NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Industry Webinar

Project 2020-06 Verification of Data and Models for Generators (IBR Definitions)

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  - Participants are reminded that this webinar is public. The access number was widely distributed. Speakers on the call should keep in mind that the listening audience may include members of the press and representatives of various governmental authorities, in addition to the expected participation by industry stakeholders.

Webinar Agenda

- Welcome, introduction, and thank you
- Project Background
- What we heard
- Summary of Changes (Draft 2)
- Technical Rationale
- Project Timeline
- Related Resources
- Questions & Answers

Introduction

- The reliability risks we face are becoming increasingly more complex.
- Timely action is required. We need to evolve.
- Our response needs to be coordinated.

Drafting Team (DT) Members

Name	Company
Brad Marszalkowski (chair)	ISO-New England
Katie Iversen (vice-chair)	S Power (AES Corporation)
Andrew Arana	Florida Power & Light
Jonathan Rose	ERCOT
William Casey Harman	Puget Sound Energy
Ebrahim Rahimi	California ISO
Jason MacDowell	GE Energy Consulting
Sam Li	BC Hydro
Wes Baker	Southern Company
Michael (Bing) Xia	Powertech Labs
Jerry L Thompson	Kestrel Power Engineering
Robert J. O'Keefe	American Electric Power

Project Background

- Model accuracy is essential in transmission planning
- Continued increased use of inverter-based resources (IBR)
- Standard Authorization Request (SAR) prepared by the Inverter-Based Resource Performance Task Force (IRPTF)
- Initial SAR accepted by SC – September 2020
- SAR Drafting Team formed – March 2021
- Increased emphasis on IBR performance, modeling, and supporting programs
- IBR definition (Draft 2) – formal comment period open through April 8, 2024

NERC Glossary of Terms

Reliability Standard(s) include both:

- Applicability
  - Functional Entity(s)
  - Facilities
- Requirement(s)

- Definitions found in the Glossary of Terms are available for use in Standards.
- This project and discussion are focused on defining the terms IBR and IBR Unit to be used in multiple standards.

Intent of IBR Definitions

- The intent of the IBR definitions is to describe the technologies considered IBR, and to help distinguish between a **Unit** (the part) and a **plant/facility** (the whole).
- An IBR is defined by its technology. Thus, voltage connection level (kV), facility capability level (MW/MVA), or other factors do not impact the inclusion of an IBR.
- The applicability each Standard for a Registered Entity is based on a combination of:
  - The registration criteria; and
  - The applicability of each Standard(s) or its specific Requirement(s)
- Exceptions or clarifications in the usage of IBR or IBR Unit may be added within the applicability section or individual requirements of each respective standard.

IBR Definitions (Draft 2)

- **Inverter-Based Resource (IBR):** A plant/facility that is connected to the electric system, consisting of one or more IBR Unit(s) operated as a single resource at a common point of interconnection. IBRs include, but are not limited to, solar photovoltaic (PV), Type 3 and Type 4 wind, battery energy storage system (BESS), and fuel cell.

- **Inverter-Based Resource Unit (IBR Unit):** An individual device that uses a power electronic interface, such as an inverter or converter, capable of exporting Real Power from a primary energy source or energy storage system, and that connects at a single point on the collector system; or a grouping of multiple devices that uses a power electronic interface(s), such as an inverter or converter, capable of exporting Real Power from a primary energy source or energy storage system, and that connect together at a single point on the collector system

What We Heard

- Further clarifications needed to multiple areas
- Concerns about voltage connection level, capability level, and other factors related to IBR definitions
- Clarification needed for IBR vs. HVDC
- Clarification needed for IBR Unit, collector system, and resource
- Why does the IBR Unit definition focus on Real Power?
- Batteries in charging, idle, and discharge mode

Summary of Changes (Draft 2)

- Clarifications in Technical Rationale
- Removal of confusing language
- Addition of language to "Unit" to cover device (singular) and devices (plural)

Term(s):

Inverter-Based Resource (IBR): A ~~source (or sink in the case of a charging battery energy storage system (BESS)) of electric power~~plant/facility that is connected to the electric ~~power~~ system ~~(transmission, sub-transmission, or distribution system), and that consists~~, consisting of one or more IBR Unit(s) operated as a single resource at a common point of interconnection. IBRs include, but are not limited to, solar photovoltaic (PV), Type 3 and Type 4 wind, battery energy storage system (BESS), and fuel cell.

~~IBR Unit~~**Inverter-Based Resource Unit (IBR Unit):** An individual device~~,~~ that uses a power electronic interface, such as an inverter or converter, capable of exporting Real Power from a primary energy source or energy storage system, and that connects at a single point on the collector system; or a grouping of multiple devices~~,~~ that uses a power electronic interface(s), such as an inverter or converter, capable of exporting Real Power from a primary energy source or energy storage system, and that connect together at a single point on the collector system.

Technical Rationale

- Technical Rationale
- Provides examples with illustrations and additional clarifications

Examples of IBRs

Examples of IBRs include:

IBRs	Not an IBR
• Solar photovoltaic • Type 3 wind • Type 4 wind • Battery energy storage system (BESS) • Fuel cell(s) • Hybrid combination of IBRs • Portions of co-located facility that are IBR • VSC HVDC with dedicated connection to IBR • This is not an all-inclusive list.	• Stand-alone FACTS device (e.g., STATCOM or SVC) • Flywheels • Synchronous generator • Synchronous condenser • VSC HVDC • LCC HVDC • This is not an all-inclusive list.

Table 1: Inverter-Based Resource (IBR) examples

Example Diagram with Collector

Figure 2.1 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.

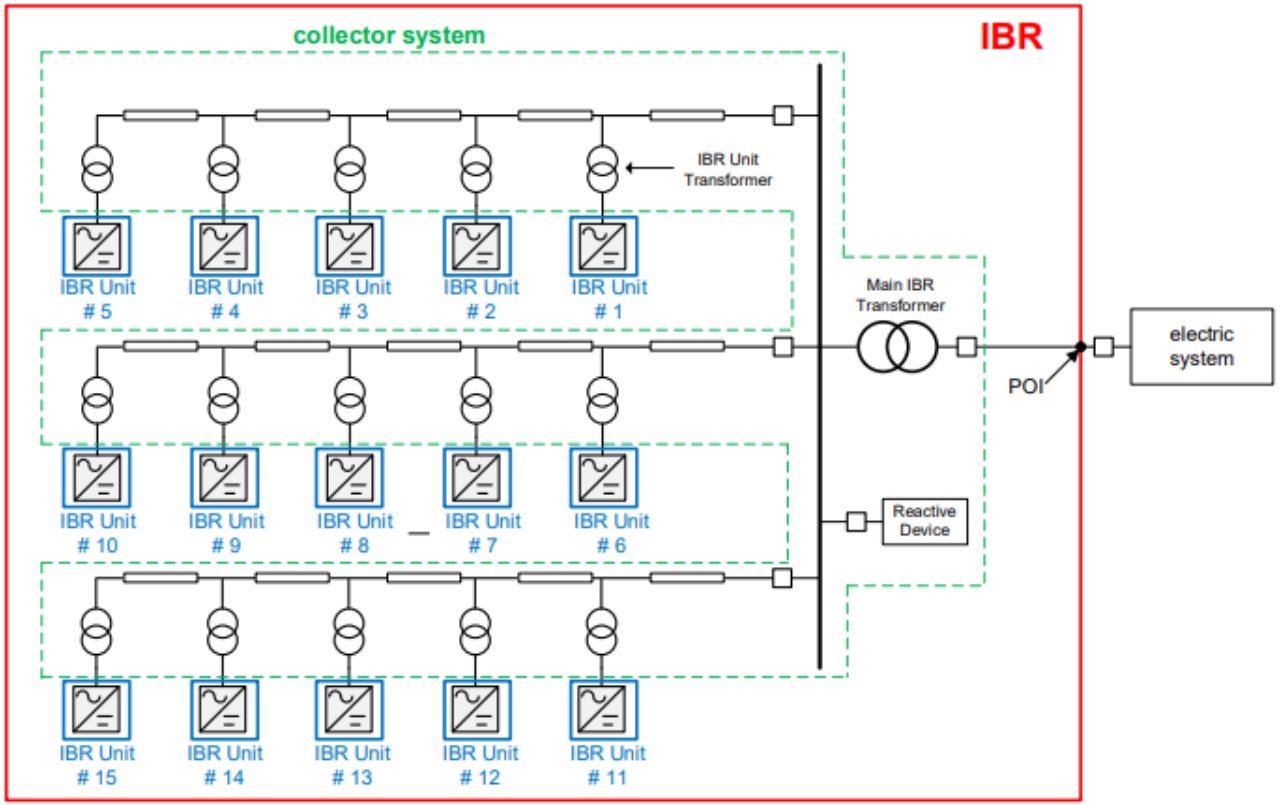


Figure 2.1 Example diagram of an IBR depicting the IBR (red box), collector system (green box), and IBR Units (blue boxes)

IBR Unit Configurations

Inverter-Based Resource Unit (IBR Unit): An individual device that uses a power electronic interface, such as an inverter or converter, capable of exporting Real Power from a primary energy source or energy storage system, and that connects at a single point on the collector system; or a grouping of multiple devices that uses a power electronic interface(s), such as an inverter or converter, capable of exporting Real Power from a primary energy source or energy storage system, and that connect together at a single point on the collector system.

10. Examples of common IBR Unit configurations are shown in Figures 2.2 and Figure 2.3.

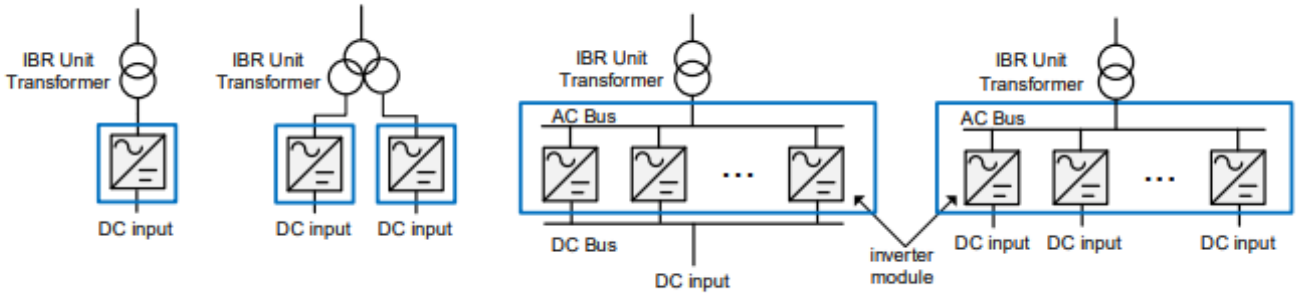


Figure 2.2. Example configurations of full converter-based IBR Units

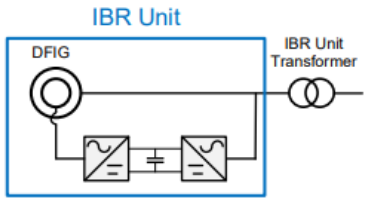


Figure 2.3. Type III wind IBR Unit example

- If a DT identifies a constraint in the application of the IBR Unit term in a Standard or Requirement, the DT can annotate an exception specific to the Standard or Requirement.
- The inverter step-up transformer is part of the collector feeder.

Draft 2 IBR Definitions

- **Inverter-Based Resource (IBR):** A plant/facility that is connected to the electric system, consisting of one or more IBR Unit(s) operated as a single resource at a common point of interconnection. IBRs include, but are not limited to, solar photovoltaic (PV), Type 3 and Type 4 wind, battery energy storage system (BESS), and fuel cell.

- **Inverter-Based Resource Unit (IBR Unit):** An individual device that uses a power electronic interface, such as an inverter or converter, capable of exporting Real Power from a primary energy source or energy storage system, and that connects at a single point on the collector system; or a grouping of multiple devices that uses a power electronic interface(s), such as an inverter or converter, capable of exporting Real Power from a primary energy source or energy storage system, and that connect together at a single point on the collector system

Project Timeline

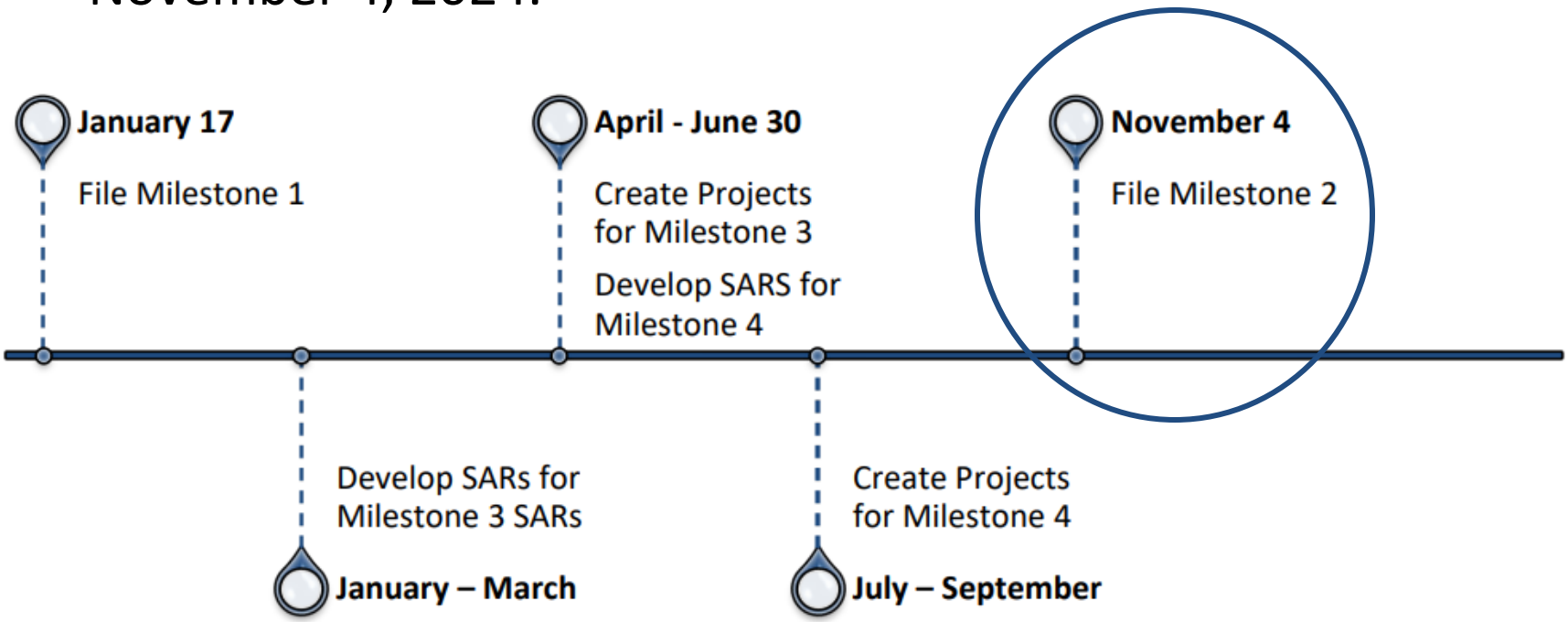
- 45-day formal ballot and comment period
  - Scheduled for February 22 to April 8, 2024
- Subsequent additional ballot (AB3)
  - Not scheduled, based on a timing constraint for FERC Order No. 901
- NERC Board Adoption
  - Scheduled for August 2024

Resources

- Project 2020-06 Verification of Models and Data for Generators
- Inverter-Based Resource Strategy, June 2022
- FERC Order No. 901, October 2023
- NERC Work Plan to Address FERC Order No. 901, January 2024
- IBR Registration Initiative Resources, February 2024
  - IBR Registration Quick Reference Guide, February 2024
  - Proposed Revisions to ROP, March 2024

Relation to FERC Order No. 901

The IBR-related definitions are used in 3 active projects associated with Milestone 2 of NERC's Work Plan to address FERC Order No. 901, which has a filing deadline of November 4, 2024.



ROP Propose Revisions

- Proposed Revisions to ROP, March 2024
- **Appendix 5B – Statement of Compliance Registry Criteria Revision #1:** NERC proposes to revise GO and GOP Registry Criteria to include a new category. These functions would address registration of the entity that i) owns and maintains or ii) operates non-BES inverter-based generating resources that have an aggregate nameplate capacity of greater than or equal to 20 MVA delivering such capacity to a common point of connection at a voltage greater than or equal to 60 kV.
- **Business Case:** As described in Docket No. RD22-4, through several assessments, event reports, and studies, NERC has determined that organizations which own or operate unregistered IBRs that i) aggregate to nameplate capacity equal or greater than 20 MVA; at ii) a common point of connection at a voltage greater than or equal to 60 kV, are material to the Reliable Operation of the interconnected BPS. In response to comments on NERC's September 13th posting, NERC revised its proposal to reflect updates to the GO and GOP Registry Criteria directly rather than creation of associated GO-IBR and GOP-IBR functions.

Questions and Answers