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

**Implementation of Dynamic Line Ratings)
)
)**

Docket No. RM24-6-000

**COMMENTS OF THE
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION, MIDWEST
RELIABILITY ORGANIZATION, NORTHEAST POWER COORDINATING
COUNCIL, INC., RELIABILITYFIRST CORPORATION, SERC RELIABILITY
CORPORATION, TEXAS RELIABILITY ENTITY, INC., AND WESTERN
ELECTRICITY COORDINATING COUNCIL ON
THE ADVANCE NOTICE OF PROPOSED RULEMAKING**

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The North American Electric Reliability Corporation (“NERC”), along with Regional Entities Midwest Reliability Organization, Northeast Power Coordinating Council, Inc., ReliabilityFirst Corporation, SERC Reliability Corporation, Texas Reliability Entity, Inc., and Western Electricity Coordinating Council (collectively, the “ERO Enterprise”)¹ hereby provide comments on the Advance Notice of Proposed Rulemaking (“ANOPR”) issued by the Federal Energy Regulatory Commission (“FERC” or the “Commission”) in this proceeding on June 27, 2024.² NERC is the Commission-certified Electric Reliability Organization (“ERO”) responsible for the development and enforcement of mandatory Reliability Standards.³

In the ANOPR, the Commission proposes, pursuant to section 206 of the Federal Power Act (“FPA”), to require that transmission line ratings incorporate Dynamic Line Ratings (“DLRs”)

¹ The “ERO Enterprise” refers to NERC and the six Regional Entities. The Regional Entities are (i) Midwest Reliability Organization (“MRO”); (ii) Northwest Power Coordinating Council, Inc. (“NPCC”); (iii) ReliabilityFirst Corporation (“ReliabilityFirst”); (iv) SERC Reliability Corporation (“SERC”); (v) Texas Reliability Entity, Inc. (“Texas RE”); and (vi) Western Electricity Coordinating Council (“WECC”).

² Advance Notice of Proposed Rulemaking, *Implementation of Dynamic Line Ratings*, 187 FERC ¶ 61,201 (2024) [hereinafter ANOPR].

³ *Rules Concerning Certification of the Electric Reliability Organization; and Procedures for the Establishment, Approval, and Enforcement of Electric Reliability Standards*, Order No. 672, 114 FERC ¶ 61,104 (2006) [hereinafter Order No. 672], *order on reh’g*, Order No. 672-A, 114 FERC ¶ 61,328 (2006). NERC was certified by the Commission as the ERO, pursuant to § 215(c) of the Federal Power Act (“FPA”), by Commission order issued July 20, 2006. *N. Am. Elec. Reliability Corp.*, 116 FERC ¶ 61,062 (2006) [hereinafter Certification Order].

under the *pro forma* Open Access Transmission Tariff (“OATT”) to improve the accuracy of transmission line ratings and system transfer capability.

NERC, as the Commission-certified ERO,⁴ and the Regional Entities hereby submit comments on the DLR ANOPR in response to certain questions related to Reliability Standards. The ERO Enterprise appreciates the opportunity to support the Commission’s careful consideration of the potential reliability benefits of DLRs and has considered whether accommodating DLRs might require modifications to NERC Reliability Standards. Comments herein are consistent with NERC and Regional Entity comments on DLRs in earlier proceedings.⁵ The ERO Enterprise supports the Commission’s consideration of the reliability benefits associated with a market-related rule to require the use of DLRs, and believes that Reliability Standard FAC-008 and the CIP Reliability Standards do not require changes, while it may be beneficial to modify PRC-023.

I. SUMMARY

The ANOPR proposes requiring that transmission providers use DLRs, considering the impacts of solar heating and wind, to “improve the accuracy of transmission line ratings”⁶ and system transfer capability to ensure just and reasonable Commission-jurisdictional rates.⁷ While

⁴ *Id.*

⁵ ERO Enterprise comments in the underlying proceedings include: *Comments of the ERO Enterprise in Response to Notice of Inquiry on Implementation of Dynamic Line Ratings*, AD22-5-000 (Apr. 25, 2022), https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20220425-5283 [hereinafter *Comments on NOI*]; *Comments of NERC in Response to Notice of Proposed Rulemaking on Managing Transmission Line Ratings*, RM20-16-000 (Mar. 22, 2021), https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20210322-5189 [hereinafter *Comments on TLR NOPR*]; *Comments of NERC in Response to Notice inviting Post-Technical Conference Comments*, AD19-15-000 (Nov. 1, 2019), https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20191101-5210 [hereinafter *Comments on TLR Technical Conference*]; *Remarks of Howard L. Gugel, NERC Vice President and Director of Engineering and Standards*, Managing Transmission Line Ratings Technical Conference, AD19-15-00 (Sept. 10, 2019), https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20190917-4015 [hereinafter *Gugel Remarks on TLR at 2019 Technical Conference*].

⁶ ANOPR at P 1.

⁷ ANOPR at P 73.

the Commission's DLR proposal would revise the *pro forma* OATT, the proposed changes implicate questions regarding NERC Reliability Standards. As such, the Commission seeks comment on the applicability of the following standards and whether any changes would need to be made to accommodate DLRs:

- Reliability Standard FAC-008 associated with transfer line ratings;
- Reliability Standard PRC-023 associated with transmission loadability; and
- CIP Reliability Standards considering communication devices involved in DLRs.⁸

At this time, the ERO Enterprise believes that Reliability Standard FAC-008 and the CIP Reliability Standards are flexible enough to incorporate needs associated with DLRs without requiring modification. (*See infra* Sections IV.A. and IV.B.) By contrast, it may be beneficial for the ERO Enterprise and industry to explore revisions to Reliability Standard PRC-023, considering FERC's DLR ANOPR and other factors. (*See infra* Section IV.C.) This is because PRC-023's loadability requirement is centered on the highest seasonal Facility Ratings, which are static and not dynamic ratings. Additionally, NERC encourages the Commission to consider additional reliability concerns presented by DLRs that should be addressed. (*See infra* Section IV.D.)

II. NOTICES AND COMMUNICATIONS

Notices and communications with respect to this filing may be addressed to the following:⁹

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⁸ See ANOPR at P 112-113 (seeking comment on these standards as they relate to accommodating DLRs).

⁹ Persons to be included on the Commission's service list are identified by an asterisk. NERC respectfully requests a waiver of Rule 203 of the Commission's regulations, 18 C.F.R. § 385.203 (2024), to allow the inclusion of more than two persons on the service list in this proceeding.

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III. INTRODUCTION TO THE ERO ENTERPRISE AND ITS STATUTORY MISSION

NERC is the ERO certified by the Commission under Section 215 of the FPA and the Commission’s implementing regulations.¹⁰ NERC’s mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid. NERC is responsible for developing and enforcing mandatory Reliability Standards, subject to Commission approval, and assessing the

¹⁰ 16 U.S.C. § 824o, 18 C.F.R. § 39 (2024); Certification Order, *supra*.

reliability and adequacy of the Bulk Power System (“BPS”)¹¹ in North America.¹² NERC accomplishes its mission with the support of the six Regional Entities. As the ERO Enterprise, NERC and the Regional Entities are committed to NERC’s vision of a highly reliable and secure North American BPS. The Regional Entities help the ERO Enterprise support reliability across various interconnections with specific needs and characteristics pursuant to individual Regional Delegation Agreements (“RDAs”).¹³ NERC and the Regional Entities, as the ERO Enterprise, are responsible for ensuring that the users, owners, and operators of the BPS comply with NERC Reliability Standards.

NERC and the Regional Entities develop and enforce Reliability Standards to accomplish their collective mission by ensuring reliability for the Bulk Electric System (“BES”) and assessing reliability and adequacy of the BPS. NERC Reliability Standards are developed using a results-based approach that focuses on performance, risk management, and Registered Entity (or “entity”) capabilities. Reliability Standards obligations apply to entities registered with NERC pursuant to the Rules of Procedure (“ROP”).¹⁴ Once registered, such entities are subject to Commission-approved Reliability Standards. This includes entities that the Commission considers transmission

¹¹ Unless otherwise designated, all capitalized terms shall have the meaning set forth in Appendix 2 to the NERC ROP or the NERC Glossary of terms, available at https://www.nerc.com/AboutNERC/RulesOfProcedure/Appendix%20%20eff%2020240627_signed.pdf and https://www.nerc.com/pa/stand/glossary%20of%20terms/glossary_of_terms.pdf.

¹² Section 215(a)(2). *See also* Section 215(c) (providing the ERO certification criteria). *See also* Pub. L. 109–58, title XII, §1211(b), Aug. 8, 2005, 119 Stat. 946 (clarifying, “[t]he Electric Reliability Organization... and any regional entity delegated enforcement authority... are not departments, agencies, or instrumentalities of the United States Government.”).

¹³ 18 C.F.R. § 39.8; *N. Am. Elec. Reliability Corp.*, 173 FERC ¶ 61,277 (2020) (conditionally approving revised regional delegation agreements to be effective January 1, 2021 and directing compliance filing), *order on compliance*, *N. Am. Elec. Reliability Corp.*, Docket No. RR20-5-001 (Aug. 31, 2021) (delegated letter order). *See also* Pro Forma Regional Delegation Agreement, [https://www.nerc.com/AboutNERC/RDAs/Pro%20Forma_RDA_2021_FERC_Revisions\(CLEAN\).pdf](https://www.nerc.com/AboutNERC/RDAs/Pro%20Forma_RDA_2021_FERC_Revisions(CLEAN).pdf).

¹⁴ *See* NERC ROP at Section 500 and Appendices 5A and 5B, <https://www.nerc.com/AboutNERC/Pages/Rules-of-Procedure.aspx>.

providers¹⁵ and so will be affected by the Commission’s proposed rule mandating DLRs. The DLR ANOPR and underlying proceedings recognize reliability issues associated with transmission line ratings and examine potential impacts to Reliability Standards with implementation of DLRs.

IV. COMMENTS

The Commission states that it proposes to require DLR under the *pro forma* OATT to improve the accuracy of transmission line ratings and “congestion reporting practices.”¹⁶ The Commission would also require that transmission line ratings account for both solar heating and wind conditions.¹⁷ Specifically, the Commission states these proposals are needed because “without these reforms, [the Commission] believe[s] that transmission line ratings may be insufficiently accurate and may unjustly and unreasonably increase the cost to reliably serve wholesale electric customers by forgoing many potential benefits.”¹⁸ The proposed rule would require that transmission providers:

- “reflect the impacts of solar heating by considering the sun’s position and forecastable cloud cover” in all transmission line ratings;¹⁹
- “reflect forecasts of wind conditions – wind speed and wind direction – on certain transmission lines;”²⁰
- “ensure transparency in the development and implementation of [DLRs];”²¹ and

¹⁵ “Transmission provider” is an organization defined in FERC Order 888 and *pro forma* OATT is “the public utility (or its Designated Agent) that owns, controls, or operates facilities used for the transmission of electric energy in interstate commerce and provides transmission service under the Tariff.” The NERC Functional Model does not include “transmission provider” as a single function; rather, the Commission-defined “transmission provider” has actually bundled several functions within the NERC Functional Model that can today be performed by separate organizations, all of which fall under the rubric of “transmission provider” and who, therefore, would be subject to the Commission’s proposed rule to mandate that transmission providers incorporate DLRs into their transmission line ratings. See NERC’s Functional Model FAQ, https://www.nerc.com/pa/Stand/Pages/Functional_Model_FAQ.aspx.

¹⁶ ANOPR at PP 1, 3.

¹⁷ ANOPR at PP 1, 54.

¹⁸ ANOPR at P 54.

¹⁹ ANOPR at P 3.

²⁰ *Id.*

²¹ ANOPR at Summary.

- “enhance data reporting practices related to congestion in non-regional transmission organization/independent system operator regions to identify candidate transmission lines for the requirement to reflect forecasts of wind conditions.”²²

In the ANOPR, the Commission emphasizes that DLRs can “provide reliability benefits by increasing the transfer capability on the existing transmission system in a way that provides system operators with more options during stressed system conditions.”²³ The Commission also recognizes that mandating DLRs could potentially affect reliability, and seeks comment on the applicability of NERC Reliability Standards FAC-008 (Facility Ratings) and PRC-023 (Transmission Relay Loadability) “to accommodate a potential wind requirement”²⁴ and whether there should be changes to NERC Critical Infrastructure Protection (“CIP”) Reliability Standards or other industry practices.²⁵

NERC and the Regional Entities appreciate the opportunity to provide comments in this proceeding. NERC previously provided comments on the reliability and security aspects of DLRs. As discussed therein, NERC reiterates that system reliability depends on proper coordination of transmission line ratings, and urges consideration of the reliability impacts of any market-related reforms adopted subsequent to the ANOPR.

In addition, NERC recognizes that relay settings have played significant roles in blackouts on the North American grid and led to implementation of NERC Reliability Standard PRC-023 on relay loadability.²⁶ As detailed below, while the ERO Enterprise has determined that Reliability Standard FAC-008 and the applicable CIP Reliability Standards would accommodate DLR implementation if required under the *pro forma* OATT, Reliability Standard PRC-023 might

²²

Id.

²³

ANOPR at P 76.

²⁴

ANOPR at P 112.

²⁵

See ANOPR at P 113.

²⁶

Gugel Remarks on TLR at 2019 Technical Conference at 1-2.

benefit from closer examination. The ERO Enterprise also highlights certain other considerations associated with DLRs and their potential relationship to BPS reliability.

A. Reliability Standard FAC-008 is Designed and Implemented in a Manner that could Encompass the Use of DLRs in Transmission Line Ratings

The Commission seeks comment on the impact of FAC-008 and PRC-023 to the wind requirement and “whether any changes would need to be made to these or other NERC Reliability Standards to accommodate a potential wind requirement.”²⁷ (*See infra* Section IV.C. for discussion of PRC-023.) Consistent with earlier NERC Comments on the Notice of Inquiry (“NOI”),²⁸ the ERO Enterprise continues to find that Reliability Standard FAC-008 already accommodates DLRs if used by transmission providers under revised OATTs.

The method delineated by applicable entities for determining Facility Ratings per FAC-008 would incorporate DLRs and therefore fall within the scope of NERC’s Compliance Monitoring and Enforcement Program (“CMEP”) as appropriate. FAC-008 requires entities to have a documented methodology (Facility Rating methodology or “FRM”) and to have Facility Ratings “consistent with the associated Facility Ratings methodology.”²⁹ Thus, FAC-008 relies on entities having a documented methodology, regardless as to whether it includes static ratings or DLRs.³⁰ When CMEP staff perform verification between Facility Ratings and Real-time models, they ask entities to provide evidence that Facility Ratings observed are consistent with the calculation

²⁷ ANOPR at P 112.

²⁸ Comments on NOI at 7 (stating that “[t]he mandatory use of DLRs by transmission providers would fit within the existing FAC-008 framework, provided the methodologies used by the Transmission Owners also incorporate DLR. DLR data would be considered real-time operating data subject to other currently effective Reliability Standards.”).

²⁹ FAC-008-5 Requirements 1-3, 6.

³⁰ At the March 22, 2023 Standards Committee meeting, the ERO Enterprise staff examined whether FAC-008 should be modified to incorporate DLRs and, after internal and stakeholder discussions, determined no modification was necessary for the reasons set forth above. NERC Standards Committee, Meeting Minutes (agenda item 8, FAC-008 Reliability Improvements Standard Authorization Request), <https://www.nerc.com/comm/SC/Agenda%20Highlights%20and%20Minutes/March%20Meeting%20Minutes%20-%20Approved%20April%2019,%202023.pdf>.

method as described in the entity’s Facility Ratings Methodology.³¹ As a result, the standard is flexible enough to incorporate DLRs into Facility Ratings requirements because if FERC requires DLRs, the transmission provider should include DLRs as part of their FAC-008-required methodology. ERO Enterprise staff would conduct compliance monitoring and enforcement of FAC-008 according to the documented methodology as required by the standard (which would be anticipated to include DLRs for transmission line ratings if directed by FERC under revisions to the OATT).³² While FAC-008 does not require updating, CMEP staff would need to account for the complexity that incorporating wind conditions and cloud cover would add to auditing an entity’s Facility Ratings Methodology if the methodology incorporates DLRs.

B. CIP Reliability Standards Accommodate DLRs Due to CIP-002 Impact Rating Criteria

The Commission inquires whether changes to CIP Reliability Standards are necessary to “ensure the physical security and cybersecurity of the sensors, data communications, transmission line rating and forecasting systems, and energy management systems (‘EMS’) improvements used to implement the proposed wind requirement.”³³ In particular, the Commission questions whether additional controls will be necessary to validate operation of sensors used for DLRs and whether entities should have a “backup or other means to acquire the data or establish transmission line ratings if the DLR systems are compromised or not functioning properly.”³⁴ The ERO Enterprise

³¹ See ERO Enterprise CMEP Practice Guide on Evaluation of Facility Ratings and System Operating Limits (June 17, 2020) at 3 (stating that “[w]hen performing verification between Facility Ratings and Real-time models using DLR, CMEP staff should ask the entity to provide evidence that Facility Ratings observed are consistent with the calculation method as described in the entities FRM”), [https://www.nerc.com/pa/comp/guidance/CMEPPpracticeGuidesDL/ERO Enterprise CMEP Practice Guide_Evaluation of Facility Ratings and System Operating Limits.pdf](https://www.nerc.com/pa/comp/guidance/CMEPPpracticeGuidesDL/ERO%20Enterprise%20CMEP%20Practice%20Guide_Evaluation%20of%20Facility%20Ratings%20and%20System%20Operating%20Limits.pdf).

³² To the extent that an entity’s Facility Ratings Methodology does not incorporate DLRs, this would not, on its own, constitute a noncompliance with the current version of FAC-008.

³³ ANOPR at P 113.

³⁴ ANOPR at P 113.

finds, consistent with prior NERC comments,³⁵ that CIP Reliability Standards already accommodate DLRs if used by transmission providers under revised OATTs because CIP Reliability Standards require evaluation of all systems and related assets to determine the necessary application of CIP Standards to DLR systems and assets.

DLR systems depend on measurements from a number of distributed devices. Implementing such systems could increase the threat landscape for malicious attacks or increase the reliability risk associated with the failure of sensor devices or communications systems, so these devices and components must be cyber secure. Existing NERC CIP Reliability Standards will provide protections to help mitigate cyber risks associated with DLR equipment. NERC registered entities must perform an evaluation of their DLR elements to determine the appropriate CIP Reliability Standard applicability based on CIP-002 impact rating criteria (high/medium/low). CIP Reliability Standards that apply to BES Cyber Assets would (1) require identification of DLR elements (e.g., sensors used to implement DLRs) that should be subject to cyber- and physical security protections included in the suite of CIP Reliability Standards, (2) require application of the appropriate cybersecurity and related physical security protections, and (3) therefore fall within compliance monitoring and enforcement as appropriate.

CIP-002-5.1a requires Responsible Entities to appropriately identify “BES Cyber Systems and their associated BES Cyber Assets” to determine applicability of other protections under CIP Reliability Standards. As a result, if DLR assets are determined to meet the CIP-002³⁶ definition

³⁵ See Comments on NOI at 6 (stating that “NERC registered entities must perform an evaluation of their DLR elements to determine the appropriate CIP Reliability Standard applicability based on CIP-002 impact rating criteria (high/medium/low).”)

³⁶ See CIP-002, currently effective version CIP-002-5.1a – Cyber Security – BES Cyber System Categorization (stating that “[i]n order to identify BES Cyber Systems, Responsible Entities determine whether the BES Cyber Systems perform or support any BES reliability function according to those reliability tasks identified for their reliability function and the corresponding functional entity’s responsibilities as defined in its relationships with other functional entities in the NERC Functional Model. This ensures that the initial scope for consideration

of BES Cyber Systems or an associated BES Cyber Asset, they will be subject to the same cyber and physical security requirements as other BES Cyber Systems and associated BES Cyber Assets based on CIP-002 impact rating criteria (high/medium/low).³⁷

ERO Enterprise staff would conduct compliance monitoring and enforcement of CIP Reliability Standards according to the CIP-002 impact rating criteria (which would be anticipated to include DLR assets if DLR is directed by FERC under revisions to the OATT). Therefore, appropriate controls to validate DLR assets (including sensors) will be required, as will backup or alternative means for acquiring similar data if DLR system(s) are compromised or functioning improperly.³⁸ However, as noted in the Comments on the NOI, the ERO Enterprise emphasizes that applying “CIP Reliability Standards to new assets [required for DLR systems] would increase the volume of assets requiring CIP protections, which may require additional compliance resources from NERC registered entities and the ERO Enterprise alike.”³⁹

includes only those BES Cyber Systems and their associated BES Cyber Assets that perform or support the reliable operation of the BES. The definition of BES Cyber Asset provides the basis for this scoping.”). Available at, [https://www.nerc.com/pa/Stand/Reliability Standards/CIP-002-5.1a.pdf](https://www.nerc.com/pa/Stand/Reliability%20Standards/CIP-002-5.1a.pdf). *See also* ERO comments on the DLR NOI at 6 (emphasizing that entities “must perform an evaluation of their DLR elements to determine the appropriate CIP Reliability Standard applicability based on CIP-002 impact rating criteria (high/medium/low).”).

³⁷ Elements operated at 100kV or higher are categorized as a BES Cyber Asset and will be subject to the suite of CIP Reliability Standards. CIP-002-5.1a applies the suite of CIP Reliability Standards to all BES Cyber Assets. *See* Background and Attachment 1 of CIP-002-5.1a (noting that BES Cyber Systems not included for categorization as High Impact or Medium Impact “default to be low impact”). *See also* Glossary of Terms Used in NERC Reliability Standards definitions of (1) BES (“all Transmission Elements operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher”) and (2) BES Cyber Asset (an asset “that, if rendered unavailable, degraded, or misused would, within 15 minutes of its required operation, misoperation, or non-operation, adversely impact one or more Facilities, systems, or equipment, which, if destroyed, degraded or otherwise rendered unavailable when needed, would affect the Reliable Operation of the [BES]”), [https://www.nerc.com/pa/Stand/Glossary of Terms/Glossary_of_Terms.pdf](https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf).

³⁸ *See* CIP-009, currently effective version CIP-009-6 – Cyber Security – Recovery Plans for BES Cyber Systems (addressing requirements to “recover reliability functions performed by BES Cyber Systems by specifying recovery plan requirements in support of continued stability, operability, and reliability of the BES.”). Available at [https://www.nerc.com/pa/Stand/Reliability Standards/CIP-009-6.pdf](https://www.nerc.com/pa/Stand/Reliability%20Standards/CIP-009-6.pdf).

³⁹ *See* Comments on NOI at 6.

C. Reliability Standard PRC-023 May Require Modification to Encompass the Use of DLRs in Determining Protective Relay Settings

The Commission also asks for comment on the applicability of PRC-023 “to the wind requirement and whether any changes would need to be made” to this Reliability Standard.⁴⁰ The ERO Enterprise suggests that PRC-023 may require modifications to accommodate DLRs if used by transmission providers under revised OATTs. If mandatory DLRs would effectively require maximizing what transmission lines can carry (*i.e.*, max out loadability), entities would need to adjust the relays accordingly in order to fully utilize the actual transfer capability. Under the currently effective PRC-023 Standard, it is possible for a transmission line rating to be lower than the rating when using DLR.

PRC-023 requires that applicable entities have relay settings (1) set to reliably detect and protect the electrical network from fault conditions, and (2) set so as not to limit transmission loadability. PRC-023 Requirement R1 sets the criteria for determining relay settings. Most entities use one of two criteria:

- PRC-023, R1, Criteria 1: (most entities use this criteria) – Set transmission line relays so that they do not operate at or below 150% of the **highest seasonal** Facility Rating of a circuit, for the available defined load during nearest 4 hours (expressed in amperes); or
- PRC-023, R1, Criteria 2: Set transmission line relays so that they do not operate at or below 115% of the highest seasonal 15-minute Facility Rating of a circuit (expressed in amperes).

PRC-023’s loadability requirement is centered on the highest seasonal Facility Rating, which is a static rating (assuming conservative seasonal worst-case conditions). If the OATT requires transmission providers to adjust relays to maximize load of transmission lines in real time based on the use of DLRs, there may be a gap where there may be more transmission capacity on

⁴⁰ ANOPR at P 112.

a line than the relays allow for under certain conditions. This could present a challenge if there is a possibility of having more capacity on a line than the relay setting allows and there is a perceived need for the additional capacity as calculated using DLR to be utilized. It would also be important to examine what might occur if the rating using DLR is less than the static rating.

As previously highlighted by NERC, another limitation for line ratings is in PRC-023's testing criteria that entities use "to determine if a circuit could ever get highly loaded enough under various operating conditions as to require mitigation of relay loadability limitations for that circuit. Similar testing criteria would be appropriate for any transmission circuit being considered for application of dynamic line ratings; some circuits cannot be physically loaded anywhere near their thermal limitations under any foreseeable operating conditions because of terminal equipment limitations."⁴¹

Additionally, entities must consider stability limitations in addition to thermal limitations. Simply increasing a Facility Rating as a way of implementing DLRs may not provide the ANOPR's indicated aim of increased capacity, and it may not provide reliability benefits. Relay settings are a factor in calculating System Operating Limits ("SOL").⁴² If the Commission requires DLRs and it has a downstream consequence of maximizing potential transmission loadability, overloading as understood now could occur. Therefore, the ERO Enterprise would recommend evaluating Reliability Standard PRC-023 for modifications to mitigate overloading in non-emergency situations in such a way that prevents cascading outages.

⁴¹ Gugel Remarks on TLR at 2019 Technical Conference at 2.

⁴² FAC-011-4 - System Operating Limits Methodology for the Operations Horizon, Requirement R3.3 (requiring Reliability Coordinators to "include in its SOL methodology the method for Transmission Operators to determine the System Voltage Limits to be used in operations. The method shall... [r]equire that System Voltage Limits are greater than or equal to in-service BES relay settings for undervoltage load shedding systems and Undervoltage Load Shedding Programs"). Available at [https://www.nerc.com/pa/Stand/Reliability Standards/FAC-011-4.pdf](https://www.nerc.com/pa/Stand/Reliability%20Standards/FAC-011-4.pdf).

Should the Commission issue a rule mandating DLRs, the ERO Enterprise recommends that the ERO Enterprise considers developing modifications to PRC-023 to accommodate DLRs.⁴³ Additionally, ERO Enterprise staff would conduct compliance monitoring and enforcement of PRC-023 according to the criteria chosen by Entities to determine relay settings.

D. Additional Reliability Related Considerations Pertaining to DLRs

Consistent with ERO Comments on the NOI and with NERC Comments on DLRs in earlier proceedings,⁴⁴ the ERO Enterprise finds that there are additional issues that need to be considered and addressed to implement DLRs reliably. This is because the reliability of the grid depends upon the proper coordination of transmission line ratings,⁴⁵ and mandating the use of DLRs introduces “complexities for reliable operations” involving increased variability or new resources and variable ratings.⁴⁶

DLRs will require system operators to account for the added complexity, especially during system event conditions because system operators will be working with tighter margins and shorter timeframes for action. Entities will need to:

- ensure robust data exchange capabilities (*i.e.*, communications systems to transmit real-time data to and between grid operators) so that operators and coordinators are aware of the DLRs on adjacent transmission systems and potential parallel flow impacts during events and that there is appropriate coordination on tie lines among impacted operators and coordinators in real-time operation, as well as ensure that transmission of this data is performed within the context of the NERC CIP Reliability Standards;⁴⁷

⁴³ This needs to be prioritized in addition to other considerations and needs.

⁴⁴ See Comments on NOI; Comments on TLR NOPR; Gugel Remarks on TLR at 2019 Technical Conference.

⁴⁵ See Comments on TLR NOPR at 4.

⁴⁶ Comments on NOI at 4, 8.

⁴⁷ See Comments on NOI at 11 (stating that “[t]he challenges for coordinating DLR across seams could be more significant than [ambient-adjusted ratings (‘AAR’)] given the added variables; enhanced coordination and communication is necessary”); see also Gugel Remarks on TLR at 2019 Technical Conference (stating that how “[DLRs] are communicated in real time operations is a priority consideration. Reliability coordinators, transmission operators, and the operational study groups supporting them must have ratings on adjacent transmission systems to understand interactions including parallel flow impacts” and that “[t]hese communication and control channels will need to be cyber secure”).

- ensure the accuracy of DLR data, as the ability to use DLRs depends on the reliability, accuracy, and precision of the sensors and weather data;⁴⁸
- seamlessly integrate DLRs with existing grid management and control system; and
- ensure accurate SOLs. As capacity increases as a result of DLRs, resolving system criteria challenges and first contingency violations become critical to maintaining overall grid reliability.⁴⁹ This may require more robust EMS models and real-time contingency analysis tools to avoid an unstudied state with respect to transfer capability.⁵⁰ This is aligned with NERC Standard TOP-001-6, which requires Transmission Operators (“TOPs”) to mitigate SOL exceedances and FAC-011-4, which requires factoring relay settings into calculating SOL.

System Planners should consider how DLR implementation should be incorporated into operational planning and long-term planning studies.⁵¹ Since line ratings are highly dependent on specific ambient conditions, it may be difficult to predict for future timeframes with the accuracy needed to determine the expected line ratings for SOLs and planning time-horizon transfer capability.⁵² Additionally, the ERO Enterprise encourages FERC to consider the effectiveness of

⁴⁸ See Comments on NOI at 10 (stating that “[t]echnologies used to implement DLRs need to be tested, parameters adjusted, and settings verified on a regular basis to ensure proper implementation. There should be consideration of proper calibration, testing, and maintenance of DLR equipment”).

⁴⁹ See Comments on NOI at 11 (stating that “Entities may need to consider the potential impacts of higher ratings generated by DLR on relays and special protection systems/remedial action schemes, and make adjustments where necessary” and that “Entities should consider the need for mechanisms to reduce power flows quickly when a DLR drops suddenly and dramatically due to changes in wind conditions”).

⁵⁰ See Comments on NOI at 9 (stating that “[t]here may be times when adjacent, parallel extra high voltage lines simultaneously receive DLRs that, when combined, yield a transfer capability that has never been previously studied or result in non-typical flows and flow patterns. Voltage and angular stability limits may be exceeded and will need to be reassessed with DLRs”).

⁵¹ See Comments on NOI at 12 (stating that “[p]lanners should consider the extent to which DLR or resulting effects from implementation (e.g., changing use patterns) should be incorporated into longer-term planning studies”).

⁵² See Gugel Remarks on TLR at 2019 Technical Conference (stating that “there are limitations on how dynamic ratings can be used in planning studies, since they are highly dependent on specific ambient conditions that are not available at all hours. This will also impact how [SOLs] can be established, and how transfer capability can be calculated”); see also Comments on NOI at 9 and 10 (stating that with DLR implementation entities may “need to consider impacts to modeling and study assumptions to generate operating plans for the system operator, and review existing operating procedures and real-time System Operating Limit/Interconnection Reliability Operating Limit calculations” and that “[o]perators should also consider that wind speeds are not as predictable as temperatures; attention needs to be paid to assumptions, so that there are not mismatches between overly optimistic operating plan assumptions and DLRs experienced in real-time”); See also *Managing Transmission Line Ratings*, Order No. 881, 177 FERC ¶ 61,179, at P 131 (2021), https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20211216-3112 (stating in response to NERC’s concern about reconciling AARs used for planning and operations functions that “AARs used in near-term operations will deviate from those transmission line ratings used in various planning

Order No. 881 mandating ambient-adjusted ratings (“AARs”) in transmission line ratings and potential lessons learned, and the overall costs of deployment, including additional infrastructure construction that may be required and the changes entities will need to make to incorporate DLRs, before issuing a final order mandating DLRs.

V. CONCLUSION

The ERO Enterprise appreciates this opportunity to support the Commission’s consideration of the potential security and reliability considerations associated with requiring the use of DLRs under the *pro forma* OATT. In response to the Commission’s request for input, the ERO Enterprise believes that Reliability Standard FAC-008 and the CIP Reliability Standards do not require modification to incorporate DLRs. At the same time, the ERO Enterprise finds that it may be worthwhile to consider modifications to Reliability Standard PRC-023 to incorporate DLRs reliably. Last, the ERO Enterprise highlights additional reliability-related insights associated with the implementation of DLR for the Commission’s consideration.

Respectfully submitted,

functions. As transmission providers progress closer in time to a given interval, near-term ambient air temperature forecasts will necessarily be updated. These updates will impact [total transfer capability (TTC)], and, as a result, [available transfer capability (ATC)] and system operating limits” and to confirm that Order No. 881 “does not advocate for operating the transmission system beyond the system operating limits and established facility ratings”).

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