

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

**Transmission Line Ratings and
Related Practices**

:

Docket No. AD19-15-000

**POST-TECHNICAL CONFERENCE COMMENTS OF
PJM INTERCONNECTION, L.L.C.**

Pursuant to the Federal Energy Regulatory Commission's ("Commission") Notice Inviting Post-Technical Conference Comments (the "Notice") published in the above-referenced docket on October 2, 2019, PJM Interconnection, L.L.C. ("PJM") hereby submits comments in response to the indicated questions in Sections 1, 2, 4, and 6 of the Notice. PJM's comments supplement the record in this docket, including the previously-filed Testimony of Shaun Murphy, Senior Engineer at PJM, and information previously provided by PJM and the PJM Transmission Owners concerning the management of transmission line ratings in the PJM region.

In summary, PJM's comments evidence PJM's belief that footprint-wide implementation of ambient-adjusted line ratings ("AARs") is possible and can realize significant operational value. Dynamic line ratings ("DLRs"), by contrast, are more appropriately utilized as a real-time optimization tool because, today, DLRs are not easily adaptable to reliable forecasting outside of real time determinations. As such, DLRs are best implemented strategically in areas of the system with high congestion and appropriate system conditions and topology. Although DLRs are not presently capable of broad implementation across PJM's footprint, DLRs should nevertheless be further studied in pilot programs to identify opportunities for strategic implementation as DLRs may help alleviate congestion on specific lines and promote a net reduction in congestion on the system to a degree AARs alone cannot achieve.

I. COMMENTS

1. *Discussion of a Possible Requirement for Transmission Owners to Implement AARs*

a. *Should transmission owners be required to implement AARs?*

In PJM, AARs are determined by reference to a “look up” table where the ratings are pre-determined and published by the transmission owner based on a set of forecasted ambient temperatures. AARs utilize the following eight ambient temperatures that are each 9 degree steps apart: 95°, 86°, 77°, 68°, 59°, 50°, 41°, and 32° (in degrees Fahrenheit). In addition, there is a set of ratings for the night period and a set for the day period corresponding to these eight ambient temperatures. PJM’s real-time operational procedures specify when PJM is to change a rating based on changing temperature conditions, and PJM may make multiple real-time ratings changes over the course of a day.

PJM sees significant operational value in the PJM transmission owners’ wholesale adoption of AARs.¹ The use of AARs allows for the realization of additional incremental capability on the system. As such, the PJM transmission owners’ adoption of AARs gives PJM operations more flexibility and promotes more efficient and reliable system dispatch and cost-effective markets operations. The conference record demonstrates that the use of AARs are a recognized practice among the overwhelming majority of transmission owners in the PJM region.² Other RTOs/ISOs (or similar organizations) also acknowledge implementing AARs.³

¹ As the hearing record makes clear, the determination of ratings is the responsibility of the transmission owner and must not be imposed upon the Regional Transmission Organization or Independent System Operator (“RTO/ISO”).

² See Testimony of Michael Kormos (Exelon) at 1 (“Exelon has adopted ambient-adjusted facility ratings for the transmission facilities of five of our six utilities, with Commonwealth Edison scheduled to complete the transition to ambient-adjusted facility ratings next year.”); Testimony of Francisco Velez (Dominion) at 2-3; see also Steve Huntoon, *Waste Not, Want Not*, RTO Insider at 4 (Oct. 29, 2019) (“Ambient ratings, at least for temperature, have been used in PJM for decades.”).

Therefore, although the Commission should preserve flexibility in *how* AARs are determined by individual transmission owners, the record supports requiring the use of AARs across all regions to avoid market inefficiencies if some transmission providers along a given transmission path utilize AARs while others do not. The Commission could address this requirement by either seeking to have NERC revisit its existing transmission line rating standard or exercising its authority to determine reasonable terms and conditions of transmission service. These regulatory implementation details are logistical issues best left for the Commission to decide.

- b. If AARs are required, should they be required for modeling in both the day-ahead and real-time markets?*

Temperature can be forecasted within a reasonable degree of certainty making such forecasts reliable. Therefore, PJM sees no reason why AARs should not be implemented in both the PJM day-ahead market and the PJM real-time market.

- c. What type of forecasting (e.g., how frequently, how granularly, and of what variables) is needed to incorporate AARs and DLRs into both real-time and day-ahead markets? . . . Who is liable if forecasted ratings are wrong?*

For AARs, temperature forecasting is needed to incorporate AARs into the PJM real-time and day-ahead markets. PJM's process for implementing AARs in real time is discussed above. AARs incorporated into the day-ahead market use forecasted temperature for each hour for each zone.

Unlike AAR implementation which has been used in PJM for many years, as DLR technology continues to evolve, DLRs require further study to promote their strategic implementation on appropriate transmission lines in the system. Moreover, the Commission

³ See Testimony of Dede Subakti (CAISO) at 1; Testimony of Aaron Markham (NYISO) at 2; *see also* Testimony of Chad Thompson (ERCOT) at 1-2.

should observe that DLR implementation poses potential risks if forecasted ratings are “wrong,” in that errant DLRs could cause equipment damage or the issuance of emergency operating procedures to protect the reliability of the system. In addition, day-ahead forecasting parameters should be aligned with real-time forecasting so as to minimize balancing congestion charges in the PJM markets. If DLRs were to be implemented more broadly in PJM, further study is needed on forecasting DLRs to promote the achievement of this alignment in the PJM day-ahead and real-time markets. At present, PJM is not aware of a proven approach or field-tested proof of concept associated with this important implementation feature of DLRs.

- d. *Aside from ambient air temperature, are there other ambient conditions that can be forecasted or calculated without need for local sensors that should be considered in AARs?*

Typically, air temperature is the only variable condition not held constant when determining AARs. PJM believes there would be little value and added risk to consider other ambient conditions besides temperature absent deploying local sensors. Local sensors are often necessary to measure actual conditions due to the inherent variability and less reliable forecasting associated with non-temperature conditions.

2. *Reducing Barriers to DLRs*

- a. *Can RTOs/ISOs currently accept and use a DLR data stream from a transmission owner in both real-time and day-ahead markets?*

PJM has the capability to accept and use DLR data streams from a transmission owner. Such data streams are sent to PJM via Inter-Control Center Communications Protocol (ICCP). As stated above, although there are challenges to PJM implementing DLRs, DLRs should be further studied in pilot programs.

Would a transmission owner's or RTO/ISO's implementation of AARs be sufficient to also implement DLRs?

No, an RTO/ISO's implementation of AARs would not be sufficient to implement DLRs.

In contrast to the "look up" table used for AARs discussed above, in the case of DLRs, PJM relies on the asset owner to determine multiple real-time measurements (i.e., wind, temperature, etc.), some of which, given their highly locational nature, cannot be forecasted with sufficient accuracy to serve as a substitute across-the-board for AARs.

b. Would a requirement for transmission owners or other entities (e.g., RTOs/ISOs) to study the cost effectiveness of DLRs on their most congested lines be appropriate?

PJM encourages the use of pilot programs to evaluate the appropriateness of DLRs to be implemented strategically. By way of example, as noted by PJM witness Shaun Murphy,⁴ PJM participated in a pilot project with American Electric Power ("AEP") to deploy DLR sensors on AEP's Cook-Olive 345 kV transmission line. AEP deployed a non-contact transmission line monitoring system by Genscape called LineVision that used an array of electromagnetic field ("EMF") sensors to monitor the line. The purpose of the pilot was to develop an understanding of the technology.

As part of the pilot, PJM received and reviewed DLR ratings. The sensors collected the EMF data which was then fed into an analytical model that determined various conductor properties including loading, clearance, temperature, effective wind speed, and DLR. The line's DLR was shown to provide significant additional capacity, as compared to its static line rating, during the sample period of January 2017.⁵ The additional capacity provided by DLR is an

⁴ Testimony of Shaun Murphy (PJM) at 1-2.

⁵ J. Marmillo, B. Mehraban, S. Murphy, and N. Pinney, *A Non-Contact Sensing Approach for the Measurement of Overhead Conductor Parameters and Dynamic Line Ratings*, at 1, CIGRE National Committee 2017 Grid of the Future Symposium, Cleveland, OH. See <https://watttransmission.files.wordpress.com/2017/11/genscape-cigre-gotf-whitepaper-2017.pdf>.

example of how an advanced transmission technology can provide flexibility to grid operators, while reducing congestion in power markets and improving their efficiency, increasing situational awareness and aiding grid resiliency.

PJM agrees that DLRs represent a technology, still under development, which is best utilized on a targeted basis focusing on the most congested facilities. Certainly, RTOs can ‘rank’ their most congested lines to serve as a ‘test bed’ to analyze the degree to which congestion may be impacted by the DLR inputs.

4. Discussion of Transparency of Transmission Line Rating Methodologies

a. Should transmission owners’ transmission line rating methodology be made more transparent?

Transmission owners’ actual line ratings should be transparent. To that end, PJM posts the actual transmission owner line ratings on the PJM website.⁶ The transmission owners’ rating methodology (along with the transmission owners’ ratings) are audited by regional reliability organizations. In addition, notwithstanding NERC’s retirement of FAC-008 R4 and R5 effective January 21, 2014,⁷ the PJM transmission owners work collaboratively with PJM to share actual line ratings and information about their respective line ratings methodologies, if asked.

b. Should transmission owners or other entities (e.g., NERC regional entities or RTOs/ISOs) be required to develop a database to document each transmission facility’s most limiting element?

Transmission owners, who are the asset owners, should maintain a database to document each transmission facility’s most limiting element. PJM operations tools incorporate the

⁶ See <https://www.pjm.com/markets-and-operations/etools/oasis/system-information/ratings-information.aspx>.

⁷ *Elec. Reliability Org. Proposal to Retire Requirements in Reliability Standards*, 143 FERC ¶ 61251 at ¶¶ 46, 47 (June 20, 2013) (“NERC asserts that FAC-008-3, Requirements R4 and R5 represent ‘an administrative task that does little, if anything, to benefit or protect the reliable operation of the BES, and has the potential to implicate commercially sensitive issues.’”); *Elec. Reliability Org. Proposal to Retire Requirements in Reliability Standards*, 145 FERC ¶ 61147 at ¶ 17 (Nov. 21, 2013).

transmission facility rating based on transmission owner data (not PJM data), which reflects the most limiting element, regardless of whether that element is the conductor or a terminal device. Moreover, the creation of the database contemplated by this question is not necessarily straightforward, as it would require the asset owner to incorporate all elements of a given transmission path that could impact the resultant rating. Based on the primary source and quantity of data required to populate the contemplated database, it is not efficient or practical for an entity that is not an asset owner (for example, the RTO/ISO) to maintain such a database. In any event, some or all of the contents of any database may require protection from disclosure consistent with PJM's Critical Energy Infrastructure Information ("CEII") rules.

- c. *If a transmission system operator contacts a transmission owner to request an ad hoc increase in transmission line ratings above static or seasonal ratings, should information about the request be publicly posted? If so, where, when, and how often should such information be posted?*

Yes. For example, with respect to operations, PJM publicly posts line ratings every fifteen minutes on the PJM website,⁸ and PJM would post any "ad hoc" increase in transmission line ratings above static or seasonal ratings consistent with its posting of other operations ratings. Any transmission facilities which are permitted to use short-term emergency ratings are documented within the PJM manuals.

⁸ See <https://www.pjm.com/markets-and-operations/etools/oasis/system-information/ratings-information.aspx>.

6. NERC Reliability Standards

- a. *Are there security concerns associated with implementing AARs and DLRs with respect to communicating line ratings and field measurements?*

With respect to communicating line ratings and field measurements, PJM does not believe there are security concerns associated with implementing AARs because the approach does not introduce significant opportunities for interference. As noted above, in PJM, the AAR line rating process is essentially a “look up” table where the ratings are determined and published in advance by the transmission owner based on a predetermined set of forecasted ambient temperatures. As a result, this AAR system is not readily susceptible to interference.

With respect to communicating line ratings and field measurements for DLRs, local sensors are often necessary to measure actual conditions. DLR equipment that is installed on the ground should, therefore, be physically and cyber protected to safeguard the accuracy of the measurements of actual conditions to minimize the potential for interference with this equipment. DLR equipment that is installed on conductors does not generally pose additional increased security concerns beyond the need for physical and cyber protection.

II. CONCLUSION

PJM thanks the Commission for this opportunity to submit comments in this matter.

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November 5, 2019

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Audubon, Pennsylvania, this 5th day of November, 2019.

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