

151 FERC ¶ 61,097
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Norman C. Bay, Chairman;
Philip D. Moeller, Cheryl A. LaFleur,
Tony Clark, and Colette D. Honorable.

PJM Interconnection, L.L.C.

Docket No. ER15-1193-000

ORDER CONDITIONALLY ACCEPTING TARIFF REVISIONS
AND DIRECTING COMPLIANCE FILING

(Issued May 5, 2015)

1. On March 6, 2015, PJM Interconnection, L.L.C. (PJM) filed proposed revisions to its Open Access Transmission Tariff (OATT),¹ pursuant to section 205 of the Federal Power Act (FPA),² to incorporate changes to its generator interconnection rules to require that “enhanced inverter” capabilities be used by prospective interconnection customers contemplating the interconnection of non-synchronous resources.³ We conditionally

¹ PJM Interconnection, L.L.C., Intra-PJM Tariffs, [OATT ATTACHMENT O-FORM OF INTERCONNECTION SERVICE AGREEMENT, 4.0.0](#), [OATT ATTACHMENT O.A2.4.7 Reactive Power, 1.0.0](#), [OATT ATTACHMENT O SCHEDULE H, 2.0.0](#), [OATT ATTACHMENT O-1, 3.0.0](#), [OATT ATTACHMENT P, 2.0.0](#), [OATT ATTACHMENT P.SCHEDULE N, 2.0.0](#). Capitalized terms not otherwise defined herein take the meaning specified in PJM’s OATT.

² 16 U.S.C. § 824d (2012).

³ “Non-synchronous resources” are generating units, typically wind turbines or solar power plants, which are connected to the bulk power system through power electronics, but do not produce power at system frequency (60 Hz). Non-synchronous generators do not operate in the same way as traditional generators and respond differently to network disturbances. *See Interconnection for Wind Energy*, Order No. 661, FERC Stats. & Regs. ¶ 31,186, at P 3 n.4, *order on reh’g*, Order No. 661-A, FERC Stats. & Regs. ¶ 31,198 (2005).

accept PJM's proposed tariff revisions, subject to a compliance filing, to become effective May 1, 2015, as requested, as discussed in the body of this order. We further direct PJM to submit its compliance filing within 30 days of the date of this order.

I. Background

2. In Order No. 2003, the Commission adopted standard procedures and a standard agreement for the interconnection of large generation facilities to achieve greater standardization of interconnection terms and conditions.⁴ The Commission noted in Order No. 2003-A that a different approach might be more appropriate for non-synchronous resources.⁵ To supplement Order No. 2003, the Commission issued Order No. 661 to establish technical requirements for the interconnection of wind plants with an output rated over 20 MW at the point of interconnection.⁶ Recognizing the technical differences of wind plants from standard generation technologies, their increasing size and level of penetration on some transmission systems, their effects on system reliability, and the benefits to customers of removing unnecessary obstacles to their development, the Commission required that wind plants must maintain a power factor range of 0.95 leading to 0.95 lagging only if the transmission provider shows, through a system impact study, that such capability is required of that plant to ensure safety or reliability.⁷ The Commission explained that this uniform standard would prevent undue discrimination, remove unnecessary obstacles to the increased growth of wind generation, and ensure that large wind plants provide reactive power support if needed to ensure safety and reliability. The Commission also stated that regional transmission organizations (RTOs) and independent system operators (ISOs) could apply for flexibility

⁴ *Standardization of Generator Interconnection Agreements and Procedures*, Order No. 2003, FERC Stats. & Regs. ¶ 31,146, at PP 1, 824 (2003), *order on reh'g*, Order No. 2003-A, FERC Stats. & Regs. ¶ 31,160, *order on reh'g*, Order No. 2003-B, FERC Stats. & Regs. ¶ 31,171 (2004), *order on reh'g*, Order No. 2003-C, FERC Stats. & Regs. ¶ 31,190 (2005), *aff'd sub nom. Nat'l Ass'n of Regulatory Util. Comm'rs v. FERC*, 475 F.3d 1277 (D.C. Cir. 2007), *cert. denied*, 552 U.S. 1230 (2008).

⁵ Order No. 2003-A, FERC Stats. & Regs. ¶ 31,160 at PP 280, 407 & n.85.

⁶ *Interconnection for Wind Energy*, Order No. 661, FERC Stats. & Regs. ¶ 31,186, *order on reh'g*, Order No. 661-A, FERC Stats. & Regs. ¶ 31,198 (2005).

⁷ Order No. 661, FERC Stats. & Regs. ¶ 31,186 at P 50.

through the “independent entity variation” standard.⁸ The Commission reiterated its findings in Order No. 661-A.⁹

3. According to PJM, the installed capacity megawatt value of non-synchronous resources on the PJM system alone has increased from approximately 8,000 MW in the 2007-2008 delivery year to nearly 12,000 MW in the 2013-2014 delivery year, and PJM has approximately 25,000 MW of expected maximum net capability of non-synchronous resources at various stages of development in its new services interconnection queue in future delivery years.¹⁰ PJM explains that the capacity of these resources, individually, is small relative to large scale legacy generating units, but when aggregated, can have a large impact on the electric system. PJM states that the intermittent nature of the output of these non-synchronous resources causes voltages generated from these resources to fluctuate more than legacy generation resources, raising potential grid reliability issues. Although PJM has been able to manage such voltage swings with legacy equipment, as the penetration levels of non-synchronous resources increases, the magnitude and frequency of voltage swings could become increasingly difficult to control without requiring voltage support from non-synchronous resources (e.g., reactive power).¹¹ In addition, PJM explains that traditional interconnection settings relative to long-term system fluctuations for non-synchronous resources have been conservative, such that units trip offline during minor frequency and voltage system events. More recently, however, the North American Electric Reliability Corporation (NERC), the Institute of Electrical and Electronics Engineers (IEEE),¹² and the Commission have all recognized the need for mandatory “ride-through” requirements for non-synchronous resources.¹³

⁸ *Id.* PP 107, 109.

⁹ Order No. 661-A, FERC Stats. & Regs. ¶ 31,198 at PP 41–46.

¹⁰ PJM Interconnection, L.L.C. March 6, 2015 Transmittal Letter at 2 (PJM Transmittal Letter).

¹¹ PJM Transmittal Letter at 2.

¹² PJM notes that, although the IEEE 1547a standard does not explicitly mandate increased “ride-through” requirements, the standard does recognize that resource owners and system operators should discuss whether such requirements must be enabled. PJM Transmittal Letter at 3 (citing *Standard for Interconnecting Distributed Resources with Electric Power Systems*, IEEE Std. 1547a-2014, 2014).

¹³ PJM Transmittal Letter at 2-3 (citing *Generator Verification Reliability Standards*, Order No. 796, 146 FERC ¶ 61,213 (2014)). NERC Reliability Standard

(continued...)

4. PJM explains that, in 2014, its stakeholders examined whether PJM should adopt enhanced interconnection standards and requirements for non-synchronous resources to specify that all interconnected non-synchronous resources must provide reactive power support, expanded frequency trip points, and low voltage “ride-through”¹⁴ capabilities, similar to those requirements in place for legacy generating resources. According to PJM, non-synchronous resources use inverters to convert direct current output to alternating current before the resulting energy can enter the electrical system. While many inverters in use today can produce real power, they cannot provide reactive power necessary to provide voltage and frequency support. However, the PJM stakeholders found that “enhanced inverters” commercially available on the market for the past several years are economically capable of generating or consuming reactive power and mitigating voltage swings associated with non-synchronous resources, in addition to achieving fault “ride-through” capability.¹⁵ After several months, PJM and its stakeholders developed the tariff revisions proposed herein, which PJM represents were approved without objection or abstention.

II. PJM’s Filing

5. PJM proposes tariff revisions to require that all non-synchronous resources entering PJM’s new interconnection services queue on May 1, 2015: (1) have the capability to autonomously provide dynamic reactive support within a range of 0.95 leading to 0.95 lagging at inverter terminals; (2) adhere to NERC Reliability Standard PRC-024-1 with respect to voltage and frequency ride-through capabilities, irrespective of resource size. PJM also submits, for informational purposes, a summary of related manual provisions that require non-synchronous resources to have generator

PRC-024-1, which is to become effective beginning July 1, 2016, requires that generator owners set their generator protective relays such that generating units remain connected during defined frequency and voltage excursions, unless a specified exception applies, and meets the Commission’s earlier stated directive that any such proposed Reliability Standard explicitly require all generators be capable of “riding through” the same set of Category B and Category C contingencies as required by wind generators through application of Order No. 661.

¹⁴ Low voltage ride-through requirements involve a generator’s ability to stay connected to and synchronized with the transmission system during system disturbances.

¹⁵ PJM Transmittal Letter at 3.

power management controls to include the capability of active power control, ramp rate control, and frequency control.¹⁶

A. Reactive Power Support

6. In accordance with Order No. 661, non-synchronous resources are not currently required to provide reactive power unless a system impact study shows that reactive power is needed from that resource to maintain grid reliability.¹⁷ When reactive power support is required, it is measured at the point of interconnection. PJM proposes to establish a presumptive tariff requirement, instead, which provides that all non-synchronous resources entering the new services interconnection queue beginning May 1, 2015, be capable of providing dynamic reactive support within a range of 0.95 leading to 0.95 lagging at the inverter terminals. PJM requests an “independent entity variation” from Order No. 661 in order to implement this proposed reactive power requirement.¹⁸

7. PJM supports its request for an “independent entity variation” by asserting that the Commission did not consider when it issued Order No. 661 the increased penetration of non-synchronous resources, retirements of legacy units, policies and economics favoring non-synchronous resources, technological advancements in reactive power capability of non-synchronous resources, reduced costs of these technologies, and compensation for reactive power. Specifically, PJM argues that the increasing number of non-synchronous interconnection requests, combined with anticipated resource retirements, necessitates the availability of reactive power on a presumptive basis to ensure the safety and reliability of the transmission system as a whole.¹⁹ PJM asserts that this increase in non-synchronous resources, level of upcoming legacy retirements, and comprehensive policies and economics favoring non-synchronous resources were not considered by the

¹⁶ PJM Transmittal Letter at 4-5.

¹⁷ PJM Transmittal Letter at 5.

¹⁸ PJM Transmittal Letter at 6 (citing Order No. 661, FERC Stats. & Regs. ¶ 31,186 at PP 107, 109, Order No. 661-A, FERC Stats. & Regs. ¶ 31,198 at P 26, and Order No. 2003, FERC Stats. & Regs. ¶ 31,146 at P 827).

¹⁹ PJM Transmittal Letter at 5-7 (explaining that PJM has seen approximately 288 proposed interconnection requests enter the new service queue, representing over 25,000 MW of expected non-synchronous resource capability, and expects approximately 12,000 MW to be retired over the next several years, the bulk of which is made up of legacy units).

Commission when it issued Order No. 661.²⁰ In addition, PJM contends that the Commission relied on the technology that existed at the time to determine whether to require reactive power support from non-synchronous resources, but technological advancements since 2005 support a presumptive reactive power requirement in PJM. PJM explains that the Type I and Type II wind units that existed when the Commission issued Order No. 661 could absorb reactive power, but could not control reactive power output; now, the standard Type III and Type IV units are capable of providing dynamic reactive power capability at very little, if any, incremental cost, thereby reducing, or even eliminating, cost disparity.²¹ PJM argues that, even if inherent dynamic reactive power is not already “baked-in” to the equipment a non-synchronous resource owner installs, the additional manufacturing costs to install necessary firmware upgrades on inverters is only around 10 percent, or about \$0.10 per watt.²² PJM explains that these costs are further moderated by the fact that PJM compensates reactive power suppliers under its OATT.²³

8. PJM recognizes that, in 2010, the Commission rejected a similar proposal from the California Independent System Operator, Inc. (CAISO) to require all large non-synchronous resources to provide reactive power.²⁴ In that case, the Commission found that CAISO did not adequately explain why system impact studies are not the proper venue for determining whether a non-synchronous resource needs to provide reactive power and why CAISO must implement a broad requirement applicable to all non-

²⁰ PJM Transmittal Letter at 7.

²¹ PJM Transmittal Letter at 7 (citing *Payment for Reactive Power*, Commission Staff Report, Docket No. AD14-7, at App’x 2 (Apr. 22, 2014)) (stating that, in 2012, vendors making up approximately 70 percent of the market share of wind turbines sold in the United States during 2010-2012 already offered dynamic reactive power capability for their units equal to or better than the standards proposed by PJM here).

²² PJM Transmittal Letter at 8 (citing San Diego Gas & Electric, *Inverter Technical Standards Proposal*, at 7 (Aug. 7, 2013)).

²³ PJM Transmittal Letter at 8 (citing PJM Interconnection, L.L.C., Intra-PJM Tariffs, OATT, Attachment O, Appendix 2, § 4.7.4; PJM Interconnection, L.L.C., Intra-PJM Tariffs, OATT, Schedule 2; PJM Interconnection, L.L.C., Intra-PJM Tariffs, OATT, Attachment K, Appendix, § 3.2.3B).

²⁴ PJM Transmittal Letter at 9 (citing *California Indep. Sys. Operator Corp.*, 132 FERC ¶ 61,196, at PP 27-28 (2010) (CAISO Order), *order on reh’g*, 137 FERC ¶ 61,143 (2011) (CAISO Rehearing Order)).

synchronous resources.²⁵ PJM argues that the proposals are distinguishable because, although one of the Commission's primary justifications for adopting Order No. 661 was to protect owners of non-synchronous resources from undue discrimination in having to adhere to costly requirements to provide reactive power, now there are little to no incremental costs associated with maintaining reactive power capability; therefore, PJM states that such concerns of undue discrimination are not present here.²⁶ Moreover, PJM notes that, as mentioned above, to the extent non-synchronous resource owners realize incremental costs in providing reactive power support, PJM compensates resources for the capability and actual provision of reactive power, which is not the case in CAISO.²⁷

9. Moreover, PJM contends that its proposed tariff revisions can be distinguished from CAISO's because, while CAISO failed to explain why system impact studies, as opposed to presumptive requirements, are not the proper venue for identifying power factor requirements for wind generators, PJM has provided such an explanation.²⁸ PJM argues, in particular, that, given the expected non-synchronous resource penetration in future delivery years, reliance on system impact studies to determine the need for system-wide reactive support is shortsighted. According to PJM, a system impact study can identify system needs dependent on system topology given a pre-supposed future state, but fails to take into account larger system needs for reactive power support based on expected conditions on a wide-reaching scale.²⁹ PJM explains that a system impact study conducted today that shows that a non-synchronous resource is not required to provide reactive power may have very different results as the project is actually completed; in other words, system impact studies are not the appropriate mechanism to make long-term planning determinations since they are focused on relatively more near-term transmission conditions.³⁰

²⁵ CAISO Order, 132 FERC ¶ 61,196 at PP 45-46.

²⁶ PJM Transmittal Letter at 9.

²⁷ PJM Transmittal Letter at 9 (citing California Independent System Operator, Inc., OATT, § 8.2.3.3).

²⁸ PJM Transmittal Letter at 9 (citing CAISO Order, 132 FERC ¶ 61,196 at P 46).

²⁹ PJM Transmittal Letter at 9.

³⁰ PJM Transmittal Letter at 5, 9.

B. Voltage and Frequency Ride-Through Requirements

10. PJM proposes to enhance its existing “ride-through” requirements by amending the *pro forma* interconnection agreements to incorporate the Commission’s recent approval of NERC Reliability Standard PRC-024-1 in Order No. 796, which requires generator owners to set their generator protective relays such that generating units remain connected during defined frequency and voltage excursions, unless a specified exception applies.³¹ Although PJM’s proposal will expand the applicability of this Reliability Standard to the non-Bulk Electric System in some instances, PJM states that these changes will provide greater protection against the possibility of losing generation and will allow the transmission system to better withstand disturbances. Moreover, PJM contends that applying these provisions to non-synchronous units is both technically and economically feasible, and should have little to no impact on prospective customers because these requirements do not require any significant technical redesign of inverter equipment. Finally, with regard to applying these provisions prior to the full effective date of the standard, which is July 1, 2016, PJM states that most projects entering the new services queue after May 1, 2015, will likely not be in-service by July 1, 2016, so would need to comply with those provisions anyway.³²

11. PJM requests waiver of the Commission’s prior notice requirement to allow an effective date of May 1, 2015, to coincide with the beginning of a new interconnection services queue. PJM contends that good cause exists because this effective date will permit PJM to implement the new rules in the least administratively burdensome manner possible while, at the same time, ensuring that all prospective interconnection customers within a respective interconnection queue are treated similarly.³³

III. Notice

12. Notice of PJM’s filing was published in the *Federal Register*, 80 Fed. Reg. 13,526, with interventions and protests due on or before March 27, 2015.

13. The Delaware Division of Public Advocate; Invenergy LLC; the American Wind Energy Association (AWEA) together with the Mid-Atlantic Renewable Energy

³¹ PJM Transmittal Letter at 10; Order No. 796, 146 FERC ¶ 61,213 at P 20.

³² PJM Transmittal Letter at 10.

³³ PJM Transmittal Letter at 12.

Coalition; the NRG Companies;³⁴ the North Carolina Electric Membership Corporation; and NextEra Energy Resources, Inc. (NextEra) filed timely motions to intervene. NextEra filed timely comments, and AWEA filed out-of-time comments. PJM filed an answer to NextEra's comments and then filed an answer to AWEA's comments.

IV. Procedural Matters

14. Pursuant to Rule 214 of the Commission's Rules of Practice and Procedure,³⁵ the timely, unopposed motions to intervene serve to make the entities that filed them parties to this proceeding.

15. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure prohibits an answer to a protest unless otherwise ordered by the decisional authority.³⁶ We will accept PJM's answers because they have provided information that assisted us in our decision making process.

A. Responsive Pleadings

16. NextEra generally supports PJM's proposed tariff revisions, but asks that the Commission condition its acceptance on PJM: (1) adding tariff language clarifying that, should reactive power capability be required beyond the requirement set forth in its new tariff language, it will not exceed the clear standard set forth in Order No. 661 (i.e., 0.95 leading to 0.95 lagging measured at the point of interconnection); (2) clarifying that uprates of existing non-synchronous generation, achieved without any physical change to existing generation facilities, should not be subject to the new reactive power requirements; and (3) correcting a reference in one of its tariff revisions to where reactive power capability is measured.³⁷ NextEra explains that PJM's system impact studies so commonly result in PJM requiring reactive power capability from 0.95 leading to 0.95 lagging for wind plants that, for development purposes, NextEra assumes any new wind plant will need to have that reactive power capability at the point of interconnection; thus, PJM's proposed presumptive requirement is not a significant

³⁴ The NRG Companies consist of NRG Power Marketing LLC and GenOn Energy Management, LLC.

³⁵ 18 C.F.R. § 385.214 (2014).

³⁶ 18 C.F.R. § 385.213(a)(2) (2014).

³⁷ NextEra Energy Resources, Inc. March 27, 2015 Motion to Intervene and Comments at 2-3 (NextEra Comments).

change. In addition, whereas PJM has measured reactive power capability at the point of interconnection, it now proposes to measure it at the generator terminals. According to NextEra, this will allow resource owners to avoid the need for additional, costly equipment at or close to the point of interconnection. NextEra points out that the practical result will be that the amount of reactive power capability available at the point of interconnection for wind plants may actually be less than what PJM has been requiring under the system impact study approach. NextEra finds this balanced approach to be appropriate.³⁸

17. NextEra argues, however, that PJM's proposed tariff language³⁹ is unclear because, although the actual tariff language strikes all references to a potential system impact study to evaluate alternative reactive power requirements (beyond 0.95 leading to 0.95 lagging), PJM's transmittal letter appears to reserve for PJM the discretion to impose any other reactive power requirement that it finds appropriate through a system impact study.⁴⁰ NextEra expresses concern that PJM will continue to use system impact studies to justify requiring more conservative reactive power requirements, putting aside the clear requirement to provide reactive support within a range of 0.95 leading to 0.95 lagging at the generator terminals. NextEra also points out that there are no boundaries on PJM's discretion in this regard, which is contrary to the clear requirements in Order 661-A.⁴¹ NextEra requests that the Commission condition its acceptance of PJM's proposed tariff revisions on PJM clarifying its proposed tariff language to ensure that reactive power requirements do not exceed the standards set forth in Order 661-A. Like NextEra, AWEA does not support PJM's discretion to implement more conservative reactive power requirements through a system impact study, and requests that the

³⁸ NextEra Comments at 3-5.

³⁹ PJM Interconnection, L.L.C., [Intra-PJM Tariffs, ATTACHMENT O.A2.4.7, OATT ATTACHMENT O.A2.4.7 Reactive Power, 1.0.0.](#)

⁴⁰ NextEra Comments at 5 (citing PJM Transmittal Letter at 4-5).

⁴¹ NextEra Comments at 6 (citing Order No. 661-A, FERC Stats. & Regs. ¶ 31,198, Appendix B). Appendix B to Order No. 661-A sets forth the technical requirements for interconnection service as applicable to wind generating plants. These requirements clearly specify that a wind generating plant shall only maintain a power factor within the range of 0.95 leading to 0.95 lagging if necessary to ensure safety or reliability.

Commission require PJM to remove any reference to this discretion.⁴² AWEA points out that this discretion would impose significant uncertainty on wind developers, undermining all of the benefits of moving to a clear and consistent methodology.

18. Both NextEra and AWEA also assert that PJM's proposed tariff revisions imposing a presumptive reactive power requirement should not apply to existing wind units that request an incremental increase in their capacity or energy output (i.e., to uprates). Specifically, NextEra argues that uprates that involve no physical change to the generating unit, but rather involve adjustments to software and other system settings to slightly increase energy production, should be exempt from the new rules. NextEra contends that this modification would preserve the rights of existing resource owners that have made investments to meet PJM's existing requirements.⁴³ AWEA likewise requests that the Commission accept PJM's proposal, conditioned on PJM clarifying that uprates are not subject to the new reactive power requirements.⁴⁴

19. Further, NextEra points out that the last sentence of section 4.7.1.2 of Attachment O of PJM's OATT is inconsistent because it states that the reactive power capability for non-synchronous resources will be measured at the point of interconnection. Whereas section 4.7.1.1 of Attachment O of PJM's OATT requires measurement of reactive power capability to occur at the generator terminals. NextEra requests that the Commission condition acceptance of PJM's proposal on correcting this inconsistency.⁴⁵

20. AWEA also generally supports PJM's proposal, but requests certain clarifications. AWEA argues that the reactive power requirement should only be measured under conditions in which a wind plant's real power output exceeds 25 percent of its nameplate capacity. AWEA explains that, when real power output is low, the ability of plant-level controllers to regulate reactive power output can be impaired. Thus, AWEA asserts that measuring reactive power capability based only on conditions in which a wind plant's

⁴² American Wind Energy Association March 31, 2015 Motion for Leave to File Comments Out of Time and Comments at 3-4 (AWEA Comments) (citing PJM Transmittal Letter at 4-5).

⁴³ NextEra Comments at 7-8.

⁴⁴ AWEA Comments at 2-3.

⁴⁵ NextEra Comments at 8.

real power output exceeds 25 percent of its nameplate rated capacity would avoid that concern without compromising system reliability.⁴⁶

21. AWEA also comments on the other components of PJM's proposed tariff revisions. First, AWEA seeks clarification that PJM's proposed "ride-through" requirement will be a generator relay-setting standard, consistent with NERC Reliability Standard PRC-024-1⁴⁷ and Commission Order No. 796,⁴⁸ and not a generator performance standard. Such clarification, in AWEA's view, is important for ensuring that NERC Reliability Standard PRC-024-1 applies equally to all generators on a technology-neutral basis, and does not impose a more rigorous standard on non-synchronous generators.⁴⁹

22. Finally, AWEA takes issue with PJM's proposed manual requirements for active power control, ramp rate control, and frequency response. In particular, AWEA asserts that PJM is unclear in its proposal about what capabilities it seeks and how those capabilities will be used by PJM. AWEA provides recommendations to improve clarity.⁵⁰

B. PJM's Answers

23. In its answer to NextEra's comments, PJM clarifies that it does not intend to impose more conservative reactive power requirements through system impact studies.⁵¹ PJM notes that its transmittal letter, as it pertains to PJM's discretion to conduct system impact studies to determine if more conservative reactive power requirements are necessary, is incorrect. PJM explains that, while the transmittal letter is incorrect, the proposed tariff language it submitted with its filing is correct in striking references to

⁴⁶ AWEA Comments at 3.

⁴⁷ PRC-024-1 requires that generator owners set their generator protective relays such that generating units remain connected during defined frequency and voltage "ride-through."

⁴⁸ Order No. 796, 146 FERC ¶ 61,213 at P 1.

⁴⁹ AWEA Comments at 4-5.

⁵⁰ AWEA Comments at 5-7.

⁵¹ PJM Interconnection, L.L.C. April 13, 2015 Motion for Leave to Answer and Answer at 2-3 (PJM April 13 Answer).

system impact studies. Additionally, with regard to applying the proposed presumptive reactive power requirement to existing generator uprate requests, PJM acknowledges ambiguity in the proposed tariff language and clarifies that it does not intend to apply the requirement to existing generators seeking uprates; PJM supports a compliance requirement to clarify the proposed tariff language. Finally, PJM also agrees with the commenters that there appears to be unchanged language in proposed tariff section 4.7.1.2 that references the point of interconnection as the appropriate point to measure the power factor. PJM explains that the tariff language should refer to generator terminals instead. Thus, PJM also supports a compliance requirement to clarify this section.⁵²

24. In its answer to AWEA's comments, PJM agrees with AWEA that its proposed reactive power 0.95 leading to 0.95 lagging capability requirement should only be measured under conditions in which the plant's real power output exceeds 25 percent of nameplate capacity.⁵³ However, PJM explains that such requirements are normally set forth in PJM's manuals; PJM proposes to review existing testing requirements in its manuals and, through the stakeholder process, to update them as necessary to address AWEA's concern.⁵⁴

25. With regard to AWEA's request that PJM clarify its "ride-through" requirements, PJM states that its proposed frequency and voltage disturbance tolerance requirements are intended to be performance requirements, not generator relay settings. PJM explains that modern wind units have excellent frequency and voltage "ride-through capabilities," and PJM's proposed changes are intended to leverage these unique operating characteristics and uniformly apply the stricter Order No. 661-A requirements; reference to PRC-024-1 was intended to provide a reference point for those performance standards.⁵⁵ PJM explains that its proposal merely extends the disturbance tolerance requirements from Order Nos. 661 and 661-A, which are stricter than for conventional generators, to units with similar operating characteristics.⁵⁶

⁵² PJM April 13 Answer at 4.

⁵³ PJM Interconnection, L.L.C. April 24, 2015 Motion for Leave to Answer and Answer at 2 (PJM April 24 Answer).

⁵⁴ PJM April 24 Answer at 2-3 (citing PJM Manual 14D, Attachment E).

⁵⁵ PJM April 24 Answer at 3.

⁵⁶ PJM April 24 Answer at 3-4.

26. PJM also responds to AWEA's concerns about the power management requirements. Specifically, PJM clarifies that it is only requiring that non-synchronous units have the *capability* to provide active power control, ramp rate control, and frequency response. PJM has not yet defined the specific requirements or whether such support will be required on a comprehensive basis; rather, PJM only proposes here to require that non-synchronous units be *capable* in the event PJM and its stakeholders determine these power management requirements are needed.⁵⁷

V. Substantive Matters

27. We conditionally accept PJM's proposed revisions to its OATT, subject to a compliance filing, to become effective May 1, 2015, as requested.⁵⁸ We further direct PJM to submit its compliance filing within 30 days of the date of this order.

A. Reactive Power Support

28. We find that PJM's proposed tariff revisions concerning the reactive power requirements for non-synchronous resources are just and reasonable and justified as an "independent entity variation" to Order No. 661. Under the "independent entity variation" standard, an RTO must demonstrate that its proposed variation is just and reasonable and not unduly discriminatory and would accomplish the goals of Order

⁵⁷ PJM April 24 Answer at 4.

⁵⁸ Although PJM proposes to include power management requirements in its manuals for non-synchronous resources, it does not propose any tariff revisions to implement these requirements. This is consistent with the manner in which PJM provides power management requirements for synchronous resources, in accordance with its *pro forma* interconnection agreement. See PJM Manual 14D § 7.1 (Generator Real-Power Control); PJM Interconnection, L.L.C., Intra-PJM Tariffs, Attachment O, § 8.0 (3.0.0). We note that the Commission does not approve the content of manuals that merely contain "implementation details" of tariffs or "general operating procedures." See, e.g., *California Indep. Sys. Operator Corp.*, 122 FERC ¶ 61,271, at P 16 (2008); *Preventing Undue Discrimination and Preference in Transmission Service*, Order No. 890, FERC Stats. & Regs. ¶ 31,241, at P 1650, *order on reh'g*, Order No. 890-A, FERC Stats. & Regs. ¶ 31,261 (2007), *order on reh'g*, Order No. 890-B, 123 FERC ¶ 61,299 (2008), *order on reh'g*, Order No. 890-C, 126 FERC ¶ 61,228, *order on clarification*, Order No. 890-D, 129 FERC ¶ 61,126 (2009). As such, AWEA's comments regarding PJM's proposed manual requirements for active power control, ramp rate control, and frequency response are outside the scope of this proceeding.

No. 661.⁵⁹ The goals of Order No. 661 were to establish interconnection procedures and requirements for wind generators commercially available at that time that recognized the unique design and operating characteristics of wind plants. Order No. 661 also sought to remove unnecessary obstacles to the development of wind generation, while protecting system reliability.⁶⁰ PJM's proposal accomplishes these goals. Although there are still technical differences between non-synchronous generators and traditional generators, with regard to the provision of reactive power, those differences have significantly diminished since the Commission issued Order No. 661. As PJM explains, the cost of the technology necessary for a non-synchronous resource to provide reactive power has lessened such that the cost of installing equipment that is capable of providing reactive power is comparable to the costs of a traditional generator.⁶¹ Thus, we agree with PJM that the technology has changed both in availability and in cost since the Commission rejected CAISO's proposal in 2010. Therefore, we find that PJM's proposal will not present a barrier to non-synchronous resources. In addition, granting an "independent entity variation" to PJM from Order No. 661 is appropriate because there is less opportunity for undue discrimination from PJM applying reactive power requirements to all non-synchronous resources than for non-independent entities.⁶²

29. We next turn to each of the issues raised by AWEA and NextEra, both of which supported PJM's proposal on the condition that the Commission requires certain clarifications. NextEra, referencing a statement made by PJM in its transmittal letter,⁶³ is

⁵⁹ CAISO Order, 132 FERC ¶ 61,196 at P 45 n.44 (citing Order No. 2003, FERC Stats. & Regs. ¶ 31,146 at PP 822–827, Order No. 2003-A, FERC Stats. & Regs. ¶ 31,160 at P 759, and Order No. 661, FERC Stats. & Regs. ¶ 31,186 at PP 107–109).

⁶⁰ Order No. 661, FERC Stats. & Regs. ¶ 31,186 at P 11.

⁶¹ *Payment for Reactive Power*, Commission Staff Report, Docket No. AD14-7, at App'x 1, p. 6, App'x 2, pp. 4-5 (Apr. 22, 2014).

⁶² In Order No. 2003, the Commission describes the "independent entity variation" as a "balanced approach that recognizes that an RTO or ISO has different operating characteristics depending on its size and location and is less likely to act in an unduly discriminatory manner than a Transmission Provider that is a market participant. The RTO or ISO shall therefore have greater flexibility to customize its interconnection procedures and agreements to fit regional needs." Order No. 2003, FERC Stats. & Regs. ¶ 31,146 at P 827.

⁶³ PJM Transmittal Letter at 4-5 (describing PJM's proposal as requiring that all variable energy resources entering PJM's interconnection queue after May 1, 2015, have "the capability to autonomously provide dynamic reactive support within a range of

(continued...)

concerned that PJM proposes to retain discretion to use a system impact study to determine if a more conservative reactive power requirement is necessary; however, as PJM clarified in its answer, the sentence referenced by NextEra from PJM's transmittal letter was incorrect, and PJM did not intend to retain this discretion through the referenced tariff provision.⁶⁴ We find that PJM's clarification is sufficient to address NextEra's concern and accept the relevant tariff language, consistent with PJM's explanation.

30. Next, with respect to NextEra and AWEA's comments about applying PJM's proposed reactive power requirements to uprates, PJM clarified in its answer that it does not intend to apply the new reactive power requirements to uprates. However, we find that PJM's proposed tariff language could be interpreted as inconsistent with PJM's representation, such that uprate requests submitted to PJM by existing non-synchronous resources could be subject to the presumptive requirement. We therefore also condition our acceptance on PJM including in the compliance filing directed herein revised tariff language to clarify that its new reactive power requirements will not apply to uprates sought by existing non-synchronous resources.

31. NextEra also pointed out, and PJM acknowledged, unchanged tariff language in section 4.7.1.2, which refers to measuring reactive power capability at the "point of interconnection," rather than at generator terminals. We agree that this unchanged language is inconsistent with PJM's proposal to measure reactive power capability at generator terminals. Therefore, we further condition our acceptance of the filing on PJM including in its compliance filing revised tariff language to correct the inconsistent language in section 4.7.1.2. We also condition our acceptance of the filing on PJM including in its compliance filing corrections to a typographical error in section 4.7.1.2. Specifically, the word "out" in the phrase "continuous rated power out at a power factor" should instead be "output."

32. AWEA seeks clarification that the reactive power requirement will only be measured under conditions in which a wind plant's real power output exceeds 25 percent of its nameplate capacity. PJM agrees with AWEA's requested clarification, but states that such requirements are normally set forth in PJM's manuals.⁶⁵ We note that although PJM's tariff requires that reactive power design criteria be measured at "continuous rated

0.95 leading to 0.95 lagging at inverter terminals *unless a system impact study . . . establishes a need for more conservative limits*" (emphasis added)).

⁶⁴ PJM April 13 Answer at 3.

⁶⁵ PJM April 24 Answer at 2-3 (citing PJM Manual 14D, Attachment E).

power output,”⁶⁶ instances in which real power output is below 25 percent of nameplate capacity can impair the measurement of reactive power output. Therefore, we condition our acceptance of the filing on PJM including in its compliance filing revised tariff language that clarifies that reactive power will only be measured under conditions in which a wind plant’s real power output exceeds 25 percent of its nameplate capacity.

B. Voltage and Frequency Ride-Through Requirements

33. We will conditionally accept PJM’s proposed voltage and frequency “ride-through” requirements as discussed below. PJM proposes to apply the requirements of NERC Reliability Standard PRC-024-01, which the Commission accepted, to a broader range of resources and earlier than the effective date of the Reliability Standard. We agree with PJM that these changes will provide greater protection to its system and that applying them to a broader range of resources is just and reasonable because they do not require any significant technical redesign of inverter equipment. With regard to applying these provisions prior to the full effective date of the standard, which is July 1, 2016, we find persuasive PJM’s statement that most projects entering the new services queue after May 1, 2015, will likely not be in-service by July 1, 2016, so would need to comply with the provisions at that time.

34. PJM’s answer to AWEA addresses whether the proposed “ride through” requirements are generator performance standards or relay-setting requirements. We are not convinced that PJM’s answer settles the matter. PJM states that its proposal is intended to incorporate NERC Reliability Standard PRC-024-1, which requires that generator protective relays be set such that generating units remain connected during defined frequency and voltage excursions, unless a specified exception applies. However, PJM’s answer and the proposed tariff language go beyond NERC Reliability Standard PRC-024-1. For example, the proposed tariff language appears to require that a non-synchronous resource remain connected during defined frequency and voltage excursions without exception. Accordingly, we condition our acceptance of the filing on PJM including in its compliance filing tariff revisions to make clear that Schedule H does not require a non-synchronous resource to remain online during circumstances where such unit would be permitted to trip under NERC Reliability Standard PRC-024-1.

⁶⁶ Specifically, PJM’s OATT states that “For all new wind-powered and other non-synchronous generation facilities the Generation Interconnection Customer shall design its Customer Facility with the ability to maintain a composite power delivery at continuous rated power output at a power factor of at least 0.95 leading to 0.95 lagging.” See PJM Interconnection, L.L.C., [Intra-PJM Tariffs](#), [ATTACHMENT O.A2.4.7, OATT Reactive Power, 1.0.0.](#)

The Commission orders:

(A) PJM's tariff revisions are hereby conditionally accepted, subject to a compliance filing, to become effective May 1, 2015, as discussed in the body of this order.

(B) PJM is hereby directed to submit a compliance filing within 30 days of the date of this order, as discussed in the body of this order.

By the Commission.

(S E A L)

Kimberly D. Bose,
Secretary.