

Consideration of FERC Order 901 Directives

Project 2020-06 Verifications of Models and Data for Generators | August 2025

On October 23, 2023, FERC issued a Final Rule, Order No. 901, directing the North American Electric Reliability Corporation (NERC) to develop new or modified Reliability Standards that address Model Validation and Model Verification.

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
P7.B. “Second, 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 IBRs, unregistered IBRs, and IBR-DERs in the aggregate.”	MOD-026-2	<p>A timeline outlines key milestones to meet the regulatory deadline of November 4, 2025. Completed tasks are listed below:</p> <ol style="list-style-type: none">1. Standards Committee approved Standard Authorization Request (SAR) for posting – May 15, 20242. SAR posted for comment - May 17 – June 24, 20243. 26-day initial formal comment period with ballot – ending June 22, 2025 <p>Model Validation is being completed in revisions to MOD-026 for registered IBRs in Requirements R2 and R3. The unregistered IBRs and IBR-DERs in the aggregate aspects of directive P7 are being fulfilled in Project 2021-01 with revisions to MOD-033 in Requirement R1, Part 1.1 and Part 1.2.</p>

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
<p>P85. “Pursuant to section 215(d)(5) of the FPA, we adopt the NOPR proposal to direct NERC to include in the new or modified Reliability Standards technical criteria to require registered IBR generator owners to install disturbance monitoring equipment at their buses and elements, to require registered IBR generator owners to provide disturbance monitoring data to Bulk-Power System planners and operators for analyzing disturbances on the Bulk-Power System, and to require Bulk Power System planners and operators to validate registered IBR models using disturbance monitoring data from installed registered IBR generator owners’ disturbance monitoring equipment.”</p>	<p>MOD-026-2 MOD-033-3</p>	<p>MOD-026-2 requires the GO(s) or TO(s) to Model Validate individual registered IBR facilities and equipment. The TP reviews and approves Model Validation of individual registered IBRs facilities and equipment by assessing GO(s) or TO(s) Model Validation results against the TP and PC’s joint requirements. Therefore, the TP and PC are part of the Model Validation process for registered IBRs.</p> <p>In MOD-033 System Model Validation activities, the operation data (such as from state estimator) is used to initialize the system model to the state just before the disturbance. The disturbance is recreated in the model, and the system model response is compared to the field event. Registered IBR models are validated (i.e. undergo Model Validation activities) when PC(s) compare disturbance monitoring data (quantities such as Real Power, Reactive Power, and Voltage) obtained from the GO(s) or TO(s) with the same quantities from the simulated System model of the same disturbance; this is done under MOD-033 activities. Discrepancies can be addressed through either MOD-026-2 Requirement R6 which requires GO to address model deficiencies identified and communicated by Transmission Planners, or MOD-032 Requirement R3, Part 3.1.</p> <p>Each TP is either their own PC or within PC’s footprint such that system Model Validation by PC(s) does not present a reliability gap.</p>

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
		<p>MOD-033 requires Planning Coordinators to preform Model Validation system models, which include registered and unregistered IBR models.</p> <p>MOD-033 provides a mechanism for Planning Coordinators to obtain disturbance data as part of "System behavior data" either through Reliability Coordinators and Transmission Operators, or through Reliability Standards PRC-028 and PRC-002.</p> <p>Generator Owners are required to provide disturbance data to Planning Coordinator as per Reliability Standard PRC-028.</p> <p>Transmission Owners are required to provide disturbance data to Planning Coordinators as per Reliability Standard PRC-002.</p>
<p>P126. "With respect to NERC's recommendation for model benchmarking, we direct NERC to determine through its standards development process whether the development of benchmark cases to test model performance and a subsequent report comparing model performance are needed and at what periodicity."</p>	MOD-026-2	<p>The revised standard documents Model Verification in Requirement R3, Part 3.2. It requires demonstration that the configurable, site-specific parameters of the submitted facility model(s) accurately represent the parameters of the in-service equipment, for those parameters that the Generator Owner or Transmission Owner can confirm. The timeframe for this verification is specified in Attachment 2.</p> <p>NERC, through the drafting team (DT) for project 2020-06, determined that the development of specific benchmark cases were not needed to test model performance. Benchmark cases</p>

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
		<p>only test facilities within the modeling space and does not determine model accuracy against real-world behavior which is the main purpose of MOD-026.</p> <p>Model performance tests are addressed by performance of the Model Validation process which includes validation tests performed under MOD-026 Requirements R2 and R3 and system Model Validation from system events under MOD-033 Requirement R1.</p> <p>Under Requirement R2, the model performance is benchmarked against measured performance of the facility in the field from staged testing, and in Requirement R3, the model performance is benchmarked against OEM testing. Further, under Requirement R3, the EMT model is benchmarked against the positive sequence model of Requirement R2 in order to ensure consistency between simulation domains.</p> <p>Lastly, should any deficiencies be identified by the Transmission Planner (TP) during this process, Requirements R5 and R6 allow for the TP to request corrections be made to the models.</p>
P140. “Pursuant to section 215(d)(5) of the FPA, we adopt the NOPR proposal and direct NERC to develop new or modified Reliability Standards that require the generator owners of registered IBRs, transmission owners that have unregistered	MOD-026-2 MOD-033-3	MOD-026-1 and MOD-027-1 are being combined into MOD-026-2. The revised standard requires Generator Owners of registered IBRs to provide models that represent the dynamic behavior of these IBRs at a sufficient level of fidelity for system planners, as outlined in Requirements R2 and R3. Requirement R2, Attachment 1, Table

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
<p>IBRs on their system, and distribution providers that have IBR-DERs on their system to provide models that represent the dynamic behavior of these IBRs at a sufficient level of fidelity to provide to Bulk-Power System planners and operators to perform valid interconnection-wide, planning, and operational studies on a basis comparable to synchronous generation resources.”</p>		<p>1.2 demonstrates the sufficient IBR model level of fidelity requirement. Additionally, Attachment 1, Tables 1.1 and 1.2 show that the model level of fidelity and verification processes in Requirement R2 are the same for both IBR generators and synchronous generation. This ensures comparability to synchronous generation resources within the directive language.</p> <p>MOD-026-2, Requirement R1, Part 1.1, mandates the use of MOD-032-2 model specifications in the development of the verified model. MOD-032-2 covers the IBR model submission process for performing valid interconnection-wide planning and operational studies on a basis comparable to synchronous generation resources.</p> <p>MOD-026-2 focuses solely on registered IBR models and their validation and verification requirements, while MOD-032-2 addresses models detailed requirements for unregistered IBRs and DERs, as specified in Requirement R2 and Attachment 1.</p> <p>The MOD-033-3 draft standard addresses the Model Validation for unregistered IBRs and IBR Distributed Energy Resources (DER) in the aggregate through system-level Model Validation.</p>
<p>P141. “We also direct NERC to require the generator owners of registered IBRs and the transmission owners that have unregistered IBRs</p>	MOD-026-2	<p>The revised standard requires, in Requirements R2 and R3, Generator Owners of registered IBRs to submit verified dynamic models where the configurable, site-specific parameters of the IBR</p>

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
on their system to provide to the Bulk-Power System planners and operators (e.g., planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities) dynamic models that accurately represent the dynamic performance of registered and unregistered IBRs, including momentary cessation and/or tripping, and all ride through behavior.”		<p>model(s) are representative of the parameters of the in-service equipment of the facility. In addition, the submitted IBR models are required to be validated using staged tests or a measured system disturbance.</p> <p>Additionally, the revised standard, in Requirement R3, requires generator owners to submit hardware test result(s) demonstrating a comparison of the IBR unit response and the unit's EMT model response for large signal disturbances. The IBR unit EMT model is to be used to build the facility EMT model. This will ensure that the IBR facility model accurately represents the dynamic performance of the facility including its ride-through behavior.</p> <p>Furthermore, the standard requires generator owners to include all relevant protection schemes in their facility’s IBR model, per Attachment 1, Table 1.2.</p> <p>Models for unregistered IBR’s are considered in MOD-033-3 (Requirement R1.)</p>
P143. “While we decline to include this level of detail in the directive to NERC, we nonetheless direct NERC to establish a standard uniform model verification process. A uniform model verification process will ensure that all entities use the same set of minimum requirements to verify that all generation resource (i.e., synchronous and non-	MOD-026-2	MOD-026-1 and MOD-027-1 are being combined into MOD-026-2 which will include a standard uniform Model Verification process for applicable dynamic models. Generator Owners (GOs) and Transmission Owners (TOs) under MOD-026 Requirement R2, Parts 2.1, 2.2, and 2.3 are to perform certain verification steps and must repeat those processes as required by Requirement 2, Part 2.4. To address the IBR modelling behavior during large signal

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
synchronous) models are complete and that the models accurately represent the dynamic behavior of all generation resources at a sufficient level of fidelity for Bulk-Power system planners and operators to perform valid interconnection-wide, planning, and operational studies.”		<p>disturbances, EMT Model Verification requirement is added for IBRs with Requirement R3, Part 3.2.</p> <p>The Model Verification processes in Requirement R2 are the same for both IBRs or synchronous machines. This is to fulfill the same set of minimum requirements to verify all generating resource types within the directive language.</p>
P143. “Therefore, we direct NERC to define the model verification process and to require consistency among the model verification processes for existing Reliability Standards (e.g., FAC-002, MOD-026, and MOD-027) and any new or modified Reliability Standards.”	MOD-026-2	The Model Verification process in MOD-026-2 follows the same structure of MOD-026-1 and MOD-027-1 and adds the necessary Model Verification process for commissioned IBRs dynamic models. Along with this standard development, the draft team defined the terms “Model Verification” and “Model Validation” to clarify the model expectations in this standard and to be used in any new or modified Reliability Standards. The DT has addressed Model Verification within the MOD-026/27 standards since these address facilities that have completed commissioning.
P149. “Moreover, although the Reliability Standards will apply to a different (albeit overlapping) set of entities than Order No. 2023, we believe consistency is needed between the complimentary proceedings and therefore direct NERC to include in the new or modified Reliability Standards a similar model verification process timeline consistent with FERC Order No. 2023 modeling deadline requirements.”	MOD-026-2	The DT ensured that the MOD-026-2 draft remains aligned with Order 2023 and timelines will not conflict with Order 2023. The MOD-026-2 draft focuses on post commissioning of a facility. MOD-026-2 does not conflict with Order 2023 since Order 2023 focuses on the interconnection process, and MOD-026-2 is only effective after the interconnection process has been completed. The DT will review this directive if the DT reviews and revises FAC-002.

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
P161. “Further, we direct NERC to include in the new or modified Reliability Standards a requirement for generator owners, transmission owners, and distribution providers to regularly update and communicate the verified data and models of registered IBRs, unregistered IBRs, and IBR-DERs by comparing their resulting models against actual operational behavior to achieve and maintain necessary modeling accuracy for inclusion of these resources in the system models.”	MOD-026-2	MOD-026-2 fulfills this directive in Attachment 1, Table 1.2. This table refers to stage testing of Generator Owner and Transmission Owner facilities to complete the Model Validation process. This stage testing of the facilities while they are connected to the grid captures actual operational behavior. MOD-026-2 also fulfills this directive in the Periodicity table in Attachment 2, line item 4. This line item talks about GOs and TOs completing Model revalidation when a frequency excursion occurs or within a 12-month time period. This would cause the GO and TO to resubmit updated models to the TP/PC for use in their system models, as the model needs to be regularly updated from a change or within a time period.
P226. “Further, we believe that there is a need to have all of the directed Reliability Standards effective and enforceable well in advance of 2030 and direct NERC to ensure that the associated implementation plans sequentially stagger the effective and enforceable dates to ensure an orderly industry transition for complying with the IBR directives in this final rule prior to that date.”	MOD-026-2	The DT has aligned the Implementation Plan to have the MOD-026-2 Implementation Plan and all Requirements language to be in full effect before the 2030 date specified in FERC Order No. 901, along with being aligned between projects that have an effect with achieving this date, Project 2022-02 and the MOD-032-2 standard being fully implemented.