

Technical Rationale

Project 2020-06 Verification of Models and Data for Generators Inverter-based Resource Definition | July 2024

Inverter-based Resource (IBR) Definition

The drafting team (DT) utilized the IEEE 2800-2022 definitions as an initial basis for the inverter-based resource terms for the NERC Glossary of Terms and adjusted as necessary. The DT acknowledges the efforts of the P2800 Wind and Solar Plant Interconnection Performance Working Group and IEEE members in developing those definitions. The DT also used recent FERC and NERC documents, which included inverter-based resource related terms and descriptions, as the basis for the IBR definitions.

The IBR ~~and IBR Unit~~ definitions is are intended to describe technologies that shall be considered IBR ~~and to distinguish between a unit and resource~~. An IBR is defined by technology, thus voltage connection level (kV), facility capability level (MW/MVA), or other factors do not impact the inclusion as an IBR. An IBR can be connected to any part the transmission system, sub-transmission system, or distribution system. For a Reliability Standard(s) that uses either the IBR or IBR Unit terms, the Applicability Section for that Reliability Standard(s) will specific which IBRs are applicable. Each of these Reliability Standards, including the Applicability Section(s) will be balloted in accordance with the NERC Rules of Procedure, and the Applicability Section. For ~~exampleexample~~, an Applicability Section may specify that IBR Facilities (BES), IBRs that are owned by a Generator Owner (Category 2), or IBRs that are operated by a Generator Operator (Category 2), are considered applicable.

IBRs have commonly been referred to as “generating resources.” An IBR is not a HVDC system (except for a VSC HVDC with a dedicated connection to an IBR, as this is part of the IBR facility), stand-alone flexible ac transmission systems (FACTS) (e.g., static synchronous compensators (STATCOM) and static VAR compensators (SVC)), or any resources that are not inverter-based, e.g., gas and steam power plants with synchronous generators. A list of IBRs is provided in Table 1 below.

IBRs may include any hybrid combination of IBR types (e.g., BESS and solar PV), see ~~F~~table ~~4~~below. IBRs also include co-located portions of a facility that are IBR technologies (e.g., a BESS, which is co-located at synchronous generation facility), see ~~F~~table ~~below~~4.

Examples	
<u>IBR</u>	<u>Not an IBR</u>
<ul style="list-style-type: none"> <u>Solar photovoltaic</u> <u>Type 3 wind</u> <u>Type 4 wind</u> 	<ul style="list-style-type: none"> <u>Stand-alone FACTS device (e.g., STATCOM or SVC)</u> <u>Flywheels</u> <u>Synchronous generator</u>

Examples	
<u>IBR</u>	<u>Not an IBR</u>
<ul style="list-style-type: none"> • <u>Battery energy storage system (BESS)</u> • <u>Fuel cell(s)</u> • <u>Hybrid combination of IBRs</u> • <u>Portions of co-located facility that are IBR</u> • <u>VSC HVDC with dedicated connection to IBR</u> • <u>This is not an all-inclusive list.</u> 	<ul style="list-style-type: none"> • <u>Synchronous condenser</u> • <u>VSC HVDC</u> • <u>LCC HVDC</u> • <u>This is not an all-inclusive list.</u>

Examples of IBRs include:

<u>Inverter-Based Resource (IBR)</u>	<u>Not an IBR</u>
<ul style="list-style-type: none"> • <u>Solar photovoltaic</u> • <u>Type 3 wind</u> • <u>Type 4 wind</u> • <u>Battery energy storage system (BESS)</u> • <u>Fuel cell(s)</u> • <u>Hybrid combination of IBRs</u> • <u>Portions of co-located facility that are IBR</u> • <u>VSC HVDC with dedicated connection to IBR</u> • <u>This is not an all inclusive list.</u> 	<ul style="list-style-type: none"> • <u>Stand-alone FACTS device (e.g. STATCOM or SVC)</u> • <u>Flywheels</u> • <u>Synchronous generator</u> • <u>Synchronous condenser</u> • <u>VSC HVDC</u> • <u>LCC HVDC</u> • <u>This is not an all-inclusive list.</u>

Table 1: Inverter-Based Resource (IBR) examples

An inverter is a power electronic device that inverts DC power to AC sinusoidal power. A rectifier is a power electronic device that rectifies AC sinusoidal power to DC power. A converter is a power electronic device that performs rectification and/or inversion.

Figure 1ABC shows an example diagram of an IBR. The IBR (red box) includes the IBR Units (blue boxes), collection system (green boxes), power plant controller(s) (not shown), and reactive resources within the

IBR plant. If the IBR is connected to the electric system via a dedicated voltage source converter high-voltage direct current (VSC HVDC) system, the VSC HVDC system is part of the IBR.

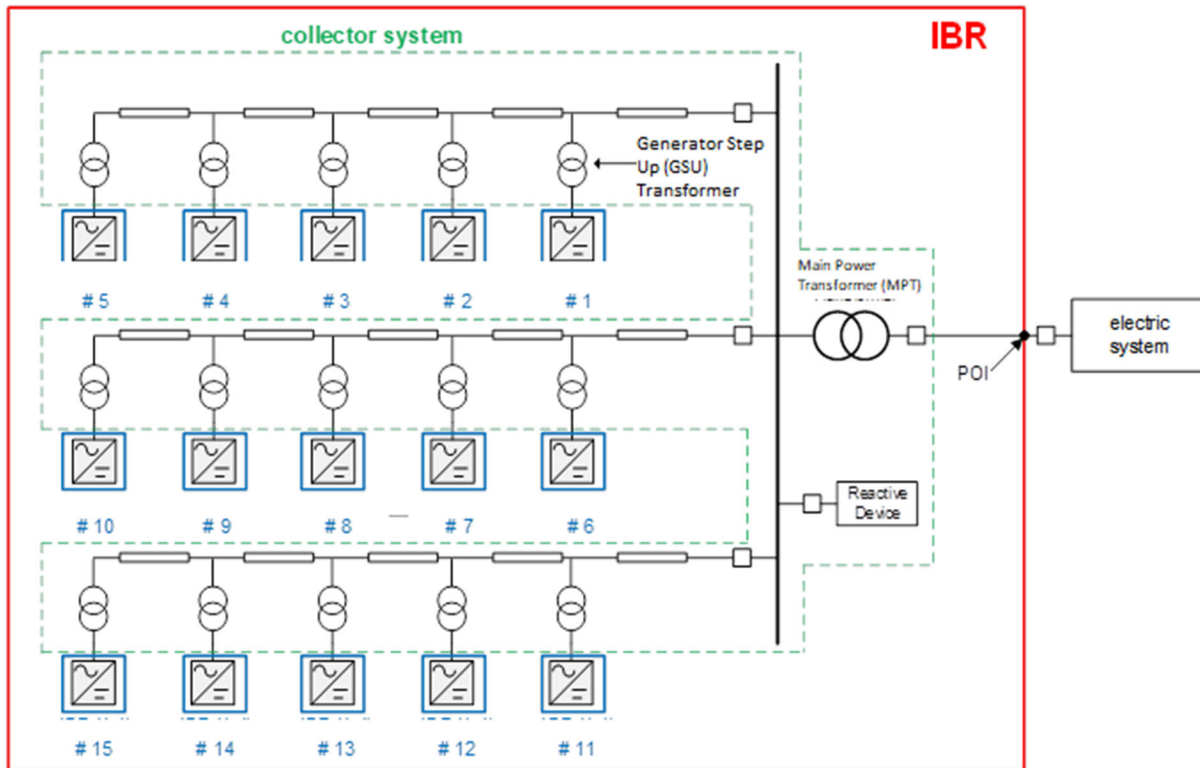


Figure 12.1 Example diagram of an IBR depicting the IBR (red box), collector system (green box), and devices IBR Units (blue boxes).

The inclusion of ‘capable of exporting Real Power’ is to clarify that loads connected to the electric system via power electronics are not IBRs. IBRs are capable of exporting Real Power and may also be capable of providing Reactive Power. The DT contemplated adding the phrase “may also be capable of providing Reactive Power” in the definition(s). However, the DT believed this may be misinterpreted that IBRs include technologies such as FACTS devices or HVDC.

Battery energy storage systems (BESS) are considered IBRs whether the device is operating in a charging, idle, or discharging mode. Within each Reliability Standard, a DT may draft operating mode-specific Requirements, as needed.

The Project 2020-06 DT intends to use the Glossary Terms of ~~IBR Unit and~~ IBR for MOD-026-2. Additional standards development projects and related standards that may use these defined terms include:

- Project 2020-02 Generator Ride-through (new PRC-029, modified PRC-024)
- Project 2021-01 Modifications to PRC-019 and MOD-025

- Project 2021-04 Modifications to PRC-002 (new PRC-028)
- Project 2022-04 EMT Modeling
- Project 2023-01 EOP-004 IBR Event Reporting
- Project 2023-02 Analysis and Mitigation of BES Inverter-Based Resource Performance Issues~~Performance of IBRs~~ (new PRC-030)

Distributed Energy Resources (DER) related projects that may or may not need to use IBR/~~IBR Unit~~ if they end up with their own definition)

- Project 2022-02 Modifications to TPL-001 and MOD-032 (DER)
- Project 2023-05 FAC-001/FAC-002 DER
- Project 2023-08 MOD-031 Demand and Energy (DER)