

145 FERC ¶ 61,280
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Cheryl A. LaFleur, Acting Chairman;
Philip D. Moeller, John R. Norris,
and Tony Clark.

PJM Interconnection, L.L.C.

Docket No. ER14-207-000

ORDER CONDITIONALLY ACCEPTING TARIFF REVISIONS

(Issued December 26, 2013)

1. On October 28, 2013, PJM Interconnection, L.L.C. (PJM) submitted proposed revisions to its Open Access Transmission Tariff (OATT), pursuant to section 205 of the Federal Power Act (FPA).¹ In its filing, PJM proposes to include a requirement for interconnection customers/generators to incorporate phasor measurement units (PMU) when interconnecting a new generator equal to or greater than 100 megawatts (MW). PJM proposes that the new requirement apply to all new facilities entering the interconnection queue on or after October 1, 2012 that have not yet entered into an Interconnection Service Agreement.² We conditionally accept and suspend the proposed tariff changes, subject to a compliance filing, effective December 28, 2013, as requested.

I. Background

2. PJM states that it has been working with the U.S. Department of Energy and PJM's Transmission Owners to deploy synchrophasor measurement devices on its system.³ PJM explains that PMUs provide continuous, high speed records of conditions on the system. PMUs provide information at a rate of 30 scans per second as opposed to the current rate of one scan every 4-10 seconds obtained through existing equipment.

¹ 16 U.S.C. § 824e (2012).

² See PJM Interconnection, L.L.C., FERC FPA Electric Tariff, Intra-PJM Tariffs, [ATTACHMENT O.A2.8.5, OATT ATTACHMENT O.A2.8.5 Communications, 1.0.0](#).

³ See PJM October 28 Transmittal Letter at 2. PJM notes that by the end of 2013, it will receive synchrophasor data from 97 substations, none of which are located within generation stations.

3. PJM states that high resolution synchrophasor data obtained through installation of PMUs on the generator side of the interconnection will provide unique benefits that cannot be obtained by installation solely on transmission owner facilities. PJM states that such data is integral to improved communication and to the reliability of the system and, as such, benefits both the system and the generators. PJM asserts that PMUs at the generator site will, among other things, provide greater visibility to PJM's transient stability analysis for real-time operations; allow for better monitoring of dynamic system oscillations aiding in detection and remediation to protect generator assets; improve component and system modes in both on-line and off-line network analysis; allow the collection and sharing of high-speed data across its entire system; and facilitate a generation owner's ability to comply with North American Electric Reliability Corporation (NERC) generator verification standards.⁴ PJM explains that PMU data can also be used for event analysis and model validation and can reflect actual dynamic behavior during system disturbances.

4. PJM proposes to require new generators that are equal to or greater than 100 MWs in size to install PMUs. PJM explains that phasor measurement devices can be either stand-alone PMUs or multi-function devices such as relays or digital fault recorders. According to PJM, PMUs can be installed as part of a new interconnection for a relatively low cost, approximately \$20,000 per site. PJM believes that PMUs should be viewed as similar to other telemetry and communication equipment. Accordingly, PJM proposes that the costs of PMU installation should be directly assigned to the generator. PJM explains that the interconnection customer will be responsible for installing and maintaining the PMU collection system in the generation station at its own expense. PJM proposes to cover the initial and on-going service cost associated with the data communication link between the PMUs and PJM. PJM proposes to impose the PMU installation requirements on all projects in the interconnection queue on or after October 1, 2012 which have not yet entered into an Interconnection Service Agreement.⁵ PJM states that it would welcome any further guidance on the Commission's vision as to the pace and level of deployment of PMUs to existing generators.

II. Notice of Filing and Responsive Pleadings

5. Notice of PJM's filing was published in the *Federal Register*, 78 Fed. Reg. 67,133 (2013), with interventions and protests due on or before November 18, 2013. Timely-

⁴ See PJM October 28 Transmittal Letter at 3-4. See also Notice of Proposed Rulemaking on Generator Verification Reliability Standards, 144 FERC ¶ 61,205 (2013). Specifically, proposed NERC standards MOD-026 and MOD-027 affect generators equal or greater than 100 MVA.

⁵ See PJM October 28 Transmittal Letter at 9-10.

filed motions to intervene were filed by American Electric Power Service Corporation, Duke Energy Corporation, North Carolina Electric Membership Corporation, and American Municipal Power, Inc.

6. The American Wind Energy Association (AWEA) and Mid-Atlantic Renewable Energy Coalition (MAREC) (collectively, AWEA and MAREC) filed a timely motion to intervene and protest. Invenergy Wind Development LLC and Invenergy Thermal Development LLC (collectively, Invenergy) filed a timely motion to intervene and comments in support of AWEA and MAREC's protest. On December 4, 2013, PJM filed a motion for leave to answer and answer to AWEA and MAREC's protest and to Invenergy's comments. On December 19, 2013 AWEA and MAREC filed a motion for leave to answer and answer to PJM's answer.

A. Protests and Comments

7. Invenergy, AWEA, and MAREC state that PJM's proposed cost allocation imposes unjust and unreasonable costs on interconnection customers.⁶ Invenergy, AWEA, and MAREC argue that the benefits of PMU installation primarily accrue to the transmission service provider, and that PJM has not provided sufficient evidence that the installation of PMUs will provide significant benefits to the generator.⁷

8. Invenergy, AWEA, and MAREC argue that PMUs would provide greater benefits if they were installed on the integrated network of the bulk power system.⁸ AWEA and MAREC contend that generators are typically radially connected to the power system via a generator tie line, and, as such, the information provided from PMUs about power flows, phase angles, and voltages on the bulk power system is limited. AWEA and MAREC contend that siting all PMUs at the most highly connected network buses was more valuable than locating one of those PMUs at the generator site.⁹ AWEA and MAREC also dispute PJM's claims that PMUs will benefit the generators. Specifically, AWEA and MAREC suggest that while PMUs can be used to comply with NERC generator verification standards, a generator may use other equipment to comply.

⁶ See AWEA and MAREC Joint Protest at 5-7; Invenergy Comments at 3.

⁷ See AWEA and MAREC Joint Protest at 3-4; Invenergy Comments at 3.

⁸ See AWEA and MAREC Joint Protest at 3-4; Invenergy Comments at 3.

⁹ See AWEA and MAREC Joint Protest at 5 (citing *available at*: <http://www.cs.unc.edu/~welch/media/pdf/Zhang2010ab.pdf>, Figures 2 and 3).

9. AWEA and MAREC also argue that PJM's proposal to require only generators larger than 100 MW to install PMUs is arbitrary. AWEA and MAREC suggest that, if PMUs provide the benefits claimed by PJM, PMUs would be required at all generator sites regardless of the size of the generator.¹⁰ As such, AWEA and MAREC conclude that the installation of PMUs is not essential for the reliable interconnection of new generators, and therefore PJM's proposal fails the "but for" and "beneficiary pays" tests the Commission uses to assign the costs of interconnection facilities.¹¹ AWEA and MAREC argue that PMUs are distinguishable from other communication and telemetering equipment such as Supervisory Control and Data Acquisition (SCADA) systems, asserting that SCADA is necessary to participate in PJM's markets and provide grid operators with essential information used in real-time operations. AWEA and MAREC argue that, consequently, PMUs are network upgrades whose costs should be allocated under the "but for" test.

B. Answers

10. In its answer, PJM states that reliance on the "but for" cost allocation precedent by AWEA/MAREC in their protest is misplaced. PJM asserts that PMUs are not network upgrades. PJM claims the "but for" standard is the standard for network upgrades, which are those upgrades, as determined by the relevant interconnection studies, that are needed for the transmission system that are built at or beyond the point of interconnection.¹² PJM suggests that PMUs at the generator site should be viewed as similar to other telemetry and communication equipment, such as remote terminal units and internet-based SCADA equipment, the costs for which generators are currently responsible. PJM suggests that PMUs provide a level of system reliability monitoring (including local disturbances), performance, and alarming that is not available through historical metering and communication methods.

11. PJM states that its filing is based on the grounds that PMUs should be considered a part of basic telemetry requirements for new generators going forward. PJM also reiterates that there are substantial benefits to generators which would justify their bearing the nominal costs of PMUs.¹³ PJM states that while PMUs are an improvement to the transmission system, grid disturbances are not "wholly divorced from the actions of

¹⁰ See AWEA and MAREC Joint Protest at 4-5.

¹¹ See AWEA and MAREC Joint Comments at 5-6 (citing *Marcus Hook I*, 107 FERC ¶ 61,069; and *Jeffers South, LLC v. Midwest Independent Transmission System Operator, Inc.* 144 FERC ¶ 61,033, at P 64 (2013)) .

¹² See PJM December 4, 2013 Answer at 10-11.

¹³ *Id.* at 9.

generators.”¹⁴ PJM states that it has agreed to pay the bulk of the ongoing costs, which are expected in the area of the communication link between the PMUs and PJM.¹⁵

12. In their answer, AWEA and MAREC reiterate that siting PMUs at the most highly connected network buses would provide more valuable information to PJM.¹⁶ AWEA and MAREC suggest that while certain studies call for siting PMUs at large generators, they suggest that the MW threshold should be far larger than the 100 MWs threshold proposed by PJM.¹⁷ Further, AWEA and MAREC contend that those studies affirm that the vast majority of PMU benefits accrue to the transmission system, supporting their contention that the costs of PMUs be allocated to the transmission system and not to generators.¹⁸

III. Discussion

A. Procedural Matters

13. Pursuant to Rule 214 of the Commission’s Rules of Practice and Procedure, 18 C.F.R. § 385.214 (2013), the timely, unopposed motions to intervene serve to make the entities that filed them parties to this proceeding.

¹⁴ *Id.* at 10.

¹⁵ *Id.* at 11-12.

¹⁶ See AWEA and MAREC December 19, 2013 Answer at 2-3 (citing *available at*: <https://www.misoenergy.org/Library/Repository/Project%20Material/Project%20Documentation/Synchrophasor%20Project/MISO%20PMU%20Placement%20Approach%20White%20Paper.pdf>; Chow J, L Beard, M Patel, et al. June 2011. “Guidelines for Siting Phasor Measurement Units,” *available at*: <https://www.naspi.org/File.aspx?fileID=518>; and Madani, V.; Parashar, M.; Giri, J.; Durbha, S.; Rahmatian, F.; Day, D.; Adamiak, M.; Sheble, G., "PMU placement considerations — A roadmap for optimal PMU placement," *Power Systems Conference and Exposition (PSCE), 2011 IEEE/PES*, vol., no., pp.1,7, 20-23 March 2011).

¹⁷ *Id.* at 4.

¹⁸ *Id.* At 3. AWEA and MAREC note that model validation is of primary benefit to generators.

14. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.213(a)(2) (2013), prohibits an answer to a protest or an answer to an answer unless otherwise ordered by the decisional authority. We will accept PJM's answer and AWEA and MAREC's answer because it has assisted us in our decision-making process.

B. Commission Determination

15. We accept and suspend the proposed tariff changes, effective December 28, 2013, subject to PJM submitting revised tariff records in a compliance filing. We find that, with the modifications discussed below, the proposed revisions will be just and reasonable.

16. Invenenergy, AWEA, and MAREC object to the costs of such PMUs being allocated to interconnection customers, arguing that this treatment is inconsistent with the Commission's "but for" principle. The Commission has several tests for determining whether costs should be the responsibility of the interconnection customer or the transmission provider, including the "at-or-beyond" test and the "but for" test. However, the "but for" test applies only to network upgrades that must be constructed to accommodate a generation interconnection request beyond the point of interconnection on the transmission system. This test does not apply to requirements or facilities needed prior to the point of interconnection. The PMUs at issue here are telemetry and communication equipment installed prior to the point of interconnection. The Commission has previously determined that a transmission provider can require an interconnection customer to install telemetry and communications equipment that may be reasonably required.¹⁹

17. We find merit in PJM's claims that PMU data is integral to improved communication and to the reliability of the system and, as such, benefits both the system and the generators. PJM has explained that the PMUs will be used to, *inter alia*, provide information specific to an individual generator's interaction with the grid and pinpoint the source of any particular disturbance, collect and share high-speed, real-time, time-synchronized grid condition data across the entire system, and allow generators to conduct model validation without taking the generator offline. PJM has sufficiently demonstrated that PMUs are communication, measurement, and verification equipment that assist in reliably interconnecting new generators equal to or greater than 100 MW,

¹⁹ According to the Commission's *pro forma* Large Generator Interconnection Agreement at section 5.10.2, the "Interconnection Customer shall make such changes to the [Interconnection Facilities] as may reasonably be required by Transmission Provider, in accordance with Good Utility Practice, to ensure that the [Interconnection Facilities] are compatible with the telemetry, communications, and safety requirements of the Transmission Provider."

and thus pursuant to its OATT,²⁰ PJM can require such generators to install such equipment. We note that PJM has limited the cost to interconnection customers to the cost of the PMUs themselves and that PJM has agreed to provide the communication link between the PMUs and PJM, which are expected to constitute the bulk of ongoing PMU-related costs.

18. Invenergy, AWEA, and MAREC question whether PMUs are most efficient when located behind the point of interconnection or whether they should instead be placed beyond the point of interconnection. In effect, Invenergy, AWEA, and MAREC are suggesting an alternative requirement for the siting of PMUs. However, we find that PJM has offered a reasonable explanation of why installing these units prior to the point of interconnection will assist PJM in monitoring the generating units. As noted by PJM, PMUs at the generator site will increase PJM's ability to detect and remediate dynamic system oscillations via additional measurements of generators' rotor angles.²¹ Without such equipment located on the generator side of the interconnection, it is possible that system oscillations may go unnoticed or potentially be misdiagnosed.²² Further, AWEA and MAREC note that PMU data can improve model validation by refining the models used to analyze the power system and provide a means of benchmarking study results.²³

19. We are also not persuaded by AWEA and MAREC's assertion that PJM's proposal to require PMUs only for new generators equal or greater than 100 MW is arbitrary. We find that new generators that are 100 MW or greater at this time can contribute the most useful information, particularly in light of the relatively small costs to the overall capital expenditures of generator projects greater than or equal to 100 MW. As noted by PJM the cost of installing a PMU at the time the generator is under construction is less costly and disruptive to system from an outage perspective.²⁴ We

²⁰ See, e.g. Appendix 2 Standard Terms and Conditions for Interconnections section 8.5.1 (addressing interconnection customer obligations for communications equipment): "Interconnection Customer shall install and maintain satisfactory operating communications with Transmission Provider's system dispatcher or its other designated representative and with the Interconnected Transmission Owner."

²¹ See PJM December 4, 2013 Answer at 5, 8. PJM explains that rotor angle is the balance between the electrical power out of, and mechanical power in to, the generator.

²² *Id.* at 9.

²³ See AWEA and MAREC December 19, 2013 Answer at 2.

²⁴ See PJM October 28 Transmittal Letter at 7.

find it appropriate to include the new provisions in any interconnection agreements that were not yet executed as of October 1, 2012, as proposed.²⁵

20. We note, however, that PJM's proposed tariff language inappropriately references PJM's manuals for more detailed descriptions of the facilities and methods in which PMU equipment must be installed at an interconnection site. Such details can impact the costs of the PMUs, and thus are more appropriately included in the OATT. Specifically the Commission accepts this filing under the condition that PJM revises its OATT to: include the point at which phasor measurements will be made; define which phasor measurements must be sent to the Transmission Provider; clarify the extent to which the interconnection customer can utilize existing equipment, such as relays or digital fault recorders with phasor measurement capabilities; and state how long PMU data will have to be stored locally. Accordingly, PJM must make a compliance filing within 30 days of the date of this order to respond to this condition.

The Commission orders:

The Commission hereby accepts and suspends the revised tariff record referenced in footnote 2, to become effective December 28, 2013, as requested, subject to a compliance filing, to be made within 30 days of this order, as discussed in the body of this order.

By the Commission.

(S E A L)

Kimberly D. Bose,
Secretary.

²⁵ See *Midwest Independent Transmission System Operator, Inc.*, 125 FERC ¶ 61,277, at P 10 (2008) (requiring interconnection agreements filed after revisions were in place to be modified to include the revised provisions).