

Consideration of FERC Order 901 Directives

Milestone 3: Project 2022-02 Uniform Modeling Framework for IBR

April 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 aggregation of data, parameters, and estimation methods to provide the Transmission Planner (TP) and Transmission Operator (TOP) with the estimate values, explanation for limitations on data availability, and the method used for all estimations. This project has a FERC regulatory deadline of November 4, 2025. Below provides the directives from FERC Order 901 along with the drafting team's (DT's) consideration of the directives.

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
P7. "... 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..."	IRO-010 MOD-032 TOP-003	A timeline has been drafted to meet the regulatory deadline of November 4, 2025. Completed tasks listed below. <ul style="list-style-type: none">• An industry workshop completed January 14-17, 2025. (outreach)• Many virtual drafting team meetings completed weekly from January – March 2025. (publicly posted)• In-person DT completed February 11-13, 2025. (publicly posted)• Industry Webinar March 6, 2025. (publicly posted)• DT outreach with trade groups and entities March 3 – 14, 2025• Industry comment and ballot period April 17 – May 16, 2025. (publicly posted)

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
		<ul style="list-style-type: none"> A second industry workshop scheduled for June 3-5, 2025. (publicly posted)
<p>P76. “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 registered IBR generator owners and operators to provide IBR-specific modeling data and parameters (e.g., steady-state, dynamic, and short circuit modeling information, and control settings for momentary cessation and ramp rates) that accurately represent the registered IBRs to their planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities that are responsible for planning and operating the Bulk-Power System. As several commenters indicate, ensuring the sharing of appropriate IBR modeling data is critical to create and maintain the models used in reliability studies, and in turn to ensure that Bulk-Power System transmission planners or operators are able to plan for, operate, and reliably integrate IBRs onto the Bulk-Power System.”</p>	<p>IRO-010 MOD-032 TOP-003</p>	<p>Theme: IBR/Generator Owner to provide specific modeling data.</p> <p>IRO-010 and TOP-003:</p> <ul style="list-style-type: none"> While TOP-003 and IRO-010 allow any data to be requested, the DT felt it was important to add “IBR-specific data and parameters” specifically to IRO-010-6 Requirements R1 subpart 1.1 and TOP-003-8 Requirement R1 subpart 1.1 and Requirement R2 subpart 2.1 to ensure it is clear what data may be specifically requested to address FERC Order 901. In addition, IBR encompasses IBR-DER, and this information could be requested. The team considered adding a new subpart at the end of Requirement 1 (e.g., 1.6), but after reviewing Requirement language, the team determined the data and information lists within the existing subparts were the appropriate place to capture IBR-specific modeling data and parameters. <p>MOD-032:</p> <ul style="list-style-type: none"> Generator Owner and Generator Operator – The DT decided to put the responsibility on just the Generator Owner and did not add Generator Operator as a functional entity to the applicability section. If data is needed from the Generator Operator, then the Generator Owner can reach out to the Generator Operator for necessary data via contractual obligations, etc. The team does

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
		<p>not find it necessary to require two applicable entities when one oversees the other.</p> <ul style="list-style-type: none"> The team modified attachment 1 to include Generation and storage units, removed photovoltaic system (covered within IBR) and added Inverter-Based Resources. The wind turbine was updated for clarity that it is for Type 1 and Type 2.
<p>P77. “With regard to AEU and ACP/SEIA’s comments that the Commission direct NERC to specify data sharing requirements from transmission owners to generator owners and operators, we believe that this request may already be addressed through each transmission planner’s existing processes. For example, the New York Independent System Operator (NYISO) and CAISO both have processes for obtaining such data after demonstrating a need for the specific information requested and that the required information protection and non-disclosure agreements are signed. Nevertheless, to support accurate modeling and performance, we direct NERC to consider during its standards development process AEU and ACP/SEIA’s suggested data sharing requirements when developing the framework, criteria, and necessary data exchange requirements to meet the registered IBR data sharing directive.”</p> <p>P74. “AEU and ACP/SEIA ask that, in addition to data provision requirements for generator owners and operators, the Commission direct NERC to specify data sharing requirements from transmission owners to generator owners. For example, AEU explains that</p>	MOD-032	<p>Theme: Information going from Transmission Owner to Generator Owner/Generator Operator (consider):</p> <p>MOD-032</p> <ul style="list-style-type: none"> There is no specific requirement within MOD-032 that requires Transmission Owners to share data with the Generator Owners and Generator Operators. However, Transmission Planners and Planning coordinators have a framework where requests for data can be sent for inclusion for the interconnection-wide models. At this time, the team does not see a need for a requirement to be drafted requiring Transmission Owners to provide data to Generator Owners and Generator operators. The team believes this is most appropriately addressed through processes that exist outside of NERC reliability standards and concurs with the suggestion in P77 that these processes are already in place.

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
generator owners and operators also require data from transmission owners to support accurate modeling and performance, e.g., short circuit data, grid data for offshore wind, information on other power electronic devices around the IBR plant, and voltage harmonics. AEU adds that putting requirements on transmission owners would be consistent with revisions being developed for NERC's Modeling, Data, and Analysis (MOD) Reliability Standards."		
P78. "Commenters raised general concerns that mandating specific modeling and data submissions would reduce the flexibility and discretion of transmission planners and operators to identify the information they need. We find that, given the need for IBRs to operate in a predictable and reliable manner to ensure the reliable operation of the Bulk-Power System, it is necessary to establish uniform, minimum categories or types of data that must be provided so that Bulk-Power System planners and operators can predict the behavior of all IBRs. As discussed in more detail in section IV.C of this final rule, we are also directing NERC to develop new or modified Reliability Standards that require the use of approved industry IBR models that accurately reflect the behavior of all IBRs during steady state, short-circuit, and dynamic conditions."	MOD-032 TOP-003 IRO-010	<p>Theme: Individual use of approved IBR models. (ERO Approved Criteria for Acceptable Models)</p> <p>Applicability: Transmission Planner and Transmission Operator</p> <p>MOD-032</p> <ul style="list-style-type: none"> An ERO Approved Criteria for Acceptable Models document has been developed. The Criteria for Acceptable Models defines the minimum criteria for model usability and quality for model submissions under the MOD-032, TOP-003, and IRO-010 Reliability Standards, as well as other Reliability Standards that may be revised from time to time to incorporate these Criteria. IBR has been included in Attachment 1 of MOD-032 under steady state (item 3), dynamics (item 7), and short circuit ensuring that entities are clear that IBR needs to be addressed as required per FERC Order 901. IBR was added to the TOP and IRO standards to clarify obligations when this specific data is requested.

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
<p>P86. “As a general matter, we agree with ACP/SEIA regarding the need to balance the burden to generator owners of collecting and providing data collected by disturbance monitoring equipment with the benefit of that data to reliability. Thus, in developing the directed data collection requirements, we direct NERC to consider the burdens of generators collecting and providing data, while assuring that Bulk-Power System operators and planners have the data they need for accurate disturbance monitoring and analysis. Likewise, regarding CAISO’s request that the Commission direct NERC to consider requiring registered IBRs to provide additional data, we agree that such data collections may be warranted, and direct NERC to consider through its standards development process whether additional IBR data points (e.g., telemetry collections or other automated platform integrations) are needed to further enhance real-time visibility of Bulk-Power System operations.”</p>	<p>TOP-003 IRO-010</p>	<p>Theme: Disturbance and monitoring (Consider) (real-time operations) Applicability: Generator Owner TOP-003/IRO-010</p> <ul style="list-style-type: none"> TOP-003 and IRO-010 Reliability Standards are already structured in an open way so that any type of data needed can be requested at any time. In addition, transmission of information from the plant level is generally dealt with via interconnection agreements and does not rise to the level of a requirement being needed at this time. Lastly, PRC-028 PMU devices must be installed for every IBR installation. These additional monitoring devices will allow additional data requests related to those devices if the applicable entities would find that useful.
<p>P102. “Pursuant to section 215(d)(5) of the FPA, we adopt the NOPR proposal, with modification. Specifically, as proposed in the NOPR, we direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that require: (1) transmission owners to provide to Bulk-Power System planners and operators modeling data and parameters for unregistered IBRs in their transmission owner areas that, individually or in the aggregate, materially affect the reliable operation of the Bulk-Power System and (2) distribution providers to provide to Bulk-Power System</p>	<p>MOD-032 IRO-010 TOP-003</p>	<p>Theme: 1) TO provide data for unregistered IBR and 2) DPs provided data for IBR-DER Applicability: Transmission Owner and Distribution Provider</p> <ul style="list-style-type: none"> The DT added IBRs (including unregistered-IBRs) and DER (including IBR-DER) to Attachment 1. After a good bit of discussion, it was determined to add that the respective functional entity can estimate, should there be limitations of availability of data. In addition, the DT did not know how to interpret material affect and therefore, left it up to the Planning Coordinator and each of its Transmission Planners to review,

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
planners and operators modeling data and parameters for IBR-DERs in the aggregate in their distribution provider areas where the IBR-DERs in the aggregate materially affect the reliable operation of the Bulk-Power System.”		<p>consider, and determine all unregistered IBR that would be material impacted.</p> <ul style="list-style-type: none"> The IRO-010 and TOP-003 language already there to address the IBRs.
<p>P104. “Recognizing that there may be instances in which transmission owners are unable to gather adequate unregistered IBR modeling data and parameters to create and maintain unregistered IBR models in their transmission owner areas, we modify the NOPR proposal and direct NERC to develop new or modified Reliability Standards that require each transmission owner, if unable to gather accurate unregistered IBR data or unable to gather unregistered IBR data at all, to provide instead to the Bulk-Power System planners and operators in their areas: (1) an estimate of the unregistered IBR modeling data and parameters, (2) an explanation of the limitations of the availability of data, (3) an explanation of the limitations of any data provided by unregistered IBRs, and (4) the method used for estimation. We believe that this directive appropriately balances commenters’ concerns about data accessibility and burden with the established need for transmission owners to provide unregistered IBR modeling data and parameters to Bulk-Power System planners and operators in their transmission owner area. We recognize that estimated modeling data and parameters are approximations of actual modeling data and parameters. We further acknowledge that there is some degree of error in</p>	<p>MOD-032 IRO-010 TOP-003</p>	<p>Theme 1: 1) Estimation, if not able to get data from unregistered IBRs, 2) an explanation of the limitations of the availability of data, 3) explanation of the limitations of any data provided by unregistered IBRs, and 4) method for estimation. (directive)</p> <p>Theme 2: Implement a process or mechanism by which Transmission Owners would receive modeling data and parameters. (consider)</p> <p>Applicability: TO</p> <ul style="list-style-type: none"> The DT added a Requirement R2 Part 2.1 allowing the functional entity to use the method of estimation should it find itself in a place unable to gather unregistered IBR data or DER data. However, it must include an explanation of the limitations of the availability of data, an explanation of the limitations of any data provided for unregistered IBRs or DERs, and the method used for estimation. The DT discussed implementing a process or mechanism by which Transmission Owners would receive modeling data and parameters in depth. It was determined that if an entity is unable to gather data from unregistered IBRs, then it is better to leave open for Transmission Owner and Distribution Provider to acquire data how they see fit. This is something that entities can determine in the planning process.

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
estimated modeling data and parameters. However, on balance we believe that requiring such estimates with explanation of any limitations is an improvement from not having any data at all; and that even estimates will increase the overall adequacy of models and improve the reliability of the Bulk-Power System. To support this data collection, we further direct NERC to consider commenters suggestions to implement a process or mechanism by which transmission owners would receive modeling data and parameters.		<ul style="list-style-type: none"> IRO-010 and TOP-003 language already there to address the IBRs.
P105. “We also recognize that there may be instances where distribution providers are similarly unable to gather adequate modeling data and parameters from IBR-DERs. Accordingly, to account for instances in which distribution providers are unable to gather adequate modeling data and parameters of IBR-DERs to create and maintain IBR-DER models, we modify the NOPR proposal and direct NERC to develop new or modified Reliability Standards that require that each distribution provider, if unable to gather accurate IBR-DERs data in the aggregate or unable to gather IBR-DERs data in the aggregate at all, provide instead to the Bulk-Power System planners and operators in their areas: (1) an estimate of the modeling data and parameters of IBR-DERs in the aggregate, (2) an explanation of the limitations of the availability of data, (3) an explanation of the limitations of the data provided by IBR-DERs, and (4) the method used for estimation. In support of above, we further direct NERC to consider commenters’ suggestions to	MOD-032 IRO-010 TOP-003	<p>Theme 1: 1) an estimate of the modeling data and parameters of IBR-DERs in the aggregate, (2) an explanation of the limitations of the availability of data, (3) an explanation of the limitations of the data provided by IBR-DERs, and (4) the method used for estimation. (Directive)</p> <p>Theme 2: consider commenters’ suggestions to implement a process or mechanism by which distribution providers would receive modeling data and parameters. (Consider)</p> <p>Applicability: Distribution Provider</p> <p>The DT added a new Requirement R2 Part 2.1 that if the responsible entity is unable to gather unregistered IBR data or DER data and provide it to the Transmission Planner and Planning Coordinator, as specified in the data requirements and reporting procedures developed under Requirement R1, the responsible entity shall provide an estimate of the modeling data and parameters and include an explanation of the limitations of the availability of data, an explanation of the limitations of any data provided for unregistered IBRs or DERs, and the method used for estimation.</p>

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
implement a process or mechanism by which distribution providers would receive modeling data and parameters.”		The DT discussed the possible mechanism by which Distribution Providers would receive modeling data and parameters. The team did not feel this rose to the level of a requirement as the Distribution Provider can ask for the modeling data and parameters from the respective entity.
P106. “Finally, as noted by commenters, we recognize that there may be instances where IBR-DERs are connected to an entity that does not meet the criteria for registration with NERC as a distribution provider. For those areas with IBR-DERs that in the aggregate materially affect the reliable operation of the Bulk-Power System but do not have an associated registered distribution provider, we direct NERC to determine the appropriate registered entity responsible for providing data of IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, or, when unable to gather such accurate IBR-DERs data, to provide instead to the Bulk-Power System planners and operators in their areas: (1) an estimate of the modeling data and parameters of IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, (2) an explanation of the limitations of the availability of data, (3) an explanation of the limitations of any data provided by the IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, and (4) the method used for estimation.”	MOD-032 IRO-010 TOP-003	Theme: Who is the responsibility entity when no registered DP of IBR-DER (1) an estimate of the modeling data and parameters of IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, (2) an explanation of the limitations of the availability of data, (3) an explanation of the limitations of any data provided by the IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, and (4) the method used for estimation. <ul style="list-style-type: none"> Upon a decent amount of conversation, the DT determined that if there is no registered Distribution Provider, then the next best entity would be a Transmission Owner. The DT created a footnote stating: “The DP is the typical responsible entity for collecting and providing data for DER connected to its system either directly or through an unregistered Distribution Provider (i.e., not included on the NERC Compliance Registry) with no other registered entity systems between the DER connection point and the DP’s system. The Transmission Owner is the typical responsible entity for collecting and providing data for DER where there is no associated registered Distribution Provider between the DER connection point and the TO’s system.”
P108. “Regarding CAISO’s concern regarding the potential “compliance trap” where planners and operators rely on third-party data and IRC’s request that the final rule specify the data to be submitted by	MOD-032 IRO-010 TOP-003	Theme: minimum categories or types of data that must be provided to transmission planners, transmission operators, transmission owners, and distribution providers that are necessary to predict the behavior of all

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
all IBRs (i.e., registered IBRs, unregistered IBRs, and IBR-DERs in the aggregate) and transmission devices using similar technologies, we direct NERC to determine through its standards development process the minimum categories or types of data that must be provided to transmission planners, transmission operators, transmission owners, and distribution providers necessary to predict the behavior of all IBRs and to ensure that compliance obligations are clear. As discussed in more detail in section IV.C of this final rule, we are also directing NERC to develop new or modified Reliability Standards that require the use of approved industry IBR models that accurately reflect the behavior of all IBRs during steady state, short-circuit, and dynamic conditions. By contrast, we believe that a directive to task distribution providers as the appropriate registered entity to collect and share the modeling data and parameters of IBR-DERs in the aggregate is preferable to deferring to the stakeholder process as suggested by APS. The distribution provider, as the entity providing and operating the lines between the transmission and distribution systems, is the entity best situated to have access to the data necessary for accurate estimation and, other than Indicated Trade Associations that suggested the piecemeal approach already discussed above, no commenter identified other potential entities as an equally efficient option.”		<p>IBRs and to ensure that compliance obligations are clear (ERO Approved Acceptable Criteria for Models/IEEE1547 ref./modify req./Tech rationale)</p> <p>Applicability: Transmission Planners, Transmission Operators, Transmission Owners, and Distribution Providers</p> <ul style="list-style-type: none"> The ERO Approved Criteria for Acceptable Models ensures that acceptable behavior is being considered for all types of IBRs, and added Requirement R2 Part 2.1 ensures entities have a way to address unregistered IBR and IBR-DER data if it is not available. In addition, the ERO Approved Criteria section from the ERO Approved Criteria for Acceptable Models requires planning models, operational models, and usability requirements demonstrate disturbance behavior of all IBRs during steady state, short-circuit, and dynamic conditions.
P122. “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	MOD-032 IRO-010 TOP-003	Theme: require the use of approved industry generic library IBR models that accurately reflect the behavior of IBRs during steady state, short-

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
use of approved industry generic library IBR models that accurately reflect the behavior of IBRs during steady state, short-circuit, and dynamic conditions when developing planning, operations, and interconnection-wide models. For example, the new or modified Reliability Standards could reference the NERC approved component model list, which defines the models that may be used, and those models that may not be used, for specific types of studies. This approved component model list includes WECC's IBR models. Without requiring the use of approved industry generic library models, Bulk-Power System planners and operators may not be able to create system models that adequately predict IBR behaviors and subsequent impacts on the Bulk-Power System."		<p>circuit, and dynamic conditions when developing planning, operations, and interconnection-wide models.</p> <p>The Criteria for Acceptable Models defines the minimum criteria for model usability and quality for model submissions under the MOD-032, TOP-003, and IRO-010 Reliability Standards, as well as other Reliability Standards that may be revised from time to time to incorporate these Criteria. The applicable standards connect the ERO Approved Criteria for Acceptable Models via requirements language added in each standard. In addition, IBRs have been added to Attachment 1 ensuring this is captured in steady state, short-circuit, and dynamic conditions.</p>
P124. "We direct NERC to determine through its standards development process which nation-wide approved component models are needed to build IBR plant models for steady state, short-circuit, and dynamics studies. We acknowledge NERC's comment that user-defined models may be helpful for specific local reliability studies; however, the user-defined model cannot be used in place of nation-wide approved component models for regional analysis or interconnection-wide analysis because the user-defined model may cause non-convergence and other issues. However, NERC may allow the submission of user-defined models alongside the approved industry generic IBR model. Various entities do not accept user-defined models or only accept them for limited		<p>Theme: nation-wide approved component models are needed to build IBR plant models for steady state, short-circuit, and dynamics studies. (ERO Approved Criteria for Acceptable Models)</p> <p>The ERO Approved Criteria for Acceptable Models will focus on the use and representation of positive sequence phasor domain (PSPD) models in registered entity footprints and in Interconnection-wide models. Interconnection-wide modeling may be different from the models used in specialized studies dedicated to a particular technical objective. NERC's Criteria for Acceptable Models applies to the models where NERC Reliability Standards require its use (generally for planning and operation models where multiple entities share information beyond their portion of the electric system, which includes Interconnection-wide models). Further guidance for</p>

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
instances along with the open-source code which then allows internal model components to be viewed and modified. For example, PJM does not accept user-defined models and requires generic models for model verification in accordance with currently effective Reliability Standards MOD-026-1 and MOD-027-1. NYISO accepts a user-defined model in limited instances but requires either the open-source code (allowing anyone to access the internal model) or dynamic link library data and code files (compiled code that must be decompiled to view the internal model) that must be supplied for existing power flow software and in perpetuity.”		interconnection applications can be found in the <i>NERC Dynamic Model Recommendations</i> .
P125. “Accordingly, we direct NERC to develop new or modified Reliability Standards that require the sole use of nation-wide approved component generic library models for system models to facilitate the exchange of neighboring entities’ respective planning and operation models and to build interconnection-wide models. One example of a way NERC could meet this directive would be to require an equivalent generic library model along with all submissions of user-defined models so that the generic library model can be used when combining neighboring transmission system models and in interconnection-wide models.”	MDO-032 IRO-010 TOP-003	Theme: nation-wide approved component generic library models for system models to facilitate the exchange of neighboring entities’ respective planning and operation models and to build interconnection-wide models. (ERO Approved Criteria for Acceptable Models/Req language) <ul style="list-style-type: none"> Nation-wide approved components via generic library models are addressed via the development of the ERO Approved Criteria for Acceptable Models and the addition of a Requirement Part has been added to MOD-032, TOP-003, and IRO-010. If an entity wants to provide a generic model library, they are allowed to do so, but if equipment-specific models satisfy usability criteria, they are not prohibited.
P141. “We also direct NERC to require the generator owners of registered IBRs and the transmission owners that have unregistered IBRs on their system to provide to the Bulk-Power System planners and operators (e.g.,	MOD-032 IRO-010 TOP-003	Repeat of above. Applicability: GO

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
<p>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. Recognizing that there may be instances in which transmission owners are unable to gather accurate unregistered IBR modeling data and parameters to create and maintain accurate unregistered IBR dynamic models in their transmission owner areas, we modify the NOPR proposal and direct NERC to develop new or modified Reliability Standards that require each transmission owner, if unable to gather accurate unregistered IBR data or unable to gather unregistered IBR data at all, to provide instead to the Bulk-Power System planners and operators in their areas, dynamic models of unregistered IBRs using estimated data in accordance with this final rule's section IV.B.3 data sharing directives. Further, we direct NERC to require distribution providers to provide to the planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities aggregated dynamic models that adequately represent the dynamic performance of IBR-DERs on their systems that in the aggregate have a material impact on the Bulk-Power System, including momentary cessation and/or tripping, and all ride through behavior (e.g., IBR-DERs in the aggregate modeled by interconnection requirements</p>		<ul style="list-style-type: none"> Nation-wide approved components via generic library models are addressed via the development of the ERO Approved Criteria for Acceptable Models and the addition of a Requirement Part has been added to MOD-032, TOP-003, and IRO-010. This approach is aligned with the FERC Order directives while addressing the practical limitations raised by industry at January 15-16 NERC Industry Engagement Workshop MOD-032, Attachment 1 was modified to specifically add that capabilities related to momentary cessation, tripping, and Ride-through, be reflected in the required model data for IBR and DER.

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
<p>performance to represent different steady-state and dynamic behavior). Recognizing that there may be instances in which distribution providers are unable to gather data that accurately represents IBR-DERs in the aggregate, we modify the NOPR proposal and direct NERC to include in the proposed new or modified Reliability Standards a requirement that the distribution provider, if unable to gather data of IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, provide to the Bulk-Power System planners and operators (i.e., the data recipients) a dynamic model using estimated data for IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, in accordance with this final rule's section IV.B.3 data sharing directives. Furthermore, we acknowledge that there may be areas with IBR-DERs in the aggregate that materially impact the reliable operation of the Bulk-Power System but do not have an associated registered distribution provider. Therefore, we modify the NOPR proposal and direct NERC to determine the appropriate registered entity responsible for providing adequate data and parameters of IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, and to identify the registered entities for coordinating, verifying, and keeping up to date the respective dynamic models. Finally, NERC must ensure that the proposed new or modified Reliability Standards account for the dynamic performance of IBR-DERs that</p>		

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
in the aggregate have a material impact on the Bulk-Power System.”		
P146. Accordingly, we direct NERC to develop new or modified Reliability Standards that require the use of the DER_A model or successor models to represent the behaviors of IBR-DERs that in the aggregate have a material impact on the Bulk-Power System at a sufficient level of fidelity for Bulk-Power System planners and operators to create valid planning and operations and interconnection-wide models and to be able to perform respective system studies. For example, the new or modified Reliability Standards could require models of IBR-DERs (i.e., DER_A model) to adequately reflect the steady-state and dynamic aggregate resource performance in both a transmission area and across the interconnection. Additionally, estimated modeling data and parameters of IBR-DERs that in the aggregate (i.e., DER_A model) have a material impact on the Bulk-Power System could be used where measured and collected data is not available. We believe requiring the DER_A model will address NERC’s request for entities to work collaboratively with the state regulators to identify, implement, and perform an effective model validation approach for IBR-DERs in the aggregate as opposed to requiring validated models of IBR-DER in the aggregate that can have a material impact on the reliable operation of the Bulk-Power System.	MOD-032 IRO-010 TOP-003	Theme: IBR-DER Model <ul style="list-style-type: none"> The ERO Approved Criteria for Acceptable Models document requires models that are appropriate for the intended use and meet usability criteria. The currently available DER_A model is sufficient only for positive sequence phasor domain simulations. With the variety of other simulation domains necessary to study IBRs, mandating this model could prevent TPs or PCs performing their studies. This further reinforces the team’s election to not require the use of the DER_A model, but rather a model that achieves specific performance criteria and conforms with MOD-032 edits in Attachment 1 and R1. The team considered referencing the DER_A model specifically, but refrained due to the rapidly evolving nature of models and concerns for the time required to update such a reference in a NERC Standard. Further, challenges with precisely defining and determining what a “successor model” is could potentially create more future reliability risks.
P157. We believe the development of new or modified Reliability Standards is an important corollary to NERC’s	MOD-032 TOP-003	Theme: Who is the responsible entity when no registered DP of IBR-DER. Framework aspect.

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
<p>ongoing effort to identify and register generator owners and operators of IBRs. Although NERC's registration changes will not at this time address IBR-DERs that in the aggregate have a material impact on the Bulk-Power System, we believe APS's concerns regarding system-wide model validation is addressed in NERC's Reliability Guidelines and through the use of the EPRI DER Settings Database. We recognize that some distribution providers may not be able to provide a precise set of modeling data and parameters that accurately represent IBR-DERs in the aggregate. For these situations, NERC has provided a technical means to estimate in aggregating the needed IBR-DER modeling data and parameters (i.e., for the DER_A model) in the IBR-DER Data Collection Guideline. Further, NERC's 2021 Aggregate DER Model Verification Guideline provides transmission planners and planning coordinators with tools and techniques that can be adapted for their specific systems to verify that aggregate DER models (i.e., DER_A models) are a suitable representation of these resources in planning assessments. Furthermore, for those areas with IBR-DERs in the aggregate that materially impact the reliable operation of the Bulk-Power System but do not have an associated registered distribution provider, we modify the NOPR proposal to direct NERC to determine the appropriate registered entity responsible for the data and parameters of IBR-DERs in the aggregate and to establish a process that</p>	<p>IRO-010</p>	<p>Upon a decent amount of conversation, the DT determined that if there is no registered Distribution Provider, then the next best entity would be a Transmission Owner. The DT created a footnote stating: "The DP is the typical responsible entity for collecting and providing data for DER connected to its system either directly or through an unregistered Distribution Provider (i.e., not included on the NERC Compliance Registry) with no other registered entity systems between the DER connection point and the DP's system. The Transmission Owner is the typical responsible entity for collecting and providing data for DER where there is no associated registered Distribution Provider between the DER connection point and the TO's system."</p>

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
requires identified registered entities to coordinate, validate, and keep up to date the system models.		
<p>P161. “Pursuant to section 215(d)(5) of the FPA, we modify the NOPR proposal to provide additional specificity to explain coordination and keep up to date in a timely manner the verified data and models of registered IBRs, unregistered IBRs, and IBR-DERs in the aggregate in the system models. Specifically, we direct NERC to develop new or modified Reliability Standards that require planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities to establish for each interconnection a uniform framework with modeling criteria, a registered modeling designee, and necessary data exchange requirements both between themselves and with the generator owners, transmission owners, and distribution providers to coordinate the creation of transmission planning, operations, and interconnection-wide models (i.e., system models) and the validation of each respective system model. 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</p>	<p>MOD-032 IRO-010 TOP-003</p>	<p>The DT modified MOD-032 to ensure it captures the uniform framework with modeling criteria, a registered modeling designee, and necessary data exchange has been modified via TOP-003 and IRO-010.</p>

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
resources in the system models. For those areas with IBR-DERs in the aggregate that have a material impact on the reliable operation of the Bulk-Power System but do not have an associated registered distribution provider, we modify the NOPR proposal to direct NERC to determine the appropriate registered entity responsible for the models of those IBR-DERs and to determine the registered entities responsible for updating, verifying, and coordinating models for IBR-DERs in the aggregate to meet the system models directives. NERC may implement this directive by modifying Reliability Standards MOD-032-1 and MOD-033-2 or by developing new Reliability Standards to establish requirements mandating an annual process to coordinate, validate, and keep up-to-date the transmission planning, operations, and interconnection-wide models.”		
P226. “Although we are not directing NERC to include implementation dates in its informational filing and are leaving determination of the proposed effective dates to the standards development process, we are concerned that the lack of a time limit for implementation could allow identified issues to remain unresolved for a significant and indefinite period. Therefore, we emphasize that industry has been aware of and alerted to the need to address the impacts of IBRs on the Bulk-Power System since at least 2016. The number of events, NERC Alerts, reports, whitepapers, guidelines, and ongoing standards projects more than demonstrate the need for the expeditious	MOD-032 IRO-010 TOP-003	Theme: sufficient timeframe. The DT felt that four years was an appropriate timeframe for the MOD-032, IRO-010, and TOP-003 standards. However, taking into consideration an implementation plan completion of 2030 per FERC Order 901 required the team to go back to the table and re-think the timeframe knowing that milestone 4 still needs to be completed and allowed implementation plan time. It is understood that based on what is being required via MOD-032, industry would need at least one year to gather data, hold meetings with respective OEM or developers to gather models needed, and then an additional two years to update models based on the ERO Approved Criteria for Acceptable Models document, etc. The team settled on three years implementation plan for MOD-032 and then synced up TOP-003 and IRO-010 with three years

FERC Order 901 Directives		
Directive Language	Standards Impacted	Consideration of Directives
implementation of new or modified Reliability Standards addressing IBR data sharing, data and model validation, planning and operational studies, and performance requirements. Thus, in that light, the Commission will consider the justness and reasonableness of each new or modified Reliability Standard's implementation plan when it is submitted for Commission approval. 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."		implementation plan for the respective functional entities to provide data upon requests.