111 FERC ¶ 61,353
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

18 CFR Part 35

(Docket No. RM05-4-000 – Order No. 661)

Interconnection for Wind Energy

(Issued June 2, 2005)

AGENCY: Federal Energy Regulatory Commission.

ACTION: Final Rule

SUMMARY: The Federal Energy Regulatory Commission (Commission) is amending its regulations to require public utilities to append to their standard large generator interconnection procedures and large generator interconnection agreements in their open access transmission tariffs (OATTs) standard procedures and technical requirements for the interconnection of large wind generation.

EFFECTIVE DATE: This final rule will become effective [**INSERT DATE 60 DAYS FROM THE DATE OF PUBLICATION IN THE FEDERAL REGISTER**].

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SUPPLEMENTARY INFORMATION

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FEDERAL ENERGY REGULATORY COMMISSION

Interconnection for Wind Energy Docket No. RM05-4-000

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FINAL RULE

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FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Pat Wood, III, Chairman;
Nora Mead Brownell, Joseph T. Kelliher,
and Suedeen G. Kelly.

Interconnection for Wind Energy Docket No. RM05-4-000

ORDER NO. 661

FINAL RULE

(Issued June 2, 2005)

1. In this Final Rule, to meet our responsibility under sections 205 and 206 of the Federal Power Act (FPA)[1] to remedy undue discrimination, the Commission adopts standard procedures and technical requirements for the interconnection of large wind plants. The Commission requires all public utilities that own, control, or operate facilities for transmitting electric energy in interstate commerce to append to the Large Generator Interconnection Procedures (LGIPs) and Large Generator Interconnection Agreements (LGIAs) in their Open Access Transmission Tariffs (OATTs) the Final Rule Appendix G adopted here. These standard technical requirements provide just and reasonable terms for the interconnection of wind plants.[2] The rule recognizes the technical differences of

[1] 16 U.S.C. §§ 824d-e (2000).

[2] As discussed in greater detail below, the Final Rule Appendix G applies only to wind plants, due to the unique characteristics of wind generating technology.

wind generating technology, and benefits customers by removing unnecessary obstacles to further development of wind generating resources while ensuring that reliability is protected.

I. Introduction

2. In Order No. 2003,[3] the Commission adopted standard procedures and a standard agreement for the interconnection of large generation facilities. The Commission required public utilities that own, control, or operate facilities for transmitting electric energy in interstate commerce to file revised OATTs containing these standard provisions, and use them to provide interconnection service to generating facilities having a capacity of more than 20 megawatts.

3. In Order No. 2003-A, on rehearing, the Commission noted that the standard interconnection procedures and agreement were based on the needs of traditional synchronous generation facilities and that a different approach might be more appropriate for generators relying on non-synchronous technologies,[4] such as wind plants.[5]

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[3] Standardization of Generator Interconnection Agreements and Procedures, Order No. 2003, 68 Fed. Reg. 49,845 (Aug. 19, 2003), FERC Stats. & Regs., Regulations Preambles ¶ 31,146 (2003) (Order No. 2003), order on reh'g, 69 Fed. Reg. 15,932 (Mar. 24, 2004), FERC Stats & Regs., Regulations Preambles ¶ 31,160 (2004) (Order No. 2003-A), order on reh'g, 70 Fed. Reg. 265 (January 4, 2005), FERC Stats & Regs., Regulations Preambles ¶ 31,171 (2004) (Order No. 2003-B), reh'g pending; see also Notice Clarifying Compliance Procedures, 106 FERC ¶ 61,009 (2004).

[4] A wind generator is considered non-synchronous because it does not run at the same speed as a traditional generator. A non-synchronous generator possesses significantly different characteristics and responds differently to network disturbances.

Accordingly, the Commission granted certain clarifications, and also added a blank Appendix G (Requirements of Generators Relying on Non-Synchronous Technologies) to the standard LGIA for future adoption of requirements specific to non-synchronous technologies.[6]

4. Therefore, in a Notice of Proposed Rulemaking (NOPR), the Commission proposed technical standards applicable to the interconnection of large wind generating plants[7] to be included in Appendix G of the LGIA.[8] We proposed the standards in light of our findings in Order No. 2003-A noted above and in response to a petition submitted by the American Wind Energy Association (AWEA) on May 20, 2004.[9] The Commission proposed to adopt certain technical requirements that Transmission Providers would be required to apply to interconnection service for wind generation plants, which are different from those required of traditional synchronous generating plants. These standard technical requirements are now needed because of the increased

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[5] Order No. 2003-A at P 407, n.85.

[6] Id.

[7] Large wind generating plants are those with an output rated over 20 MW at the point of interconnection.

[8] See Interconnection for Wind Energy and Other Alternative Technologies, Notice of Proposed Rulemaking, 110 FERC ¶ 61,036 (2004) (NOPR).

[9] See Petition for Rulemaking or, in the Alternative, Request for Clarification of Order No. 2003-A, and Request for Technical Conference of the American Wind Energy Association (May 20, 2004), filed in Docket Nos. RM02-1-005 and PL04-15-000.

presence of larger aggregated wind plants on many Transmission Providers' systems. The NOPR stated that, except for those articles of the LGIA for which wind plants have been exempted,[10] these requirements would supplement the standard interconnection procedures and requirements adopted by the Commission in Order No. 2003. Additionally, the NOPR sought comments on certain specific issues, including whether there are other non-synchronous technologies, or other technologies in addition to wind, that should also be covered by the proposed Appendix G.

II. Background

5. In Order No. 2003, to meet our responsibility under sections 205 and 206 of the FPA to remedy undue discrimination, the Commission required all public utilities that own, control, or operate facilities for transmitting electric energy in interstate commerce to append to their OATTs the LGIP and LGIA. To achieve greater standardization of interconnection terms and conditions, Order No. 2003 required such public utilities to file revised OATTs containing the LGIP and LGIA included in Order No. 2003.

6. As explained above, because some of the technical requirements in the LGIA were inappropriate for non-synchronous technologies (such as wind generators), the Commission clarified in Order No. 2003-A that LGIA article 5.4 (Power System Stabilizers), LGIA article 5.10.3 (Interconnection Customer's Interconnection Facilities

[10] LGIA article 5.4 (Power System Stabilizers), LGIA article 5.10.3 (Interconnection Customer's Interconnection Facilities Construction), and LGIA article 9.6.1 (Power Factor Design Criteria).

Construction) and LGIA article 9.6.l (Power Factor Design Criteria) would not be applied to wind generators.[11] Additionally, the Commission noted that "there may be other areas of the LGIP and LGIA that may call for a slightly different approach for a generator relying on newer technology because it may have unique electrical characteristics."[12]

7. On May 20, 2004, in Docket No. RM02-1-005, AWEA submitted a petition for rulemaking or, in the alternative, request for clarification of Order No. 2003-A, and a request for a technical conference. AWEA asked the Commission to adopt in Appendix G certain standards for the interconnection of wind generation plants. Specifically, AWEA submitted a proposed Appendix G that it argues addresses the concerns of both Transmission Providers and the wind generation industry. AWEA's proposed Appendix G included a low voltage ride-through capability standard that would allow the Transmission Provider to require as a condition of interconnection that wind generation facilities have the ability to continue operating or "ride through" certain low voltage conditions on the transmission systems to which they are interconnected. AWEA's proposed Appendix G also included that as a condition of interconnection, wind plants would install equipment enabling remote supervisory control and data acquisition (SCADA) that would limit the maximum plant output during system emergency and

[11] Id. at P 407, n. 85.

[12] Id.

system contingency events and telemetry communication between the system operator and the wind plant for automatic forecasting and scheduling. Additionally, AWEA proposed that the power factor design criteria of up to 0.95 leading/lagging (required in Order No. 2003) be applied to wind generation plants, with flexibility regarding whether the reactive support equipment would be located at the common point of interconnection of all the generators in the plant rather than at the high side of the wind plant substation transformers. Further, AWEA proposed that the Commission require Transmission Providers and wind generator manufacturers to participate in a formal process to develop, update, and improve the engineering models and specifications used in modeling wind plant interconnections. Finally, AWEA proposed to include language in Appendix G allowing the wind Interconnection Customer to "self-study" interconnection feasibility by entering the interconnection queue without providing certain power and load flow data required of other large generators, receiving certain information from the Transmission Provider, and conducting its own Feasibility Study.

8. On September 24, 2004, the Commission held a Technical Conference to discuss the issues raised by AWEA's petition, including the technical requirements for the interconnection of wind plants and other such alternative technologies and the need for specific requirements for their interconnection. Additionally, the Technical Conference considered how wind and other alternative generator technologies may respond differently to transmission grid disturbances and have different effects on the

transmission grid. The Commission also solicited and received post-Technical Conference comments from interested persons.

9. As noted above, the Commission's NOPR proposed to adopt in Appendix G to the LGIA a somewhat modified version of the low voltage ride-through, SCADA and power factor design standards proposed by AWEA in its May 20, 2004 petition. Specifically, the NOPR proposed to establish uniform standards in Appendix G that would require large wind plants seeking to interconnect to the grid to (1) demonstrate low voltage ride-through capability; in other words, show that the plant can remain on line during voltage disturbances up to specified time periods and associated voltage levels; (2) possess SCADA capability to transmit data and receive instructions from the Transmission Provider; and (3) maintain a power factor within the range of 0.95 leading to 0.95 lagging, measured at the high voltage side of the substation transformers. In the case of the low voltage ride-through requirement, the Commission proposed to permit the Transmission Provider to waive the requirement on a comparable and not unduly discriminatory basis for all wind plants. In the case of the power factor requirement, the Commission proposed to permit the Transmission Provider to waive or defer compliance with the requirement where it is not necessary. The Commission declined, however, to adopt AWEA's proposal to allow a wind generator to "enter the interconnection queue and conduct its own Feasibility Study, having obtained the information necessary to do so

upon paying the initial deposit and submitting its interconnection application."[13] We asked for comments on how to balance the need of wind generators to obtain certain data from the Transmission Provider before completing their Interconnection Requests with the need to protect critical energy infrastructure information and commercially sensitive data against unwarranted disclosure.

III. Discussion

10. Based on AWEA's petition, the comments received during and after the Technical Conference, and the comments filed in response to the NOPR, the Commission is adopting certain standard procedures and technical requirements for the interconnection of wind generating plants, as discussed in greater detail below. These procedures and technical requirements will be appended, as Appendix G, to both the LGIP and the LGIA.[14]

[13] See AWEA Petition at 13.

[14] In the NOPR, the Commission proposed to include Appendix G as an attachment to the LGIA only. Upon further consideration, the Commission directs that the Final Rule Appendix G provisions related to completion of the Interconnection Request by a wind plant interconnection customer be appended to the LGIP, since they are procedural in nature, and that the remaining technical requirements be appended to the LGIA, to ensure that the provisions adopted here are applied throughout the interconnection process.

11. These technical requirements for the interconnection of wind plants recognize the unique design and operating characteristics of wind plants,[15] their increasing size and increasing level of penetration on some transmission systems (in terms of the wind generating capacity's percentage contribution to total system generating capacity), and the effects they have on the transmission system. In Order No. 2003, the Commission noted that in the past, requests for interconnection frequently resulted in complex and time-consuming disputes over technical matters such as feasibility, cost, and cost responsibility.[16] That is true for wind interconnection as well as interconnection of more conventional generation. The special standard procedures we are adopting for the interconnection of large wind plants will minimize opportunities for undue discrimination by Transmission Providers and remove unnecessary obstacles to the development of wind generation, while protecting system reliability.[17] Like the LGIP and LGIA in Order No. 2003, the Final Rule Appendix G is to be added to the OATT of each public utility that

[15] As noted above, wind plants over 20 MW in total size are subject to the standard technical requirements in the Final Rule Appendix G. These wind plants are generally made up of several small induction wind generating turbines, laid out over a large area, and connected through a medium-voltage collector system. This collector system is connected to the low voltage side of the step-up transformer, which is then connected to the transmission system at a single Point of Interconnection.

[16] Order No. 2003 at P 11.

[17] See id. at P 11-12.

owns, controls, or operates facilities for transmitting electric energy in interstate commerce.

12. The Final Rule Appendix G we adopt here applies only to the interconnection of wind plants. As discussed further below, the Commission does not believe at this time that the standard procedures and technical requirements in this Final Rule are appropriate for other alternative generating technologies that may supply over 20 MW at one Point of Interconnection. The standard procedures and technical requirements adopted here recognize the unique characteristics of wind plants, including the fact that they use induction generators, consist of several or numerous small generators connected to a collector system, and do not respond to grid disturbances in the same manner as large conventional generators.

13. The Appendix G procedures and technical requirements for the interconnection of wind generation plants are not the sole interconnection requirements for wind plants; large wind plants are subject to the other standard interconnection procedures and requirements adopted by the Commission in Order No. 2003, unless wind plants are exempted from such procedures and requirements by Order No. 2003 and its rehearing orders, and this order.

14. Additionally, as discussed further below, the Commission adopts a reasonable transition period for the technical requirements adopted in the Final Rule. Specifically, the standard technical requirements, if applicable, for low voltage ride-through capability, SCADA capability, and power factor design criteria apply only to LGIAs signed, filed

with the Commission in unexecuted form, or filed as a non-conforming agreement, on or after January 1, 2006, or the date six months after publication of the Final Rule in the Federal Register, whichever is later. The procedural requirements related to the completion of the Interconnection Request by a wind plant Interconnection Customer, however, apply when the Final Rule takes effect, which is 60 days after the date of publication in the Federal Register.[18]

A. Low Voltage Ride-Through Capability

15. As the Commission stated in the NOPR, early wind generator technology would shut down the wind generating unit if there was a sudden change in voltage on the transmission system. With the increasing number and size of wind plants in the United States, there is a concern that wind plants tripping off-line during a low voltage situation could raise significant reliability concerns. As a result, Transmission Providers state that they need large wind plants to remain on-line during low voltage occurrences to maintain reliability. Further, in the past, Transmission Providers would often shut down wind units during a system disturbance. Wind generators would prefer to stay on-line, but they are concerned that having each Transmission Provider design its own low voltage ride-

[18] As discussed in greater detail below, in this Final Rule the Commission is adopting procedures that permit a wind plant Interconnection Customer to provide in the Interconnection Request a set of electrical design specifications that depict the wind plant as a single generator. These procedures recognize that the unique characteristics of wind plants do not permit them to submit a detailed electrical design in the initial Interconnection Request stage, and allow wind plants to enter the queue and receive the base case data necessary to provide a detailed design to the Transmission Provider.

through requirement would greatly affect wind turbine manufacturing costs. As a result, both wind generators and most Transmission Providers support having a low voltage ride-through standard for large wind plants.

16. The NOPR proposed to require that large wind plants seeking to interconnect to the transmission system demonstrate low voltage ride-through capability, unless waived by the Transmission Provider on a comparable and not unduly discriminatory basis for all wind plants. Specifically, the NOPR Appendix G would require that wind generating plants demonstrate the ability to remain on-line during voltage disturbances up to the time periods and associated voltage levels set forth in Figure 1 of the NOPR. We proposed to measure voltage levels at the high voltage side of the wind plant substation transformer. The NOPR noted that while low voltage ride-through capability is needed for wind plants, it is less of a concern for large synchronous generating facilities because most of these facilities are equipped with automatic voltage control devices to increase output during low voltage events.

17. The NOPR sought comments on the proposed low voltage ride-through standard. In particular, the Commission was interested in comments addressing whether it should adopt a low voltage ride-through standard at all, whether the proposed standard or another standard is appropriate, and whether the proposed standard is specific enough. Specifically, the Commission sought comments on whether the required time periods and associated voltage levels proposed in Figure 1 of the NOPR Appendix G were appropriate or should be modified.

1. Comments

18. Several commenters, including AWEA,[19] Western, FirstEnergy, and the Midwest ISO, state that they support the low voltage ride-through standard in Figure 1 of the NOPR. Midwest Reliability Organization suggests, however, that the standard could be in article 9.6 of the LGIA. CenterPoint contends that the reliability concerns presented by the failure of a large wind plant to ride through a low voltage event also exist if other generators also fail to ride through such events, and thus would apply a low voltage ride-through requirement to all generators. Western supports the standard as proposed, with the understanding that it may need to be modified later if it causes unforeseen problems on the transmission system.

19. Numerous other entities support the proposed low voltage ride-through requirement with modifications. For instance, numerous commenters, including AWEA, PacifiCorp-PPM Energy, FPL Energy, Southern California Edison, AEP, Xcel, PJM, National Grid and Southern, believe that the required voltage should be measured at the point of interconnection, as opposed to the high side of the wind plant substation transformer.

20. Additionally, several entities dispute the specific time periods and associated voltage levels set forth in Figure 1 of the proposed Appendix G. American

[19] See AWEA Reply Comments (April 1, 2005) at 10. Specifically, AWEA asks that the proposed low voltage ride-through standard be adopted, specifically the proposed standard of Figure 1.

Superconductor states generally that the proposed low voltage ride-through curve in Figure 1 of the NOPR is unrealistic and does not resemble voltage situations that wind plants are likely to encounter. It also argues that the low voltage requirement proposed in the NOPR is not comparable to what is required of conventional generators. Midwest ISO TOs, CenterPoint and Xcel assert that requiring the low voltage ride-through capability to go only to 15 percent of the rated line voltage (as set out in Figure 1 of the NOPR) may be too high and may present reliability problems. They recommend that the Figure 1 low voltage ride-through profile require the wind turbine to ride through low voltage at zero percent of the rated line voltage for 150 milliseconds. NUSCo recommends that the Commission require wind generators to ride through a fault with zero percent of the rated line voltage at the point of interconnection for 250 milliseconds (15 cycles). American Transmission argues that the low voltage ride-through curve of Figure 1 should show the voltage to be at 0.90 per unit prior to time zero. ISO New England states that to the extent the Commission adopts a low voltage ride-through requirement, it should require wind plants to remain connected to the transmission system for a zero voltage level for the time period associated the typical time it takes to clear a normal design contingency fault.[20]

[20] NERC similarly states that to meet its general reliability standards for system performance, wind plants should remain online "through a normally cleared fault." NERC Comments at 3. Also, PJM states that wind plants should be required to operate during a zero voltage level at the Point of Interconnecton until the fault is cleared by primary protective devices on the Transmission System.

21. Several of the commenters, including AWEA, Gamesa, and GE suggest that the low voltage ride-through standard should be clarified to apply only to three-phase faults. AWEA also asks that the requirement be clarified to state that a wind plant would not be expected to continue to operate in low voltage situations where the wind farm is tripped off-line following a fault if (a) this action is performed intentionally under a special protection scheme, or (b) if the fault is on the Transmission Provider's side of the Point of Interconnection and clearing the fault would effectively disconnect the wind plant from the system. Midwest ISO TOs and Montana-Dakota Utilities also seek clarification regarding application of the proposed standard to unbalanced phase voltages.

22. Many commenters, while supportive of requiring wind plants to possess low voltage ride-through capability, argue that the specific standard should be permitted to vary based on reliability needs. For example, the New York PSC, while agreeing that large wind plants should possess low voltage ride-through capability, argues that the specific voltage-time standard should be developed on a case-by-case basis to reflect system needs. Midwest ISO TOs similarly contend that Transmission Providers should be able to establish different low voltage ride-through standards on a case-by-case basis. NYISO asserts that the low voltage ride-through standard proposed by the Commission should be a minimum performance requirement, and that Transmission Providers should have the flexibility to require a higher low voltage ride-through standard if the particular site location or wind plant design requires a higher standard to protect system reliability. Similarly, LIPA suggests that the Commission adopt a two-part low voltage ride-through

standard; the first part would be the standard proposed in the NOPR, while the second part would apply a more stringent low voltage ride-through standard where the studies indicate that the NOPR requirements are inadequate, such as in locations with special reliability concerns. ISO New England recommends that the Commission not adopt a specific standard for low voltage ride-through capability, or alternatively, that the standard serve only as a guideline for wind turbine manufacturers. BPA and NERC contend that the development of low voltage ride-through standards should be left to the Western Electricity Coordinating Council, NERC, regional reliability councils, the Institute of Electrical and Electronics Engineers (IEEE), and the American National Standards Institute.[21] American Superconductor, Nevada Power, and NUSCo, among others, assert that the low voltage ride-through standard should be based on established regional reliability standards. Likewise, NorthWestern Energy asks that the standard be modified to allow the Transmission Provider to use the reliability council standard in effect when the LGIA is signed.

23. FPL Energy asks that the proposed low voltage ride-through requirement be modified so that the determination of whether a wind plant must have low voltage ride-through capability is made on a case-by case basis. According to FPL Energy, the NOPR would have the "unintended consequence" of mandating costly low voltage ride-through

[21] Similarly, EEI suggests that the Commission adopt standards on an interim basis, until NERC, the regional reliability councils, or IEEE establish formal standards.

technology for all wind plants because Transmission Providers will not be able to determine that the capability will never be needed.[22] FPL Energy argues that the Commission's Final Rule should require the Transmission Provider to determine through the System Impact Study, on a case-by-case basis, whether the wind plant is required to possess low voltage ride-through capability. It notes that currently, Transmission Providers may not require an Interconnection Customer to be responsible for Network Upgrades that are not identified in the studies as necessary, and that a similar process should apply to the low voltage ride-through requirement. Finally, FPL Energy expresses concern that the use of the term "demonstrate" in the proposed requirement could be interpreted to require the wind plant to physically demonstrate the capability, risking harm to its electrical equipment.

24. With regard to the Commission's proposal to permit the Transmission Provider to waive the low voltage ride-through requirement, NUSCo and Tucson Electric both argue that no waiver of the low voltage ride-through requirement should be permitted. NUSCo asserts that the reliability of one Transmission Provider's system may be affected by the grant of a waiver by a neighboring Transmission Provider.

[22] FPL Energy estimates that for a 100 MW wind farm, the cost of low voltage ride-through exceeds $1.5 million.

25. Xcel and LIPA believe there should also be a high voltage ride-through standard for wind plants, comparable to the high voltage ride-through standards for conventional generators.

2. Commission Conclusion

26. As discussed further below, we adopt the low voltage ride-through standard proposed in the NOPR, but will not require that it be met unless the System Impact Study shows that it is needed. Specifically, under the requirement we adopt in this Final Rule, a wind plant is required to satisfy the low voltage ride-through standard if the Transmission Provider shows, through the System Impact Study, that such capability is required to ensure safety or reliability. This differs from the NOPR, which proposed to require low voltage ride-through capability in all cases, except when the Transmission Provider waived the requirement on a comparable and not unduly discriminatory basis for all wind plants. Additionally, the Final Rule adopts the Point of Interconnection as the point of measurement for the low voltage ride-through standard, instead of the proposed high side of the wind plant substation transformers, and replaces the term "demonstrate" with "possess." We also grant certain clarifications, as discussed further below.

27. The Commission believes that establishing the achievable low voltage ride-through standard in this Final Rule if the Transmission Provider shows that it is necessary to maintain safety or reliability provides certainty to wind plant developers that their interconnection to the grid will not be frustrated, and limits opportunities for undue discrimination. A requirement based on a uniform standard ensures that wind developers

are not faced with widely varying interconnection standards in different areas of the country, which would increase manufacturing costs needlessly. We believe that in the long run this is in the best interests of the wind industry and customers, as it helps provide a secure and reliable power supply, and will facilitate increased use of wind as a generation resource while ensuring that reliability is protected.

28. As noted above, the Commission requires low voltage ride-though capability only if the Transmission Provider shows that it is needed on a case-by-case basis, as FPL Energy requests. Specifically, low voltage ride-through capability is required only if the Transmission Provider shows, through the System Impact Study, that it is required to ensure the safety or reliability of the Transmission Provider's transmission system. Given that Transmission Providers have responsibility for ensuring the reliable operation of their systems (pursuant to NERC and regional reliability council standards), the Commission believes that they are in the best position to establish whether low voltage ride-through capability is needed in individual circumstances. The System Impact Study is the best vehicle for assessing the need for such capability, and this study should determine if there is a need for a wind plant to remain on-line during low voltage events to ensure the safety or reliability of the system. Requiring low voltage ride-through capability only if the System Impact Study shows it to be necessary ensures that the increased reliance on wind plants does not degrade system safety or reliability. It also ensures that the Transmission Provider does not require a wind plant to install costly equipment that is not needed for grid safety or reliability. This limits the opportunities

for undue discrimination; a wind plant Interconnection Customer will not have its interconnection frustrated by unnecessary requirements to install costly equipment that is not needed for safety or reliability. Should the wind plant Interconnection Customer disagree with the Transmission Provider that the System Impact Study shows that low voltage ride-through capability is needed, it may challenge the Transmission Provider's conclusion through dispute resolution or appeal to the Commission.

29. Given our decision to apply the low voltage ride-through capability standard only on a case-by-case basis if the Transmission Provider shows, through the System Impact Study, that it is needed to ensure safety or reliability, there is no need for the waiver provision in the NOPR. As a result, issues raised by commenters regarding the waiver provision are moot.

30. As noted above, many entities representing a broad mix of market participants request that the low voltage ride-through requirement be modified to require that the voltage be measured at the Point of Interconnection, as opposed to the high voltage side of the wind plant substation transformer. Given the need to protect grid safety and reliability by having wind plants ride through low voltage events where necessary, and continue to provide output at the point where the plant and its associated interconnection facilities join the grid, we will do so. Use of this measurement point recognizes that the Point of Interconnection is the point at which the Interconnection Customer's responsibility ends and the Transmission Provider's responsibility begins. Additionally, this change to the NOPR is broadly supported, and simplifies the interconnection process

by maintaining the same Point of Interconnection definition adopted in Order No. 2003.

31. We also find convincing FPL Energy's argument that using the term "demonstrate the ability" could be interpreted to require the wind plant to physically demonstrate that it has low voltage ride-through capability and thus could lead to unnecessary tests that could harm the wind plant electrical equipment. Accordingly, we replace the term "demonstrate the ability" with "be able."

32. We also clarify certain portions of the low voltage ride-through standard. First, we clarify that the low voltage ride-through requirement, and the time periods and associated voltage levels set forth in Appendix G, Figure 1, apply to three-phase faults.[23] This is because three-phase faults are the most severe, whereas two-phase or single-phase faults drop the voltage to a level not as low as that specified in Figure 1. Further, in response to AWEA, we clarify that a wind plant is not required to satisfy the standard in Appendix G, Figure 1 if the wind plant is intentionally tripped off line following a fault under a "special protection scheme"[24] agreed to by the Transmission Provider. These

[23] A three-phase fault is an unintentional short circuit condition involving all three phases in an electric system. It is the most severe in its impact, but occurs least frequently. For complete reliability, it is virtually universal to design an electric system for three-phase faults. Other types of faults are: single line-to-ground fault, line-to-line fault, and double line-to-ground fault.

[24] A special protection scheme is an automatic protection scheme designed to detect abnormal or predetermined system conditions and take corrective actions to

(continued)

situations may include a fault on the Transmission Provider's side of the Point of Interconnection, as well as a fault other than a three-phase fault covered by the low voltage ride-through standard.

33. We reject the requests that the standards be only guidelines. The Commission sets forth in this Final Rule a low voltage ride-through standard that it believes, after consideration of the comments from all interested entities, including the wind industry, is achievable and will maintain grid safety and reliability while facilitating the increased use of wind resources. As noted above, the Commission is setting a standard for low voltage ride-through to provide certainty and diminish the opportunities for undue discrimination. Permitting Transmission Providers to set their own specific low voltage ride-through standards would create too great a risk that this opportunity would be used to frustrate wind plant interconnections or to favor a Transmission Provider's wind generating affiliate.

34. In response to comments suggesting that we should allow NERC and the regional reliability councils to establish low voltage ride-through standards, we are aware of the work being done by these organizations to address wind plant interconnection standards. However, no such standards are available today, and Transmission Providers and wind Interconnection Customers are looking for interconnection standards to apply now. If

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maintain system reliability. Such actions may include changes in demand, generation, or system configuration to maintain acceptable voltage or power flows.

other entities develop an alternate standard, a Transmission Provider may seek to justify adopting them as variations from Appendix G, as discussed below. Additionally, the Commission would consider a future industry petition to revise Appendix G to conform to NERC developed standards.

35. With respect to Midwest ISO TOs' concern that Appendix G, Figure 1 does not contain information on how the standard would apply to unbalanced voltages in close proximity to the point of interconnection,[25] we note that it is impossible to identify all possible conditions and circumstances that may arise on the transmission system. The low voltage ride-through standard is a general one that will be adequate under most circumstances. We recognize that special circumstances may occur. These may be identified by the System Impact Study, which should identify any additional protection requirements in addition to this standard. We also note that, as discussed below, the Commission permits variations from the Final Rule Appendix G that are "consistent with or superior to" the standard provisions, that are based on regional reliability council requirements, or that are offered by independent entities such as Regional Transmission Organizations (RTOs) or Independent System Operators (ISOs).

36. Similarly, we are not persuaded to alter the specific time periods and associated voltage levels in Figure 1 of the NOPR Appendix G. The low voltage ride-through

[25] Additionally, a number of commenters suggest low voltage ride-through levels and timing or cycling standards different from those reflected in the NOPR Appendix G, Figure 1.

standard proposed in that figure and adopted here is close to the standard used in other countries and was presented to the Commission by representatives of the wind industry as an achievable requirement. Several commenters, including Transmission Providers, support the standard as one that would safeguard reliability. The Western Electricity Coordinating Council (WECC), a regional reliability council, has approved a similar low voltage ride-through standard. The standard we adopt in this Final Rule is an international standard that has been accepted for use by the Alberta Electric System Operator and Germany, and was developed following detailed study. We do not believe it would be appropriate to deviate from such a widely-accepted and achievable standard in this rulemaking.

37. We are not convinced of a need for a separate high voltage ride-through standard for wind generators. The record developed here does not indicate that this is a general concern across the country. Parties that believe a high voltage ride-through standard is required should ask NERC or the regional reliability councils to address this need. A Transmission Provider may seek to justify variations from Appendix G to establish these requirements under the variation provisions of Order No. 2003 and its rehearing order, as briefly summarized below in section III.G, "Variations from the Final Rule."

B. Power Factor Design Criteria (Reactive Power)

38. The Commission stated in the NOPR that until recently, Transmission Providers did not require wind generators to have the capability to provide reactive power because the generators were generally small and had little effect on the transmission grid.

However, because of the larger size of many of the wind plants being built and the increased presence of wind energy on various transmission systems, the Commission proposed to require wind plants to operate within a specified power factor range to help balance the reactive power needs of the transmission system.

39. Specifically, the NOPR proposed to require that large wind plants maintain a power factor within the range of 0.95 leading to 0.95 lagging (as required by Order No. 2003), to be measured at the high voltage side of the wind plant substation transformer.[26] In Appendix G of the NOPR, we further proposed to allow wind plants flexibility in how they meet the power factor requirement; for example, using either power electronics designed to supply this level of reactive capability, fixed and switched capacitors if agreed to by the Transmission Provider, or a combination of the two.[27] Additionally, the NOPR proposed to allow the Transmission Provider to waive the power factor requirement for wind plants where it is not needed at that location or for a generating facility of that size, provided that such waiver is not unduly discriminatory (that is, is offered on a comparable basis to similarly situated wind plants). The NOPR stated, however, that if the Transmission Provider waived the power factor requirement, the

[26] This proposed measurement point is different from Order No. 2003, which measures the power factor at the Point of Interconnection.

[27] Conventional generators inherently provide reactive power, whereas most induction-type generators used by wind plants currently can only provide reactive power through the addition of external devices.

interconnection agreement would be considered a non-conforming agreement under section 11.3 of the LGIP and thus would have to be filed with the Commission. The NOPR also proposed to require that wind plants have the capability to provide sufficient dynamic (as opposed to static) voltage support to interconnect to the transmission system, if the System Impact Study shows that dynamic capability is necessary for system reliability.[28]

40. The NOPR sought comments about whether the proposed power factor range should be increased or decreased for wind generating plants. It also sought comments as to whether any dynamic (i.e., controllable) reactive capability should be required of wind plants, and if so, how much. Finally, the NOPR sought comments on the proposed waiver provision.

41. The comments received fall into several categories, including the general application of a power factor requirement to wind plants and the waiver provisions, the power factor range and operation within that range, measurement of the power factor requirement at the point of interconnection, and whether dynamic reactive power capability should be a requirement. These subcategories are separately addressed below.

[28] NOPR at P 18.

1. Comments – Power Factor Range and General Application of the Requirement

42. Western, NERC, BPA and Great River support the proposed power factor range of 0.95 leading to 0.95 lagging (hereinafter stated as +/- 0.95). Southern California Edison agrees that the proposed power factor range is appropriate unless it is waived by the Transmission Provider.

43. Numerous other commenters state that they support the standard, but that the Transmission Provider should be allowed to impose a wider power factor range on a wind generating plant to maintain the reliability of the transmission system. American Superconductor, for instance, believes that the +/- 0.95 power factor range should be adopted as a standard except in cases where the Transmission Provider's System Impact Study indicates that additional reactive support is needed. Similarly, EEI asserts that the wind plant should operate within the +/- 0.95 power factor range unless the Transmission Provider has established a different standard that applies to all generators in its control area. New York PSC agrees with the NOPR power factor range, but argues that the Transmission Provider should be able to require a power factor of 0.90 lagging if the System Impact Study indicates it is needed for system reliability. FirstEnergy and American Transmission believe that to ensure a greater level of reliability, the Commission should adopt a power factor range of 0.90 lagging to 0.95 leading. NRECA-APPA maintains that while most Transmission Providers impose the +/- 0.95 power factor requirement on conventional generators, some impose a larger range, such

as 0.90 lagging to 0.95 leading, to meet reliability criteria. In that situation, they contend that the Transmission Provider should be allowed to impose that same wider power factor range on wind generating plants. In similar comments, NYISO urges the Commission to (1) consider the power factor standard a minimum requirement, as opposed to a maximum, and (2) find that the large wind farms should not be able to depend on the transmission system interconnection for the plants' excitation power.

44. NRECA-APPA and Xcel also state that the standard is unclear about whether the wind generator can operate anywhere in the +/- 0.95 range. Xcel asks that the Commission clarify whether the wind generator is expected to operate over the entire +/- 0.95 power factor range or at a specified point within that range.

45. Several commenters assert that the adherence to the Transmission Provider's voltage schedule is more important than merely maintaining a power factor within the specified range. NRECA-APPA asks that the wind plant be required to comply with the Transmission Provider’s voltage schedule directives. PacifiCorp/PPM Energy asks the Commission to revise the proposed power factor standard to require the Transmission provider to specify a power factor or voltage control set point within the 0.95 leading to 0.95 lagging range. PacifCorp/PPM Energy also contends that the parenthetical in the proposed Appendix G (stating “taking into account any limitations due to voltage level, real power output, etc.”) is ambiguous and should be eliminated.

46. AWEA argues that we should specify the minimum real power output of the wind facility at which the +/- 0.95 power factor range would apply. It states that to be clear

about the limits of this standard, the reactive power output criteria should use a minimum real power output set at greater than 10 percent of the rated output of the generator. FPL Energy states that General Electric wind turbines cannot meet the proposed power factor standard over the full range of real power output, and that dynamic VAR control (DVAR) banks or static capacitors would have to be installed at an additional expense to meet the proposed power factor over the entire range. FPL Energy asserts that such costs would provide limited reliability benefits.

47. Zilkha, FirstEnergy, NorthWestern Energy, and BPA indicate that the Transmission Provider should be allowed to waive the power factor requirement where it is not required. NUSCo, ISO New England and Midwest ISO TOs oppose allowing such a waiver. Midwest ISO TOs argue that if the Commission allows waiver, it should require that, where the Transmission Provider granting the waiver is not also the owner, the Transmission Owner approve the waiver. AWEA asserts that the proposed requirement that an interconnection agreement be filed with the Commission as a non-conforming agreement if the Transmission Provider has waived the reactive power requirement is inappropriate and inconsistent with Order No. 2003-A.

48. AWEA and FPL Energy ask that the +/- 0.95 power factor standard not be required of a wind plant unless the Transmission Provider shows that it is needed for system safety or reliability. FPL Energy states that the Transmission Provider should have the burden of demonstrating that the reactive power standard is needed. It suggests that the Commission use the same test it used in the NOPR for dynamic voltage support,

which requires that the Transmission Provider, before requiring such capability, must show that it is necessary for system reliability. The CPUC recommends a "least cost, best fit" approach to dealing with the reactive power requirement needs of wind farms.

49. Southern California Edison states that because reactive power at wind generating plants may be produced from devices external to the generator, a time delay may be necessary to allow for switching of reactive resources to enable the wind generator to operate at the appropriate power factor within the +/- 0.95 power factor range. It states, however, that exempting the wind generating plant altogether from the power factor requirement is inappropriate.

2. Commission Conclusion - Power Factor Range and General Application of the Requirement

50. We adopt the power factor range of +/- 0.95 for large wind generating plants. We modify other parts of the proposed requirements. First, this Final Rule requires the wind plant to maintain the required power factor range only if the Transmission Provider shows, through the System Impact Study, that such capability is required of that plant to ensure safety or reliability. This differs from the NOPR, which required the wind plant to maintain the required power factor in all cases, except if the Transmission Provider waived or deferred compliance with the reactive power standard. Establishing an achievable reactive power standard if it is needed for safety or reliability provides assurance to wind plant developers that their interconnection to the grid will not be frustrated or face uncertainty due to a lack of standards, and thus will limit opportunities

for undue discrimination. This uniform standard ensures that wind developers, when they seek to interconnect, are not faced with widely varying standards in different areas, or for different wind technologies, manufacturers, or plant owners. This should remove unnecessary obstacles to the increased growth of wind generation. Furthermore, ensuring that a large wind plant provides reactive support to the transmission grid if needed will ensure that safety and reliability is protected.

51. Specifically, the Commission revises the proposed power factor standard to require that the wind plant maintain the required power factor only on a case-by-case basis if the Transmission Provider, in the System Impact Study, shows that it is necessary to ensure safety or reliability. The reactive power standard adopted here properly requires the Transmission Provider to show that reactive power capability is needed for each wind plant Interconnection Customer. As we noted with regard to low voltage ride-through capability, because the Transmission Provider is responsible for the safe and reliable operation of its transmission system (pursuant to NERC and regional reliability council standards), it is in the best position to establish if reactive power is needed in individual circumstances. The System Impact Study is the appropriate study for assessing the need for reactive power capability, and this study should determine if there is a need for a wind plant to have reactive power capability to ensure that the safety or reliability of the system is maintained. Also, as we reasoned above with regard to low voltage ride-through, requiring wind plants to maintain the required power factor only if the System Impact Study shows it to be necessary ensures that the increased reliance on

wind plants does not degrade system safety or reliability. It also ensures that the Transmission Provider does not require a wind plant to install costly equipment that is not needed for grid safety or reliability. Furthermore, requiring that the System Impact Study find a need for reactive power will limit the opportunities for undue discrimination; a wind plant Interconnection Customer will not have its interconnection frustrated by unnecessary requirements that are not necessary to maintain safety or reliability. Should a wind plant Interconnection Customer disagree with the Transmission Provider that the System Impact Study shows that the power factor requirement is needed, it may challenge the Transmission Provider's conclusion through dispute resolution or appeal to the Commission.

52. Given our decision to require that a wind plant maintain the power factor standard only on a case-by-case basis where the Transmission Provider shows, through the System Impact Study, that reactive power is needed to ensure reliability, there is no need to retain the waiver provisions proposed in the NOPR. As a result, issues raised by commenters regarding the waiver provisions are moot.

53. We clarify that the wind generating plant, if required to provide reactive power capability as described above, should be able to operate anywhere in the +/- 0.95 power factor range.

54. We reject proposals to change the power factor range standard in Appendix G to 0.90 lagging to 0.95 leading. Adopting such a standard would make the power factor requirement more onerous for wind plants than for conventional generators. Concerning

NYISO's request that the Commission consider the standard as a minimum requirement as opposed to a maximum, as we declined to do so in Order No. 2003, we decline to do so here for the same reasons.

55. In response to those who assert that adherence to the voltage schedule is more important than merely maintaining a power factor within the specified range, we note that article 9.6.2 of the LGIA already requires that the "Interconnection Customer . . . . operate the Large Generating Facility to maintain the specified output voltage or power factor at the Point of Interconnection." This language applies to wind plants and addresses this concern.

56. We disagree with PacifiCorp/PPM Energy that the parenthetical statement in the NOPR, "taking into account any limitations due to voltage level, real power output …," is ambiguous and unnecessary. AWEA explains that the stated power factor range cannot be accomplished by all equipment vendors at all levels of output, and asks that the wind plant be held to the +/- 0.95 power factor range only when it is generating above 10 percent of its rated output. The parenthetical statement is necessary due to the technical differences of wind plants, which cannot meet the power factor standard below certain levels of output, and addresses the concern raised by the wind industry.

57. We disagree with the CPUC's recommendation of a "least cost, best fit" approach. Such a "standard" is not a standard at all. Adopting such a least cost approach would result in widely varying "standards" for wind turbines and related equipment. This would not only open the door further for the undue discrimination that this rule is designed to

eliminate, but also would lead to high cost individualized generator designs by equipment manufacturers that would not serve the long-term needs of the wind industry.

3. Comments - Point of Interconnection

58. In the NOPR, the Commission proposed to measure the required power factor at the high side of the wind plant substation transformers, as opposed to the Point of Interconnection measurement point used in Order No. 2003. Numerous commenters, including NUSCo, Southern, National Grid, PacifiCorp/PPM Energy, and Southern California Edison request that the power factor be measured at the Point of Interconnection, as opposed to at the high voltage side of the wind plant substation transformer. FPL Energy notes that while meeting the power factor requirement at the Point of Interconnection may be more costly for wind plants that have long generation tie lines, reliability requirements will not be met by measuring the power factor at a different point. AWEA states that the appropriate point of measurement is either at the Point of Interconnection or at the high side of the wind plant's transformer, depending upon the particular electrical circumstances. It adds that the point of measurement should be determined based on the Transmission Provider's System Impact Study.

4. Commission Conclusion - Point of Interconnection

59. We adopt the Point of Interconnection as the appropriate measurement point for the power factor standard. We agree that adopting the Point of Interconnection as the measurement point will better protect system reliability because it is closer to the bulk electrical power system, and will be consistent with Order No. 2003. In addition,

numerous Transmission Providers and wind energy developers including PPM Energy and FPL Energy endorse establishing the point of measurement at the Point of Interconnection, instead of the high side of the substation transformers, as proposed in the NOPR. Moreover, FPL Energy supports this measurement point, even though it may be more costly for plants with long generation tie lines, because it is necessary for system safety and reliability.

5. Comments - Dynamic Reactive Power Capability

60. The Commission proposed in the NOPR to require wind plants to be able to provide sufficient dynamic voltage support if the System Impact Study shows that it is needed to maintain system reliability. Several commenters assert that wind generators should have dynamic reactive capability for the entire power factor range, and that dynamic reactive capability must be required in every instance. Midwest ISO TOs assert that the System Impact Study may show that no such capability is needed at the time of the study, but the need may arise later. They contend that at a minimum, a wind plant should not degrade the transient under-voltage performance of the transmission system at the Point of Interconnection.

61. Midwest ISO points to language from NERC standards[29] and argues that the need for dynamic reactive power capability cannot be determined by the System Impact Study because it is almost impossible to conceive of every possible disturbance scenario ahead of time. AEP argues that dynamic reactive capability must be required and that the specific level of dynamic capability should be determined on a need basis. ISO New England states that the wind plant's rate of response for dynamic voltage control should be comparable to that provided by a conventional synchronous generator using an automatic voltage regulator.

62. FirstEnergy and FPL Energy ask the Commission to clarify what it meant by the term "sufficient dynamic voltage support." It claims that the term "sufficient" is vague and requires clarification. Similarly, FPL Energy contends that the term "sufficient" is ambiguous, and should be clarified or removed from the Final Rule.

63. Further, FPL Energy notes that only one wind turbine manufacturer currently holds the patent for the variable speed wind turbine electronics that allow the turbine to produce dynamic reactive power. According to FPL Energy, the Commission, as a

[29] Specifically, Midwest ISO cites the following language: "Dynamic reactive power support and voltage control are essential during power system disturbances. Synchronous generators, synchronous condensers, and static var compensators (SVCs and STATCOMs) can provide dynamic support." See Comments of Midwest ISO at 5-6, citing NERC Planning Standard I. D., System Adequacy and Security – Voltage Support and Reactive Power, approved by the NERC Board of Trustees on September 16, 1997.

matter of public policy, should consider whether it is appropriate to set a power factor standard that will give one turbine manufacturer a significant competitive advantage.

64. American Superconductor argues that based on its experience of integrating wind generating plants into transmission systems, it is not always necessary to install dynamic capability for all of the reactive compensation required at a wind generating plant. It reports that all eight of the reactive compensation systems it has provided to wind generating plants used a combination of dynamic and static reactive capability. These hybrid systems consist of a small STATCOM device (with full dynamic capability)[30] that controls a number of switched shunt capacitors or reactors. They have proven to be very sound technically, as well as good economic choices, according to American Superconductor. It asks the Commission to recognize that the benefits of dynamic reactive capability can be achieved, often at substantially lower cost, by such systems.

65. NorthWestern Energy argues that dynamic reactive capability should not be required if the wind developer demonstrates that the wind generating plant will not cause voltage fluctuations greater than the "Border Line of Irritation," as identified in Section 10.5.1 of the IEEE's Standard 519, measured at the Point of Interconnection. The wind developer should also demonstrate that its addition will not diminish the rating of an

[30] A Static Compensator (STATCOM) provides voltage support to the electric system in a manner similar to a synchronous condenser and therefore is superior to Static VAR compensators or switched capacitor banks. Hybrid systems consist of a small STATCOM device and a number of switched capacitors or reactors.

existing transmission line by reducing reactive voltage support, according to NorthWestern Energy. It agrees that wind generators should be allowed to use a combination of fixed and/or switched capacitors and reactors in combination with dynamic capability to control the voltage. It states that dynamic capability would allow for the smooth switching of these devices, as well as the energizing and de-energizing of the wind turbines, without affecting the quality of power delivered to customers.

6. Commission Conclusion – Dynamic Reactive Power Capability

66. The Commission adopts the language in the NOPR regarding dynamic reactive power capability. The Final Rule Appendix G, as explained above, requires that a wind plant have reactive power capability if the Transmission Provider shows, in the System Impact Study, that it is needed for safety or reliability. The Final Rule does not require that the reactive power capability installed by the wind plant be dynamic unless the System Impact Study also shows that this type of capability is needed for system reliability. We are not convinced that dynamic reactive capability is needed in every case, and we permit the Transmission Provider to make that determination on a case-by-case basis through the System Impact Study. We believe that the Transmission Provider is best situated to determine in the first instance whether dynamic reactive capability is needed, and what level of dynamic capability is necessary. We emphasize, however, that Transmission Providers must assess the need for dynamic reactive power capability on a comparable and not unduly discriminatory basis.

67. We reject requests that the Final Rule require that the reactive capability possessed by the wind plant be dynamic in every case. We conclude that the Transmission Provider's System Impact Study should show that dynamic reactive capability is needed in a particular case. If the wind plant Interconnection Customer disagrees with the Transmission Provider that the System Impact Study shows that dynamic reactive power capability is needed, it may challenge the Transmission Provider's conclusion through dispute resolution or appeal to the Commission. We disagree with Midwest ISO TOs that a System Impact Study can account only for the need of the dynamic reactive capability on the day of the study; the study should be able to make reasonable assumptions about future days.

68. We disagree with FirstEnergy and FPL Energy that the term "sufficient" requires clarification. The Final Rule allows the Transmission Provider to determine the sufficient level of dynamic reactive capability on a case-by-case basis through the System Impact Study. As noted above, if the wind plant Interconnection Customer disagrees with the Transmission Provider's determination, it may challenge the Transmission Provider's conclusion through dispute resolution or appeal to the Commission.

69. We acknowledge that dynamic reactive capability can be achieved, often at substantially lower cost, by systems with a combination of true dynamic capability plus switched shunt capacitors and reactors. The Final Rule Appendix G gives wind plants the flexibility to use a variety of combinations to provide the reactive capability necessary.

70. In response to FPL Energy's concern regarding wind turbine supply competition, we note that the wind turbine industry is highly competitive and that manufacturers are continually improving their designs. Although one manufacturer may have a competitive advantage right now, other manufacturers have indicated that they can rapidly improve their designs as required. Also, no manufacturer took exception to the Commission's proposed requirements. Furthermore, as described in detail below, there will be a transition period before the Appendix G standards will apply.

C. Supervisory Control and Data Acquisition Capability

71. We noted in the NOPR that in the past, Transmission Providers generally did not require wind generators to have remote supervisory control and data acquisition (SCADA) capability because of their small size and minimal effects on the transmission system. Many Transmission Providers now argue that with the increasing number of large wind plants connecting to transmission systems, SCADA capability is needed to acquire wind facility operating data and ensure the safety and reliability of the transmission system during normal, system emergency, and system contingency conditions.

72. The NOPR proposed to require that a large wind plant seeking to interconnect to the transmission grid possess SCADA capability to transmit data and receive instructions from the Transmission Provider. Additionally, Appendix G would have required that the Transmission Provider and the wind plant owner determine the type of SCADA information and equipment that is essential for the proposed wind plant, taking into

account the size of the plant, its characteristics, its location, and its importance in maintaining generation resource adequacy and transmission system reliability.[31]

73. The NOPR sought comments regarding the proposed SCADA capability requirements, specifically on whether there is any essential SCADA information that large wind plants should be required to provide, such as information needed to determine how the plant's maximum megawatt output and megawatt ramp rate vary over time with changes in the wind speed or information needed to forecast the megawatt output of the plant.

1. Comments

74. Great River, Midwest ISO, First Energy and Southern California Edison support the SCADA requirement in the NOPR. Ohio Consumer's Council, while also supportive, suggests that the Commission clarify the SCADA requirement so that future disputes regarding interpretation of it are minimized.

75. Numerous other commenters support the requirement with certain modifications. For example, EEI states that the requirement should require the parties to adhere to good utility practice, as that term is refined over time. It also asserts that the Commission

[31] Unlike synchronous generating plants, which generally have SCADA capability, can respond to automatic generation control signals from the control center and are often staffed, wind generating plants consist of numerous induction generators connected through a medium-voltage collector system, and are often remote, unmanned, and characterized by an unpredictable rate of change of output, thus making it difficult for the Transmission Provider to limit the output of the wind plant when necessary for system reliability.

should recognize that NERC and other regional reliability councils are the appropriate entities to determine how to support real-time operations associated with data acquisition and data exchange. Western and Gamesa, among others, believe that SCADA capability, at a minimum, should include real-time and hourly real power output and reactive power output information and interconnection facility status information. Gamesa and NorthWestern Energy also argue that third parties who have experience with wind energy forecasting, not the Transmission Provider or the control area operator, should develop wind forecasting models and paradigms. NorthWestern Energy further asserts that the wind plant should be manned at all times. Similarly, Xcel supports a requirement that wind plants provide a leased voice line from the Transmission Control Center to a manned wind plant control center for voltage support.

76. Xcel, New York PSC, AEP, NERC and LIPA, among others, support a SCADA requirement, but generally contend that the type of SCADA capability required should be determined between the individual Transmission Provider and the wind plant, based on local system requirements. LIPA, New York PSC and Southern assert that the right to determine what SCADA capability is required should not be delegated in whole or part to the wind plant developer. Southern is also concerned that limiting SCADA information requirements to only what is “essential” for the wind plant may be interpreted to jeopardize reliability. It suggests eliminating the term “essential” and replacing it with “required” to ensure that reliability is not jeopardized.

77. NRECA-APPA generally support the Commission's proposed SCADA requirement, but they question the Commission's statement in footnote 13 of the NOPR that it is difficult for the Transmission Provider to limit the output of a wind plant when necessary for reliability. They state that according to General Electric, wind farms in Europe are installing communications and control equipment (including turbine blades that can be adjusted to reduce the output of the wind generator at various wind speeds) to allow this to be done. They note that while not all wind plants need this capability, it may be needed at some plants, depending on the size of the plant or the number of wind plants on a transmission system, or other system characteristics.

78. AWEA and FPL Energy both express concern that the requirement in the NOPR that wind plants have the capability to "receive instructions" through SCADA could be interpreted to require control of the wind plant by the Transmission Provider, for example, to curtail the wind plant remotely at any time. FPL Energy asks the Commission to revise the requirement that the wind plant be able to "receive instructions" through SCADA to apply only during Emergency Conditions, as defined in the LGIA. AWEA asks that the Commission clarify that the proposed SCADA requirement does not establish a presumption that output controls are part of the standard, and that it state clearly that the terms and conditions for use of SCADA capability is a separate transmission service issue, not an interconnection issue, and must be resolved by contract or Commission-approved transmission tariff. Conversely, BPA asserts that direct SCADA control by the Transmission Provider is preferable and that the final

SCADA requirement should permit a Transmission Provider to exercise supervisory control over a wind plant.

79. Southern, Nevada Power and American Transmission maintain that the SCADA requirement for wind generators should be the same as that for synchronous generators.

2. Commission Conclusion

80. We adopt the SCADA requirement proposed in the NOPR. In response to AWEA and FPL Energy, however, we clarify that Appendix G requires the wind plant to have only the capability to receive instructions. Nothing in this Final Rule authorizes a Transmission Provider to control a wind plant. Any such authorization would be subject to separate negotiation and agreement between the Interconnection Customer and the Transmission Provider.

81. Under the SCADA requirement adopted here, the wind Interconnection Customer will provide SCADA capability, with the specific SCADA information and control capability required to be agreed to by the wind plant Interconnection Customer and the Transmission Provider. This flexible requirement ensures that wind plants have SCADA capability, which we believe is necessary to ensure that system reliability is protected, and permits the wind plant Interconnection Customer and the Transmission Provider to negotiate the specific SCADA capability that meets the needs of the transmission system at the specific location of the wind plant. We expect Transmission Providers to be reasonable in these negotiations and not to use their control over the Transmission System to unnecessarily burden wind plants. Should the wind plant Interconnection

Customer disagree with the Transmission Provider about the level of SCADA capability required, it may challenge the Transmission Provider's conclusion through dispute resolution or appeal to the Commission.

82. In response to EEI's request, the SCADA requirement does not need to be revised explicitly to require adherence to good utility practice. We note that Appendix G is a component of the LGIA, and the LGIA itself already requires the parties to adhere to good utility practice.

83. With respect to comments concerning the type of SCADA information needed for wind plants, the SCADA requirement in the NOPR allows the Parties to decide what information should be provided and the equipment to be installed at the site. We adopt this policy in this Final Rule. We are not deciding such issues as whether third parties should be used to develop wind forecasting models and paradigms. We simply require that some SCADA capability be installed for operation and reliability purposes. The flexible nature of the requirement we adopt here recognizes, as NERC states, that other entities are more appropriate to determine how best to support real-time operation with data acquisition and exchange. We agree with AWEA and others that this Final Rule only requires that SCADA capability be provided by the wind plant, and that the type of SCADA information supplied and control exercised can be negotiated and set forth in a separate agreement between the wind plant Interconnection Customer and the Transmission Provider.

84. Similarly, we deny requests that the Transmission Provider have the sole authority to determine the type of SCADA equipment to be installed at the wind plant. To ensure that unnecessary SCADA equipment is not required of the wind plant, the parties must determine together the SCADA capability and equipment needed, taking into account the size, location and characteristics of the wind plant and the safety and reliability of the transmission system. Southern has not shown that replacing the term "essential" with "required" would add any clarity to the requirement.

85. We are not convinced by arguments that the SCADA requirements for wind plants should be the same as for conventional generators. Since wind is different from conventional generators (as discussed above), information exchanged between the Transmission Provider and the wind plant may be of a different nature. As a result, it is appropriate to have different, more flexible SCADA requirements for wind plants.

D. Wind Plant Interconnection Modeling

86. In its May 20, 2004 petition, AWEA proposed that Transmission Providers be required to "participate in a formal process for updating, improving, and validating the engineering models used for modeling the interconnection impacts of wind turbines."[32] The Commission did not propose such a requirement in the NOPR, because such a process should take place outside the Commission, through industry technical groups or the regional reliability councils. The Commission recognized, however, that

[32] See Petition of AWEA at 5.

improvements in the way that wind interconnections are modeled would be beneficial, and encouraged the industry to address this issue.

1. Comments

87. Those submitting comments regarding wind plant interconnection modeling generally support the Commission's conclusion that the issue is best addressed through industry technical groups, NERC, and regional reliability councils.

2. Commission Conclusion

88. As we stated in the NOPR, we recommend that wind developers, wind turbine manufacturers, Transmission Providers and affected parties form technical groups and participate in a formal process to address, update, improve and validate wind turbine engineering models. We remain convinced, however, that the Commission is not the appropriate forum for such a process.

E. Self-Study of Interconnection Feasibility

89. In the NOPR, the Commission rejected a proposal by AWEA that would permit a wind plant Interconnection Customer to enter the interconnection queue and receive the base case data to "self-study" the feasibility of its proposed interconnection without having first submitted an Interconnection Request that includes power and load flow data and fully completed plant electric design specifications, as required under Order No. 2003.[33] The Commission noted that Order No. 2003 requires that a valid and complete

[33] See id. at 13-14.

Interconnection Request be on file with the Transmission Provider before the Interconnection Customer may receive Base Case data.[34] We further noted, however, that Section 2.3 of the LGIP did not address situations where the Interconnection Customer might need access to the Base Case data before it could complete its Interconnection Request. The Commission therefore sought comments on how to balance the need of wind generators to receive the base case data and "self-study" before filing a completed Interconnection Request with the need to protect this critical energy infrastructure information and commercially sensitive data against unwarranted disclosure.

1. Comments

90. Several entities, including Tucson Electric, Midwest Reliability Organization, Montana-Dakota Utilities, New York PSC, Nevada Power, Great River, LIPA, BPA, American Transmission, NUSCo, Xcel, and Midwest ISO TOs oppose AWEA's proposal to allow wind generators to be placed in the queue, receive the base case data and "self-study" before filing completed electric design specifications and other related technical data. They generally argue that wind plants should be treated no differently from other generating plants. Montana-Dakota Utilities suggests that wind plant developers use generic power flow network models before filing Interconnection Requests, since these models would not likely reveal commercially sensitive data or critical energy

[34] See NOPR at P 22, citing LGIP, section 2.3; see also Order No. 2003 at P 77-84.

infrastructure information. BPA does state, however, that while it supports the Commission's decision not to alter the LGIA timelines, the requirement that wind plants provide detailed project specifications could be relaxed at the Feasibility Study stage, and that it is willing to work with wind developers to ensure that they have the information necessary to develop their Interconnection Requests. It asserts that the Commission should allow Transmission Providers the flexibility to determine when wind developers should submit turbine specifications and detailed electrical design data. LIPA argues that all generators should have comparable access to base case data, subject to their willingness to sign a confidentiality agreement, and that discussion of how to accommodate alternative plant designs (such as wind plants) in the interconnection process should be left to the Transmission Provider and the generator.

91. NRECA-APPA state that while they are willing to accept AWEA's proposal, they do not object to the NOPR proposal. Numerous other commenters, including Western, PacifiCorp/PPM Energy, FPL Energy, and the Ohio Consumer's Council indicate that they generally support the AWEA "self-study" proposal, or offer suggestions to balance the need of wind plants to obtain base case data with the need to protect such data from unwarranted release. Western has no objection to allowing wind generators to self-study if the Transmission Provider is given final approval before the Interconnection Request is completed. It asserts that wind plants should request base case data directly from the regional reliability council, execute a confidentiality agreement and pay a fee. PJM similarly contends that allowing wind plants to obtain base case data from the regional

reliability councils will allow sufficient self-study by the developer while also limiting the need for multiple restudies by the Transmission Provider. Western contends that self-study and base case information should be available to all prospective Interconnection Customers.

92. Ohio Consumer's Council asks that the Commission seriously consider AWEA's proposal that wind projects not be required to provide some detailed design data as a condition of obtaining a place in the interconnection queue. It states that large wind projects are based on complex and variable site work compared to the more traditional generating plants that are studied for selected locations based on transportation needs and access to water for cooling purposes. It stresses that the Commission's requirements regarding the submission of design data for entry in the interconnection queue should reflect these differences in technologies.

93. AWEA and PacifiCorp/PPM Energy ask the Commission to reconsider its proposal not to adopt AWEA's self-study proposal. PacifiCorp/PPM Energy state that wind turbine performance varies significantly by manufacturer and that wind plant developers necessarily typically negotiate turbine selection and evaluate the configuration of the facility throughout the interconnection study period. AWEA similarly notes the complexities involved in laying out the medium voltage collector systems used by wind plants, and states the layout cannot be finalized until the Point of Interconnection is firmly established. It states that consequently, the detailed design and data for the collector system, which many Transmission Providers assert is required by the

Interconnection Request, cannot be available when the Interconnection Request is submitted. AWEA suggests that, rather than requiring that the generating plant design be "substantially completed" at the time the Interconnection Request is submitted, the Commission should allow a wind plant to file an Interconnection Request with the generating plant design data and other related data depicting the wind plant as "a single generating unit connected through step-up transformation, with the equivalent power output characteristics (MW output and MVAR range) as the total net MW output of the wind generating facility in question."[35] Under this proposal, the wind plant developer would be required to provide a "substantially completed" generating plant design before the System Impact Study, along with either the power system load flow data sheets or the newly developed machine models with substantially complete input data to those models. AWEA states that many, but not all, Transmission Providers now accept such data as satisfying the requirements of the Interconnection Request.

2. Commission Conclusion

94. In this Final Rule, we allow a wind plant Interconnection Customer to satisfy the requirements of the Interconnection Request by providing a set of preliminary electric design specifications depicting the wind plant as a single equivalent generator, as explained below. Once completing the Interconnection Request in this manner, the wind plant may enter the queue and receive the base case data as provided for in Order No.

[35] Comments of AWEA at 10-11.

2003. The Commission directs that these provisions be attached as Appendix G to the LGIP in the OATTs of all public utilities that own, control, or operate facilities for transmitting electric energy in interstate commerce.[36]

95. In the NOPR, we noted that Section 2.3 of the LGIP did not address situations in which the Interconnection Customer needs the Base Case data before it can complete its Interconnection Request. We sought comments on how to balance the need of wind generators to have this information before filing a completed Interconnection Request with the need to protect this critical energy infrastructure information and commercially sensitive data against unwarranted disclosure. In addition, we sought to ensure that one class of customers was not being given undue preferential treatment.

96. We note that many Transmission Providers, non-wind generators, and a state regulatory commission oppose allowing wind generators to file Interconnection Requests, and hence be given a place in the queue, before submitting their final plant designs and related technical data. However, some trade organizations, wind developers, and Transmission Providers with substantial experience interconnecting wind plants, including AWEA, FPL Energy, PacifiCorp/PPM Energy, Western and Ohio Consumer's

[36] The Commission requires that these procedural provisions be separately appended as Appendix G to the LGIP, because they are procedural in nature, and to ensure that they are in force during the initial stages of the interconnection process. We are retaining the Appendix G moniker to ensure that these procedural provisions are recognized as applicable only to the interconnection of large wind plants, the subject of this Final Rule. The remaining technical requirements adopted in this Final Rule must be appended as Appendix G to the LGIA.

Council, support the AWEA proposal or some accommodation of wind's special needs.

97. We are persuaded that wind projects are not the same as conventional generators with regard to Interconnection Requests. Large conventional generators are generally standard in design, and their design specifications and configurations do not necessarily change as a result of where they are located on the Transmission Provider's transmission system. Large wind plants, on the other hand, are located on sites made up of several acres of land. Their physical layout often consists of hundreds of wind turbines in the more remote areas of a Transmission Provider's system, and that layout can extend for several miles. The physical placement of the turbines, transformers and voltage support devices that affect the electrical characteristics created by the medium voltage collector system depend on the size and location of the wind plant and the location of other generators on the Transmission Provider's system. For these reasons, wind plant developers are unable to submit completed design specifications for individual wind turbines until much later in the interconnection process, in comparison with other developers.

98. However, a wind plant developer can provide at the time the Interconnection Request is submitted design specifications for the wind generating plant based on its aggregate output, though perhaps not for the individual wind turbines. As we stated in Order No. 2003-A and in the NOPR, the Appendix G we adopt in this rule is designed to account for these unique technical characteristics of wind plants. Recognizing these

unique characteristics is not favoring one form of generation over others; it simply removes barriers to wind plant development that are not necessary to protect safety or reliability.

99. In short, we are persuaded that the technical characteristics of wind plants prevent them from providing certain detailed design specifications and other information at the time of the Interconnection Request. Therefore, the Commission adopts provisions in the Final Rule Appendix G permitting the wind developer to satisfy the requirements of the Interconnection Request by providing a set of preliminary electrical design specifications depicting the wind plant as a single equivalent generator.[37] Upon satisfying these and other applicable Interconnection Request requirements in Order No. 2003, the wind plant may enter the queue and receive the base case data as provided for all large generators in Order No. 2003. However, no more than six months later, the wind plant must submit completed detailed design specifications and other data (including collector system layout data) needed to allow the Transmission Provider to complete its System Impact Study. This information must be provided before the System Impact Study can begin. This deadline provides a date certain regarding when the final design specifications must be submitted to the Transmission Provider to avoid having uncertain projects in the queue.

[37] "Single equivalent generator" information is design data that represents the aggregate electrical characteristics of the individual wind generators as a single generator.

100. Permitting wind plants to provide single-generator-equivalent specifications at the Interconnection Request stage appropriately balances the need of a Transmission Provider to have adequate data in the Interconnection Request and the difficulty that a wind plant developer has in completing its detailed design before entering the queue and receiving access to the base case data. This provision also protects critical energy infrastructure information by making none of it available to anyone who has not made a satisfactory Interconnection Request. Wind plants will follow all other requirements of the queue and study processes set forth in Order No. 2003, including the timelines and confidentiality provisions.

F. Applicability to Other Generating Technologies

101. In the NOPR, the Commission sought comments as to whether there are other alternative technologies that should be covered by Appendix G.

1. Comments

102. Numerous entities state that other alternative technologies should be made subject to Appendix G.[38] Southern California Edison asserts that all non-synchronous generators should be subject to Appendix G. Tucson Electric submits that solar generators without fueled backup should be included in Appendix G. Other commenters, including Midwest Reliability Organization, National Grid, Xcel, the CPUC and Great River generally state

[38] These entities include PJM, BPA, ISO New England, NYISO, Southern California Edison, CenterPoint, the NARUC, LIPA, New York PSC, Nevada Power, NUSCo and Tucson Electric.

that they do not necessarily support including other alternative technologies within the coverage of Appendix G. The CPUC, for example, does not believe that Appendix G should be expanded to apply to "renewable" technologies other than those that are intermittent or geographically constrained. National Grid states that these proceedings have focused exclusively on wind generation and thus does not support applying Appendix G more broadly. Xcel states that other non-synchronous technologies have not matured sufficiently to operate on a scale greater than 20 MW, and therefore should not be able to use Appendix G.

103. American Transmission asserts that the Commission should adopt the Alberta Electric System Operator definition of asynchronous generation, which is "a type of generator that produces alternating electric current that matches the frequency of an interconnected power system and the mechanical rotor of the generator does not rotate in synchronism with the system frequency." It argues that the Alberta Electric System Operator definition is superior because it is used in the electric power technical community to refer to the type of generator to which the NOPR is directed and because it compares the speed of an asynchronous generator to that of a traditional generator.

2. Commission Conclusion

104. The Commission concludes that the Final Rule Appendix G exceptions to the LGIP and LGIA apply only to large wind plants. As discussed above, the Appendix G was designed around the special needs and design characteristics of wind generators. The NOPR asked whether there were other generators that have similar characters and require

similar technical requirements to those contained in Appendix G. Although numerous commenters suggested that other generators may have special needs and suggested that they should be made subject to Appendix G, none other than Tucson (who suggested solar generators without fueled backup) offered a specific induction generator technology with similar characteristics to wind as an Appendix G candidate. The Appendix G provisions adopted here focuses on the special characteristics of large wind plants, particularly the fact that they utilize many induction generators connected to the transmission system at a single point through a medium-voltage collector system. The Commission has not found at this time that any other technologies, including the solar generators without fueled backup offered by Tucson, have similar characteristics.

105. The Commission does not adopt American Transmission's proposed definition of "asynchronous generation" in the Final Rule. The Commission is not relying on the concept of asynchronous generation in this Final Rule, and we do not believe that this characteristic appropriately identifies the interconnection needs of large wind plants addressed by the Final Rule Appendix G. Accordingly, we do not make any definitional changes.

106. While we are not applying the Final Rule Appendix G to non-wind technologies, we may do this in the future, or take other generic or case-specific actions, if another technology emerges for which a different set of interconnection requirements is necessary.

G. Variations from the Final Rule

107. The NOPR proposed to permit Transmission Providers to justify variations from the Final Rule Appendix G using the same three variation standards in Order No. 2003. First, public utilities may seek variations from the Final Rule Appendix G based on regional reliability council requirements.[39] Second, we proposed that public utilities may argue that proposed variations are "consistent with or superior to" the Final Rule Appendix G.[40] Third, we proposed to permit independent public utility Transmission Providers, such as Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs), greater flexibility in adopting Appendix G(the "independent entity variation").[41]

1. Comments

108. Numerous entities request that they be permitted to justify variations from the Appendix G requirements. Several ask the Commission to clarify that the Appendix G performance standards are minimum requirements, as noted elsewhere.[42] Some commenters encourage the Commission to use NERC or regional reliability councils to

[39] See NOPR at P 25, citing Order No. 2003 at P 823-24.

[40] See NOPR at P 25, citing Order No. 2003 at P 816.

[41] See NOPR at P 25, citing Order No. 2003 at P 822-27 and Order No. 2003-A at P 48.

[42] These entities include Midwest ISO TOs, FirstEnergy, NYISO, LADWP, NorthWestern Energy, CPUC and Southern, among others.

develop necessary technical standards and requirements applicable to wind generation and its effect on reliability, including the incorporation of NERC's American National Standards Institute-approved standards, field tests and other requirements.

2. Commission Conclusion

109. As we proposed in the NOPR, we apply here all three of the variation standards in Order No. 2003. If a Transmission Provider seeks to justify variations from Appendix G, it may do so in its compliance filing. A Transmission Provider may propose to include standards developed by NERC or a regional reliability council in its own Appendix G. The Commission is mindful of the work being done by these organizations in developing standards for the interconnection of wind plants, and we strongly encourage all interested parties, including Transmission Providers, wind plant developers and wind turbine manufacturers, to continue to participate in developing these standards. The Commission will consider them in any request for a variation from the Final Rule Appendix G by an individual Transmission Provider, or a request by many to revise Appendix G.

H. Transition Period

110. In the NOPR, the Commission did not propose a transition period before the technical requirements in Appendix G would take effect.

1. Comments

111. AWEA, FPL Energy, and PacifiCorp/PPM Energy ask that there be a transition period so Appendix G would apply only to LGIAs signed or unexecuted LGIAs filed with the Commission after January 1, 2006, or six months after the issuance of this Final

Rule, whichever is later. FPL Energy asserts that a transition period is needed to prevent added costs and delays to protect previously executed wind equipment purchase agreements and power purchase arrangements. PacifiCorp/PPM Energy add that wind turbines are already in the process of being manufactured that would require substantial changes to their electronics to meet the proposed requirements. AWEA asserts that the Commission has historically provided a transition period in similar circumstances, including in Order No. 2003.

112. AWEA also asks that all wind plants that are interconnected to the transmission system when Appendix G is adopted, or that have executed an LGIA or filed an unexecuted LGIA with the Commission before January 1, 2006 or six months after the issuance of this Final Rule, whichever is later, be exempted from the Appendix G requirements for the remaining life of the existing wind generator equipment. Likewise, Ohio Consumer's Council, LIPA and Xcel support a transition period and state that existing wind projects or those in advanced planning should be exempt from the Appendix G requirements.

113. BPA and American Transmission are opposed to any transition period. American Transmission states that once Appendix G is adopted, no deviations should be permitted unless otherwise agreed to by the Transmission Provider. BPA states that installing outdated or inferior wind equipment that is incapable of complying with reliability criteria is contrary to the intent of this proceeding. American Transmission also maintains that existing interconnection agreements with wind plants must be amended to

conform to the requirements adopted in this proceeding. It argues that technical requirements for similar generating facilities should not be based merely on the timing of the interconnection.

2. Commission Conclusion

114. For the low voltage ride-through, SCADA, and power factor design criteria requirements adopted in the Final Rule Appendix G, which are substantive technical requirements, the Commission adopts the transition period requested by AWEA and others. Accordingly, these technical requirements in the Final Rule Appendix G, if applicable, apply only to LGIAs signed, filed with the Commission in unexecuted form, or filed as non-conforming agreements, on or after January 1, 2006, or the date six months after publication of the Final Rule in the Federal Register, whichever is later. The procedures permitting the wind plant Interconnection Customer to complete the Interconnection Request with single-generator equivalent design specifications apply immediately when the Final Rule becomes effective, 60 days after its publication in the Federal Register. This effective date also applies for purposes of public utilities making compliance filings to meet this Final Rule, as discussed further below.

115. It would be unfair and unreasonable to apply the low voltage ride-through, SCADA and power factor requirements in the Final Rule immediately or retroactively. The reasonable transition period we establish in this Final Rule allows wind equipment currently in the process of being manufactured to be completed without delay or added expense. This ensures that the Final Rule does not interrupt the supply of wind turbines.

Further, we disagree with BPA that the transition period will undermine the reliability of a Transmission Provider's system. We note that during the transition period, our large generator interconnection rule applies to wind plants. Even though article 9.6.1 (Power Factor Design Criteria) of the LGIA does not apply to wind plants, the other provisions of that rule are adequate to prevent an interconnection that would undermine reliability of a Transmission Provider's system

116. Consistent with our action grandfathering existing interconnection agreements in Order No. 2003,[43] the Commission is not requiring modifications to existing interconnection agreements, and is not requiring that interconnection agreements signed, filed with the Commission in unexecuted form, or filed as a non-conforming agreement before January 1, 2006, or the date six months after publication of the Final Rule in the Federal Register, whichever is later, comply with the low voltage ride-through, SCADA and power factor requirements of the Final Rule Appendix G, if applicable.

I. Miscellaneous Comments

117. The Fertilizer Institute notes that wind generators and generators that use waste heat have several things in common; for example, both produce electricity without any fuel consumption or air emissions. It states that through no fault of their own, neither wind generators nor fertilizer-fired generators can meet the rigorous balancing and scheduling requirements imposed by Transmission Provider's. It urges the Commission

[43] See Order No. 2003 at P 911.

to exempt both from any requirement to balance their power deliveries and power receipts during any time period shorter than the peak and non-peak periods of a given day.

118. Also, American Transmission contends that Transmission Owners who are part of an RTO/ISO should be allowed to pursue ADR before an LGIA is filed with the Commission on an unexecuted basis.

1. Commission Conclusion

119. In response to the comments of the Fertilizer Institute, we note that the Commission recently issued a NOPR in Docket No. RM05-10-000 to address generator imbalance penalties assessed to intermittent generating resources.[44] We will consider the Fertilizer Institute's comments in that proceeding.

120. Further, in response to American Transmission's request that ADR be permitted before an unexecuted LGIA is filed, we note that the LGIP already provides dispute resolution procedures that apply to wind plant interconnections.[45]

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[44] Imbalance Provisions for Intermittent Resources Assessing the State of Wind Energy in Wholesale Electricity Markets, Notice of Proposed Rulemaking, 70 Fed. Reg. 21,349 (Apr. 26, 2005), 111 FERC ¶ 61,026 (2005).

[45] See LGIP § 13.5.

J. Compliance Issues

121. As in Order No. 2003,[46] the Commission is requiring all public utilities that own, control, or operate transmission facilities in interstate commerce to adopt the Final Rule Appendix G as amendments (as discussed above) to the LGIP and LGIA in their OATTs 60 days after publication of the Final Rule in the Federal Register. Public utilities subject to this Final Rule are directed to adopt the low voltage ride-through, SCADA, and power factor design criteria requirements of the Final Rule Appendix G as amendments to their LGIAs, and to adopt the procedural provisions in the Final Rule Appendix G concerning completion of the Interconnection Request by the wind plant Interconnection Customer as amendments to their LGIPs. Further, consistent with our approach in Order No. 2003 and as discussed above,[47] we are not requiring retroactive changes to wind plant interconnection agreements that are already in effect. Also, as noted above, the low voltage ride-through, SCADA and power factor requirements adopted in the Final Rule Appendix G, if applicable, do not apply to LGIAs signed, filed with the Commission in unexecuted form, or filed as a non-conforming agreement, on or before January 1, 2006 or six months after the publication of this Final Rule in the Federal Register, whichever is later. As we state above, however, the procedures adopted in the Final Rule Appendix G

[46] See Order No. 2003 at P 910.

[47] Id. at P 911.

regarding completion of the Interconnection Request by a wind plant Interconnection Customer apply beginning on the effective date of this Final Rule.

IV. Information Collection Statement

122. Office of Management and Budget (OMB) regulations require OMB to approve certain information collection requirements imposed by agency rule.[48] The Commission solicited comments on the Commission's need for this information, whether the information would have practical use, the accuracy of provided burden estimates, ways to enhance the quality, utility and clarity of the information to be collected, and any suggested methods for minimizing respondents' burden, including the use of automated information techniques. With the exception of BPA, which supported the objectives of the Paperwork Reduction Act, the Commission did not receive any comments concerning its burden or cost estimates. Therefore, the Commission retains the estimates proposed in the NOPR.

123. Public Reporting Burden:

Data Collection	No. of Respondents	No. of Responses	Hours Per Response	Total Annual Hours
FERC-516	238	1	18	4,284

Title: FERC-516, Electric Rate Schedule Filings

Action: Proposed Information Collection.

[48] 5 CFR § 1320.11 (2004).

OMB Control No.: 1902-0096

The applicant shall not be penalized for failure to respond to this collection of information unless the collection of information displays a valid OMB control number.

Respondents: Business or other for profit.

Frequency of Responses: On occasion.

Necessity of Information: The regulations revise the requirements contained in 18 CFR Part 35. The Commission is revising its standardized interconnection procedures and agreements to adopt standard technical requirements and procedures specifically applicable to wind generating plants. In particular, the Commission requires that public utilities add to their standard interconnection procedures and agreements standard technical requirements and procedures for the interconnection of wind generation plants. The Final Rule requires that each public utility that owns, operates, or controls transmission facilities make filings incorporating these technical requirements into its open access transmission tariff.

Internal Review: The Commission has assured itself, by means of internal review, that there is specific, objective support for the burden estimates associated with the information collection requirements. The Commission's Office of Market, Tariffs and Rates uses the data included in filings under section 203 and 205 of the Federal Power to evaluate efforts for interconnection and coordination of the U.S. electric transmission system as well as for general industry oversight. These information requirements conform to the Commission's plan for efficient information collection, communication,

and management within the electric power industry. Interested persons may obtain information on the reporting requirements by contacting the Federal Energy Regulatory Commission, 888 First Street, N.E., Washington, D.C. 20426, Attention: Michael Miller, Office of the Executive Director, phone: (202) 502-8415, fax: (202) 273-0873, e-mail: michael.miller@ferc.gov. Comments on the requirements of the subject rule may also be sent to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503, Attention: Desk Officer for the Federal Energy Regulatory Commission, phone: (202) 395-4650.

V. Environmental Analysis

124. The Commission is required to prepare an Environmental Assessment or an Environmental Impact Statement for any action that may have a significant adverse effect on the human environment.[49] As we stated in the NOPR, the Commission has categorically excluded certain actions from this requirement as not having a significant effect on the human environment. Included in this categorical exclusion are rules that are clarifying, corrective, or procedural, or that do not substantially change the effect of the regulations being amended.[50] The categorical exclusion also includes information

[49] Order No. 486, Regulations Implementing the National Environmental Policy Act, 52 Fed. Reg. 47897 (Dec. 17, 1987), FERC Stats. & Regs. Preambles 1986-1990 ¶ 30,783 (Dec. 10, 1987).

[50] 18 CFR § 380.4(a)(2)(ii) (2004).

gathering, analysis, and dissemination.[51] This Final Rule updates and clarifies the application of the Commission's standard interconnection requirements to wind generating plants. Further, this Final Rule involves information gathering, analysis, and dissemination regarding the interconnection of wind generators. Therefore, the rule falls within the categorical exemptions provided in the Commission's Regulations, and as a result neither an environmental impact statement nor an environmental assessment is required. Additionally, we note that this rule removes unnecessary obstacles to the development and interconnection of wind plants, eliminating the airborne and other emissions that would otherwise result from the construction of fossil fuel generating plants.

VI. Regulatory Flexibility Act Certification

125. The Regulatory Flexibility Act of 1980 (RFA)[52] generally requires a description and analysis of final rules that have significant economic impact on a substantial number

[51] 18 CFR § 380.4(a)(5) (2004).

[52] 5 U.S.C. § 601-612 (2000).

of small entities.[53] The Commission is not required to make such analyses if a rule would not have such an effect.

126. The Commission does not believe that this Final Rule will have such an impact on small entities. Most filing companies subject to the Commission's jurisdiction do not fall within the RFA's definition of a small entity. Further, the filing requirements contain standard generator interconnection procedures and agreement for interconnecting wind plants larger than 20 MW, which exceeds the threshold of the Small Business Size Standard of NAICS. Therefore, the Commission certifies that this rule will not have a significant economic impact on a substantial number of small entities.

VII. Document Availability

127. In addition to publishing the full text of this document in the Federal Register, the Commission provides all interested persons an opportunity to view and/or print the contents of this document via the Internet through FERC's Home Page (http://www.ferc.gov) and in FERC's Public Reference Room during normal business

[53] The RFA definition of "small entity" refers to the definition provided in the Small Business Act, which defines a "small business concern" as a business that is independently owned and operated and that is not dominant in its field of operation. 15 U.S.C. § 632 (2000). The Small Business Size Standards component of the North American Industry Classification System defines a small electric utility as one that, including its affiliates, is primarily engaged in the generation, transmission, and/or distribution of electric energy for sale and whose total electric output for the preceding fiscal years did not exceed 4 million MWh. 13 CFR § 121.201 (Section 22, Utilities, North American Industry Classification System, NAICS) (2004)).

hours (8:30 a.m. to 5:00 p.m. Eastern time) at 888 First Street, N.E., Room 2A, Washington, D.C. 20426.

128. From the Commission's Home Page on the Internet, this information is available in the Commission's document management system, eLibrary. The full text of this document is available on eLibrary in PDF and Microsoft Word format for viewing, printing, and/or downloading. To access this document in eLibrary, type the docket number excluding the last three digits of this document in the docket number field.

129. User assistance is available for eLibrary and the FERC's website during normal business hours. For assistance, please contact FERC Online Support at 1-866-208-3676 (toll free) or 202-502-6652 (e-mail at FERCOnlineSupport@FERC.gov), or the Public Reference Room at 202-502-8371, TTY 202-502-8659 (e-mail at public.referenceroom@ferc.gov).

VIII. Effective Date and Congressional Notification

130. This Final Rule will take effect [insert date that is 60 days after date of publication in the **FEDERAL REGISTER].** However, as noted above (under "Transition Period"), the technical requirements in the Final Rule LGIA Appendix G will apply only to LGIAs signed, or agreements filed with the Commission in unexecuted form, on or after January 1, 2006, or the date six months from the date of publication of this Final Rule in the Federal Register, whichever is later. The Commission has determined with the concurrence of the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, that this rule is not a major rule within the meaning

of section 251 of the Small Business Regulatory Enforcement Fairness Act of 1996.[54] The Commission will submit the Final Rule to both houses of Congress and the General Accountability Office.[55]

List of Subjects in 18 C.F.R. Part 35

Electric power rates; Electric utilities.

By the Commission.

Linda Mitry,
Deputy Secretary.

[54] See 5 U.S.C. 804(2) (2000).

[55] See 5 U.S.C. 801(a) (1) (A) (2000).

In consideration of the foregoing, the Commission revises part 35, Chapter I, Title 18 of the Code of Federal Regulations, as follows.

PART 35 – FILING OF RATE SCHEDULES

1. The authority citation for part 35 continues to read as follows:

Authority: 16 U.S.C. §§ 791a-825r, §§ 2601-2645; 31 U.S.C. § 9701; 42 U.S.C. §§ 7101-7352.

2. In § 35.28, the first sentences of currently existing paragraphs (f)(1) and (f)(1)(iii) are revised, a new paragraph (f)(1)(iii) is added, and currently existing paragraph (f)(1)(iii) is renumbered to account for new paragraph (f)(1)(iii) all to read as follows:

§ 35.28 Non-discriminatory open access transmission tariff.

* * * * *

(f) Standard generator interconnection procedures and agreements.

(1) Every public utility that is required to have on file a non-discriminatory open access transmission tariff under this section must amend such tariff by adding the standard interconnection procedures and agreement contained in Order No. 2003, FERC Stats. & Regs. ¶ 31,146 (Final Rule on Generator Interconnection), as amended by the Commission in Order No. 661, FERC Stats. & Regs. ¶ _____ (Final Rule on Interconnection for Wind Energy), and the standard small generator interconnection procedures and agreement contained in Order No. 2006, FERC Stats. & Regs. ¶ _____

(Final Rule on Small Generator Interconnection), or such other interconnection procedures and agreements as may be approved by the Commission consistent with Order No. 2003, FERC Stats. & Regs. ¶ 31,146 (Final Rule on Generator Interconnection) and Order No. 2006, FERC Stats. & Regs. ¶ _____ (Final Rule on Small Generator Interconnection).

(i) The amendment to implement the Final Rule on Generator Interconnection required by the preceding subsection must be filed no later than January 20, 2004.

(ii) The amendment to implement the Final Rule on Small Generator Interconnection required by the preceding subsection must be filed no later than [insert date 60 days after publication in the FEDERAL REGISTER].

(iii) The amendment to implement the Final Rule on Interconnection for Wind Energy required by the preceding subsection must be filed no later than [insert date 60 days after publication in the FEDERAL Register].

(iv) Any public utility that seeks a deviation from the standard interconnection procedures and agreement contained in Order No. 2003, FERC Stats. & Regs. ¶ 31,146 (Final Rule on Generator Interconnection), as amended by the Commission in Order No. 661, FERC Stats. & Regs. ¶ _____ (Final Rule on Interconnection for Wind Energy), or the standard small generator interconnection procedures and agreement contained in Order No. 2006, FERC Stats. & Regs. ¶ _____ (Final Rule on Small Generator

Interconnection), must demonstrate that the deviation is consistent with the principles of either Order No. 2003, FERC Stats. & Regs. ¶ 31,146 (Final Rule on Generator Interconnection) or Order No. 2006, FERC Stats. & Regs. ¶ _____ (Final Rule on Small Generator Interconnection).

[NOTE: THE ATTACHMENTS WILL NOT BE PUBLISHED IN THE CODE OF FEDERAL REGULATIONS]

APPENDIX A

List of Commenter Acronyms
RM05-4-000

AEP - American Electric Power System
American Superconductor - American Superconductor Corporation
American Transmission - American Transmission Company, LLC
AWEA - American Wind Energy Association
BPA - Bonneville Power Administration
CenterPoint – CenterPoint Energy Houston Electric, LLC
CPUC - California Public Utilities Commission
EEI - Edison Electric Institute
Exelon - Exelon Corporation
FirstEnergy – FirstEnergy Companies
Fertilizer Institute – The Fertilizer Institute
FPL Energy – FPL Energy, LLC
Gamesa – Gamesa Energy USA, Inc
GE – General Electric
Great River - Great River Energy
Innovation – Innovation Investments, LLC
ISO New England – ISO New England Inc
LADWP - Los Angeles Department of Water and Power
LIPA - Long Island Power Authority and LIPA
Midwest ISO - Midwest Independent Transmission System Operator, Inc.
Midwest ISO TOs - Midwest ISO Transmission Owners
Midwest Reliability Organization – Midwest Reliability Organization
Montana-Dakota Utilities – Montana-Dakota Utilities
NARUC - National Association of Regulatory Utility Commissioners
National Grid– National Grid USA
NERC - North America Electric Reliability Council
Nevada Power - Nevada Power Company/Sierra Pacific Power Company
New York PSC - New York State Public Service Commission
NRECA/APPA - National Rural Electric Cooperative Association and the American Public Power Association
NYISO - New York Independent Transmission System Operator, Inc.
NUSCo - Northeast Utilities Service Company
NorthWestern Energy – NorthWestern Energy
Ohio Consumers' Council- The Office of the Ohio Consumers' Council
PacifiCorp/PPM Energy – PacifiCorp and PPM Energy, Inc
PJM - PJM Interconnection, LLC
SoCal Edison - Southern California Edison Company
Southern – Southern Company Services, Inc.

Tucson Electric - Tucson Electric Power
Western - Western Area Power Administration
Xcel - Xcel Energy Services, Inc.
Zilkha - Zilkha Renewable Energy, LLC

Appendix B

[NOTE: THESE PROVISIONS TO BE ADOPTED AS APPENDIX G TO THE LGIA]

APPENDIX G

INTERCONNECTION REQUIREMENTS FOR A WIND GENERATING PLANT

Appendix G sets forth requirements and provisions specific to a wind generating plant. All other requirements of this LGIA continue to apply to wind generating plant interconnections.

A. Technical Standards Applicable to a Wind Generating Plant

i. Low Voltage Ride-Through (LVRT) Capability

A wind generating plant shall be able to remain online during voltage disturbances up to the time periods and associated voltage levels set forth in the standard in Figure 1, below, if the Transmission Provider's System Impact Study shows that low voltage ride-through capability is required to ensure safety or reliability.

The standard applies to voltage measured at the Point of Interconnection as defined in this LGIA. The figure shows the ratio of actual to nominal voltage (on the vertical axis) over time (on the horizontal axis). Before time 0.0, the voltage at the transformer is the nominal voltage. At time 0.0, the voltage drops. If the voltage remains at a level greater than 15 percent of the nominal voltage for a period that does not exceed 0.625 seconds, the plant must stay online. Further, if the voltage returns to 90 percent of the nominal voltage within 3 seconds of the beginning of the voltage drop (with the

voltage at any given time never falling below the minimum voltage indicated by the solid line in Figure 1), the plant must stay online. The Interconnection Customer may not disable low voltage ride-through equipment while the wind plant is in operation. Two key features of this regulation are:

1. A wind generating plant must have low voltage ride-through capability down to 15 percent of the rated line voltage for 0.625 seconds;
2. A wind generating plant must be able to operate continuously at 90 percent of the rated line voltage, measured at the high voltage side of the wind plant substation transformer(s).

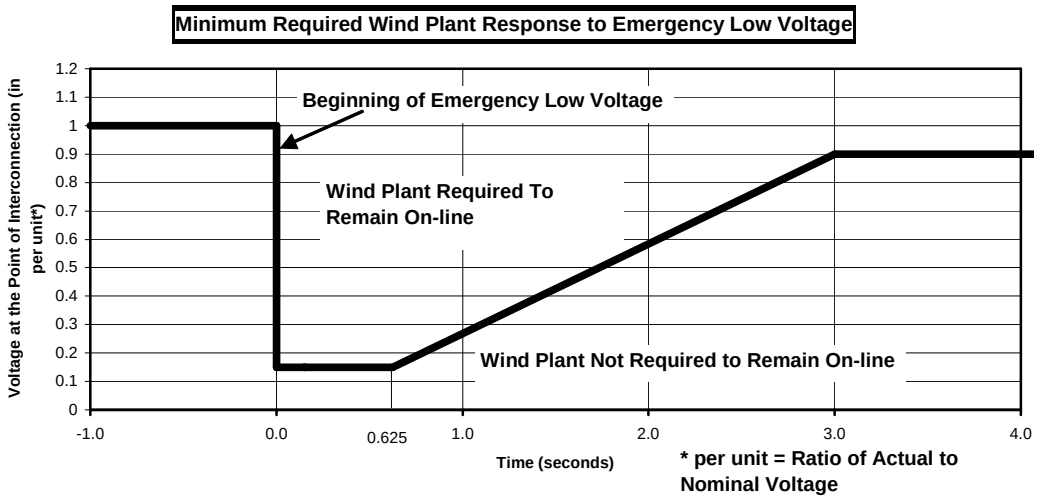

Figure 1 Proposed low voltage ride-through standard

ii. Power Factor Design Criteria (Reactive Power)

A wind generating plant shall maintain a power factor within the range of 0.95 leading to 0.95 lagging, measured at the Point of Interconnection as defined in this LGIA,

if the Transmission Provider's System Impact Study shows that such a requirement is necessary to ensure safety or reliability. The power factor range standard can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors if agreed to by the Transmission Provider, or a combination of the two. The Interconnection Customer shall not disable power factor equipment while the wind plant is in operation. Wind plants shall also be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system if the System Impact Study shows this to be required for system safety or reliability.

iii. Supervisory Control and Data Acquisition (SCADA) Capability

The wind plant shall provide SCADA capability to transmit data and receive instructions from the Transmission Provider to protect system reliability. The Transmission Provider and the wind plant Interconnection Customer shall determine what SCADA information is essential for the proposed wind plant, taking into account the size of the plant and its characteristics, location, and importance in maintaining generation resource adequacy and transmission system reliability in its area.

Appendix C

[NOTE: THESE PROVISIONS TO BE ADOPTED AS APPENDIX G TO THE LGIP]

APPENDIX G

INTERCONNECTION PROCEDURES FOR A WIND GENERATING PLANT

Appendix G sets forth procedures specific to a wind generating plant. All other requirements of this LGIP continue to apply to wind generating plant interconnections.

A. Special Procedures Applicable to Wind Generators

The wind plant Interconnection Customer, in completing the Interconnection Request required by section 3.3 of this LGIP, may provide to the Transmission Provider a set of preliminary electrical design specifications depicting the wind plant as a single equivalent generator. Upon satisfying these and other applicable Interconnection Request conditions, the wind plant may enter the queue and receive the base case data as provided for in this LGIP.

No later than six months after submitting an Interconnection Request completed in this manner, the wind plant Interconnection Customer must submit completed detailed electrical design specifications and other data (including collector system layout data) needed to allow the Transmission Provider to complete the System Impact Study.