. 841.[489] Order No. 841-A also notes that, when the Commission found that the sale of electric energy from the RTO/ISO markets to an electric storage resource that the resource then resells back to those markets must be at the wholesale LMP, it was referring to the sale of energy from the grid that is used to charge electric storage resources for later resale into the energy or ancillary service markets.[490]

223. Order No. 841 also requires RTOs/ISOs to prevent electric storage resources from paying twice for the same charging energy (i.e., they should not have to pay both the wholesale and retail price for the same charging energy).[491] To the extent that the host distribution utility is unable—due to a lack of the necessary metering infrastructure and accounting practices—or unwilling to net out any energy purchases associated with an electric storage resource's wholesale charging activities from the host customer's retail bill, the Commission found that RTOs/ISOs would be prevented from charging that resource wholesale rates for the charging energy for which it is already paying retail rates.[492] Order No. 841-A clarifies that an RTO/ISO could require verification from the host distribution utility that it is unable or unwilling to net wholesale demand from retail settlement before the RTO/ISO ceases to settle an electric storage resource's wholesale demand at the wholesale LMP.[493] Order No. 841-A clarifies further that the Commission would consider on compliance each RTO's/ISO's proposal to identify whether a distribution utility is unable or unwilling to net out from a host customer's retail bill the

[489] Order No. 841-A, 167 FERC ¶ 61,154 at P 142 (citing Order No. 841, 162 FERC ¶ 61,127 at P 324).

[490] *Id.* (citing Order No. 841, 162 FERC ¶ 61,127 at P 294).

[491] *Id.* P 326.

[492] Paragraph 326 of the preamble of Order No. 841 uses the phrase "resources using the participation model for electric storage resources" with respect to the requirements set forth therein (e.g., "we require each RTO/ISO to prevent resources using the participation model for electric storage resources from paying twice for the same charging energy"). However, section 35.28(g)(9)(ii) of the Commission's regulations (as modified by Order No. 841), which these requirements are intended to implement, specifies that it applies to electric storage resources. Thus, the Commission used the incorrect term in paragraph 326 of Order No. 841. In this order, we use the correct term throughout.

[493] Order No. 841-A, 167 FERC ¶ 61,154 at P 138.

wholesale energy purchases associated with charging an electric storage resource that is participating in the RTO/ISO market.

i. Filing

224. In its First Compliance Filing, PJM stated that it will directly meter Energy Storage Resources as part of the Storage Participation Model.[494] PJM stated that its proposed changes to the definitions of Energy Storage Resource and Capacity Storage Resource (which were accepted effective February 3, 2019) would allow resources with retail-serving capability to immediately begin participating in PJM's capacity, energy, and ancillary services markets. PJM explained that it would test its proposed accounting methodology on those Energy Storage Resources with retail-serving capability in order to obtain sufficient testing data to ensure that an Energy Storage Resource's wholesale and retail sales and purchases are appropriately captured, accounted for, and settled.[495] PJM stated that it would develop and test its metering and accounting practices prior to implementation of the Storage Participation Model on December 3, 2019.[496]

225. In the instant compliance filing, PJM proposes Tariff provisions providing that a purchaser of Non-Dispatched Charging Energy must arrange to provide directly to the Transmission Provider, on a daily basis, its peak load (net of operating behind-the-meter generation, but not to be less than zero, unless such generation is separately metered and reported to PJM) as well as its hourly load.[497] PJM also proposes that, for behind-the-meter generation of a purchaser of Non-Dispatched Charging Energy that requires metering pursuant to Operating Agreement, section 14.5, it must arrange for the Transmission Owner or electric distribution company to provide directly to PJM information pertaining to such behind-the-meter generation and the total load at its location as necessary for PJM's planning purposes.[498] PJM also proposes that, to the extent required, PJM will reconcile a Non-Dispatched Charging Energy purchaser's hourly energy responsibilities as initially reported to PJM and its hourly energy

[494] Compliance Filing, Docket No. ER19-462-000, Transmittal at 8.

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

[496] *Id.* at 2.

[497] Compliance Filing, Tariff, Attachment F-2, Specifications for Network Integration Transmission Service for Purchases of Non-Dispatched Charging Energy, §§ 3.1, 3.3.

[498] *Id.* § 3.6.

consumption based on, or estimated from, metered usage, and provide corresponding charges and credits at the particular rate.[499]

ii. Protests/Comments

226. Advanced Energy Economy contends that PJM must include in its Tariff a basic workable framework of its metering and accounting practices.[500] Advanced Energy Economy states that such practices for Energy Storage Resources must include flexibility and provide guidance for resolving disputes for resources connected to the distribution grid or located behind the meter.[501] Additionally, Advanced Energy Economy explains that the metering and accounting practices must be carefully designed and implemented so as to not negatively impact competition and just and reasonable rates.

227. FirstEnergy Utilities/Dayton P&L/EKPC also contend that PJM's proposal leaves numerous metering issues unresolved that must be addressed, including: installing separate metering infrastructure to account for the wholesale market activity and retail load of each individual Energy Storage Resource, metering testing obligations, metering ownership, metering maintenance, data collection, and cost recovery.[502] FirstEnergy Utilities/Dayton P&L/EKPC argue that distribution utilities will need to work with state commissions to develop or revise processes, rates, and tariffs regarding the development of Energy Storage Resource metering infrastructure and policies regarding data collection, metering, testing, and maintenance before PJM's proposal can be implemented.[503]

228. Several commenters express concern about the ability of electric storage resources located on the distribution system or behind the meter to participate in PJM's markets under its compliance proposal.[504] These commenters contend that PJM has failed to describe how such resources are able to inject and withdraw energy and provide all of the

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[499] *Id.* § 5.0.

[500] Advanced Energy Economy Comments at 7-8.

[501] *Id.* at 8.

[502] FirstEnergy Utilities/Dayton P&L/EKPC Comments at 11.

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

[504] *See* Advanced Energy Economy Comments at 4; EDF Comments at 1; Tesla Comments at 18.

wholesale services they are technically capable of providing.[505] To address this issue, Advanced Energy Economy states that PJM must revise its Tariff to ensure that its proposed participation model includes electric storage resources located on the distribution grid or behind the meter and specifically allows such resources to charge and discharge at wholesale LMP when dispatched to provide any wholesale services.[506] EDF similarly asks the Commission to require PJM to explain how its proposed participation model allows electric storage facilities located behind the meter or on the distribution system to participate on equal footing with transmission-level electric storage facilities and to simultaneously participate in wholesale and retail-level programs.[507] EDF states that PJM does not address whether it will prohibit electric storage resources from dual retail/wholesale market participation.[508]

229. Public Interest Organizations state that, to avoid conflict with state or local jurisdiction over retail electric service, PJM's past practice has been to deny interconnection applications when it could result in electric storage resources charging at wholesale and then later discharging to serve retail load.[509] They assert that this conflict appears to have been resolved by the electric storage resource accounting practices PJM filed in Docket No. ER19-462-000. However, to remove ambiguity, Public Interest Organizations request that the Commission direct PJM to clarify that the potential for electric storage resources participating in wholesale markets to also provide energy to retail loads will no longer serve as grounds for rejecting market participation.

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[505] Advanced Energy Economy Comments at 4 (asserting that Order No. 841 requires each RTO/ISO to provide all Energy Storage Resources, including those located on the distribution grid or behind the meter, with a clear path to provide all of the wholesale services they are technically capable of providing); EDF Comments at 1; Tesla Comments at 18.

[506] Advanced Energy Economy Comments at 6.

[507] EDF Comments at 1, 5 (citing Order No. 841, 162 FERC ¶ 61,127 at PP 29, 325).

[508] *Id.* at 5-6 (citing Order No. 841, 162 FERC ¶ 61,127 at P 325).

[509] Public Interest Organizations Comments at 24 (citing David Egan, Distributed Energy Resource Scenarios (2016) at 8-9, https://www.pjm.com/-/media/committees-groups/committees/mrc/20160617-special/20160617-item-06-distributedenergy-resource-scenarios.ashx).

230. According to Tesla, PJM's existing rules allow a behind-the-meter electric storage resource to elect a portion of its capacity to serve onsite load as a demand resource and another portion of its capacity to operate as a generation resource, which artificially limits the amount of capacity the resource can offer as both a demand resource and a generation resource.[510] To ensure that electric storage resources are compensated comparably for the full range of their service, Tesla urges the Commission to require PJM to allow behind-the-meter electric storage resources to seamlessly cycle between reducing on-site demand and injecting onto the grid.[511]

iii. Answers

231. PJM disagrees with Advanced Energy Economy that metering and accounting practices should be documented in its Tariff because, according to PJM, such arrangements could show wide diversity and analogous accounting methods (e.g., determination of municipal or rural electric co-op load) are not documented in the Tariff.[512]

232. PJM states that several commenters request that PJM explain how behind-the-meter electric storage resources can participate under PJM's proposal.[513] PJM explains that behind-the-meter electric storage resources can participate in PJM under two constructs: (1) a "net-excess" construct, where discharging power is first used to reduce on-site load, and only unused surplus power is injected onto the grid and sold at wholesale to PJM Markets, and (2) a "virtual buy-all/sell-all" construct, where a resource is directly metered at the device level and settled at wholesale for 100 percent of its energy flows, and the retail customer meter is "grossed-up" so that electric storage resource discharging does not inappropriately reduce the customer's billed load. PJM states that under either construct, the retail regulator retains authority over the retail billing arrangements, and the Commission retains authority over all wholesale sales. PJM states it can accommodate both of these constructs today, and clarifies that it intends to document metering and accounting requirements in PJM's Manuals.

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[510] Tesla Comments at 20-21.

[511] *Id.* at 21.

[512] PJM March 5, 2019 Answer at n.91 (citing Advanced Energy Economy Comments at 7-8).

[513] *Id.* at 29 (citing Advanced Energy Economy Comments at 4; Tesla Comments at 21).

233. NRECA filed an answer to Advanced Energy Economy's and Tesla's comments arguing that the tariff provisions they seek are beyond the scope of the Order No. 841 compliance proceedings. According to NRECA, the compliance proceedings should not become vehicles to restructure, unbundle, or otherwise federally regulate local distribution facilities, local distribution services, or retail electric services, which NRECA claims would be beyond the requirements of Order No. 841 and the Commission's statutory authority.[514]

234. In response to Advanced Energy Economy's argument that Order No. 841 "requires a clear path" for electric storage resources on distribution systems or behind the retail meter "to be able to inject energy onto the wholesale grid (provided they are technically and contractually able to do so) and provide all wholesale services they are technically capable of providing,"[515] NRECA states that Order No. 841 never uses the term "clear path" and instead requires each RTO/ISO to revise its tariff to establish market rules that "facilitate . . . participation" by electric storage resources and "remove barriers" to such participation.[516] According to NRECA, Order No. 841 is exclusively addressed to RTOs/ISOs and does not require an RTO/ISO to adopt market rules that clear a new path through non-RTO/ISO local distribution facilities, retail meters, or retail electric regulation more generally.[517]

235. In response to Tesla's assertion that behind-the-meter electric storage resources should be able to seamlessly transition between serving onsite load and injecting energy onto the grid, NRECA states that Order No. 841 never uses the term "seamlessly transitioning" or authorizes behind-the-meter storage to operate in contravention of state or local law.[518] NRECA asserts that nothing in the rule disturbs state and local regulation of retail metering, retail net metering, or storage use on local distribution systems, including behind-the-meter storage.[519] NRECA further argues that Tesla's reference to a program in ISO-NE as a "best practice" for all behind-the-meter resources is beyond the

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[514] NRECA Answer at 2 (citing 16 U.S.C. § 824 (2018)).

[515] Advanced Energy Economy Comments at 7.

[516] NRECA Answer at 4 (citing Order No. 841, 162 FERC ¶ 61,127 at PP 1, 3, 19, 20).

[517] *Id.* (citing Order No. 841, 162 FERC ¶ 61,127 at PP 19, 20; 18 C.F.R. § 35.28(g)(9)).

[518] *Id.* at 5-6 (citing Tesla Comments at 18).

[519] *Id.* at 6.

scope of the issues in these compliance proceedings and that mechanisms to prevent double-compensation of distributed energy resource (DER) aggregations must be addressed in Docket No. RM18-9-000.[520]

iv. Data Request Response

236. In response to a request for PJM to provide specific citations to show how the metering requirements of PJM's Manual 14D are applicable to Energy Storage Resources, PJM states that it considers all Energy Storage Resources that inject onto the grid and sell electric energy in applicable PJM markets to be generators. PJM adds that its Tariff's definition of Small Generation Resource covers Energy Storage Resources. PJM notes that Energy Storage Resources interconnecting with PJM will execute an Interconnection Service Agreement or a Wholesale Market Participation Agreement, which will contain the necessary metering information.[521]

237. PJM clarifies that it does not intend to make a filing with the Commission regarding the metering and accounting practices that PJM will implement on December 3, 2019. PJM states that, consistent with existing practice, those metering and accounting practices will be located in PJM's Manuals.[522] PJM states that it plans to present to stakeholders at the May 20, 2019 DERs Subcommittee draft metering and accounting practices for Energy Storage Resources in various configurations. PJM explains that both "net excess" and "virtual buy all/sell all" approaches will be included among the presented draft practices and it will document the practices in its manuals prior to the December 3, 2019 implementation deadline.[523]

238. With respect to preventing Energy Storage Resources from paying twice for the same charging energy, PJM states that it will work with Energy Storage Resources to facilitate meeting all requirements to opt in to the participation model, both for new and existing resources. PJM states that those Energy Storage Resources that are located behind a retail meter must be identified as such in the PJM New Services Queue under existing rules. PJM explains that, because such resources are potentially subject to retail

[520] *Id.* at 6-7 (citing Tesla Comments at 19).

[521] Data Request Response at 30.

[522] *Id.* at 33-34.

[523] *Id.* at 34.

billing for charging energy, PJM staff will coordinate with the distribution utility to identify whether it intends to bill charging energy at retail, and if it does, PJM will not set up metering or accounting that would bill the resource for charging energy at wholesale.

v. Comments on Data Request Response

239. Advanced Energy Economy states that PJM's intention to include its metering and accounting practices in PJM Manuals does not satisfy the Commission's "rule of reason policy."[524] Advanced Energy Economy explains that provisions that have a significant impact on rates, terms, and conditions of service must be included in the Tariff. As a result, Advanced Energy Economy argues that the Commission should direct PJM to provide a basic workable methodology or framework in its Tariff, with the precise metering and accounting details laid out in PJM's Manuals.[525]

vi. Commission Determination

240. We find that PJM's proposed tariff revisions partially comply with the requirements of Order No. 841 pertaining to metering and accounting practices for electric storage resources and require PJM to file, within 60 days of the date of issuance of this order, a further compliance filing as more fully described below.

241. As discussed above, PJM has demonstrated that its Tariff provides that Energy Storage Resources will be charged wholesale LMP for their charging energy that is purchased from PJM markets to be resold back to those markets. PJM explains that it is still in the process of developing the necessary metering and accounting practices to implement that Tariff requirement. Thus, as commenters point out, PJM's proposal leaves numerous metering and accounting issues unaddressed. We encourage PJM to continue working with stakeholders to draft and implement those practices before implementation of the Storage Participation Model.

242. We are concerned that PJM's compliance filing does not include any information about its metering and accounting practices in its Tariff and that PJM does not intend to make a filing with the Commission regarding such practices. Decisions regarding whether an item should be placed in a tariff or in a business practice manual are guided by the Commission's rule of reason policy, under which provisions that "significantly affect rates, terms, and conditions" of service, are readily susceptible of specification, and are not generally understood in a contractual agreement must be included in a tariff, while items better classified as implementation details may be included only in the

[524] Advanced Energy Economy Comment on Data Request Response at 5.

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

business practice manual.[526] PJM states that analogous accounting methods are not documented in the Tariff and it, therefore, does not propose to include its accounting methods related to Energy Storage Resources in its Tariff. Given that these metering and accounting practices will enable Energy Storage Resources located on the transmission system, the distribution system, and behind the meter to pay the wholesale LMP for charging energy as required by Order No. 841, we find that these practices significantly affect rates, terms, and conditions and a general description of them should be included in the Tariff.[527]

243. While we are requiring PJM to include a general description of its metering and accounting practices in its Tariff, we agree with PJM and commenters that more detailed descriptions of these practices, which are not readily susceptible to specification, may be appropriately considered implementation details and can be located in business practice manuals or other documents. However, due to the unique nature of Energy Storage Resources, it may be particularly difficult for Energy Storage Resource market participants to ascertain which sets of procedures apply to them. Because Energy Storage Resource market participants should be aware of which procedures apply to them in order to plan and manage their participation in the markets accordingly, we find that it is imperative that the Tariff cite to the specific agreements, manuals, or other documents where market participants can locate the rules applicable to Energy Storage Resources. Accordingly, we direct PJM to file, within 60 days of the date of issuance of this order, Tariff revisions to include a general description of the metering and accounting practices for Energy Storage Resources as well as references directing market participants to any other PJM documents containing the details of those practices.

244. Order No. 841 also requires RTOs/ISOs to prevent electric storage resources from paying twice for the same charging energy. PJM states in its Data Request Response that, because Energy Storage Resources located behind a retail meter are potentially subject to retail billing for charging energy, PJM staff will coordinate with the distribution utility to identify whether it intends to bill charging energy at retail, and if it does, PJM will not set up metering or accounting that would bill the resource for charging energy at wholesale. Accordingly, we also direct PJM to file, within 60 days of the date of issuance of this order, a further compliance filing revising its Tariff to state that PJM will not charge a distribution-connected Energy Storage Resource for charging energy if

[526] *ESA v. PJM*, 162 FERC ¶ 61,296 at P 103; *see also City of Cleveland, Ohio v. FERC*, 773 F.2d at 1376 (finding that utilities must file "only those practices that affect rates and service significantly, that are reasonably susceptible of specification, and that are not so generally understood in any contractual arrangement as to render recitation superfluous").

[527] *See, e.g., ESA v. PJM*, 162 FERC ¶ 61,296 at P 103 (citations omitted).

the distribution utility is unwilling or unable to net out any energy purchases associated with the Energy Storage Resource's wholesale charging activities from the host customer's retail bill.

245. As to concerns regarding the ability of Energy Storage Resources located on the distribution system or behind the meter to participate in PJM's markets,[528] we reiterate that PJM's definitions of Energy Storage Resource and Capacity Storage Resource are inclusive of those resources located on a distribution system or behind the meter.[529] As described above, we find that PJM has demonstrated that all Energy Storage Resources, including those located on the distribution system or behind the meter, will be eligible to provide all capacity, energy, and ancillary services that they are technically capable of providing.[530]

246. However, we agree with commenters that Order No. 841 requires each RTO/ISO to allow electric storage resources to participate in RTO/ISO markets even if they also provide retail services.[531] In Order No. 841, the Commission was not persuaded by the suggestion that electric storage resources must choose to participate in either wholesale or retail markets and found that excluding resources technically capable of providing both retail and wholesale services would adversely affect competition in the RTO/ISO markets.[532] Because PJM states that its metering and accounting practices are still under development, it is unclear how and to what extent those practices will allow for participation in retail and wholesale markets. Thus, we direct PJM to file, within 60 days of the date of issuance of this order, a further compliance filing to explain how its metering and accounting practices will allow for participation in retail and wholesale markets and to make any necessary Tariff changes to ensure the separation and proper accounting of wholesale and retail uses.

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[528] *See, e.g.*, Advanced Energy Economy Comments at 4; EDF Comments at 1; Tesla Comments at 18.

[529] *See* First Compliance Order, 166 FERC ¶ 61,087 at P 10.

[530] *See supra* P 92.

[531] *See, e.g.*, EDF Comments at 5-6 (citing Order No. 841, 162 FERC ¶ 61,127 at P 325).

[532] Order No. 841, 162 FERC ¶ 61,127 at P 325.

7. Miscellaneous

a. Protests/Comments

247. Joint Consumer Advocates assert that PJM's proposal fails to address pending capacity market changes related to the minimum offer price rule (MOPR),[533] which they argue creates uncertainty and decreases potential Energy Storage Resource participation.[534] Joint Consumer Advocates emphasize that subjecting Energy Storage Resources to the MOPR would create additional barriers to participation because Energy Storage Resources would face further constraints on their flexibility to participate in PJM's capacity market.

248. Joint Consumer Advocates argue that any Order No. 841 compliance filing or MOPR construct approved by the Commission must consider the ability of the states to incent preferred resources and the goals of Order No. 841.[535] Joint Consumer Advocates warn that additional barriers to Energy Storage Resource participation would deny states in PJM access to an important resource type as they pursue their respective clean energy goals.[536] Further, Joint Consumer Advocates state that the Capacity Order makes no distinction between resource types and should be read to include Energy Storage Resources, if the inclusion aligns with a state's policy preference.[537]

249. P3 states that, while it and its members have been supportive of the Commission's directives to more fully integrate Energy Storage Resources in the wholesale markets, it urges the Commission to not lose sight of the importance of price formation efforts that must remain a priority as Energy Storage Resources and other DERs become more integrated into the markets—especially given the fact that those resources now have the ability to set energy and capacity wholesale market prices.[538] P3 states that PJM's compliance filing is largely silent on efforts PJM will take to ensure that price formation efforts are respected, prioritized, and administered in its markets given the new role of Energy Storage Resources as energy, capacity and ancillary market price-setting

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[533] *See PJM Interconnection, L.L.C.*, 163 FERC ¶ 61,236 (2018) (Capacity Order).

[534] Joint Consumer Advocates Comments at 13.

[535] *Id.* at 14.

[536] *Id.* at 13.

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

[538] P3 Comments at 3-4.

resources.[539] P3 urges the Commission to reiterate the importance of PJM's continued efforts to ensure proper price formation for all resources in PJM's markets.

250. According to PJM's Market Monitor, much of the urgency to address Energy Storage Resource-related issues is removed when recognizing the basic economics of Energy Storage Resources.[540] PJM's Market Monitor argues that Energy Storage Resources are not economic in PJM markets as energy and capacity resources and are not likely to become economic unless the difference between on-peak and off-peak prices changes significantly.[541]

251. PJM's Market Monitor also asserts that PJM's proposed Energy Storage Resource capacity market rules are not adequate.[542] PJM's Market Monitor states that every MW of capacity offered must be a substitute for every other MW and argues that PJM has not explained why Energy Storage Resources are a substitute for generation. In support of its position, PJM's Market Monitor states that Energy Storage Resources are net load, not net generation, which means that the system cannot be served by their capacity alone. PJM's Market Monitor argues that, rather than maintaining a resource agnostic standard, PJM is proposing a standard for Energy Storage Resources that is quite different from the standard that exists for thermal generation.

252. PJM's Market Monitor further contends that PJM's capacity market is based on atavistic rules about the determinants of the need for capacity based on peak load only.[543] PJM's Market Monitor argues that there is no way to reflect Energy Storage Resources as off-peak capacity demand, with a capacity payment obligation, and as on-peak capacity resources.[544] PJM's Market Monitor argues that if the cost of capacity were assigned in a manner more consistent with the actual economics, the fact that Energy Storage Resources are using capacity at times and providing capacity at times could be reflected in their costs and revenues in a manner analogous to the energy market. PJM's Market Monitor states that, rather than attempting to fit Energy Storage Resources into the existing capacity construct, another model for their participation is a well-designed

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[539] *Id.* at 5.

[540] PJM's Market Monitor Comments at 3.

[541] *Id.* at 4.

[542] *Id.*

[543] *Id.* at 8.

[544] *Id.*

demand side product and that equivalent revenue streams would result if Energy Storage Resources outside the capacity market were used to reduce customers' loads. PJM's Market Monitor further explains that the revenues to Energy Storage Resources in that case would result from the reduction of actual payments by customers for capacity which are in turn a function of both the wholesale and retail allocation of capacity costs to customers.

253. Public Interest Organizations request the Commission condition its approval of PJM's proposed Storage Participation Model for the energy and ancillary service markets on PJM providing annual publicly available reports to the Commission that address the economic and operational efficiency with which PJM uses Energy Storage Resources. [545] Additionally, Public Interest Organizations request that PJM investigate developing metrics for measuring the dispatch performance of Energy Storage Resources using Perfect Dispatch or similar methods, to be implemented once Energy Storage Resources have more than a *de minimis* participation in PJM's energy market.[546]

b. Answer

254. Joint Consumer Advocates reiterate the concern raised in its comments that PJM must address the impact of pending capacity market changes on Energy Storage Resource participation.[547] Joint Consumer Advocates state that, despite the request of multiple parties, PJM has not offered even minimal guidance as to how it would incorporate state-incentivized Energy Storage Resources into any alternative regime, as required by the Capacity Order, that would shield them from the devastating consequences of a MOPR.[548]

c. Commission Determination

255. We find issues raised by commenters about PJM's MOPR and price formation to be outside of the scope of PJM's compliance with Order No. 841.

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[545] Public Interest Organizations Comments at 22.

[546] *Id.* at 23.

[547] Joint Consumer Advocates Answer at 4 (citing *Calpine Corp v. PJM Interconnection, L.L.C.*, 163 FERC ¶ 61,236, at P 158 (2018)).

[548] *Id.* at 5 (citing Joint Consumer Advocates Comments at 10-14, New Jersey Commission Comments at 7-8).

256. PJM's Market Monitor also raises a number of general concerns about allowing Energy Storage Resources to participate in PJM's markets, including that they are not currently economic in energy or capacity markets and that they do not fit into the existing capacity market construct in the same way as thermal generation.[549] We also find these comments to be beyond the scope of this compliance proceeding. Order No. 841 requires that each RTO/ISO establish a participation model that ensures eligibility to participate in the RTO/ISO markets and that compensates electric storage resources for the wholesale services they provide in the same manner as other resources that provide these services.[550] Thus, Order No. 841 requires PJM to allow Energy Storage Resources to participate in PJM's markets and to be compensated in the same manner as other resources. Additionally, as discussed above, Order No. 841 requires each RTO/ISO to allow a resource using the participation model for electric storage resources to be eligible to provide all capacity, energy, and ancillary services that it is technically capable of providing.

257. Finally, we also decline to require PJM to provide annual reports or to develop additional metrics for measuring dispatch performance of Energy Storage Resources as these were not requirements of Order No. 841.

8. Effective Date

258. Order No. 841 requires each RTO/ISO to file tariff changes needed to implement the requirements of Order No. 841 within 270 days of its publication in the *Federal Register*, and allows a further 365 days from that date to implement the tariff provisions.[551] The Commission declined to allow the RTOs/ISOs to develop their own implementation schedules, finding that the compliance and implementation schedule set forth in the Final Rule is appropriate.[552] The Commission stated that the regional flexibility allowed in the Final Rule will assist the RTOs/ISOs in meeting the compliance and implementation deadlines.[553] Order No. 841-A reiterates that Order No. 841's

[549] PJM's Market Monitor Comments at 3-4.

[550] Order No. 841, 162 FERC ¶ 61,127 at P 52.

[551] Order No. 841, 162 FERC ¶ 61,127 at P 348.

[552] *Id.* P 349.

[553] *Id.* P 350.

compliance and implementation schedule is reasonable, and declines to permit the individual RTOs/ISOs to propose their own timeframes.[554]

a. PJM's October 8, 2019 Filing

259. On October 8, 2019, PJM made a filing informing the Commission of its intent to continue with all necessary preparatory work in anticipation of implementing the Storage Participation Model on December 3, 2019.[555] PJM requests that, if the Commission intends for PJM to activate the Storage Participation Model on December 3, 2019, the Commission issue an order accepting its proposed Tariff revisions by no later than November 3, 2019. PJM states that if the Commission issues an order accepting the Tariff revisions after November 3, 2019, or takes some other action with respect to PJM's proposed revisions, PJM may need to seek a modified effective date for its Tariff records, depending on the specific circumstances. PJM states that it is therefore resubmitting its Tariff records in this proceeding to change the corresponding effective dates from 12/3/2019 to 12/31/9998 to provide for this flexibility and will submit an informational filing and updated Tariff records with the appropriate effective date once such date is known.[556]

b. Commission Determination

260. PJM represents that it is prepared to implement its proposed Tariff revisions on December 3, 2019 as long as the Commission issues an order accepting such revisions by November 3, 2019. We affirm that we find PJM's proposed Tariff revisions to be just and reasonable and accept them as in compliance with Order No. 841, to become effective December 3, 2019. Thus, we expect PJM to implement its currently proposed Tariff revisions on December 3, 2019, as required by Order No. 841. However, we will allow PJM to propose a later effective date for the further compliance directives contained herein, which require PJM to add certain additional Tariff revisions, separate from and in addition to those PJM has already proposed, in order to achieve full compliance with the Final Rule.

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[554] Order No. 841-A, 167 FERC ¶ 61,154 at P 154.

[555] PJM October 8, 2019 Filing at 2.

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

The Commission orders:

(A) PJM's compliance filing is hereby accepted, as modified, effective December 3, 2019.

(B) PJM is hereby directed to submit a further compliance filing in Docket No. ER19-469-000, within 60 days of the date of this order, as discussed in the body of this order.

(C) Pursuant to the authority contained in and subject to the jurisdiction conferred upon the Federal Energy Regulatory Commission by section 402(a) of the Department of Energy Organization Act and the FPA, particularly section 206 thereof, and pursuant to the Commission's Rules of Practice and Procedure and the regulations under the FPA (18 C.F.R. Chapter I), the Commission hereby institutes a proceeding in Docket No. EL19-100-000, concerning the justness and reasonableness of PJM's minimum run-time requirements, as discussed in the body of this order.

(D) PJM is hereby directed to submit tariff provisions reflecting its minimum run-time rules and procedures applicable to all resources, in a new ER docket, no later than 45 days after the publication of notice in the *Federal Register* of the Commission's initiation of the section 206 proceeding in Docket No. EL19-100-000, as discussed in the body of this order. By the same date, PJM and other interested parties may file initial briefs addressing PJM's application of those rules and procedures to Capacity Storage Resources in Docket No. EL19-100-000, as discussed in the body of this order. Reply briefs may be filed no later than 30 days thereafter.

(E) Any interested person desiring to be heard in Docket No. EL19-100-000 must file a notice of intervention or motion to intervene, as appropriate, with the Federal Energy Regulatory Commission, 888 First Street NE, Washington, DC 20426, in accordance with Rule 214 of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214 (2019), within 21 days of the date of issuance of this order. The Commission encourages electronic submission of interventions in lieu of paper using the "eFiling" link at http://www.ferc.gov. Persons unable to file electronically should submit an original and three copies of the protest or intervention to the Federal Energy Regulatory Commission, 888 First Street, NE, Washington, DC 20426.

(F) The Secretary shall promptly publish in the *Federal Register* a notice of the Commission's initiation of the proceeding under section 206 of the FPA in Docket No. EL19-100-000.

(G) The refund effective date in Docket No. EL19-100-000 established pursuant to section 206 of the FPA shall be the date of publication in the *Federal Register* of the notice discussed in Ordering Paragraph (F) above.

By the Commission. Commissioner McNamee is concurring with a separate statement attached.

(S E A L)

Kimberly D. Bose,
Secretary.

V. Appendix A: Abbreviated Names of Intervenors

The following table contains the abbreviated names of intervenors that are used in this Order on Compliance Filings.

Abbreviation	Intervenor(s)
Advanced Energy Economy	Advanced Energy Economy
AEP	American Electric Power Service Corporation
AMP	American Municipal Power, Inc.
APPA	American Public Power Association
AWEA	American Wind Energy Association
Calpine	Calpine Corporation
Dayton Power & Light	The Dayton Power and Light Company
DC People's Counsel	Office of the People's Counsel for the District of Columbia
Delaware Public Advocate	Delaware Division of the Public Advocate
Delaware Municipal Electric	Delaware Municipal Electric Corporation, Inc.
Dominion	Dominion Energy Services, Inc.
EKPC	East Kentucky Power Cooperative, Inc.
EDF	EDF Renewables, Inc.
EPSA	Electric Power Supply Association
Energy Storage Association	Energy Storage Association
Exelon	Exelon Corporation
FirstEnergy Utilities	The FirstEnergy Utility Companies
GlidePath	GlidePath Power Solutions LLC
Illinois Citizens Utility Board	Illinois Citizens Utility Board
Illinois Commerce Commission	Illinois Commerce Commission

Lincoln Clean Energy	Lincoln Clean Energy, LLC
Lockheed Martin*	Lockheed Martin Corporation
LS Power	LS Power Associates, L.P.
Maryland Office of People's Counsel	Maryland Office of People's Counsel
Maryland Commission	Maryland Public Service Commission
Michigan Agency for Energy	Michigan Agency for Energy
Michigan Commission	Michigan Public Service Commission
NRECA	National Rural Electric Cooperative Association
New Jersey Commission	New Jersey Board of Public Utilities
New Jersey Division of Rate Counsel	New Jersey Division of Rate Counsel
NextEra	NextEra Energy Resources, LLC
North Carolina Electric Membership Corporation	North Carolina Electric Membership Corporation
NRDC	NRDC/FERC Project
NRG	NRG Power Marketing LLC
P3	PJM Power Providers Group
Penn Oak	Penn Oak Services, LLC
PJM's Market Monitor	Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM
RESA	Renewable Energy Systems Americas, Inc.
Union of Concerned Scientists	Union of Concerned Scientists
Voith Hydro	Voith Hydro, Inc.

* late intervention

VI. Appendix B: Abbreviated Names of Initial Commenters

The following table contains the abbreviated names of initial commenters that are used in this Order on Compliance Filings.

Initial Commenters

Abbreviation	Commenter(s)
Advanced Energy Economy	Advanced Energy Economy
AWEA/Solar Council	American Wind Energy Association and the Solar Council
Calpine	Calpine Corporation
Dominion	Dominion Energy Services, Inc. on behalf of Virginia Electric and Power Company
EDF	EDF Renewables, Inc.
Energy Storage Association	Energy Storage Association
Exelon	Exelon Corporation
FirstEnergy Utilities/Dayton P&L/EKPC	FirstEnergy Utility Companies, The Dayton Power and Light Company, and East Kentucky Power Cooperative, Inc.
GlidePath	GlidePath Power Solutions LLC
PJM's Market Monitor[557]	Monitoring Analytics, LLC
Joint Consumer Advocates	Office of the People's Counsel for the District of Columbia, Citizens Utility Board, and Delaware Division of the Public Advocate
New Jersey Commission	New Jersey Board of Public Utilities

[557] PJM's Market Monitor filed an errata to its February 7, 2019 comments on February 8, 2019.

NextEra[558]	NextEra Energy Resources, LLC
P3	PJM Power Providers Group
Public Interest Organizations	Public Interest Organizations
SEIA	Solar Energy Industries Association
Tesla	Tesla, Inc.
Union of Concerned Scientists	Union of Concerned Scientists
Voith Hydro	Voith Hydro, Inc.

[558] NextEra filed an errata to its February 7, 2019 protest on February 8, 2019.

VII. Appendix C: Abbreviated Names of Reply Commenters

The following table contains the abbreviated names of reply commenters that are used in this Order on Compliance Filings.

Abbreviation	Commenter(s)
Energy Storage Association	Energy Storage Association
FirstEnergy Utilities	The FirstEnergy Utility Companies, et al.
Joint Consumer Advocates	Office of the People's Counsel for the District of Columbia, Citizens Utility Board, and Delaware Division of the Public Advocate
PJM's Market Monitor	Monitoring Analytics, LLC
NRECA	National Rural Electric Cooperative Association
PJM	PJM Interconnection, L.L.C.

VIII. Appendix D: Tariff Sections

Docket No. ER19-469-000

PJM Interconnection, L.L.C., Intra-PJM Tariffs

C-D, OATT Definitions – C-D, 18.0.0
E-F, OATT Definitions – E - F, 22.0.0
L-M-N, OATT Definitions – L – M - N, 21.0.0
OATT Definitions – R - S, OATT Definitions – R - S, 18.0.0
SCHEDULE 9-1, OATT SCHEDULE 9-1, 3.0.0
Attachment F-2, OATT Attachment F-2, 0.0.0
OATT ATT K APPX Sec 1.4A, OATT Attachment K Appendix Sec 1.4A Energy Storage Resource, 0.0.0
OATT ATT K APPX Sec 1.7, OATT Attachment K Appendix Sec 1.7 General, 19.0.0
OATT ATT K Appx Sec 3.2, OATT Attachment K Appendix Sec 3.2 - Market Buyers, 45.0.0
OATT ATT K APPX Sec 3.6, OATT Attachment K Appendix Sec 3.6 Metering Reconciliation, 7.0.0
OATT ATT K APPX Sec 3.7, OATT Attachment K Appendix Sec 3.7 Inadvertent Interchange, 1.0.0
OATT ATT K APPX Sec 5.2, OATT Attachment K Appendix Sec 5.2 Transmission Congestion, 15.0.0
OATT ATT K APPX Sec 5.5, OATT Attachment K Appendix Sec 5.5 Distribution of Total, 2.0.0
OATT Attch K Appx Sec 7.4, OATT Attachment K Appendix Sec 7.4 Allocation of Auction Re, 15.0.0
C-D, OA Definitions C - D, 20.0.0
E-F, OA Definitions E - F, 14.0.0
I-L, OA Definitions I - L, 14.0.0
M-N, OA Definitions M - N, 12.0.0
S–T, OA Definitions S – T, 14.0.0
OA Schedule 1 Sec 1.4A, OA Schedule 1 Sec 1.4A Energy Storage Resource Participation, 0.0.0
OA Schedule 1 Sec 1.7, OA Schedule 1 Sec 1.7 General., 18.0.0
OA Schedule 1 Sec 3.2, OA Schedule 1 Sec 3.2 - Market Buyers, 44.0.0
OA Schedule 1 Sec 3.6, OA Schedule 1 Sec 3.6 - Metering Reconciliation, 7.0.0
OA Schedule 1 Sec 3.7, OA Schedule 1 Sec 3.7 - Inadvertent Interchange, 1.0.0
OA Schedule 1 Sec 5.2, OA Schedule 1 Sec 5.2 Transmission Congestion Credit Cal, 15.0.0
OA Schedule 1 Sec 5.5, OA Schedule 1 Sec 5.5 Distribution of Total Transmission Los, 5.0.0
OA Schedule 1 Sec 7.4, OA Schedule 1 Sec 7.4 Allocation of Auction Revenues., 15.0.0

OA SCHEDULE 2, OA SCHEDULE 2, 8.0.0.

Docket No. ER19-469-001

PJM Interconnection, L.L.C., FERC FPA Electric Tariff

OATT Definitions – R - S, OATT Definitions – R - S, 18.1.0
OATT ATT K APPX Sec 1.4A, OATT Attachment K Appendix Sec 1.4A Energy Storage Resource, 0.1.0
OATT ATT K Appx Sec 3.2, OATT Attachment K Appendix Sec 3.2 - Market Buyers, 45.1.1
S–T, OA Definitions S – T, 14.1.1
OA Schedule 1 Sec 1.4A, OA Schedule 1 Sec 1.4A Energy Storage Resource Participation, 0.1.0
OA Schedule 1 Sec 3.2, OA Schedule 1 Sec 3.2 - Market Buyers, 44.1.1

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C. Docket Nos. ER19-469-000
ER19-469-001
EL19-100-000

(Issued October 17, 2019)

McNAMEE, Commissioner, *concurring*:

1. I concur with today's order insofar as it finds that PJM Interconnection, L.L.C. (PJM) complies in part with Order Nos. 841[1] and 841-A[2] (together, the Storage Orders) as issued and the Commission's regulations.[3] I write separately, however, to express my continuing concern that the Commission exceeded its statutory authority under the Federal Power Act,[4] and should have, at the very least, provided states the opportunity to opt-out of the participation model created by the Storage Orders.[5]

2. On February 15, 2018,[6] the Commission issued Order No. 841 to remove barriers to the participation of electric energy storage resources (ESRs) in the capacity, energy, and ancillary service markets operated by Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs).[7] In Order No. 841, the Commission denied

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[1] *Elec. Storage Participation in Mkts. Operated by Reg'l Transmission Orgs. & Indep. Sys. Operators*, Order No. 841, 162 FERC ¶ 61,127 (2018) (Order No. 841).

[2] *Elec. Storage Participation in Mkts. Operated by Reg'l Transmission Orgs. & Indep. Sys. Operators*, Order No. 841-A, 167 FERC ¶ 61,154 (2019) (Order No. 841-A).

[3] 18 C.F.R. §§ 35.28(b)(9), 35.28(g)(9) (2019).

[4] 16 U.S.C. §§ 791a-825r (2018).

[5] *See generally* Order No. 841-A, 167 FERC ¶ 61,154 (McNamee, Comm'r concurring in part and dissenting in part) (McNamee Separate Statement).

[6] This order was later amended by an errata issued on February 28, 2018. *Elec. Storage Participation in Mkts. Operated by Reg'l Transmission Orgs. & Indep. Sys. Operators*, Docket Nos. RM16-23-000 and AD16-20-000, Errata Notice (Feb. 28, 2018).

[7] *See generally* Order No. 841, 162 FERC ¶ 61,127.

requests to allow states to decide whether distribution-level ESRs or those resources located behind a retail meter could participate in RTO or ISO markets.[8] On rehearing, in Order No. 841-A, a majority of the Commission affirmed these findings and declined to provide the states with an opt-out.[9]

3. I was not a member of the Commission at the time Order No. 841 was issued, but I concurred in part and dissented in part when Order 841-A was issued. Specifically, I stated my support for ESRs and my belief that they have the potential to transform the electricity industry. But to the extent the Commission's Storage Orders exercised authority over the distribution system and behind-the-meter, I concluded:

> [T]he majority has exceeded the Commission's jurisdictional authority by depriving the states of the ability to determine whether distribution-level ESRs may use distribution facilities so as to access the wholesale markets. By doing so, in my view, the Commission claimed jurisdiction over functions and assets reserved by statute to the states. Further, even if the majority thought they could rightly exercise jurisdiction in this matter, I think they should have furthered the path of "cooperative federalism" by permitting the states to choose whether or not behind-the-meter and distribution-connected ESRs may participate in the wholesale markets through an opt-out provision.[10]

4. Therefore, I concluded that the Commission exceeded its statutory authority in the Storage Orders and stated that I would have granted rehearing to reconsider the Commission's assertion of jurisdiction and its failure to provide states the opportunity to opt-out of the participation model created by the Storage Orders.[11]

5. While I approve PJM's compliance filing today to the extent it complies with the Commission's Storage Orders, I note that the Storage Orders are presently pending judicial review,[12] and I reiterate my concern with the Commission's assertion of

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[8] *Id.* P 35.

[9] Order No. 841-A, 167 FERC ¶ 61,154 at PP 30-56.

[10] McNamee Separate Statement, 167 FERC ¶ 61,154 at P 3 (footnotes & citations omitted).

[11] *Id.* PP 2-24.

[12] *See Nat'l Ass'n of Regulatory Comm'rs v. FERC*, Nos. 19-1142 and 19-1147

jurisdiction over ESRs interconnecting either to a distribution system or behind-the-meter. Further, I continue to believe the Commission should have included in the Storage Orders an opt-out provision for states.

For these reasons, I respectfully concur.

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Bernard L. McNamee
Commissioner

(D.C. Cir. filed July 11, 2019).