UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Reliability Standards for Frequency and Voltage Protection Setting and Ride-Through for Inverter-Based Resources	)))	Docket No. RM25-3-000

COMMENTS OF THE NEW YORK STATE RELIABILITY COUNCIL IN RESPONSE TO PROPOSED NERC STANDARD PRC-029-1

On November 4, 2024, the North American Electric Reliability Corporation ("NERC") filed a Petition for the Approval of Proposed Reliability Standards PRC-029-1 and PRC-024-4 ("Petition") with the Federal Energy Regulatory Commission ("Commission").[1] The Petition aims to enhance the reliability of the Bulk-Power System ("BPS") by establishing voltage and frequency ride-through criteria for Inverter-Based Resources ("IBR"). Specifically, proposed Reliability Standard PRC-029-1 addresses IBR ride-through performance by setting capability and performance-based requirements. It aims to ensure that IBRs remain connected during disturbances and return to pre-disturbance levels post-event. On December 19, 2024, the Commission issued a Notice of Proposed Rulemaking seeking comments on NERC's proposed reliability standards.[2] The New York State Reliability Council, L.L.C. ("NYSRC") hereby submits the following comments for consideration by the Commission in response to the Notice.[3]

I. Introduction

The NYSRC is a not-for-profit entity, organized in 1999 and authorized by the Commission, whose mission is to promote and preserve the reliability of electric service on the New York State Power System by developing, maintaining, and, from time-to-time, updating the

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1 Docket No. RM25-3-000, *Petition of the North American Electric Reliability Corporation for Approval of Proposed Reliability Standards PRC-029-1 and PRC-024-4* (filed Nov. 4, 2024).

2 Docket No. RM25-3-000, *Notice of Proposed Rule Making* (issued Dec. 19, 2024).

3 The NYSRC's comments are technical in nature. The NYSRC is available and eager to assist in explaining these comments in more detail, as necessary.

Reliability Rules which shall be complied with by the New York Independent System Operator, Inc. ("NYISO") and all entities engaging in electric transmission, ancillary services, energy and power transactions on the New York State Power System. The NYSRC conducts its mission with no intent to advantage or disadvantage any Market Participant's commercial interests. Its sole focus is maintaining the reliability of the bulk electric system in the New York Control Area. The NYSRC's comments are limited to proposed Reliability Standard PRC-029-1.

II. Comments

Legacy IBR plants that are in service at the effective date of PRC-029-1 are eligible for a conditional exception from the near-absolute ride-through requirements of this standard, but only for documented hardware limitations. IBR power plants in service after this date, including plants already in procurement or construction, are not eligible for any exceptions to the standard. There are no limitations to the PRC-029-1 ride-through requirement to recover to full pre-event power as a function of the ability of the bulk power system to accept this power injection at the location of the IBR plant's point of interconnection. PRC-029-1 provides no consideration for reliability entities to grant exceptions to ride-through requirements for situations where IBR plant ride-through is demonstrably detrimental to bulk power system security.

Low-voltage ride-through events are typically the result of bulk power system short-circuit faults. The protective response of the power system is to isolate the system from such faults by opening circuit breakers that remove the faulted transmission line, cable, transformer, or generator from the system. This removal of a circuit element inherently weakens the transmission system. In more severe contingency situations, multiple system components may be removed. Generation plant interconnection studies evaluate system performance for such contingency events based on defined planning Design Criteria. Generally, power plants are not granted interconnection if Design Criteria contingencies result in unacceptable system performance. There is a very small

but finite possibility of transmission contingency events exceeding the Design Criteria. In certain cases, Extreme Criteria contingencies can weaken the transmission system at the location of a power plant and lead to instability. Assessment of system performance under Extreme Criteria contingencies is intended to assess the robustness of the system and are not design requirements. These stability constraints apply to IBR plants as well as conventional synchronous generator plants.

It is clearly impractical to require ride-through and full power injection recovery of power plants, including IBR plants, without bounds defined by the post-event status and configuration of the transmission system to which the plant is connected. Carried to the limit, the ride-through requirements, as stated in PRC-029-1, literally require an IBR plant to ride-through an event, which removes all transmission connections to the plant as well as for Extreme Criteria contingencies.

In contrast to the absolute ride-through requirements of PRC-029-1, IEEE Standard 2800-2022 states:

> Subject to regulatory requirements, the TS owner/TS operator, in coordination with the IBR owner, should specify reasonable TS operating and network conditions for which the requirements of this standard shall apply at the time of interconnection and, as practical, over the foreseeable future considering anticipated system changes.

The NYSRC's Reliability Rule B.5 adopts IEEE Standard 2800-2022 in part, including ride-through requirements, with further specification that the standard's dynamic performance requirements for ride-through are required only for contingencies within the established NYSRC Planning Design Criteria.

The NYSRC respectfully submits that the Commission should remand the proposed PRC-029-1 to NERC for revision in accordance with the comments proposed herein. Such action should permit Regional Entities to determine and specify the system conditions and contingency levels to which ride-through requirements shall apply. Significantly, NERC PRC-029-1 places Regional Entities in a quandary regarding whether to base enforcement on a practical interpretation of the

standard's intent or literal application of the standard as written. In several instances, lack of sufficient detail in the crafting of the standard's language results in ambiguities, impractical requirements, or contradictions with the apparent intent of the rule and makes it difficult to meet the requirements as written. Examples of these instances are as follows:

- PRC-029-1 Attachment 1 Note 6 exempts IBR from meeting voltage ride-through requirements when the frequency is outside of the frequency ride-through requirements specified in Attachment 2. There is no similar exemption, however, from meeting frequency ride-through requirements when voltage ride-through is not required because system voltages are more severe than the stated thresholds. Taken literally, this omission effectively requires IBR to ride through any voltage magnitude, including zero, for an unlimited duration. The NYSRC submits that this language in PRC-029-1 should be modified so that the enforcers of such requirement will need to otherwise apply their own judgement of reasonableness over the literal requirements of the standard.
- On the surface, it appears that the voltage ride-through requirements specified in PRC-029-1 are harmonized with those in IEEE 2800-2022. The voltage thresholds and durations in Attachment 1 of PRC-029-1 and Tables 11 and 12 of IEEE 2800-2022 are identical. However, the way that the different standards apply the thresholds and durations differs significantly in the case of voltage events, for which the voltage is not constant during the disturbance. This is frequently the case in practical system fault scenarios.[4] As specified in IEEE 2800-2022, the time at which the voltage is depressed

[4] For example, infeed to a fault on a line near an IBR plant may be interrupted first at the line end near the IBR point of interconnection, while not yet cleared at the remote end. Later, the remote end circuit breakers are opened but the voltage may not immediately recover to the normal range because of the Fault Induced Delayed Voltage Recovery ("FIDVR") phenomenon. Thus, voltage at the IBR plant Point of Measure may be severely depressed for

to a greater extent than within the bounds of a particular voltage range is credited toward the ride-through requirement for that range. For example, if voltage at the Point of Measure of a solar plant is depressed to 0.6 per unit for 2.4 seconds, followed by 0.7 seconds at 0.8 p.u., IEEE 2800-2022 allows that plant to trip. However, PRC-029-1 states that "[i]f the voltage is continuously varying over time, it is necessary to add the duration within each band of Tables 1 and 2 over any 10 second time period." This means that the example IBR plant must ride through this scenario, even to the extent of sustaining operation for 3.0 additional seconds of severely disturbed voltage after already enduring 2.4 seconds of even more severely depressed voltage.

In addition to creating a much more severe requirement, this different application of the same voltage ride-through tables is likely to cause much confusion in the industry and inconsistent application of enforcement because the differences in how the ride-through tables are applied by the respective standards is not obvious without very careful reading of the supporting text. These important differences are not readily apparent, and the increased stringency of PRC-029-1 may be far greater than necessary to protect system security for realistic transmission system disturbance scenarios. Accordingly, the NYSRC recommends that PRC-029-1 be modified to harmonize with the way that IEEE 2800-2022 applies the voltage ride-through threshold and duration ranges.

- Requirement 2.1.1 of PRC-029-1 mandates IBR to continue to deliver the pre-disturbance level of Real Power for any disturbance for which voltages remain in the continuous operating range. This is physically impossible to achieve. Any voltage step will invariably cause a brief transient variation of active power. Maintenance of

a period followed by a less severe depression, and then followed by a slow ramp-up to the normal range.

absolutely constant power, even for small voltage steps remaining within the continuous operating range, requires infinite IBR control bandwidth (*i.e.*, instantaneous perfect response) which is not realizable. The small well-damped transient power variations caused by such a small voltage change are not of material impact to the bulk power system. The NYSRC submits that this requirement should be modified to reflect practical IBR control capabilities with a suitable allowance for reasonable minor and short-duration power variations initiated by abrupt voltage changes.

- Inverters are sensitive to severe phase voltage imbalance, as are conventional synchronous generators. Unlike IEEE 2800-2022, which provides exceptions to requirements for IBR to maintain continuous operation during severe and sustained voltage imbalance, PRC-029-1 provides no such exception. It is theoretically possible, although highly unlikely, for voltages within the range of continuous operation magnitudes specified in PRC-029-1 to have voltage imbalance as great as a 9.8% negative phase sequence component.[5] Synchronous generators are designed, according to IEEE Std C50.12 and IEEE Std C50.13, only to withstand continuous exposure of no more than 10% current imbalance, which equates in practice to approximately 2.5% voltage imbalance. Conventional synchronous generation plants invariably have protections to trip them from service for imbalance exceeding safe thresholds. In contrast, strict application of PRC-029-1 would require IBR to be designed to withstand continuously four times as much imbalance. Not only is this inconsistent treatment of generation technologies, but there is no benefit to bulk system security to require IBR to remain in service when conventional generation would already be taken out of

[5] Negative sequence component is a measure of phase voltage or current imbalance, representing a component that has an apparent reverse direction of phase rotation, *i.e.*, A-C-B instead of A-B-C.

service. Furthermore, situations creating such long-duration voltage imbalance at the transmission level are extremely rare and any such conditions would be local in nature and not simultaneously affecting a number of IBR plants. Accordingly, the NYSRC recommends that PRC-029-1 be modified to provide reasonable exceptions to continuous operating requirements based on phase voltage imbalance.

- Although PRC-029-1 is a ride-through requirement standard, it also effectively establishes steady-state reactive power capability requirements. Requirement 2.1.2 states that when voltages are within the Continuous Operation Range (90% to 105% of nominal voltage), the IBR shall deliver up to its "Reactive Power limit." This limit is not defined in this standard but a possible interpretation is that the reactive power capability available at the nominal voltage magnitude must be consistently available over this entire voltage range. Providing the full reactive power injection capability while the Point of Measure is at the maximum of this voltage range, and the full reactive power absorption at the minimum voltage, will unnecessarily drive IBR hardware requirements for capabilities devoid of practical value. IEEE 2800-2022 addresses this by reducing the required reactive injection near the maximum voltage and reducing the required reactive absorption near the minimum continuous operating voltage. While it could be interpreted that such graded requirements are the "Reactive Power limit" specified in Requirement 2.1.2, this requirement is ambiguous and subject to a range of interpretations. According, the NYSRC submits that this requirement should be modified to define exactly what the "Reactive Power limit" shall be, and furthermore, any such requirement should be voltage dependent as to not require unnecessary capability requirements at the voltage extremes.
- PRC-029-1's Requirement R2 and Attachment 1 Note 5 define the voltages to which ride-through requirements to be the "high-side of the main power transformer." It is

obvious that the intent is for this point of applicability to be on the transmission system side of this transformer. In the New York Control Area, there is at least one offshore wind IBR plant having its dedicated project-owned transmission tie line at a higher nominal voltage than the nominal voltage of the transmission system at the point of interconnection. In this case, specification at the "high-side" is opposite of the apparent intent of the standard. Accordingly, this language should be modified to adequately apply the intent of the standard to such situations.

III. Conclusion

The NYSRC is in support of the general requirements of the proposed PRC-029-1 and appreciates the opportunity to provide comments on NERC's Petition. As set forth herein, proposed Reliability Standard PRC-029-1 addresses IBR ride-through performance by setting capability and performance-based requirements to ensure that IBRs remain connected during disturbances and return to pre-disturbance levels post-event. The language as proposed is not sufficient to ensure that PRC-029-1 can be implemented as intended. Further clarifications are necessary. Accordingly, the NYSRC respectfully requests that the Commission remand the proposed PRC-029-1 to NERC for revision in accordance with the comments proposed herein.

Dated: March 18, 2025
Albany, New York

Respectfully Submitted,

/s/ Amanda De Vito Trinsey

Amanda De Vito Trinsey, Esq.
COUCH WHITE, LLP
Counsel for the New York State Reliability Council, L.L.C.
540 Broadway, P.O. Box 22222
Albany, New York 12201-2222
adevito@couchwhite.com

CERTIFICATE OF SERVICE

I hereby certify that the foregoing Comments of the New York State Reliability Council, L.L.C. has been served upon each person designated on the official service list compiled by the Secretary in this proceeding in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure.

Dated: March 18, 2025
Albany, New York

/s/ Amanda De Vito Trinsey
Amanda De Vito Trinsey