UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

North American Electric Reliability Corporation	**)**	**Docket No. RD22-4-000**
	)	

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION REQUEST FOR APPROVAL OF THE INVERTER BASED RESOURCES WORK PLAN AND REQUEST FOR EXPEDITED REVIEW

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On November 17, 2022, the Federal Energy Regulatory Commission ("FERC" or "Commission"), issued an order ("IBR Order") directing the North American Electric Reliability Corporation ("NERC") to file a Work Plan within 90 days to address registration of Inverter-Based Resources ("IBRs").[1] As reflected in the IBR Order and ERO Enterprise (NERC and the Regional Entities[2]) comments on the Commission's proposed rulemaking regarding Reliability Standards to address IBRs ("NOPR"),[3] there are three categories of IBRs based on how the facilities relate to the Bulk Power System ("BPS"). In particular, regulatory consideration differs based on: (i) whether the IBRs meet NERC's Bulk Electric System ("BES") definition and are registered with NERC for compliance purposes ("registered IBRs"); (ii) whether the IBRs are connected directly to the BPS but not registered with NERC ("unregistered IBRs"); or (iii) whether the IBRs are distributed energy resources (i.e. connected to the distribution system) ("IBR-DER"). The Commission states that the Work Plan should detail how NERC plans to identify and register unregistered IBRs.[4]

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1 *Registration of Inverter-Based Resources,* 181 FERC ¶ 61,124 (2022) [hereinafter *IBR Order*].

2 The Regional Entities are (i) Midwest Reliability Organization ("MRO"); (ii) Northeast Power Coordinating Council, Inc. ("NPCC"); (iii) ReliabilityFirst Corporation ("ReliabilityFirst"); (iv) SERC Reliability Corporation ("SERC"); (v) Texas Reliability Entity, Inc. ("Texas RE"); and (vi) Western Electricity Coordinating Council ("WECC"). NERC and the Regional Entities comprise the ERO Enterprise.

3 *Joint Comments of the North Am. Elec. Reliability Corp. and the Regional Entities In Response to Notice of Proposed Rulemaking*, Docket No. RM22-12-000, p. 4 (filed Feb. 6, 2023); *and Reliability Standards to Address Inverter-Based Resources,* Notice of Proposed Rulemaking, 181 FERC ¶ 61,125 (2022) [hereinafter NOPR].

NERC respectfully requests that the Commission approve the attached Work Plan (**Attachment 1**), which outlines NERC's proposed approach to identify and register owners and operators of IBRs within 36 months of Commission approval of the Work Plan. NERC also requests a 30 day public comment period (concluding approximately March 17, 2023) and 60 day Commission review thereafter (concluding approximately May 16, 2023) to support expeditious execution of the Work Plan. The requested review period would be in the public interest by supporting efficient and effective resolution of an identified risk to reliability.[5]

In particular, NERC plans to work with the six Regional Entities and stakeholders to:

(i) Revise the NERC Rules of Procedure ("ROP") to include Generator Owner – IBR ("GO-IBR") as a new registered entity function within 12 months of Commission order approving the Work Plan;
(ii) Identify candidates for GO-IBR registration within 24 months of Commission order approving the Work Plan; and
(iii) Effectuate registration of GO-IBRs within 36 months of Commission order approving the Work Plan.

NERC respectfully requests that the Commission approve this Work Plan, after expedited review. NERC will also file progress reports every 90 days following approval of the Work Plan.

In addition, NERC recognizes that the Commission issued the IBR Order in parallel with the NOPR proposing to direct that NERC develop new or modified Reliability Standards that address the following reliability gaps related to IBRs: data sharing; model validation; planning and operational studies; and performance requirements.[6] The proposed Work Plan is intended to operate in coordination with ERO Enterprise efforts to modernize mandatory Reliability Standards, including any proposed revisions to address IBRs. NERC also confirms that the Work

[5] *See also*, White Paper, **Attachment 2** (including ERO Enterprise analysis); *and* Communication Plan (**Attachment 3**) (providing the overarching communication plan to coordinate with stakeholders).

[6] *Supra*, n. 3 (citing NOPR, which provides in addition to the proposed directive, a proposal to direct NERC to submit a compliance filing that includes a detailed standards development and implementation plan.)

Plan would address IBRs interconnected to the BPS. The Work Plan does not address IBRs connected to the local distribution system,[7] and does not address IBR-DERs although the ERO Enterprise is examining potential impacts that DERs may have on reliability of the BPS.[8] In addition, NERC is continuing to examine whether revisions to the BES definition might also support continued reliability of the BPS as the grid transforms.

I. NOTICES AND COMMUNICATIONS

Notices and communications with respect to this filing may be addressed to the following:[9]

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II. RISK PRESENTED BY GAP IN REGISTRATION OF GO-IBRs.

NERC's IBR Strategy underscores that the rapid interconnection of BPS-connected IBRs "is the most significant driver of grid transformation and poses a high risk to BPS reliability."[10] ERO Enterprise filings in Commission proceedings and NERC assessments demonstrate that the

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[7] 16 U.S.C. § 824o(a)(1) (defining "Bulk-Power System" as "facilities and control systems necessary for operating an interconnected electric energy transmission network (or any portion thereof); and electric energy from generating facilities needed to maintain transmission system reliability. The term does not include facilities used in the local distribution of electric energy.") *See also*, IBR Order, at fn. 1-4.

[8] *See*, Reliability and Security Technical Committee ("RSTC") website, https://www.nerc.com/comm/RSTC/Pages/default.aspx.

[9] Persons to be included on the Commission's service list are identified by an asterisk. NERC respectfully requests a waiver of Rule 203 of the Commission's regulations, 18 C.F.R. § 385.203, to allow the inclusion of more than two persons on the service list in this proceeding.

[10] NERC IBR Strategy at p. 1, https://www.nerc.com/comm/Documents/NERC_IBR_Strategy.pdf.

increasing, rapid, integration of IBRs with the BPS is challenging long-held assumptions regarding grid operation and creating risks to reliability if unaddressed.[11]

To address risks to reliability, the ERO Enterprise develops and enforces mandatory Reliability Standards. These Reliability Standards are developed using a results-based approach that focuses on performance, risk management, and entity capabilities. Reliability Standards apply to entities registered under the NERC Compliance Registry ("NCR") in accordance with the rules and criteria under the NERC ROP. However, as recognized in the IBR Strategy and IBR Order, "despite the potential for IBRs to have a significant aggregate impact on the Bulk-Power System, many of the owners and operators of these individual resources are not required to register with NERC or comply with NERC's mandatory Reliability Standards."[12] The attached White Paper (**Attachment 2)** reflects ERO Enterprise research and analysis confirming that there is already a 16% gap in BPS-connected IBRs not subject to Reliability Standards, with that trend expected to continue.[13] The Commission underscores:

> In summary, events and disturbances have shown that IBRs, regardless of size and transmission or sub-transmission voltage, have a material impact on Bulk-Power System reliability. Further, while NERC recognizes that action is necessary to address the most common reliability issues posed by IBRs, these issues have not been resolved. Finally, even when NERC does address IBR-specific gaps through

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[11] NERC, *Resource Loss Protection Criteria Assessment Whitepaper,* (Feb. 2018), https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/IRPTF_RLPC_Assessment.pdf;
NERC, *2020 Long Term Reliability Assessment Report,* (Dec. 2020), https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2020.pdf; NERC, *Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources*, (Sept. 2019) (IBR Interconnection Requirements Guideline), https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_IBR_Interconnection_Requirements_Improvements.pdf#search=improvements%20to%20interconnection%20requirements%20for%20BPS%2DConnected*; and* IBR Order at P 2. *See also*, IBR Order at P 5 and PP 24-29 (highlighting ERO Enterprise documented analysis of risks to reliability presented by BPS-connected IBRs).

[12] IBR Order, at P 3; *see also*, NERC IBR Strategy at p. 8 and IBR Order at P 2.

[13] *See,* White Paper, **Attachment 2**, at p. 6.

> its Reliability Standards, until unregistered IBRs are registered, they will not be required to comply with the Reliability Standards.[14]

III. NERC PROPOSED WORK PLAN TO REGISTER GO-IBRs

The Commission states that it, "find[s] it necessary to ensure that NERC register the owners and operators of those unregistered IBRs that, in the aggregate, have a material impact on Bulk-Power System reliability…."[15] The Commission later adds, "we find that unregistered IBRs connected to the Bulk-Power System, regardless of size and transmission or sub-transmission voltage, that in the aggregate have a material impact on Bulk-Power System performance should be registered."[16] The Commission determines:

> Therefore, we direct NERC to develop and file a work plan within 90 days of the date of this order explaining how it will identify and register unregistered IBRs that, in the aggregate, have a material impact on the reliable operation of the Bulk-Power System, but that are not currently required to be registered with NERC under the BES definition. The work plan should explain how NERC will modify its processes to encompass unregistered IBRs (whether by working with stakeholders to change the BES definition, changing its Rules of Procedure related to registration, or some other solution) within 12 months of approval of the work plan. The work plan should also include implementation milestones ensuring that unregistered IBR owners and operators meeting the new registration criteria are identified within 24 months of the approval date of the work plan, and that they are registered and required to comply with applicable Reliability Standards within 36 months of the approval date of the work plan. The work plan will be noticed for public comment.[17]

The IBR Order also recognized that a subset list of Reliability Standards may be appropriate for currently unregistered IBR generator owners and operators affected by the measures taken under the Work Plan.[18]

In accordance with the Commission's directive, NERC proposes to modify the ROP to include a new function comprised of owners of IBRs interconnected to the BPS, as these resources

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14 IBR Order at P 30.
15 *Id.* at P 31.
16 *Id.* at P 32.
17 *Id.* at P 33.
18 *Id.* at P 34.

and their owners have a material aggregate impact on reliability of the BES. Under the Work Plan **(Attachment 1)**, the ERO Enterprise would develop proposed revisions to the ROP and Registry Criteria thereunder to incorporate a new registered function of GO-IBR. Creation of a GO-IBR function would be similar to NERC's Appendix 5B Registry Criteria for: (i) Distribution Providers responsible for certain systems or programs designed, installed, and operated for the protection of the BES, and (ii) Underfrequency Load Shedding-Only Distribution Providers ("UFLS-Only Distribution Providers").[19]

In the attached Work Plan, NERC proposes adding and registering GO-IBRs according to the following concept:[20]

> Generator Owner – Inverter-Based Resource (GO-IBR):
>
> Owners of IBRs which have aggregate nameplate capacity of less than or equal to 75 MVA and greater than or equal to 20 MVA interconnected at a voltage greater than or equal to 100 kV; or
>
> Owners of IBRs which have aggregate nameplate capacity of greater than or equal to 20 MVA interconnected at a voltage less than 100 kV.

The ERO Enterprise is also considering application of a subset list of Reliability Standards to GO-IBRs, and looks forward to working with stakeholders to enlarge upon the concepts herein.

The ERO Enterprise would develop these revisions in consultation with stakeholders such as those participating in the Compliance and Certification Committee ("CCC"), serving on the CCC's Organization Registration and Certification Subcommittee ("ORCS"), and commenting on proposed ROP revisions posted on NERC's website. As outlined in the attached Communication

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[19] *See, e.g.*, Appendix 5B, at Section III(b) (providing the criteria for UFLS-only Distribution Providers); *Id.*, at Section III.a.2 (including the following type of Distribution Provider, "Distribution Provider is the responsible entity that owns, controls, or operates Facilities that are part of any of the following Protection Systems or programs designed, installed, and operated for the protection of the BES: • a required Undervoltage Load Shedding (UVLS) program and/or • a required Special Protection System or Remedial Action Scheme and/or • a required transmission Protection System.").

[20] This concept does not intend to result in registration of owners of facilities used solely in local distribution.

Plan (**Attachment 3),** the ERO Enterprise is committed to coordinating with key stakeholders in North America to effectuate the measures in the Work Plan. This coordination shall include outreach to entities not traditionally included in the NERC NCR and shall include governmental authorities in Canada. Transformation of the grid impacts BPS reliability across North America. The ERO Enterprise looks forward to working with stakeholders in the United States and Canada, as well as Mexico.

As reflected in the attached Work Plan and White Paper, registering GO-IBR entities under the proposed approach would result in approximately 98% BPS-connected IBRs being subject to applicable NERC Reliability Standards.[21] Thus, the proposed GO-IBR function would close 14% of the 16% gap referenced above and bring Reliability Standard coverage for BPS-connected IBRs to a level comparable with conventional resources. This would address the risk to reliability presented under the transforming grid.[22]

Such modifications to the NERC Registry Criteria would address the risks to reliability presented by increasing integration of IBRs interconnecting with the BPS. Therefore, the Work Plan does not include milestones to develop changes to the BES definition. Nonetheless, in parallel path with activities under the Work Plan, NERC will continue to examine whether revision of the BES Definition might also support continued reliability of the BPS as the grid transforms. Thus, the Work Plan reflects a three phase approach over the next 36 months to: (i) revise the ROP to include GO-IBR registered entity function; (ii) identify candidates for GO-IBR registration; and (iii) effectuate GO-IBR registration.

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[21] *See*, White Paper, **Attachment 2,** at p. 9.

[22] Work Plan, **Attachment 1**, at p. 3; White Paper, **Attachment 2,** at pp. 7-9; NERC, *Assessment of Generation Trends Across the BPS*, (Sept. 14, 2022), at 70 (https://www.nerc.com/comm/RSTC/AgendaHighlightsandMinutes/RSTC_Meeting_September_14_2022_Presentations.pdf).

IV. REQUEST FOR EXPEDITED REVIEW

NERC respectfully requests that the Commission issue a 30-day public comment period for the Work Plan (with comments due approximately March 17, 2023) and an expedited Commission review period for 60 days thereafter (approximately May 16, 2023). Expedited treatment would be in the public interest as necessary and appropriate to help facilitate efficient resolution of the gap in Reliability Standards coverage identified as the resource mix transforms to include greater levels of BPS-connected IBRs.

The ERO Enterprise plans to coordinate with stakeholders on the Work Plan proposals immediately upon filing this Work Plan and has already initiated outreach, however, expedited Commission review would provide critical certainty as ROP revisions are developed. The IBR Order recognizes the pressing need for registration of BPS-connected IBRs, and the ERO Enterprise seeks to address this need as soon as reasonably possible.[23]

Expedited review and processing of this compliance filing will also not impede due process as ROP revisions would be posted for public comment on NERC's website per NERC's rules and would later be filed with the Commission. Updates to the Work Plan would also be filed every 90 days after Commission approval of the proposal. As a result, there will be ample opportunity public review and comment as the Work Plan is implemented. Expedited review would therefore balance due process with urgent reliability needs.

[23] *See Order Approving Cold Weather Reliability Standards*, 176 FERC ¶ 61,119 (2021) (approving NERC's Cold Weather Reliability Standards on an expedited basis after balancing due process with the public interest in having mandatory requirements in place as soon as reasonably possible as well as regulatory certainty to industry and potentially effected entities).

V. CONCLUSION

For the reasons set forth above, NERC respectfully requests that the Commission approve the Work Plan. In addition, NERC requests expedited public comment and review of the proposed Work Plan to support efficient and effective resolution of the risks to reliability outlined in the IBR Order.

Respectfully submitted,

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Date: February 15, 2023

Attachment 1

Work Plan Draft

Registration of Inverter Based Resources – Docket No. RD22-4-000
NERC Work Plan
February 15, 2023

On November 17, 2022, in order to respond to concerns regarding the reliability impacts from inverter-based resources (IBRs)[1] on the Bulk Power System[2] (BPS), the Federal Energy Regulatory Commission (FERC or Commission) directed the North American Electric Reliability Corporation (NERC) to submit a work plan to address registration of IBRs.[3] Regulatory consideration differs based on whether the IBRs meet NERC's Bulk Electric System (BES) definition and are registered with NERC for compliance purposes (registered IBRs), whether the IBRs are connected directly to the BPS but are not registered with NERC (unregistered IBRs), or whether the IBRs are distributed energy resources (i.e. connected to the distribution system) (IBR-DER). The Commission directed NERC to file a Work Plan within 90 days detailing how the ERO Enterprise plans to identify and register owners and operators of unregistered IBRs.

The Commission stated that the work plan should include the following:

- Explanation of how NERC will modify its processes to address unregistered IBRs (whether by working with stakeholders to change the BES definition, a change to its registration program, or some other solution) within 12 months of approval of the work plan, and
- Implementation milestones ensuring that owners and operators meeting the new registration criteria are identified within 24 months of the approval date of the work plan, and
- Implementation milestones ensuring that owners and operators meeting the new registration criteria are registered and thereby required to comply with applicable Reliability Standards within 36 months of the approval date of the work plan.

Section I. Introduction

NERC recognizes that the landscape of the electric power system across North America is experiencing a substantial transformation. Conventional generation fueled in large part by coal, nuclear, and, in recent years, natural gas turbines are being rapidly replaced by decentralized generation consisting of IBRs. These energy resources are primarily battery energy storage systems (BESS), solar photovoltaic (i.e., solar PV), and wind that are installed on the BPS and distribution systems. As stated in NERC's recent document Inverter-Based Resource Strategy Ensuring Reliability of the Bulk Power System with Increased Levels of

[1] The Order states *"This order uses the term IBRs to include all generating facilities that connect to the electric power system using power electronic devices that change direct current (DC) power produced by a resource to alternating current (AC) power compatible with distribution and transmission systems. This order does not address IBRs connected to the distribution system."*

[2] The Bulk Power System (BPS) is defined in the Glossary of Terms Used in NERC Reliability Standards as: (A) facilities and control systems necessary for operating an interconnected electric energy transmission network (or any portion thereof); and (B) electric energy from generation facilities needed to maintain transmission system reliability. The term does not include facilities used in the local distribution of electric energy. (Note that the terms "Bulk-Power System" or "Bulk Power System" shall have the same meaning.)

[3] *Registration of Inverter-Based Resources,* 181 FERC ¶ 61,124 (2022) [hereinafter *IBR Order*].

BPS-Connected IBRs[4] (IBR strategy), "[t]he rapid interconnection of bulk power system (BPS)-connected inverter-based resources (IBR) is the most significant driver of grid transformation and poses a high risk to BPS reliability."

Evidence examined by NERC and the six Regional Entities (together the ERO Enterprise) over the 2017 – 2021 five-year timeframe reveals that the total capacity supplied by fossil-fired and nuclear resources on the BPS has decreased by 29 GW and the total generation supplied by IBRs has increased by 73 GW. IBRs accounted for over 15% of total resource capacity on the BPS in 2021 but only 84% of these IBRs are registered with NERC. Further, the large majority of the non-registered IBR capacity on the BPS is located at plants 20 MW and greater – approx. 24.3 GW (2021), and this total is expected to continue its rapid increase in the foreseeable future.[5]

As recognized by the IBR Order, this transformation has created a present and ongoing risk to the Reliable Operation of the BES. As a result, the ERO Enterprise plans to develop revisions to its Registration Criteria as reflected in Sections 500, Appendix 5A, and Appendix 5B of the NERC Rules of Procedure (ROP) under the milestones set forth below.

Section II. Proposed Registration Criteria Revisions for BPS Connected Generator Owners

NERC plans to modify its process to encompass presently unregistered IBRs through changes to its registration program. In particular, NERC proposes to revise its Registry Criteria under the ROP by including a new function comprised by owners of unregistered IBRs interconnected to the BPS as these resources and their owners have a material aggregate impact on reliability of the BES. Proposed revisions to the Registry Criteria would be developed through the process applicable under the ROP, NERC Bylaws, and applicable Commission regulation. In general, however, at this stage, the proposed new function would reflect the following:

> Generator Owner – Inverter-Based Resource (GO-IBR):
>
> Owners of IBRs which have aggregate nameplate capacity of less than or equal to 75 MVA and greater than or equal to 20 MVA interconnected at a voltage greater than or equal to 100 kV; or
>
> Owners of IBRs which have aggregate nameplate capacity of greater than or equal to 20 MVA interconnected at a voltage less than 100 kV.

Registering GO-IBR entities will lead to application of results-based Reliability Standards to address issues such as facility interconnection, data sharing, modeling, ride-through, and performance. As elaborated in the IBR Order, "Unregistered IBRs often have small individual generation capacities, are connected to the Bulk-Power System at less than 100 kV transmission or sub-transmission voltages, and do not meet one of the inclusions in the BES definition."[6] As the Commission concludes, "events and disturbances have shown that IBRs, regardless of size and transmission or sub-transmission voltage, have a material impact

[4] Available at: https://www.nerc.com/comm/Documents/NERC_IBR_Strategy.pdf

[5] To help avoid potential confusion, NERC clarifies that in referring to IBRs, this Work Plan does not include distributed energy resources. Rather it only includes IBRs that are interconnected to the BPS. Nonetheless, NERC is reviewing potential impacts associated with DERs on the BPS.

[6] IBR Order, at P 23. *See also, id.*, at P 32-33.

on Bulk-Power System reliability….until unregistered IBRs are registered, they will not be required to comply with the Reliability Standards."[7]

Consistent with the Commission's statements in the IBR Order, in revising its Registration Program, NERC would consider whether it is appropriate to apply a subset list of Reliability Standards to the GO-IBR function,[8] or if there is a need to develop new Reliability Standards. Activity in connection with IBR affiliated Reliability Standards would also consider whether it is appropriate to add the new GO-IBR function to the applicability of certain NERC Reliability Standards or use some other approach.

The proposed expansion of Registry Criteria as outlined above is estimated to increase awareness and visibility of existing IBRs by approximately 14%. This would bring the total level of IBRs interconnected to the BPS subject to NERC Reliability Standards to 98%, commensurate with application of Reliability Standards to owners and operators of conventional resources.

Section III. Milestones to Implement Work Plan[9]

In addition to the milestones below, the ERO Enterprise will also continue to consider whether revisions to the BES Definition might also support continued reliability of the BPS as the grid transforms.

Within 12 months of Commission approval of the work plan, NERC will do the following to revise its Registration Program:

TIMEFRAME	ACTIVITIES
Month 1-2	• ERO Enterprise to complete review and draft proposed revisions of Section 500 and Appendices 5A and 5B of the ROP.
Month 2-3	• ERO Enterprise to coordinate with the Organization Registration and Certification Subcommittee (ORCS) of the Compliance and Certification Committee (CCC) on proposed revisions.[10]
Month 3-4	• ERO Enterprise to present proposed revisions to the CCC • ERO Enterprise to present proposed revisions to other key stakeholder organizations in North America. • NERC to present proposed revisions to the MRC. • NERC to file work plan update with FERC.
Month 4-5	• ERO Enterprise to complete revisions to initial draft ROP proposal to address informal stakeholder feedback

[7] IBR Order, at P 30.

[8] *Compare*, IBR Order, at P 34.

[9] Throughout this period and as directed in the IBR Order, once the Commission approves the proposed work plan, NERC would also submit progress updates every 90 days thereafter. Please also refer to NERC's filings in Docket No. RM22-12-000 for more information regarding matters pertaining to IBR affiliated Reliability Standards.

[10] The CCC and ORCS work plans for 2023 contemplate providing comments on proposed revisions to the ROP related to IBRs and the Registration Program.

TIMEFRAME	ACTIVITIES
	• NERC to post ROP revisions for public comment period on NERC website for 45 days.
Month 6	• If necessary, ERO Enterprise completes further revisions to the ROP to address comments. • ERO Enterprise to prepare matrix summarizing proposal, comments, and responses thereto. • NERC to file work plan update with FERC.
Month 7	• ERO Enterprise to request NERC Board of Trustees (Board) approval to file ROP revisions with FERC. OR • If deemed necessary in NERC's discretion, post ROP revisions for second public comment period for 30 days.[11]
Month 8-10	• NERC to file the proposed ROP revisions with FERC, subject to Board approval, and • Request expedited notice, comment, and review over a 3-month period.
Month 10-12	• ERO Enterprise to consider GO-IBR applicable Reliability Standards including a possible subset list of Standards, as appropriate.

Within 24 months of Commission approval of the work plan, NERC will do the following to identify GO-IBR candidates for registration that meet the updated Registry Criteria:

TIMEFRAME	ACTIVITIES
Month 12-13	• ERO Enterprise to cross reference Energy Information Administration (EIA) Form 860 Database with the NERC Compliance Registry (NCR) to identify unregistered owners of IBRs as potential GO-IBR candidates. • NERC to initiate information technology (IT) updates to extent necessary. • ERO Enterprise to issue requests for information to Reliability Coordinators,

[11] If NERC determines a second posting is appropriate, it may present the revised ROP revisions thereafter to the Board via a special meeting.

TIMEFRAME	ACTIVITIES
	Planning Coordinators, Transmission Owners, Transmission Planners, and Distribution Providers regarding GO-IBR entities in their footprints. • ERO Enterprise to issue bulletins and other communication materials announcing the GO-IBR function and obligation to register. • NERC to file work plan update with FERC.
Month 13-14	• ERO Enterprise to compare identified unregistered owners of IBRs to the GO-IBR Registry Criteria to identify GO-IBR candidates. • ERO Enterprise to develop approach for implementation of GO-IBR registration and applicable Reliability Standards, including a possible subset list of Standards, as appropriate. • ERO Enterprise to send communication to GO-IBR candidates for Registration. • ERO Enterprise to issue notice of webinar on Registration for the GO-IBR function.
Month 14-20	• ERO Enterprise to hold workshops across Regional Entities and at NERC regarding GO-IBR registration and implementation. • NERC to file work plan update(s) with FERC.
Month 20-22	• ERO Enterprise to examine any updates to EIA Form 860 Database. • NERC to file work plan update with FERC.
Month 23-24	• ERO Enterprise to send communication to any newly identified unregistered GO-IBR candidates, as needed. • NERC to continue IT transitions as necessary.

Within 36 months of Commission approval of the work plan, NERC will do the following to register GO-IBR candidates:

TIMEFRAME	ACTIVITIES
Month 25-26	• ERO Enterprise to hold training for GO-IBR entities on the Centralized

TIMEFRAME	ACTIVITIES
	Organization Registration ERO System (CORES).[12] • ERO Enterprise to provide ERO Enterprise 101 Informational Package, ERO Enterprise Entity Onboarding Checklist, and guidance. • NERC to file work plan update with FERC.
Month 26-27	• NERC to complete IT transition for expansion of registration for the GO-IBR entities.
Month 27-36	• NERC to file work plan update(s) with FERC. • ERO Enterprise to issue notification letters to new GO-IBR entities that will provide notice of GO-IBR registration and responsibility for compliance with applicable NERC Reliability Standards.

[12] The ERO Enterprise anticipates the need to update its IT, external facing communications, and systems to accommodate the registration of GO-IBR entities. This may impact the milestones reported on during 90-day progress reports.

Attachment 2

White Paper

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Analysis of the Changing Mix of Generating Resources on the BPS

ERO Enterprise BPS Resource Trends Task Force
White Paper
February 2023

Introduction

The landscape of the electric power system across North America is experiencing a substantial transformation. Conventional generation fueled in large part by coal, nuclear, and, in recent years, natural gas turbines are being rapidly replaced by decentralized generation consisting of various forms of inverter-based resources (IBRs). These IBRs are primarily battery energy storage systems (BESS), solar photovoltaic (i.e., solar PV), and wind that are installed on the Bulk Power System[1] (BPS) and distribution systems. As stated in NERC's recent document *Inverter-Based Resource Strategy Ensuring Reliability of the Bulk Power System with Increased Levels of BPS-Connected IBRs*[2] (IBR strategy), "[t]he rapid interconnection of bulk power system (BPS)-connected inverter-based resources (IBR) is the most significant driver of grid transformation and poses a high risk to BPS reliability."

This paper focuses on the analysis and associated recommendations prepared by the ERO Enterprise BPS Resource Trends Task Force (RTTF) in response to potential risks to reliability resulting from grid transformation as seen through BPS resource trends.[3] The RTTF is an ERO Enterprise group comprised of members of the Organization Registration and Certification Group (ORCG) and the Reliability Assessment and Performance Analysis Steering Group (RAPA-SG).

The purpose of the RTTF is to analyze trends in the BPS relative to the changing mix of generating resources and identify any potential reliability risks resulting from these trends. As a result, the RTTF investigated potential modifications to the Bulk Electric System[4] (BES) definition, the NERC Registration Criteria, and related NERC Reliability Standards. Lastly, this paper supports the core tenets of the IBR Strategy.[5]

[1] The Bulk Power System is defined in the Glossary of Terms Used in NERC Reliability Standards as: (A) facilities and control systems necessary for operating an interconnected electric energy transmission network (or any portion thereof); and (B) electric energy from generation facilities needed to maintain transmission system reliability. The term does not include facilities used in the local distribution of electric energy. (Note that the terms "Bulk-Power System" or "Bulk Power System" shall have the same meaning.)

[2] *Inverter-Based Resource Strategy Ensuring Reliability of the Bulk Power System with Increased Levels of BPS-Connected IBRs*:: https://www.nerc.com/comm/Documents/NERC_IBR_Strategy.pdf

[3] Earlier presentation of the research included in this White Paper were provided at the *Assessment of Generation Trends Across the BPS*, (Sept. 14, 2022), at 70: https://www.nerc.com/comm/RSTC/AgendaHighlightsandMinutes/RSTC_Meeting_September_14_2022_Presentations.pdf

[4] The Bulk Electric System is defined by the Glossary of Terms Used in NERC Reliability Standards, https://www.nerc.com/files/glossary_of_terms.pdf

[5] IBR Strategy, at p. 4.

BPS Resource Trends

The analysis in this white paper is based on publicly available Form 860 information reported to the U.S. Energy Information Administration (EIA). This data was analyzed to identify historical BPS resource capacity trends from individual generation units as well as aggregate plant data up to and including year 2021. The generation data in this study included all resources identified as being part of an electric generation utility under the North American Industry Classification System (NAICS), Sector 22, Utilities.[6] Industrial and commercial generation were not considered in the analysis since these resources are typically prime power for industrial sites or backup generation to commercial businesses and are not generally considered a BPS resource. Plants classified as utility including independent power producers, with an aggregate nameplate capacity greater than or equal to 1 MW and connected at a point-of-interconnection (POI) voltage greater than or equal to 40 kV, were included in the population of study data.[7] The data was divided further into the classification of generation units and plants that meet the NERC definition of BES as defined by the Glossary of Terms used in NERC Reliability Standards.

The primary focus was the most recent five-year period from 2017 to 2021. As shown in **Figure 1**, the BPS is undergoing a significant and rapid change in generating resource mix. **Figure 1** includes the aggregate nameplate capacity in Gigawatts (GW) on the BPS for conventional resources and IBRs for each year from 2017 to 2021. Over this short five-year time frame, the total generation supplied by conventional resources on the BPS has decreased by 29 GW and the total generation supplied by IBRs has increased by 73 GW. IBRs accounted for 9% of the total resource capacity in 2017 and now accounts for over 15% of total resource capacity as of 2021 on the BPS.

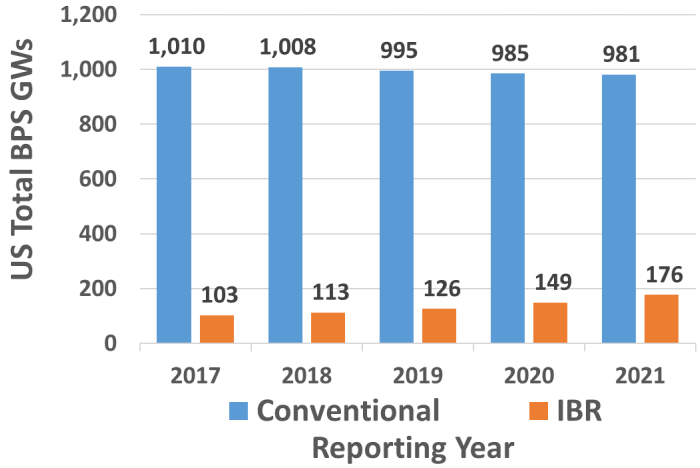

Figure 1: Total US BPS GWs of Conventional Resources and IBRs

Breaking down **Figure 1** above into BES and non-BES reveals a significant difference between conventional resources and IBRs. As shown in **Figure 2** below, conventional resources are predominately BES resources with approximately 97% of these resources being classified as BES over the last five years.

[6] https://www.naics.com/naics-code-description/?code=22
[7] Where MW or GW is referenced, it is referring to EIA data.

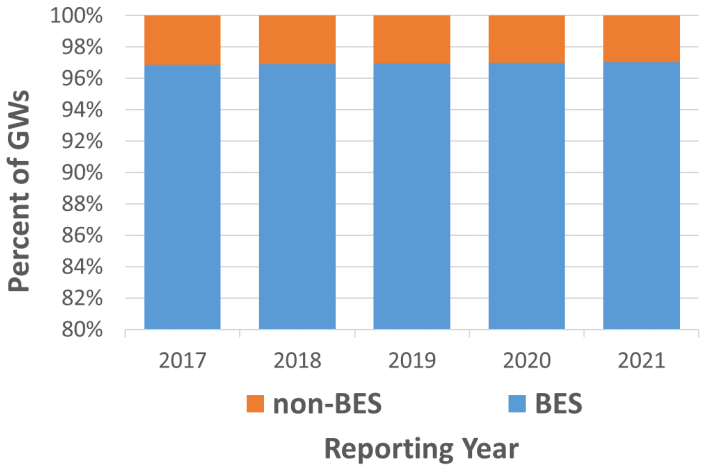

Figure 2: Percent Share of BPS Conventional Resources by BES and Non-BES

However, as shown in **Figure 3**, IBRs have a much lower percentage with approximately 84% (2021) of these resources being classified as BES over the same timeframe. This trend is concerning since the number of conventional resources has been gradually declining and the number of IBRs have continued increasing at a significantly lower BES penetration than conventional resources.

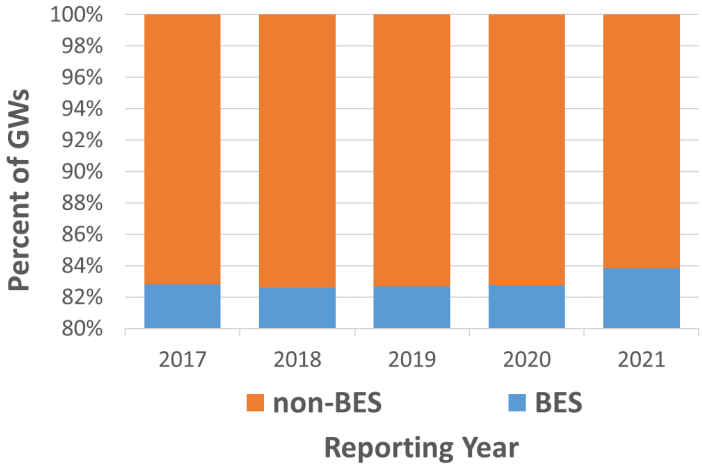

Figure 3: US Percent Share of BPS IBRs by BES and non-BES

Figure 4 details the BES versus non-BES total aggregate nameplate capacity (in GW) of IBRs. **Figure 4** demonstrates that IBRs are steadily increasing at a five-year average rate of 15% for BES resources and 12% for non-BES resources. This rapid change has resulted in a non-BES resource capacity increase of over 60% over this short timeframe to a total capacity of 29 GW in 2021.

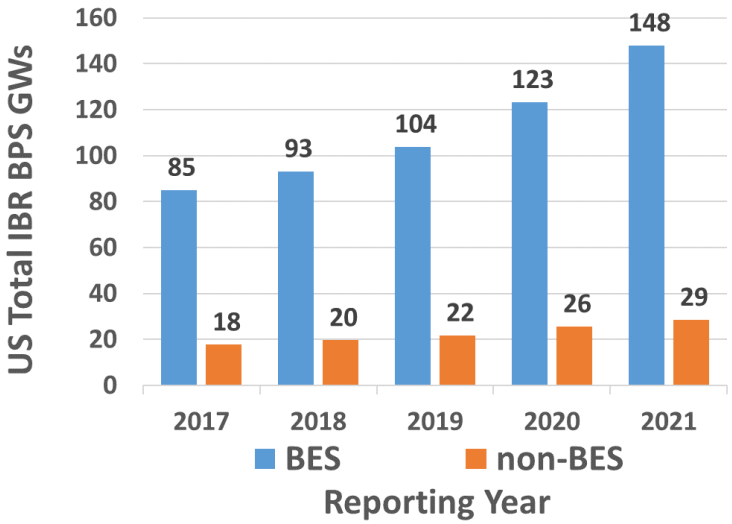

Figure 4: BPS IBRs GWs by BES and Non-BES

To further understand the characteristics of the non-BES IBRs, the RTTF analyzed the data by individual plant size and interconnection voltage.

Figure 5 provides refinement of the total non-BES IBR aggregate nameplate capacity to distinguish between plants at an interconnection voltage greater than or equal to 100 kV and less than 100 kV. In 2021, IBRs with an aggregate capacity of greater than or equal to 20 MW, at an interconnected voltage greater than or equal to 100 kV and less than 100 kV, accounted for 24.3 GW (sum of orange and grey bars) of the total 29 GW (see **Figure 4**) of non-BES IBR capacity.

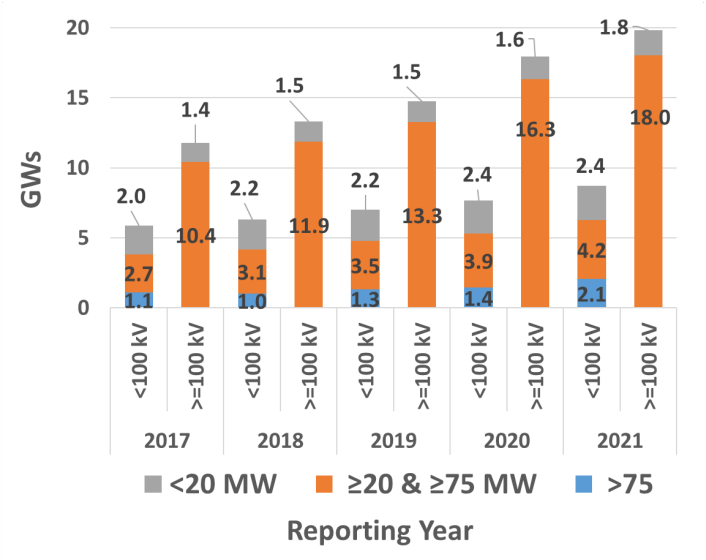

Figure 5: US Total Non-BES IBRs GWs by Voltage Class and Plant Class (<20 MW, ≥20 to ≤75 MW, and >75 MW)

The following chart was developed by Lawrence Berkeley National Laboratory, shown in **Figure 6**, labeled "Existing U.S. Generation Capacity vs. Interconnection Queues." The key takeaway from this chart is the bar graph on the far right which shows the aggregate total of proposed generation projects contained in the interconnection queues of various organizations across the United States in 2021. The "2021 Queue" bar graph shows over 1,300 GW of IBR capacity which is a substantial increase above the current level of IBR capacity, and exceeds the current total capacity of all BPS generating resources currently in service.

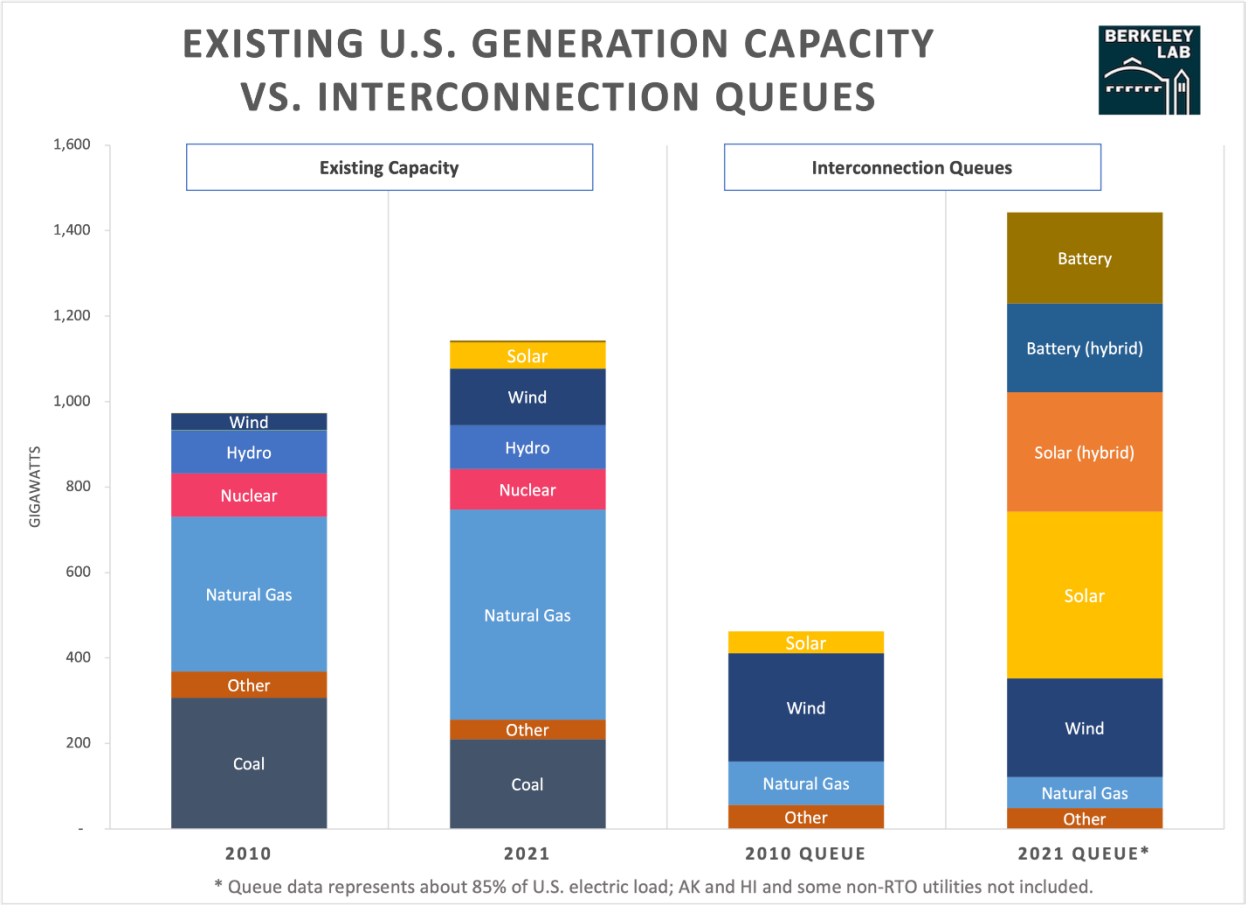

Figure 6: Interconnection Queues (All fuel types)

RTTF Conclusion

The RTTF has observed that the changing resource mix has resulted in a significant shift in generating resources on the BPS from conventional resources to IBRs and that the percentage of IBR capacity (84%) that are classified as BES resources is significantly lower compared to conventional resources (97%).

Figure 7 shows a pie chart of the aggregate nameplate capacity in GW of IBRs in 2021. The blue portion includes the existing BES resources totaling approximately 147.9 GW, or 84% of the total IBRs. The orange portion includes non-BES resources representing approximately 28.5 GW or 16% of the BPS IBRs. Within this smaller piece there are three discrete groupings of IBRs, which include:

- plants with an aggregate capacity of less than or equal to 75 MVA and greater than or equal to 20 MVA and interconnected at a voltage greater than or equal to 100 kV, totaling approximately 18 GW, or 10% of the total,
- plants with an aggregate capacity greater than or equal to 20 MVA and interconnected at a voltage less than 100 kV, totaling approximately 6.3 GW, or 4% of the total, and
- plants with an aggregate capacity of less than 20 MVA and interconnected at any voltage, totaling approximately 4.2 GW, or 2% of the total.

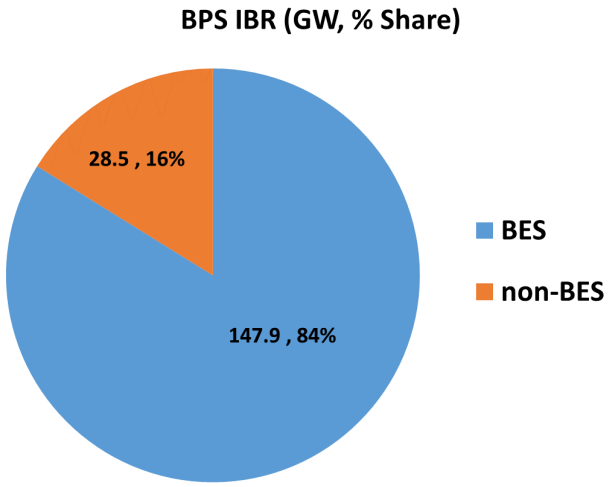

Figure 7: BPS IBRs in GWs by Percent Share (2021)

The first two bullets above represent approximately 24.3 GW of IBR capacity from plants of substantial size (i.e., ≥20 MW) that is not subject to performance requirements in accordance with NERC Reliability Standards. Furthermore, the rate of increase of IBR capacity over the last five years has been steadily increasing, and is expected to continue based on the amount of IBRs currently identified in the interconnection queues shown in **Figure 6**.

An additional concern associated with the increase in IBRs is that the available capacity exhibited by these resources during peak load periods is significantly lower than their nameplate capacity. As described in the *NERC 2022 Summer Reliability Assessment*,[8] "Because the electrical output of variable energy resources (e.g., wind, solar) depends on weather conditions, on-peak capacity contributions are less than nameplate capacity." The assessment shows "Expected Share of Nameplate (%)" for the three Interconnections (i.e., Eastern, ERCOT, and Western) combined to be 19% for wind and 70% for solar PV.

[8] See page 45, NERC 2022 Summer Reliability Assessment:
https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_SRA_2022.pdf

Also, as detailed in the NERC report *Multiple Solar PV Disturbances in CAISO, Disturbances between June and August 2021, Joint NERC and WECC Staff Report*, April 2022,[9] many non-BES solar PV facilities had active power reductions of more than 10 MW during these events. As shown in Appendix B: Detailed Review of Affected Facilities, there were a total of 12 plants across the events listed that were impacted (out of 30 total plants, or approximately 40% of the impacted plants) that are non-BES resources and whose capacity is between 20 MW and 75 MW. Also, the NERC report *Odessa Disturbance, Texas Events: May 9, 2021 and June 26, 2021, Joint NERC and Texas RE Staff Report*, September 2021[10] showed that two non-BES solar PV plants and one non-BES wind plant whose capacity is between 20 MW and 75 MW were impacted.

The RTTF has concluded that the changing resource mix, as described above, with large amounts of non-BES IBRs being added to the BPS that have no NERC Reliability Standards obligations, has resulted in a current and increasing gap in reliability of the BPS that must be addressed. This gap is exacerbated when considering reduced nameplate capacity availability due to the weather dependency of these resources. Further, the events as described in the referenced disturbance reports showed numerous non-BES plants that were impacted during these events, which is an indication that future events may continue to see increasing non-BES IBR impacts.

RTTF Recommendation

The RTTF is proposing the following recommendation to address the potential risk to the reliability of the BPS driven by the significant increase of unregistered IBR capacity connecting to the BPS that do not meet the criteria established by Inclusion I4 of the BES definition and therefore the owners of these resources are not subject to adherence with the NERC Reliability Standards. These facilities are connected to the BPS and can impact the reliability of the BES. The RTTF recommends the following:

> Creation of a new Functional Registration under Section 500 and Appendices 5A and 5B of the NERC Rules of Procedure (ROP) identified as Generator Owner – Inverter-Based Resource (GO-IBR) to include the owners of the following:[11]
>
> - an IBR whose aggregate total capacity (i.e., gross nameplate rating) is less than or equal to 75 MVA and greater than or equal to 20 MVA and interconnected at a voltage of greater than or equal to 100 kV, and
> - an IBR whose aggregate total capacity (i.e., gross nameplate rating) is greater than or equal to 20 MVA and interconnected at a voltage less than 100 kV.

This proposal will require expanding the 'applicability' of certain NERC Reliability Standards to include the new GO-IBR functional entity, where needed to reduce risk to the BPS.

[9] https://www.nerc.com/pa/rrm/ea/Documents/NERC_2021_California_Solar_PV_Disturbances_Report.pdf
[10] https://www.nerc.com/pa/rrm/ea/Documents/Odessa_Disturbance_Report.pdf
[11] In accordance the NERC Rules of Procedure (ROP), Section 501.1, "NERC shall establish and maintain the NCR of the Bulk Power System owners, operators, and users that are subject to approved Reliability Standards." GO-IBR is used for purposes of this White Paper, although another name may be considered in the future.

The applicable group of Reliability Standards would include those focused on the key parameters for BPS reliability – facility interconnection analysis, data for modeling and verification, and protection coordination and resource performance. The standards include, but are not limited to, FAC-002 (facility interconnection), IRO-010 and TOP-003 (Data), MOD-025, -026, -027, and -032 (modeling), and PRC-019 and -024 (protection and performance).

The RTTF recommendation for the creation of the new GO-IBR function and inclusion into the needed NERC Reliability Standards will address the risks presented by the analysis outlined above. It will address the potential reliability gap of unregistered IBRs not meeting BPS interconnection, data, modeling, protection, and performance criteria which can materially impact the reliability of the BPS.[12] This recommendation can be implemented in the most expeditious manner. Since the focus is on all IBRs, it would include specific IBRs (i.e., BESS, solar PV, and wind), as well as certain types of wind resources that are not considered IBRs.

Given the above referenced events, historical data, and the urgent need to ensure IBRs do not exacerbate events, revising the NERC Registry Criteria will provide the timeliest way to close the potential reliability gap. **Figure 8** highlights this first step to specifically register IBRs that are less than or equal to 75 MVA and greater than or equal to 20 MVA at an interconnection voltage greater than or equal to 100 kV and IBRs that are greater than or equal to 20 MVA at an interconnection voltage less than 100 kV will close the reliability gap.

Registering IBR entities (e.g., GO-IBR function) will allow specific performance and risk related standards such as FAC-002 (facility interconnection), IRO-010 and TOP-003 (Data), MOD-025, -026, -027, and -032 (modeling standards), and PRC-019 and -024 (protection and performance) to be modified by adding the new function to the applicability of these NERC Reliability Standards. This approach is estimated to increase awareness and visibility of existing IBRs by approximately 16% bringing the total IBRs subject to the necessary NERC Reliability Standards to 98%, commensurate with conventional resources.

[12] In accordance with ROP, Appendix 5B, Statement of Compliance Registry Criteria (Revision 7), Statement of Issue, "As the ERO, NERC intends to comprehensively and thoroughly protect the reliability of the grid. To support this goal NERC will include in its Compliance Registry each entity that NERC concludes can materially impact the reliability of the BPS." Furthermore, as stated in Limitation of responsibilities to a sub-set of Reliability Standards, "NERC may limit the compliance obligations of… a similarly situated class of entities, as warranted based on the particular facts and circumstances, to a sub-set list of Reliability Standards (which may specify Requirements/sub-Requirements)."

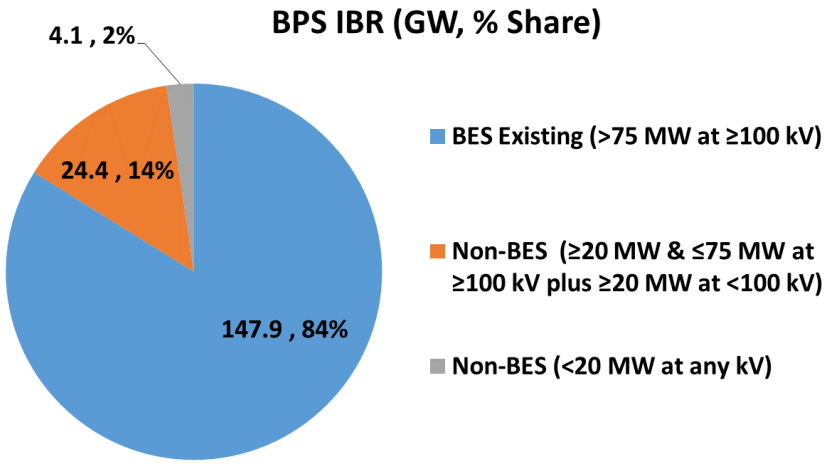

Figure 8: Recommended BPS IBRs in GWs by Percent Share (2021)

Attachment 3

Communication Plan

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Communication Plan

Generator Owner – Inverter-Based Resources

Communication Goals

NERC plans the following overarching communication strategies to begin identifying and informing Generator Owner (GO) Inverter-Based Resources (IBR) candidates of the proposed GO-IBR functional registration. This proposed communication plan includes activities during the three phases of activity outlined in the Work Plan filed with the Commission in Docket No. RD22-4-000.

The communication plan would help ensure that all stakeholders (including non-registered entities) become informed and engaged with the ERO Enterprise. The following table outlines the overarching communication activities to support the GO-IBR registration work plan.

TIMEFRAME	ACTIVITIES
Month 1-6	• Communicate to industry stakeholder groups* based on approved work plan activities that support the overall effort. • Seek feedback from generation industry. • Seek feedback from IBR industry associations. • Host informational webinar(s) regarding the work plan to make revisions the NERC ROP, including an overview of the ERO organization, Reliability Standards, and current activities. • Host informational webinar(s) regarding proposed ROP revisions to generation industry and trade associations.
Month 6-12	• Host informational session(s) on proposed ROP revisions.
Month 12-14	• Issue requests for information to Reliability Coordinators, Planning Coordinators, Transmission Owners, Transmission Planners, and Distribution Providers regarding GO-IBR entities in their footprints. • Issue bulletins and other communication materials announcing the GO-IBR function and obligation to register, including the list of applicable Reliability Standards, or a subset list, as appropriate.
Month 14-24	• Hold workshops across Regional Entities and at NERC regarding GO-IBR registration and implementation. • Share ERO Enterprise 101 Informational Package, ERO Enterprise Entity Onboarding Checklist, and onboarding guidance with newly identified GO-IBR candidates. • Send communication(s) to any newly identified GO-IBR candidates, as needed.
Months 24-36	• Issue notification letters to new GO-IBR entities that will provide notice of GO-IBR registration and responsibility for compliance with applicable NERC Reliability Standards.

***Stakeholders**

The following is an example list of the stakeholders that the ERO Enterprise may communicate with during the various activities associated with the work plan.

- American Clean Power Association (APC)
- American Public Power Association (APPA)
- American Wind Energy Association (AWEA)
- Canada Energy Regulator (CER)
- CAMPUT
- Electricity Canada (EC)
- Electric Producers (EPSA)
- Edison Electric Institute (EEI)
- Electric Power Supply Association (EPSA)
- Energy Systems Integration Group (ESIG)
- National Association of Regulatory Utility Commissioners (NARUC)
- National Rural Electrification Cooperative Association (NRECA)
- North American Generator Forum (NAGF)
- North American Transmission Forum (NATF)
- Regional Transmission Organizations (RTO) & Independent System Operators (ISO)
- Solar Energy Industries Association (SEIA)
- Transmission Access Policy Study Group (TAPS)