



Amid the rapidly increasing pace of nonsynchronous resources being added to the electric grid, the Federal Energy Regulatory Commission (FERC or the Commission) issued Order No. 901 on October 19, 2023.

This order directs the North American Electric Reliability Corporation (NERC) to develop new or modified Reliability Standards that address reliability gaps related to inverter-based resources (IBRs), which can include solar, wind, fuel cell, and battery storage resources. Order No. 901 identifies gaps in four key areas:

1. Data sharing.
2. Model validation.
3. Planning and operational studies.
4. Performance requirements.

The Commission explained that "at least 12 documented events" on the Bulk-Power System (BPS) showed IBRs "acting unexpectedly and adversely" in response to normally cleared transmission line faults on the BPS, "each highlighting one or more common mode failures of IBRs of various sizes and voltage connection levels." The new and revised NERC Reliability Standards are expected to address these risks.

## **Data Sharing**

**Gaps identified.** Currently, owners and/or operators of registered IBRs, transmission owners that have unregistered IBRs on their systems, or distribution providers that have inverter-based distributed energy resources (IBR-DERs) on their systems are not required to provide planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities with data—including modeling, planning, operations, and disturbance monitoring data—that accurately represents IBRs. FERC concluded that such data is necessary to properly plan for, operate, and analyze IBR performance on the BPS.

**Solution required.** NERC's updated Reliability Standards must require that generator owners, transmission owners, and distribution providers share validated modeling, planning, operations, and disturbance monitoring data for all IBRs with planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities. This data sharing will ensure that these groups have the necessary information to predict the behavior of registered and unregistered IBRs individually and in the aggregate, as well as IBR-DERs in the aggregate, and their impact on the reliable operation of the BPS.

## **Model Validation**

**Gaps identified.** Currently, resource owners are not required to use NERC's standardized, approved component models that are intended to ensure that BPS planners and operators can accurately predict a generation resource's behavior in response to normal and emergency conditions. Rather, resource owners may provide modeling data that is based on a user-defined model (e.g., unique to a specific original equipment manufacturer) instead of an approved and industry-vetted model. FERC found this problematic because it could lead to inaccurate data, as well as the inability of BPS planners and operators to create accurate, systemwide models.

**Solution required.** NERC's updated Reliability Standards must require that all IBR models are comprehensive, validated, and updated in a timely manner. This will enable planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities to adequately predict the behavior of registered and unregistered IBRs individually and in the aggregate, as well as their impacts on the reliable operation of the BPS.

## **Planning and Operational Studies**

**Gaps identified.** Reliability Standard TPL-001-5.1 requires planning coordinators and transmission planners to engage in BPS planning that ensures reliable operations over a broad spectrum of system conditions and following a wide range of probable contingencies such as unexpected failure or outage of various system components. However, this standard does not require planning coordinators and transmission planners to assess the performance and behavior of registered and unregistered IBRs individually and in the aggregate, or IBR-DERs in the aggregate, during normal and contingency conditions for the reliable operation of the BPS. As a result, the current standards do not mitigate the IBR reliability risks because the IBR issues are not properly detected by models and studies. NERC has explained that a need exists to understand the extent of inverter performance risks and modeling deficiencies, as well as to gather necessary data for the currently installed fleet.

**Solution required.** NERC's updated Reliability Standards must require that planning and operational studies include validated IBR models to assess the reliability impacts of registered and unregistered IBRs individually and in the aggregate, as well as IBR-DERs in the aggregate, on the reliable operation of the BPS. Furthermore, the Reliability Standards must require that planning and operational studies assess the impacts of all IBRs within and across planning and operational boundaries for normal operations and contingency event conditions.

## **Performance Requirements**

**Gaps identified.** Many IBRs respond differently to stress on the grid than synchronous generation resources, such as thermal power plants, do. For example, some IBRs trip offline during disturbances that cause frequency or voltage fluctuations, rather than remaining connected and providing frequency or voltage support (e.g., "ride through"), thus potentially exacerbating system disturbances. Moreover, IBRs do not automatically reconnect after a disturbance is resolved. The current performance requirements in NERC's Reliability Standards do not account for these different responses that registered IBRs and synchronous generation resources have during normal and contingency conditions. Nor do they require all generation resources that momentarily cease operation following a system disturbance to return to pre-disturbance output levels or require that all generation resources provide voltage support within established ranges.

**Solution required.** NERC's and revised Reliability Standards must ensure that registered IBRs provide frequency and voltage support during frequency and voltage excursions in a manner necessary to contribute toward the overall system needs for essential reliability services. The Reliability Standards must establish clear and reliable technical limits and capabilities for registered IBRs to ensure that all registered IBRs are operated in a predictable and reliable manner during normal operations and contingency event conditions. The Reliability Standards must require that the operational aspects of registered IBRs contribute towards meeting the overall system needs for essential reliability services. The Reliability Standards must include post-disturbance ramp rates and phase lock loop synchronization requirements for registered IBRs.

Notably, FERC's order aligns with NERC's efforts and those of other groups, such as the Institute of Electric and Electronics Engineers, to extend reliability standards to IBRs and smaller resources, like IBR-DERs, that are not currently covered by the Reliability Standards.

## **Timeline**

NERC must submit an informational filing within 90 days of the issuance of Order No. 901, including a detailed and comprehensive standards development plan that explains how NERC will prioritize the development of new or modified Reliability Standards to meet the following deadlines:

- **By November 4, 2024**, NERC must submit new or modified Reliability Standards that establish IBR performance requirements, including requirements addressing frequency and voltage ride through, post-disturbance ramp rates, phase lock loop synchronization, and other known causes of IBR tripping or momentary cessation. NERC must also submit new or modified Reliability Standards that require disturbance monitoring data sharing and post-event performance validation for registered IBRs.
- **By November 4, 2025**, NERC must submit new or modified Reliability Standards addressing the interrelated directives concerning: (1) data sharing for registered IBRs, unregistered IBRs, and IBR-DERs in the aggregate; and (2) data and model validation for registered and unregistered IBRs and IBR-DERs in the aggregate.
- **By November 4, 2026**, NERC must submit new or modified Reliability Standards addressing planning and operational studies for registered and unregistered IBRs and IBR-DERs in the aggregate.

Although NERC must submit the new or modified Reliability Standards by the deadlines listed above, FERC is not directing NERC to include implementation dates in its informational filings; the determination of appropriate effective dates will be established through the standards development process. However, FERC directed that all Reliability Standards implemented in accordance with Order No. 901 be implemented by dates that allow an "orderly industry transition" for complying with the new IBR directives by 2030.

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