

Technical Rationale for Reliability Standard MOD-032-2

~~October 2023~~ August 2024

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. ~~Items in Attachment 1 that were previously required to be provided by the LSE are now required to be provided by the DP. It is recognized that some distribution facilities do not have an associated DP that meets the NERC registration criteria. It is expected that TOs (or registered DPs) will need to coordinate with the owners of distribution facilities that do not have an associated NERC-registered DP to ensure the availability of the necessary data, either through interconnection agreements or other binding contracts, but it should be clear that compliance obligations can only be imposed on NERC-registered entities listed in the Applicability Section; use of the DP term within proposed Reliability Standard MOD-032-2 should be understood to refer to an entity meeting the NERC registration criteria, unless otherwise specified.~~

The ~~Standard~~-Drafting Team (SDT) has concerns that there may be challenges in collecting data for distributed energy resources (DER) connected to unregistered entities. ~~Draft 1 of proposed Reliability Standard MOD-032-2 proposed to assign this data obligation to the Transmission Owner (TO) or DP, but based on industry comments, this may place an unreasonable compliance risk on the TO/DP because any unregistered entities that connect DER to their systems have no compliance obligation to provide data to the TO/DP. As such, the SDT recommends 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 unnecessarily delay the implementation of DER data requirements. The SDT believes there is value in moving forward with MOD-032-2, as it does provide substantial improvement with respect to ensuring DER data is available for inclusion in Planning Coordinator (PC) and Transmission Planner (TP) studies. 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.~~

Additionally, the SDT reviewed the dual applicability to ~~Planning Authority (PA)~~ and ~~Planning Coordinator (PC)~~ 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 January 19, 2021, still uses both terms and, arguably, the Planning Authority (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 SDT excluded the explanatory language from MOD-032-2 ~~applicability section~~ Applicability Section.

Rationale for Distributed Energy Resource (DER) Definition

The SDT considered various DER definitions utilized in the industry and discussed in the [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 SDT determined each of these seven definitions required or would benefit from refinement to be most suitable for ~~the~~ application in MOD-032 and future reliability standards more broadly.

The SDT consensus is that the proposed definition aligns with the intent of the SPIDERWG working definition for DER (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-). Utilizing the existing NERC definition for DP and the associated area of responsibility aligns with the scope of DER data collection and modeling activities and provides clarity for the industry to aid in gathering this information. It should be clear that MOD-032-2 applicability and compliance obligations refer to NERC-registered DPs; the use of the DP term in the DER definition does not in itself imply any compliance obligation.

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

SPIDERWG definition

After considering the SPIDERWG definition, the SDT determined it provided a useful foundation, but needed refinement to be suitable for the intended use. Specifically, the SPIDERWG term 1) included transient types of DER power beyond generation and storage; 2) pointed to a SPIDERWG-specific defined term for “distribution systems”; and 3) included sources of back-up power that would have no potential grid impacts.

The SDT chose to refer to generator 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.) ~~Additionally, by specifying facilities that produce Real Power, the scope is focused on only those facilities that may be exporting Real Power to the power system or offsetting~~ DER can use various technologies including synchronous machines, induction machines, and power inverters/converters (i.e., IBR). Different types of DER can utilize a wide range of energy sources including, but not limited to, natural gas, diesel, hydro, storage, wind, and solar. Further, the DT proposed definition ~~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.~~

~~Further, the SDT term~~ uses “connected to the Distribution Provider’s system” to avoid ambiguities associated with a unique definition of “distribution system” as was required by the SPIDERWG term. -The

NERC ~~glossary~~[Glossary of Terms](#) definition for DP¹ notes that the DP is defined by providing the distribution function (this includes entities that may not [satisfy the NERC registration criteria](#)). [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.](#) ~~be NERC-registered DPs).~~

The ~~SDT~~ included the language "in non-isolated parallel operation with the Bulk ~~Power~~[Electric](#) System" to indicate that ~~distributed energy resources~~[DER](#) with potential [Bulk Electric System \(BES\)](#) reliability impacts are those that have electrical connectivity to the BES. The ~~SDT~~ intentionally avoided the term “directly connected” to differentiate electrical connectivity from an electrical connection point. -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 BES and, therefore, are not of interest from a BES-reliability perspective. -The ~~SDT~~ understands the concepts of non-isolated parallel operation versus isolated parallel operation to be commonly understood within the industry.

IEEE 1547-2018

The ~~SDT~~ reviewed the [IEEE 1547-2018](#) definition and found that it contained elements that could supplement the SPIDERWG definition to address the three issues identified above. The ~~SDT~~ 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” was used to inform the need for capturing non-isolated, long-term paralleling and the sourcing of Real Power (i.e., active power) within the ~~SDT~~ definition.

At the same time, the ~~SDT~~ did not view the IEEE definition as suitable for the ~~SDT~~’s intended use as written. The IEEE term qualifies the DER connection point as “not directly connected to a bulk power system” which the ~~SDT~~ viewed as potentially ambiguous. Instead, the ~~SDT~~ opted for the “connected to [the DP’s system](#)” language to point to a NERC defined term and concept. -The ~~SDT~~ 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 DER definition for inclusion in the NERC Glossary of Terms.

Federal Energy Regulatory Commission (FERC) Energy Primer

The ~~SDT~~ 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 planning use cases, the ~~SDT~~ and SPIDERWG definitions target sources of electric power, with the ~~SDT~~ narrowing this definition to be only sources “capable of providing Real Power.” After considering the FERC definition, the ~~SDT~~ determined it was not suitable for the intended use.

National Association of Regulatory Utility Commissions (NARUC)

¹ NERC Glossary of Terms, Updated March 2023. ~~DP is~~[Distribution Provider](#) definition is: “Provides and operates the “wires” between the transmission system and the end-use customer. For those end-use customers who are served at transmission voltages, the Transmission Owner also serves as the Distribution Provider. Thus, the Distribution Provider is not defined by a specific voltage, but rather as performing the distribution function at any voltage.”

NARUC’s definition is also inclusive of load resources (e.g., energy efficiency, demand response) and therefore, the SDT concluded it is too broad. After considering the NARUC definition, the SDT determined it was not suitable for the intended use.

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 SDT 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 SDT views as ambiguous and overly broad. After considering the NERC DERTF definition, the SDT determined it was not suitable for the intended application.

California Public Utilities Commission (CPUC)

The CPUC definition appears to be based on [California legislation](#) and includes energy efficiency, ~~electric vehicles~~**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 SDT’s use. After considering the CPUC definition, the SDT determined it was not suitable for the intended application.

New York Independent System Operator (NYISO)

The NYISO definition only considers market-qualifying resources as DER. This definition to exclude a large portion of DER (i.e. retail participation) is too narrow for the reliability planning needs identified by the SPIDERWG [DER Modeling Study](#). After considering the NYISO definition, the SDT determined it was not suitable for the intended application.

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 DP’s system and “bulk system-connected” refers to resources connected to the transmission system.

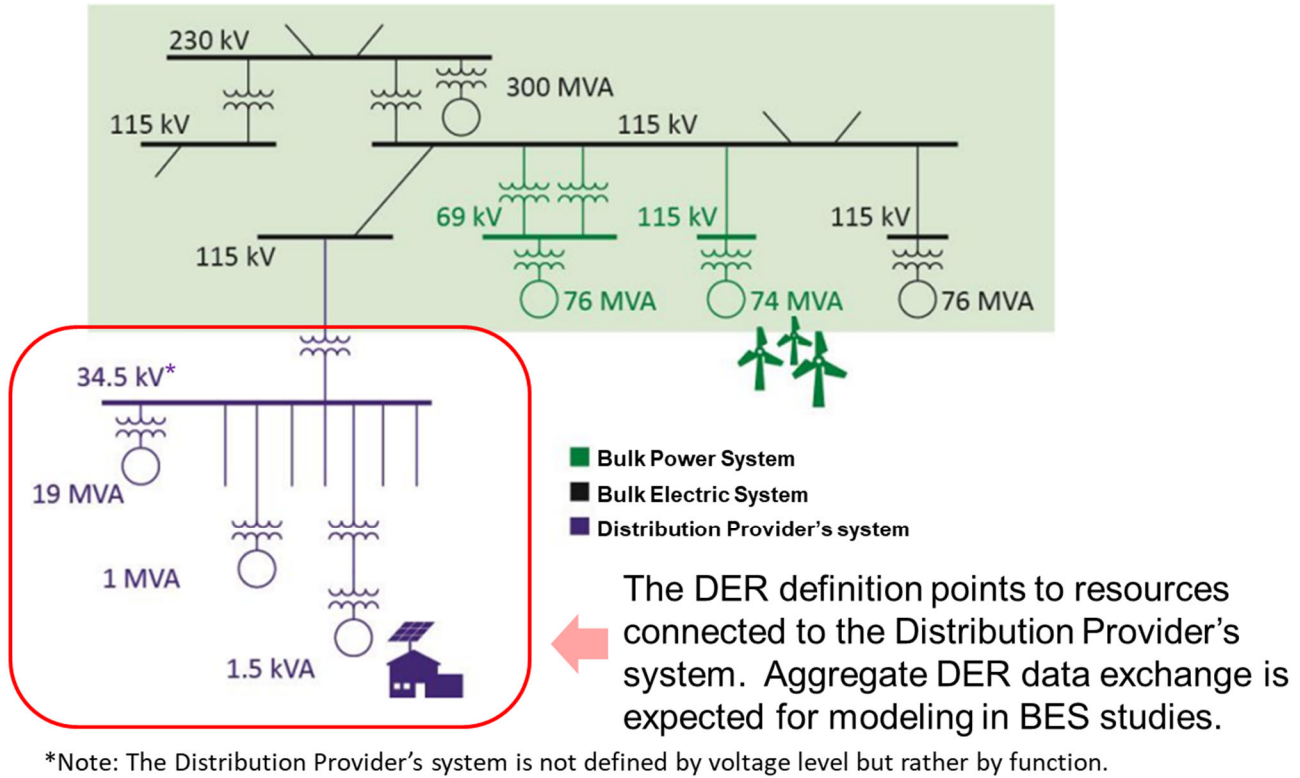


Figure 1: DER Definition Illustration

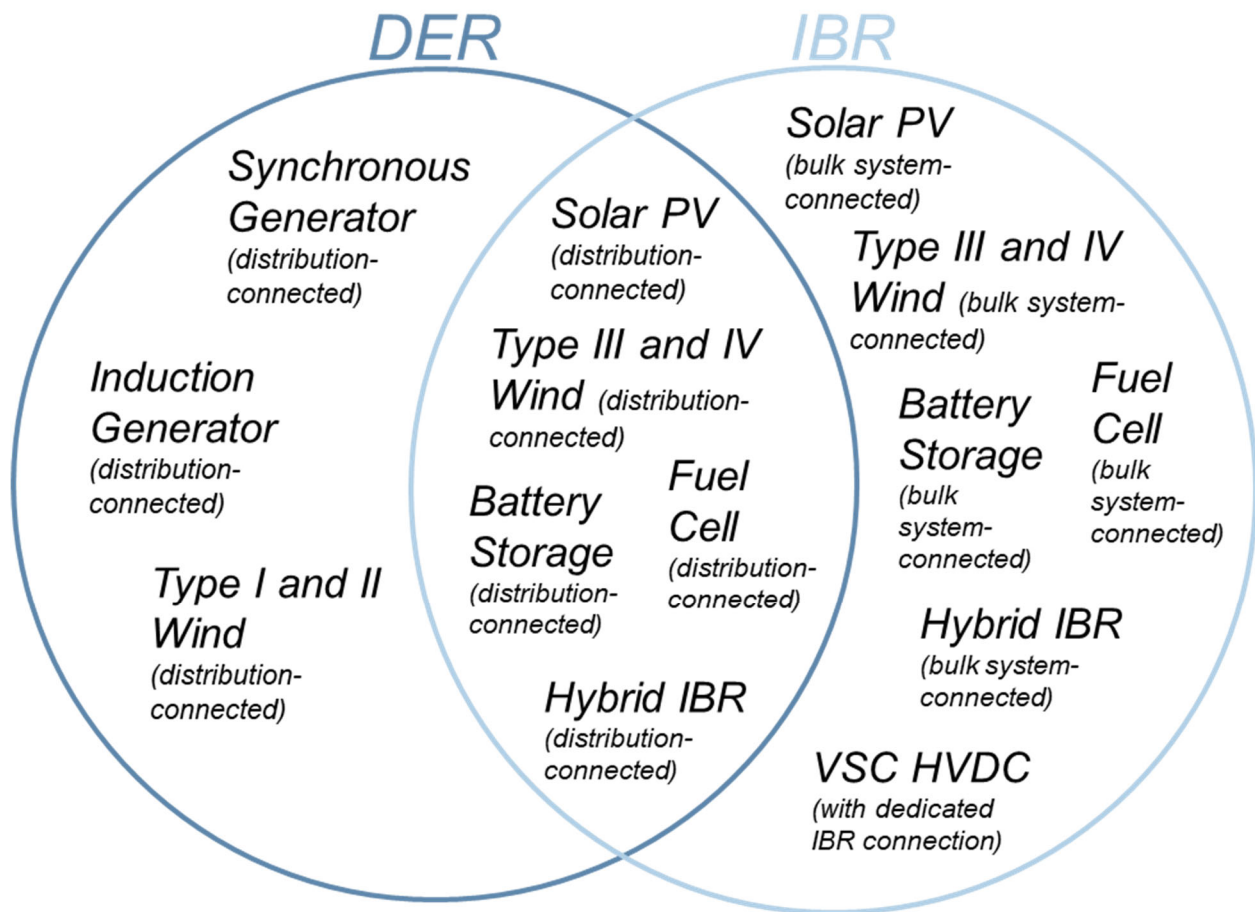


Figure 2: DER and IBR Definition Compatibility

Rationale for Modifications to Attachment 1

MOD-032-2 Attachment 1: Data Reporting Requirements was updated with data specific to DERs. -The intent is that all relevant DER data including both utility scale facilities (commonly referred to as U-DER) and smaller behind-the-meter facilities (commonly referred to as R-DER) be available and represented in models of the interconnected transmission system consistent with the approved [Reliability Guideline: DER Data Collection for Modeling in Transmission Planning Studies](#). -Specific data items listed for DER reflect the minimum amount of information expected to be needed to reasonably represent DER in transmission system models. -It is expected that aggregate DER (rather than individual DER facilities) would be represented in most ~~Planning Coordinator/Transmission Planner (PC/TP)~~ study models. In Draft 3, the word “aggregate” was specifically added to Attachment 1 to clarify this point based on industry comments. However, ~~footnote 4 explicitly allows the PC/TP to specify the level of DER data aggregation.~~ This Requirement R1 provides the PC/TP great flexibility for in developing data requirements and reporting procedures that align with local practices where and needs, so long as they include the PC/TP may elect to apply DER aggregation assumptions rather than depend on items listed in the DP/TO to apply aggregation assumptions. Requirement R1 Parts.

The PC/TP may have access to sufficient data for modeling certain DER through alternative means (e.g., direct registration of DER in certain markets). -In such cases, the DP (or TO) should not be obligated to provide duplicate DER modeling data, but care will be needed to ensure DER is not double counted. The PC/TP modeling data requirements and reporting procedures should clearly identify if there are certain classifications of DER that are excluded from the DP/TO obligation for providing DER modeling data. -This in no way absolves a DP/TO from an obligation to provide DER data according to the data requirements and reporting procedures developed by its Planning Coordinator and Transmission Planner PC and TP in Requirement R1.

The SDT intentionally maintained flexible language as to whether the underlying 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/TO applying a combination of approaches to source the data. The PC/TP modeling data requirements and reporting procedures should identify acceptable methods and their application.

The SDT decided to maintain an approach similar to MOD-032-1 where more detailed sub-bullets associated with the required DER data are only presented in the “steady state” column (though arguably such data is also relevant to “dynamics” and/or “short circuit”). The SDT concluded that this was appropriate and consistent with other “dynamics” line items such as “Wind Turbine Data” and “Photovoltaic systems” that are listed without detailed sub-bullets. -Drastically altering the structure of Attachment 1 or explicitly adding DER data to the “short circuit” column was beyond the scope of the Project 2022-02 SAR. -However, the PC or TP is not restricted from requiring any needed short circuit data in their joint modeling data requirements and reporting procedures developed per Requirement R1.

It should be noted that the modifications do not make DER a BES facility subject to NERC reliability standards. -Instead, the modifications place a compliance obligation on NERC registered DPs (or TOs) to provide basic information about DER that are connected to their systems so that DER 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. Similar to Like load, DER is not generally considered to be a BES facility. - However, BES reliability assessments require an accurate representation of both aggregate load and aggregate DER behavior. -The modifications proposed in MOD-032-2 are intended to ensure sufficient DER data is available to the PC/TP so that appropriate DER representations can be included in their BES reliability assessments.

- **Inferring DER Capabilities**

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.

- **Inclusion of Data Related to DER Subject to Trip by UFLS and/or UVLS**

There is a reliability need for the DP/TO to convey this information to the PC/TP. -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 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.

- **Inclusion of Aggregate Demand Clarification**

Footnote 2 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. ~~In situations where DER is not separately metered, a comparison to historical load levels can be used to approximate the addition of DER on the distribution feeder. A consistent reduction in load on the feeder may be indicative of DER interconnections.~~

- ~~Examples for Footnote 54~~

~~Footnote 5 was added to Attachment 1, item 9, after the bracketed statement, indicating the functional entity responsible for data reporting requirements is the “DP, TO where DER is directly connected to the TO system and not through a DP”, to cover situations where the DER is not connected to a registered DP or directly to a registered TO. In these situations, DER is connecting to an “unregistered Distribution Provider”, that is responsible for DER interconnection processes and data management but does not have NERC compliance obligations. The SDT viewed the collection of all DER data as the appropriate aim, but recognized practical constraints associated with unregistered entity compliance obligations. For that reason, the SDT added a footnote that in part states, “the next closest electrically connected registered entity (DP or TO) shall request DER data and pass through available information” to request data that cannot be required.~~

~~The SDT offers two examples to illustrate the SDT’s intended application of Footnote 5:~~

- ~~If the DER is directly connecting to an unregistered Distribution Provider that is immediately electrically adjacent to a registered TO (i.e., “next closest electrically connected registered entity”), the TO is responsible for requesting data from the unregistered DP and incorporating it in the MOD-032 data to the Planning Coordinator.~~
- ~~If the DER is directly connected to an unregistered Distribution Provider that is served by a registered DP (i.e., “next closest electrically connected registered entity”), then the registered DP is required to request data from the unregistered Distribution Provider and include this data in the MOD-032 data submission.~~

Footnote 4 was clarified and Footnote 5 from the previous draft was removed from Attachment 1 to make it clear that the functional entity that is responsible for reporting DER data under the currently available registered entities is the DP. Previous references to the TO as a responsible DER entity were removed, but the clarified footnote still states and recognizes that DER data collection efforts may generally involve DP and TO coordination. The DT continues to recognize that there are situations where DER is connected to an “unregistered Distribution Provider,” instead of a DP or TO, and that it is still an appropriate aim to collect this data. However, in agreement with industry comments, references to data collection efforts or passing through data by the DP/TO from these unregistered entities was removed from the standard language as it could add compliance risk on the DP/TO without any compliance obligation on the unregistered entities. The DT believes that there is great value in moving forward with the standard with the registered DP as the responsible entity for DER data as this will vastly improve the amount of data that is available to the TP/PC.

Where an unregistered DP (an entity not meeting the NERC registration criteria) is interconnected to the system of a registered entity (DP or TO), the DP/TO should coordinate with the unregistered DP to ensure the availability of information associated with DER that may be connected to the unregistered DP’s system. This effort would be considered as a best practice, even if not specifically required by the MOD-032 Reliability Standard. FERC Order No. 901 addresses this issue of data collection for DERs that do not have an associated registered entity and directs future efforts to determine appropriate responsible registered entities, but the DT believes that this currently falls outside of the scope of this SAR and will be addressed in the new SAR related to FERC Order No. 901, Milestone 3, Part 1. In the interim, FERC Order No. 901 also describes a process where this data is unavailable and should instead be estimated and the limitations of data availability should be documented.