Reliability Standards to Address Inverter-Based Resources

FERC IBR Order
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FERC Order

- Orders NERC to develop reliability standards to address four reliability standards gaps related to IBRs
  - Data sharing
  - Model validation
  - Planning and operational studies
  - Performance requirements
- Also directs NERC to submit within 90 days an informational detailed, comprehensive standards development plan, not subject to FERC approval, providing that all new or modified Reliability Standards necessary to address the above gaps be submitted to the Local authorities can act sooner by November 4, 2026
  - Authorities Governing Interconnection Requirements (AGIR) can act earlier (i.e. NYSRC)
  - All standards must be effective and enforceable prior to 2030
  - Ensure that Implementation plans sequentially stagger effective and enforceable dates for an orderly transition
- Order applies to new and, with some exemptions, to existing IBRs
- Urgency:
  - According to NERC, the rapid integration of IBRs is “the most significant driver of grid transformation” on the Bulk-Power System
  - Aggregate IBR impact may be greater than the most severe single contingency studied today and can lead to instability, system-wide uncontrolled separation and voltage collapse

NERC Plan (by November 4, 2024)

- NERC to submit new or modified standards that establish IBR **performance requirements**
  - Addressing frequency and voltage ride through
  - Post disturbance ramp rates
  - Phase lock loop synchronization
  - Other known causes of IBR tripping and momentary cessation
- Submit standards that require disturbance monitoring data sharing and post-event performance validation

NERC Plan (by November 4, 2025 and 2026)

For registered IBRs, unregistered IBRs and IBR-DERs in the aggregate, NERC to submit new or modified standards addressing:

- Interrelated directives (2025)
  - **Data sharing**
  - **Data and model validation**
- **Planning and operational studies** (2026)

Existing Reliability Standards Do Not Adequately Address IBR Reliability Risks: Data Sharing

- Current effective reliability standards do not require owners and/or operators of IBRs to provide data that accurately represents their IBRs
  - Such data is necessary to develop accurate system models to properly plan for, operate, and analyze IBR performance on the system
  - Include high speed and high-resolution disturbance monitoring data needed to adequately assess disturbance events and their causes

Existing Reliability Standards Do Not Adequately Address IBR Reliability Risks: Data and Model Validation

- Planners and operators need accurate planning, operations, and interconnection-wide models to ensure the reliable operation of the system
- Generator owners must provide IBR-specific generator data models and parameters
  - Electric component models are needed to build separate generation, transmission and distribution facility models for use in steady state, dynamic and short circuit studies
  - User-defined (proprietary) models are problematic because internal components cannot be viewed and modified: use of approved industry-vetted models are essential
  - Model performance must be verified by IBR owner using real-world data
  - Planners and operators must validate system models and update them to reflect any changes to IBR settings, configurations and ratings
- NERC standards are to require the use of fundamental frequency, generic, IBR library models that accurately reflect the behavior of IBRs during steady estate, short circuit and dynamic conditions
- FERC declined to direct NERC to require the provision of EMT models since such models are not used to build interconnection-wide models used on planning and operations studies
  - FERC noted that NERC has standards in development that include EMT studies and which should be continued

Existing Reliability Standards Do Not Adequately Address IBR Reliability Risks: Planning and Operational Studies

- Planners and operators need accurate planning, operations, and interconnection-wide models to ensure the reliable operation of the system
  - Models compliant with current standards do not contemplate that IBRs can reduce power, trip offline, or enter into momentary cessation, individually or in the aggregate in response to a single fault
  - Models must be verified by comparing study results against operational behavior
  - NERC is directed to develop standards that require planers to include the performance behavior of IBRs in their and neighboring systems in their planning assessments (tripping and momentary cessation conditions) on a comparable basis to existing other generation
  - NERC is directed to consider for standards to include performing planning studies under typical and stressed extreme conditions, for normal and contingency and peak and off-peak cases and for high IBR penetration
  - NERC is directed to require that operational studies (operational panning, real-time monitoring and assessments) include IBR models as well as considering the impact of IBR tripping and momentary cessation, individually or in the aggregate

Existing Reliability Standards do not Adequately Address IBR Reliability Risks: Performance Requirements

- Direct NERC to develop standards that require generator owners of IBRs to use appropriate settings (i.e., inverter, plant controller, and protection) to ride through frequency and voltage system disturbances and that permit IBR tripping only to protect the IBR equipment in scenarios similar to when synchronous generation resources use tripping as protection from internal faults
- Require IBRs to continue to inject current and provide frequency support and prohibit tripping and momentary cessation within the no-trip zone (voltage and frequency ride through, post-disturbance ramp rates, phase lock loop synchronization, and other known causes)
- NERC has the discretion to consider incorporating or referencing other standards, including IEEE 2800-2022

IBRs Present Reliability Risks and Enhancing Opportunities

- IBRs can operate during greater voltage and frequency deviations than synchronous resources
- IBRs can perform with greater precision, speed and control to mitigate system disturbances
- IBRs must be properly configured and programmed to support grid voltage and frequency during normal and abnormal conditions
- IBRs must be accurately modeled and represented in transmission planning and operations models

NYSRC NOPR Comments - February 2, 2023*

- NYSRC supported the NOPR's general requirements with the specific recommendations shown below:
  - Utilization of IEEE Standard 2800-2022 for IBR Plant interconnection studies
  - Establishment of a plant-level model validation process
  - Mandatory requirement of IBR Plant developer to provide verifiable models and data
  - System operators and IBR Plant developers to participate in performance analyses (As-designed interconnection studies, as-built validation studies, operational monitoring & disturbance evaluation)
  - Requested clarification:
    - That existing IBR Plants would be subject to the resulting Order
    - On responsibility for mitigation measures for existing IBR Plants that are non-compliant
- NYSRC was cited 26 times in the resulting Order, singly and in combination with comments from other entities

*https://www.nysrc.org/wp-content/uploads/2023/03/NYSRC-Comments-on-FERC-NOPR-RM22-12-000-FINAL-2-2-23.pdf

Critical Issues and FERC Determination

Critical Issues	FERC Determination
Supports FERC efforts that current standards must be enhanced to address IBR reliability risks	Proceed with final rule
Supports proposed directive regarding disturbance monitoring data	Require registered IBR owners to install disturbance monitoring equipment and provide date to planers and operators to validate models
TOs to collect and share unregistered IBR data and require distribution providers to do so for IBR-DERs in the aggregate	Include in final rule the collection of data that materially affects reliable operation
Require the use of approved industry generic library IBR models instead of user-defined models	Require the use of approved industry generic library IBR models that accurately reflect IBR behavior during steady state, short-circuit and dynamic conditions
Require that planning and operations models be validated and updated so they can identify possible performance issues	NERC is directed to include this requirement

Critical Issues and FERC Determination

Critical Issues	FERC Determination
Require IBRs to use appropriate settings that will ride through system disturbances	NERC is directed to include this requirement
Performance requirements to apply to new and existing IBRs	All performance requirement directives apply to new and existing registered IBRs. NERC is to include limited and documented exemptions to existing IBRs that are unable to modify their protection and control settings
NYSRC asserts that requiring transmission planners and operators to ensure there are mitigation strategies for scenarios where existing IBRs are unable to meet performance requirements would be infeasible, as they would need to plan for and address an event consisting of an unknown number of IBRs disconnecting at any time.	FERC agrees with the NYSRC and modifies the NOPR proposal by directing NERC to develop new or modified standards to mitigate reliability impacts caused by exemptions
Support the proposed directive to address post-disturbance IBR ramp rate interactions and phase lock loop synchronization.	NERC to develop new or modified Reliability Standards that require post-disturbance ramp rates for registered IBRs to be unrestricted and not programmed to artificially interfere with the resource returning to a pre-disturbance output level in a quick and stable manner after a system event