NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Technical Rationale

NERC Project 2022-02 | MOD-032-2, TOP-003-8, and IRO-010-5
April 2025

MOD-032-2 – Data for Power System Modeling and Analysis

Rationale for Applicability Section

For MOD-032-2, Load-Serving Entity (LSE) was replaced with Distribution Provider (DP) because of the removal of LSEs from the NERC registry criteria. It should be noted that Generator Owner (GO) applicability includes both Category 1 GO and Category 2 GO.

Additionally, the drafting team (DT) reviewed the dual applicability to Planning Authority (PA) and Planning Coordinator and determined that it was most appropriate to reference both terms in the applicability section until NERC registration criteria is updated to use only a single term. The posted "Appendix 5B: Statement of Compliance Registry Criteria," dated June 27, 2024, still uses both terms and, arguably, the PA term is used more prominently. However, the explanation included in MOD-032-1 refers to synchronization between registration criteria and the NERC functional model which is not maintained, was never formally approved, and is only posted as a historical document. Therefore, the DT excluded the explanatory language from MOD-032-2 Applicability Section.

Rationale for Distributed Energy Resource (DER) Definition

The approved standard authorization request (SAR) to revise MOD-032, submitted December 2021, noted that "it may be needed (based on the discretion of the DT) to add a definition for "Distributed Energy Resource (DER)" to the NERC Glossary of Terms" in conjunction with adding DER to Attachment 1, the main purpose of this SAR.[1] The DT found it necessary to draft a DER definition to clarify the usage of this term within the standard. Further, the DT recognized benefits of a Glossary of Terms definition to bring alignment and consistency of term usage across Reliability Standards. Inverter-Based Resources was recently defined in the Glossary of Terms under Project 2020-06 for a similar reason. Finally, the DT was comprised of team members with adequate experience to propose a definition, including members of the NERC SPIDERWG and IEEE 1547 working group.

The DT considered various DER definitions utilized in the industry and discussed in the NERC System Planning Impacts from Distributed Energy Resources Working Group (SPIDERWG) Terms and Definitions Working Document, including the six other definitions described in Appendix D which were not adopted by SPIDERWG. Through this review, the DT determined each of these seven definitions would benefit from refinement to be most suitable for application in MOD-032 and future reliability standards more broadly. It is expected that most reliability standard revision proposals related to DER would originate from the SPIDERWG. Thus, the DT intent was to propose a DER definition that aligned with the SPIDERWG working definition, which explicitly excludes demand response and clarifies what is in scope and out of scope with respect to where DER is connected, rather than the technology type).

[1] SAR title "MOD-032-1 Data for Power System Modeling and Analysis", submitted 12/15/2021. Available at: https://www.nerc.com/pa/Stand/Project202202ModificationstoTPL00151andMOD0321DL/2022-02_MOD-032%20SAR%20SPIDERWG_020122.pdf

The DT considered adopting a voltage threshold to define distribution. However, industry generally differentiates transmission from distribution based on the functional use of the system rather than technical specifications (e.g., voltage, active power, etc.). Setting aside the Bulk Electric System which has a clear NERC definition, defining electric facilities as either transmission or distribution is often based on State law or regulations, ISO/RTO tariff, and/or utility tariffs. The DT anticipates there are no conflicts in how applicable entities define distribution and transmission facilities for a given region, even if those definitions vary from region to region. Additionally, the DT considered an active power threshold to define DER and concluded that DER technologies can vary in size and a threshold might inappropriately exclude technologies that are DER[2]. At the same time, the DT understands that certain applications of DER data, for instance determining when or how a Transmission Planning (TP) or Planning Coordinator (PC) includes DER into planning processes (e.g., TPL-001), may include active power thresholds.

The DT considered defining DER based on the resource not being connected to the Bulk Power System (BPS), similar to the IEEE 1547-2018 definition that uses "not directly connected to the BPS" to describe DER. However, the NERC Glossary definition of BPS does not provide specificity that would enhance a definition of DER beyond an undefined term that is generally used in industry. The phrase "distribution system" was selected to expressly describe the type of electric facilities that would cause a resource to be defined as a DER, if interconnected to those facilities.

The DT recognizes that "distribution system" is not a NERC Glossary term and that the SPIDERWG proposed a definition.[3] The DT reviewed the SPIDERWG definition and concluded that it would not clarify the term DER. The SPIDERWG use of the term "transmission-distribution" interface within a definition of "distribution system" could be considered a circular reference that causes ambiguity. The DT is not proposing a definition of distribution system given any proposed definition could be of limited benefit for clarifying the proposed NERC Glossary term for DER.

Below is a summary of the rationale for the DT departing from each of the seven definitions when proposing a new DER definition.

SPIDERWG definition
After considering the SPIDERWG definition, the DT determined it provided a useful foundation but needed refinement to be suitable for the intended use. Specifically, the SPIDERWG term included transient types of DER power beyond generation and storage, and it included sources of back-up power that would have no potential grid impacts.

The DT chose to refer to generators and storage technologies specifically, rather than use the SPIDERWG language of "source", to exclude devices or resources that only transiently inject real power (e.g., regenerative elevators, transition switches, etc.). DER can use various technologies including synchronous machines, induction machines, and power inverters/converters (i.e., IBR). Different types of DER can

[2] NERC has published a study recommending that a zero MVA threshold be used when collecting DER information: https://www.nerc.com/comm/RSTC_Reliability_Guidelines/DERStudyReport.pdf
[3] SPIDERWG definition of "distribution system": The electrical facilities that are located behind a transmission-distribution transformer that serves multiple end-use customers.
https://www.nerc.com/comm/RSTC/SPIDERWG/SPIDERWG%20Terms%20and%20Definitions%20Working%20Document.pdf

utilize a wide range of energy sources including, but not limited to, natural gas, diesel, hydro, storage, wind, and solar. Additionally, the DT intention was to ensure that the scope included facilities "connected behind the meter of an end use customer" that may export Real Power to the power system or offset Real Power load (e.g., residential solar or commercial rooftop solar). This would exclude technologies such as charging-only electric vehicle (EV) installations and controllable load. To exclude transmission connected load customers that have onsite generation or storage resources, the DER definition clarifies that the behind the meter customer "is supplied from a distribution system".

The DT included the language "in non-isolated parallel operation with the Bulk-Power System" to indicate that distributed energy resources with potential BPS reliability impacts are those that have electrical connectivity to the BPS. Resources that are only operated in islanded or isolated mode (e.g., back-up generation that only operates when a facility is disconnected from the grid), will not have an impact to the BPS and, therefore, are not of interest from a BPS-reliability perspective. The DT understands the concepts of non-isolated parallel operation versus isolated parallel operation to be commonly understood within the industry. The DT intentionally avoided the term "directly connected" to differentiate electrical connectivity from an electrical connection point. The phrase "connected to the distribution system" speaks to electrical connectivity and the subsequent phrase "including those connected behind the meter of an end use customer" clarifies this connectivity includes resources directly connected to a customer system (i.e., behind the meter).

IEEE 1547-2018

The DT reviewed the IEEE 1547-2018 definition and found that it contained elements that could supplement the SPIDERWG definition to address the issues identified above. The DT incorporated the explicit reference to generation and storage aspect of the IEEE definition. Further, the IEEE concept of "capable of exporting active power to an EPS" informed the need for capturing non-isolated, long-term paralleling and the sourcing of Real Power (i.e., active power) within the DT definition.

At the same time, the DT did not view the IEEE definition as suitable for the DT's intended use as written. The IEEE term qualifies the DER connection point as "not directly connected to a bulk power system" which the DT viewed as potentially ambiguous. Instead, the DT opted for the "connected to a distribution system" language to point to the electric system location, and how facilities at that location are classified, as a key concept in differentiating DER from other generators and energy storage technology. The DT considered if it was necessary to define "supplemental DER devices" as part of the DER definition and determined this nuance is not needed for a NERC Glossary of Terms DER definition.

Federal Energy Regulatory Commission (FERC) Energy Primer

The DT identified the FERC Energy Primer definition as being inclusive of load resources (e.g., energy efficiency, demand response) which is not aligned with the SPIDERWG definition. Given the reliability use cases, the DT and SPIDERWG definitions target sources of electric power, with the DT narrowing this definition to be only sources "capable of providing Real Rower." After considering the FERC definition, the DT determined it was not suitable for the intended use.

National Association of Regulatory Utility Commissions (NARUC)
NARUC's definition is also inclusive of load resources (e.g., energy efficiency, demand response) and therefore, the DT concluded it is too broad.

NERC DERTF
The NERC DERTF definition uses the language "resource on the distribution system that produces electricity" which appears to exclude distributed energy storage, a technology necessary for inclusion in the DT definition. Further, the NERC DERTF definition defines DER as anything "not otherwise included in the formal NERC definition of the Bulk Electric System" which the DT views as overly broad.

California Public Utilities Commission (CPUC)
The CPUC definition appears to be based on California legislation and includes energy efficiency, EVs, and demand response, renewable generation resources, and energy storage. As is the case for FERC and NARUC definitions above, the inclusion of load resources is overly broad for the NERC Glossary of Terms.

New York Independent System Operator (NYISO)
The NYISO definition only considers market-qualifying resources as DER. This definition's exclusion of a large portion of DER (i.e. retail participation) is too narrow for the reliability planning needs identified by the SPIDERWG DER Modeling Study.

Figure 1 below provides a graphic illustration of the DER definition and the intended scope of facilities that would fall under the proposed definition. Figure 2 below shows that the proposed DER and IBR definitions are compatible, but distinct. Some resources may be classified as DER, but not IBR; some resources may be classified as IBR, but not DER; some resources may be classified as both DER and IBR. Note that in Figure 2, "distribution-connected" is shorthand for connected to the distribution system and "bulk system-connected" refers to resources connected to the transmission system.

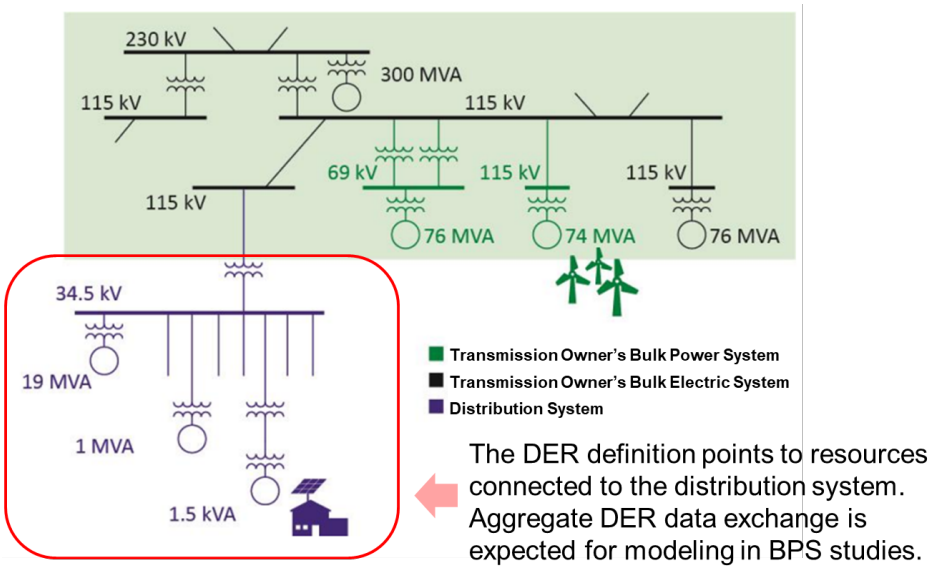

Figure 1: DER Definition Illustration

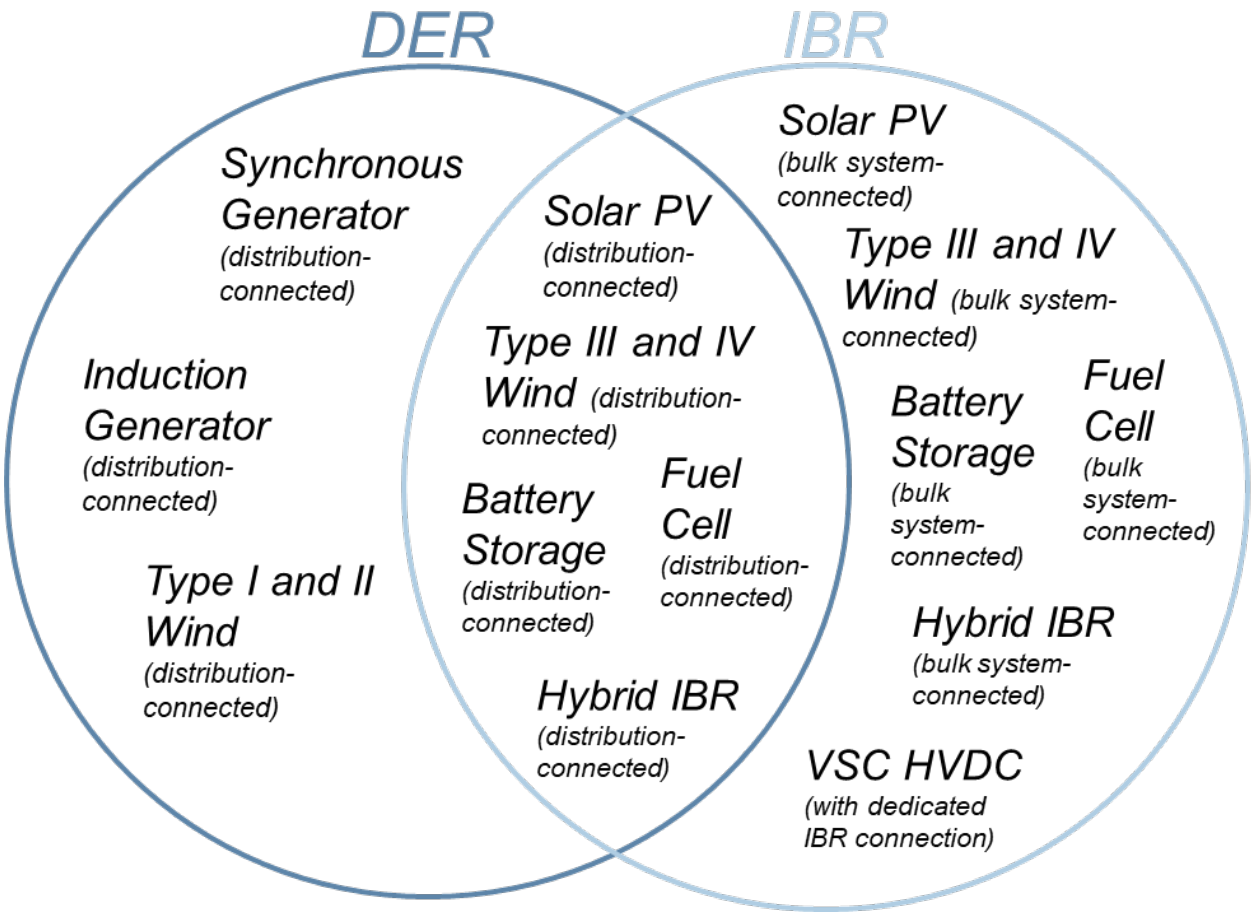

Figure 2: DER and IBR Definition Compatibility

Rationale for Modifications to Requirement R1

Requirement R1 was modified to require that PC and TP data requirements and reporting procedures include requirements for model submissions in accordance with a new ERO Approved Criteria for Acceptable Models document. The modifications are in response to FERC 901 directives.

The procedures resulting from Requirement R1 delineate data reporting responsibilities to avoid the potential for multiple submissions of the same data, which could lead to double counting of modeled elements.

FERC Order 901 directs NERC to develop reliability standards that require "the use of approved industry generic library IBR models".[4] However, pre-defining a limited set of models (i.e., a library of models) that could be used to represent generation and system components is potentially at odds with objectives to also have accurate models, especially as technology rapidly progresses. To align with industry practices while addressing the directives of the FERC Order, NERC staff incorporated elements from the NERC Dynamic Modeling Recommendations, including the proposed NERC Unacceptable Model List, into a newly developed ERO Approved Criteria for Acceptable Models document, rather than defining an

[4] FERC Order 901 at Paragraph 122.

inclusive model library. The DT supports the approach and views it as aligned with the FERC Order directives while addressing the practical limitations raised by industry at the January 15-16 NERC Industry Engagement Workshop.[5] For instance, Order 901 P125 requires "the sole use of nation-wide approved component generic library models" whereas workshop participants raised issues surrounding timelines for approving library models that reflect new IBR products, the accuracy of library models for certain products, timelines associated with updating library models, among other issues.

The ERO Approved Criteria for Acceptable Models document describes the required documentation and usability elements for planning and operational models. The ERO Approved Criteria for Acceptable Models document defines processes for modifying the criteria and the Unacceptable Models list. The DT views these processes as sufficient safeguards to prevent arbitrary or unvetted modifications being made to these documents referenced by the reliability standards.

The DT concluded that it would be most appropriate for NERC to maintain the ERO Approved Criteria for Acceptable Models as a separate document that could be referenced by reliability standards as needed rather than incorporate the criteria within reliability standards. This determination was based on the SAR language, time constraints for approval of FERC 901 Milestone 3 projects, and broader use of the new NERC document beyond MOD-032. For instance, while MOD-032 is an important application of the ERO Approved Criteria for Acceptable Models document, it will not be the only standard to reference the document. The DT considers maintenance as a separate document with NERC to be a better option for facilitating a unform modeling framework for both planning and operations in alignment with FERC Order 901 rather than incorporating concepts of the document into individualized Attachments for MOD-032 and other standards.

Rationale for Modifications to Requirement R2

Requirement R2 was modified to require estimation of modeling data if the Responsible entity (typically the Transmission Owner or Distribution Provider) is unable to gather required data. FERC Order 901 requires the provision of data related to unregistered-IBR and IBR-DER that in the aggregate have a material impact on the BPS.[6] If the data is estimated, Requirement R2.1 also requires the entity to provide an explanation of the limitations of the availability of data, an explanation of the limitations of any data provided by unregistered IBRs, and the method used for estimation.[7] The DT utilized the FERC Order language to broadly address the elements such an estimation must include, which was added as Requirement R2.1.[8] The requirement language intentionally uses the phrase "unable to gather" to mirror the FERC Order 901 language.

The DT views the introduction of these estimation methods as alleviating previous compliance obligation concerns around challenges in collecting data for DER connected to unregistered entities. The approach

[5] NERC_Industry_Engagement_Workshop–Reliable_IBR_Integration_and_Milestone_3_of_FERC_Order_901_Agenda
[6] FERC Order 901 at P104 and P105
[7] For instance, limitations on data gathering could result from legal or contractual prohibitions on requesting certain data.
[8] FERC Order 901 P104: "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."

directed by FERC is flexible as to whether the underlying unregistered IBR and DER data originates from interconnection documentation, measured quantities, estimated quantities, or other sources. Data availability or sufficiency issues, among other factors, may lead to the DP and TO applying a combination of approaches to source the data. The PC and TP modeling data requirements and reporting procedures should identify acceptable methods and their application.

While the FERC Order 901 directives only addressed IBR-DER, meaning that DER technologies based on induction generators or synchronous generators are not explicitly addressed, the DT found it practical to have a consistent estimation framework applicable for all DER technologies when DER data cannot be gathered. Therefore, R2 was intentionally written to have requirements for estimating DER data regardless of the technology type, when an applicable entity is unable to gather the data. The approach FERC directed NERC to use forms the basis for this uniform approach.

Given the challenges with collecting complete and accurate DER data, the DT would still recommend that NERC consider a range of options that could include expanding DP registration criteria or registering DER-only DPs to reduce or eliminate this potential DER data collection gap. However, the process to modify NERC registry criteria and register new entities is beyond the scope of Project 2022-02 and would delay the project beyond the FERC Order 901 Milestone 3 timeline. The DT considered adding “UFLS-Only Distribution Provider” to MOD-032-2 applicability to reduce (but not necessarily eliminate) the potential gaps associated with DER connected to unregistered entities with no compliance obligation. However, adding UFLS-Only Distribution Provider to the applicability would not be appropriate at this time based on consultation with NERC Legal staff.

Rationale for Modifications to Attachment 1

MOD-032-2 Attachment 1: Data Reporting Requirements was updated with data specific to IBR and DER.

The DT decided to maintain an approach similar to MOD-032-1 where more detailed sub-bullets associated with items are only presented in one column (i.e., some sub-bullets are only listed in the “steady state” column even though the data is also relevant to “dynamics” and/or “short circuit”). This long-standing approach was made explicit in footnote 1.

The format of Attachment 1 was modified to minimize replicating footnotes applicable to multiple items by adding a new footnotes section (Attachment 1 Data Reporting Requirements Footnotes) to the document. Along with the reformatting, language was added to the introductory paragraph to clarify that data obligations are established by the PC/TP modeling data requirements and reporting procedures rather than the listing of typical functional entities in Attachment 1.

Modifications for IBR

To incorporate IBR within Attachment 1, “and storage units” was added to generating units in the steady-state column under item 3. “Generating units” already incorporates IBR generators such as solar and wind. Storage is typically not classified as a generation resource because it has no primary energy source and consumes more energy than it injects when considering losses. Therefore, the DT found it necessary to include storage explicitly. Footnote 4, associated with “Generating units and storage”, was also updated to clarify IBR as an applicable technology for the item.

The dynamics column was updated to replace "photovoltaic systems" (PV) with "Inverter-Based Resources" under item 7. IBR encompasses PV, resulting in PV technology still being included under this new item.

The three following sub-items were added to dynamics item 7 based on specific language from the FERC Order 901, Paragraph 141.[9]

- IBR capabilities related to momentary cessation,
- Tripping, and
- Ride-through

"Frequency control" was added as a sub-item because frequency response of IBR is important for studying system reliability. For instance, a 2024 NERC Lessons Learned report shows how IBR frequency response can affect system performance.[10] Frequency control encompasses primary frequency response, fast frequency response (e.g., IEEE 2800-2022, Subclause 6.2), and potentially other frequency responsive controls (e.g., "grid-forming" virtual synchronous machine controls).

In order to clarify dynamics item 6, "wind plant model", to not overlap with the new IBR item 7, type 1 and type 2 wind turbines are specifically called out under item 6. These technologies are not IBR.

Footnote 5 was added to clarify that the TO will typically be responsible for unregistered IBR that are not captured in DER modeling data.

Modifications for DER

Item 9, "Aggregate Distributed Energy Resource (DER) data" was added to the steady state column with location, real power capability, and DER type (solar, battery, diesel generator, etc.) specified as required subitems. The DT selected these subitems as the minimum information needed to use data and make assumptions for power system modeling and analysis.

The intent is that relevant DER data be available and represented in models of the interconnected transmission system consistent with the NERC approved Reliability Guideline: DER Data Collection for Modeling in Transmission Planning Studies. Specific data items listed for DER reflect the minimum information needed to reasonably represent DER in transmission system models. "Aggregate DER" is added as new item 9 to indicate aggregate DER, rather than individual DER facilities, would be represented in most PC/TP study models.[11] The word "aggregate" was specifically added to Attachment 1 to clarify this point based on industry comments and to align with FERC Order 901. However, Requirement R1 provides the PC and TP great flexibility in developing data requirements and reporting

[9] FERC Order 901, P141 states that IBR and IBR-DER data must include "momentary cessation and/or tripping, and all ride through behavior."
[10] NERC, Lessons learned, Incorrect IBR Primary Frequency Response Logic Caused Negative ACE. Available at: https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20240501_Incorrect_IBR_Primary_Frequency_Response_Logic_Caused_Negative_ACE.pdf
[11] In certain circumstances (e.g., very large DER), a TP or PC may decide to represent individual DER. However, the DT anticipates most DER information will be aggregated based on PC and PC planning criteria.

procedures that align with local practices and needs, in addition to the required items listed in the Requirement R1 Parts. Given industry comments on DER data availability, and FERC Order 901 directives, a process is needed for estimating DER data when an entity is unable to gather it. The process for estimating those values is referenced in Requirement R2 Part 2.1.

Footnote 3, associated with "aggregate demand", was modified to clarify that the gross demand is needed at each load serving bus. Collecting and modeling a net demand that incorporates offsets due to output from DER is not consistent with a modeling framework that explicitly represents DER.

Dynamics item 5, previously "demand", was updated to be "aggregate demand" to be consistent with the steady state column and general industry practices of modeling load dynamics for aggregate demand (e.g., composite load model).

Dynamics item 10 was updated to include "Aggregate Distributed Energy Resource (DER) data" along with the subitems: "DER capabilities related to momentary cessation, tripping, Ride-through, voltage control, and frequency control"; and "indication whether DER is subject to tripping in conjunction with UFLS or UVLS"

Momentary cessation, tripping, and ride-through of aggregate DER is needed for dynamics studies. For instance, NERC's Lessons Learned, LL20220401 "Distributed Energy Resource Performance Characteristics during a Disturbance" provided information following the loss of 300 MW of DER following a system fault. [12] The report indicated that, "There is a need to understand how distribution system connected generation, and loads will behave and how they can accurately be modeled under expected system contingencies. Entities should know the behavioral characteristics of DER inverters on their system (both new and old) as well as their number, capabilities, and locations and then report that information to their Balancing Authorities and Reliability Coordinators so their models can be accurate".

Voltage control of DER can alter the exchange of reactive power between distribution and transmission systems and may affect the results of reliability studies. Examples are described in the approved Reliability Guideline: Bulk Power System Planning under Increasing Penetration of Distributed Energy Resources.

Frequency control must be accounted for because DER interconnection under different standards (e.g., IEEE 1547-2003 versus IEEE 1547-2018) have different frequency response characteristics that may affect dynamics study results. Frequency control in this case typically refers to the frequency-droop characteristic outlined in IEEE 1547-2018, Subclause 6.5.2.7 and adopted in many jurisdictions. However, should other DER frequency controls become common in industry, those would also fall under this category.

As described in the approved Reliability Guideline: Recommended Approaches for UFLS Program Design with Increasing Penetrations of DERs, accurately representing DER tripping as part of UFLS operation is

[12] https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20220401_DER_Performance_During_a_Disturbance.pdf

vital for designing and evaluating UFLS programs. Similarly, accurately representing DER tripping as part of UVLS operation is vital for designing and evaluating UVLS programs as described in the approved White Paper: DER Impact to Under Voltage Load Shedding Program Design. In cases where the PC/TP data requirements and reporting procedures require aggregated DER data to be provided, the proportion of aggregate DER subject to each UVLS/UFLS tripping stage should be identified.

Inferring DER Capabilities

Item 10 in the dynamics column indicates that aggregate DER dynamics modeling data may need to be inferred due to data availability and practical limitations. As suggested in the approved Reliability Guideline: DER Data Collection for Modeling in Transmission Planning Studies, the in-service date for DER may be used as a proxy for the PC/TP to make reasonable assumptions about DER capabilities. For example, in a certain jurisdiction DER installed after a specified date may be required to have a certain ride-through characteristic. Thus, the appropriate Ride-through characteristic representation for DER in that area could be inferred by the in-service date of the DER. However, the PC/TP modeling data requirements and reporting procedures may require the provision of alternative information to achieve the same purpose. PC/TP modeling data requirements and reporting procedures may also require more detail and/or additional information. In cases where the PC/TP data requirements and reporting procedures require aggregated DER data to be provided, it is expected that the proportion of aggregate DER amount with in-service dates before and after certain threshold dates would be needed (and specified in the PC/TP requirements) to make inferences regarding the overall aggregate DER response characteristics. Where applicable, similar assumption can be made for unregistered IBR.

Entity responsibilities and coordination

Footnote 6 provides additional distinctions that DER connected through a DP (directly connected to a registered DP, connected to an unregistered DP that is connected to a registered DP, or behind the meter of an end-use customer of either) should be reported by that DP. Further, the TO will be responsible if there is no system owned by a registered DP between the DER connection point and TO system. This clarification is necessary to reduce the possibility of DER on the system being unaccounted for by any entity. The DT was responsible for the FERC Order 901 directive requiring an entity to be identified when DER had no registered DP.

It should be noted that the MOD-032-2 modifications do not change the classification of unregistered IBR or DER to become BES facilities subject to NERC reliability standards. Instead, the modifications place a compliance obligation on NERC registered DPs (or TOs) to provide basic information about unregistered IBR or DER that are connected to their systems so they can be properly represented in Interconnection-wide cases. There are already existing requirements for DPs (or TOs) to provide information about load connected to their systems. Like load, unregistered IBR and DER are not generally considered to be BES facilities. However, BES reliability assessments require an accurate representation of aggregate load, unregistered IBR, and aggregate DER behavior. The modifications proposed in MOD-032-2 are intended to ensure sufficient data is available to the PC/TP so that appropriate unregistered IBR and DER representations can be included in their BES reliability assessments as required by FERC Order 901 and system planning needs.

IRO-010-6 – Reliability Coordinator Data Specification and Collection; and TOP-003-8 – Transmission Operator and Balancing Authority Data and Information Specification and Collection

The DT reviewed existing IRO-010 and TOP-003 versions and found that both standards had broad requirements language that encompassed generation and storage resources, including IBR. Nevertheless, to ensure no ambiguity that FERC Order 901 requirements are met, the DT included explicit references to IBR-specific data and parameters and pointed to the ERO Approved Criteria for Acceptable Models.

Rationale for Modifications to add "IBR-specific data and parameters"

The phrase "IBR-specific data and parameters" was added to the following requirements:

- IRO-010-6 Requirement R1 Part 1.1
- TOP-003-8 R1 Requirement Part 1.1
- TOP-003-8 Requirement R2 Part 2.1

These modifications were made in response to FERC Order 901 directives related to the inclusion of IBRs in operations models.[13] The phrase "IBR-specific data and parameters" in the revised IRO-010-06 and TOP-003-8 is intended to reflect what FERC describes in the order as "IBR models that accurately reflect the behavior of IBRs during steady state, short-circuit, and dynamic conditions".

Rationale for Modifications to add reference to ERO Approved Criteria for Acceptable Models

"Requirements for model submissions in accordance with the Criteria for Acceptable Models maintained by the Electric Reliability Organization" was added to the following requirements:

- IRO-010-6 Requirement R1 Part 1.5.3
- TOP-003-8 Requirement R1 Part 1.5.3
- TOP-003-8 Requirement R2 Part 2.5.3

These modifications were made in response to FERC Order 901 directives related to usage of a uniform framework in the development of operations models. The ERO Approved Criteria for Acceptable Models specifies further requirements as to what is needed for accurate models that are useful for the types of analysis specified by FERC in Order 901.

[13] FERC Order 901 Paragraph 122 and Paragraph 161