(1) *Alternative Methods of Compliance (AMOCs):* The Manager, Large Aircraft Section, International Validation Branch, FAA, has the authority to approve AMOCs for this AD, if requested using the procedures found in 14 CFR 39.19. In accordance with 14 CFR 39.19, send your request to your principal inspector or responsible Flight Standards Office, as appropriate. If sending information directly to the Large Aircraft Section, International Validation Branch, send it to the attention of the person identified in paragraph (n) of this AD. Information may be emailed to: *9-AVS-AIR-730-AMOC@faa.gov.* Before using any approved AMOC, notify your appropriate principal inspector, or lacking a principal inspector, the manager of the responsible Flight Standards Office.

(2) *Contacting the Manufacturer:* For any requirement in this AD to obtain instructions from a manufacturer, the instructions must be accomplished using a method approved by the Manager, Large Aircraft Section, International Validation Branch, FAA; or EASA; or ATR—GIE Avions de Transport Régional's EASA Design Organization Approval (DOA). If approved by the DOA, the approval must include the DOA-authorized signature.

(n) Related Information

For more information about this AD, contact Shahram Daneshmandi, Aerospace Engineer, Large Aircraft Section, FAA, International Validation Branch, 2200 South 216th St., Des Moines, WA 98198; telephone 206–231–3220; email *shahram.daneshmandi@faa.gov.*

(o) Material Incorporated by Reference

(1) The Director of the Federal Register approved the incorporation by reference (IBR) of the service information listed in this paragraph under 5 U.S.C. 552(a) and 1 CFR part 51.

(2) You must use this service information as applicable to do the actions required by this AD, unless this AD specifies otherwise.

(3) The following service information was approved for IBR on [DATE 35 DAYS AFTER PUBLICATION OF THE FINAL RULE].

(i) European Union Aviation Safety Agency (EASA) AD 2022–0201, dated September 26, 2022.

(ii) [Reserved]

(4) The following service information was approved for IBR on December 27, 2021 (86 FR 64805, November 19, 2021).

(i) European Union Aviation Safety Agency (EASA) AD 2021–0020, dated January 15, 2021.

(ii) [Reserved]

(5) For EASA AD 2022–0201 and AD 2021–0020, contact EASA, Konrad-Adenauer-Ufer 3, 50668 Cologne, Germany; telephone +49 221 8999 000; email *ADs@easa.europa.eu*; website *easa.europa.eu.* You may find these EASA ADs on the EASA website at *ad.easa.europa.eu.*

(6) You may view this service information at the FAA, Airworthiness Products Section, Operational Safety Branch, 2200 South 216th St., Des Moines, WA. For information on the availability of this material at the FAA, call 206–231–3195.

(7) You may view this service information that is incorporated by reference at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, email *fr.inspection@nara.gov,* or go to: *www.archives.gov/federal-register/cfr/ibr-locations.html.*

Issued on December 1, 2022.

Christina Underwood,

Acting Director, Compliance & Airworthiness Division, Aircraft Certification Service.

[FR Doc. 2022–26468 Filed 12–5–22; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

18 CFR Part 40

[Docket No. RM22–12–000]

Reliability Standards To Address Inverter-Based Resources

AGENCY: Federal Energy Regulatory Commission, Department of Energy (DOE).

ACTION: Notice of proposed rulemaking.

SUMMARY: The Federal Energy Regulatory Commission (Commission) proposes to direct the North American Electric Reliability Corporation (NERC), the Commission-certified Electric Reliability Organization (ERO), to develop new or modified Reliability Standards that address the following reliability gaps related to inverter-based resources (IBR): data sharing; model validation; planning and operational studies; and performance requirements. Further, the Commission proposes to direct NERC to submit to the Commission a compliance filing within 90 days of the effective date of the final rule in this proceeding that includes a detailed, comprehensive standards development and implementation plan to ensure all new or modified Reliability Standards necessary to address the IBR-related reliability gaps identified in the final rule are submitted to the Commission within 36 months of Commission approval of the plan.

DATES: Comments are due February 6, 2023 and reply Comments are due March 6, 2023.

ADDRESSES: Comments, identified by docket number, may be filed in the following ways. Electronic filing through *https://www.ferc.gov,* is preferred.

- *Electronic Filing:* Documents must be filed in acceptable native applications and print-to-PDF, but not in scanned or picture format.
- For those unable to file electronically, comments may be filed by U.S. Postal Service mail or by hand (including courier) delivery.
  - ○ *Mail via U.S. Postal Service only:* Addressed to: Federal Energy Regulatory Commission, Office of the Secretary, 888 First Street NE, Washington, DC 20426.
  - ○ *For Delivery via Any Other Carrier (including courier):* Deliver to: Federal Energy Regulatory Commission, Office of the Secretary, 12225 Wilkins Avenue, Rockville, MD 20852.

FOR FURTHER INFORMATION CONTACT:

Eugene Blick (Technical Information), Office of Electric Reliability, Federal Energy Regulatory Commission, 888 First Street NE, Washington, DC 20426, (202) 502–8803, *Eugene.Blick@ferc.gov.*

Alan J. Rukin (Legal Information), Office of the General Counsel, Federal Energy Regulatory Commission, 888 First Street NE, Washington, DC 20426, (202) 502–8502, *Alan.Rukin@ferc.gov.*

SUPPLEMENTARY INFORMATION:

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I. Introduction

1. Pursuant to section 215(d)(5) of the Federal Power Act (FPA),[1] the Commission proposes to direct NERC, the Commission-certified ERO, to submit new or modified Reliability Standards that address concerns pertaining to the impacts of IBRs[2] on the reliable operation[3] of the Bulk-Power System.[4] The Commission proposes to direct NERC to develop new or modified Reliability Standards addressing four reliability gaps pertaining to IBRs: (1) data sharing; (2) model validation; (3) planning and operational studies; and (4) performance requirements.

2. We take this action in view of the rapid change in the generation resource mix currently underway on the Bulk-Power System, including the addition of an ''unprecedented proportion of nonsynchronous resources''[5] projected over the next decade, including many resources that employ inverters and converters[6] to provide energy to the Bulk-Power System. According to NERC, the rapid integration of IBRs is ''the most significant driver of grid transformation'' on the Bulk-Power System.[7] While IBRs provide many benefits, they also present new considerations for transmission planning and operation of the Bulk-Power System.

3. IBRs can produce real and reactive power like synchronous generators, but IBRs do not react to disturbances on the Bulk-Power System in the same way. For example, synchronous resources that are not connected to a fault will automatically ride through[8] a disturbance because they are synchronized (*i.e.,* connected at identical speeds) to the electric power system and physically linked to support the system voltage or frequency during voltage or frequency fluctuations by continuing to produce real and reactive power. In contrast, IBRs are not directly synchronized to the electric power system and must be programmed to support the electric power system and to ride through a disturbance. The operational characteristics of IBRs coupled with their equipment settings may cause them to reduce power output, whether by tripping offline[9] or ceasing operation without tripping offline (known as momentary cessation),[10] individually or in the aggregate in response to response to a single fault on a transmission or sub-transmission system. Such occurrences may exacerbate system disturbances and have a material impact on the reliable operation of the Bulk-Power System.

4. The mandatory and enforceable Reliability Standards were developed to apply to the generation resources prevalent at the time that the standards were developed and adopted—nearly exclusively synchronous generation resources—and ensure the reliable operation of the Bulk-Power System. As a result, the Reliability Standards may

[1] 16 U.S.C. 824o(d)(5); 18 CFR 39.5(f).

[2] This notice of proposed rulemaking (NOPR) uses the term IBR generally to include all generation resources 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 grids. IBRs may refer to solar photovoltaic (PV), wind, fuel cell, and battery storage resources.

[3] The FPA defines reliable operation as operating the elements of the Bulk-Power System within equipment and electric system thermal, voltage, and stability limits so that instability, uncontrolled separation, or cascading failures of such system will not occur as a result of a sudden disturbance, including a cybersecurity incident, or unanticipated failure of system elements. 16 U.S.C. 824o(a)(4); *see also* 18 CFR 39.1.

[4] The Bulk-Power System is defined in the FPA 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. 16 U.S.C. 824o(a)(1); *see also* 18 CFR 39.1.

[5] NERC, *2020 Long Term Reliability Assessment Report,* 9 (Dec. 2020), *https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2020.pdf* (2020 LTRA Report).

[6] An inverter is a power electronic device that inverts DC power to AC sinusoidal power through solid state switches. A converter is a power electronic device that converts AC sinusoidal power to DC power through solid state switches. Consistent with NERC's terminology, this order uses the term ''inverter'' to refer to generating facilities that use power electronic inversion and conversion. NERC, *Inverter-Based Resource Performance and Analysis Technical Workshop,* 29 (Feb. 2019), *https://www.nerc.com/comm/PC/IRPTF%20Workshops/IRPTF_Workshop_Presentations.pdf.*

[7] NERC, *Inverter-Based Resource Strategy: Ensuring Reliability of the Bulk Power System with Increased Levels of BPS-Connected IBRs,* 1 (Sept. 2022), *https://www.nerc.com/comm/Documents/NERC_IBR_Strategy.pdf* (NERC IBR Strategy).

[8] *See Standardization of Generator Interconnection Agreements & Procs.,* Order No. 2003, 68 FR 49846 (Aug. 19, 2003), 104 FERC ¶ 61,103, at P 562 n.88, (2003) (defining ride through as ''a Generating Facility staying connected to and synchronized with the Transmission System during system disturbances within a range of over- and under-frequency[/voltage] conditions, in accordance with Good Utility Practice.'').

[9] Tripping offline is a mode of operation during which part of or the entire IBR disconnects from the Bulk-Power System and/or distribution system and therefore cannot supply real and reactive power.

[10] Momentary cessation is a mode of operation during which the inverter remains electrically connected to the Bulk-Power System, but the inverter does not inject current during low or high voltage conditions outside the continuous operating range. As a result, there is no current injection from the inverter and therefore no active or reactive current (and no active or reactive power). NERC, *Reliability Guideline: Bulk-Power System-Connected Inverter-Based Resource Performance,* 11 (Sept. 2018), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Inverter-Based_Resource_Performance_Guideline.pdf* (IBR Performance Guideline).

not account for the material technological differences between the response of synchronous generation resources and that of IBRs to the same disturbances on the Bulk-Power System.[11] Illustratively, at least 12 events on the Bulk-Power System [12] have demonstrated common mode failures of IBRs regardless of their size or voltage connection, acting unexpectedly and adversely in response to normally cleared transmission line faults on the Bulk-Power System.[13] Further, simulations indicate that IBR momentary cessation occurring in the aggregate can lead to instability, system-wide uncontrolled separation, and voltage collapse.[14]

5. We preliminarily find that the Reliability Standards may not provide Bulk-Power System planners or operators with the tools necessary to plan for and reliably integrate IBRs into the Bulk-Power System. Further, we preliminarily find that the Reliability Standards may not provide Bulk-Power System planners or operators with the tools necessary to plan for IBR–DERs connected to the distribution system that, when acting in the aggregate, can have a material impact on the reliable operation of the Bulk-Power System. Additionally, we preliminary find that the Reliability Standards do not delineate all of the performance requirements that are unique to IBRs and are necessary to ensure that IBRs operate in a predictable and reliable manner. We propose to act to ensure the continued reliable operation of the Bulk-Power System in response to current, and in anticipation of greater, IBR penetration onto the Bulk-Power System. We therefore propose, pursuant to section 215(d)(5) of the FPA and § 39.5(f) of the Commission's regulations, to direct NERC to develop new or modified Reliability Standards that address the following specific matters for IBRs: [15]

- *IBR Data Sharing:* The Reliability Standards should ensure that NERC registered entities,[16] such as planning coordinators and reliability coordinators, have the necessary data to predict the behavior of all IBRs, including unregistered IBRs and IBR–DERs, and their impact on the reliable operation of the Bulk-Power System. To achieve this, the Reliability Standards should ensure that generator owners, transmission owners, and distribution providers are required to share validated modeling, planning, operations, and disturbance monitoring data for IBRs with planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities.
- *IBR Model Validation:* The Reliability Standards should ensure that IBR models are comprehensive, validated, and updated in a timely manner, so that they can adequately predict the behavior of all IBRs, including unregistered IBRs and IBR–DERs, and their impacts on the reliable operation of the Bulk-Power System.
- *IBR Planning and Operational Studies:* The Reliability Standards should ensure that validated IBR models are included in planning and operational studies to assess the reliability impacts on Bulk-Power System performance by registered IBRs and unregistered IBRs, both individually and in the aggregate, as well as IBR–DERs in the aggregate. The Reliability Standards should ensure that planning and operational studies assess the impacts of all IBRs within and across planning and operational boundaries for normal operations and contingency event conditions.
- *IBR Performance Requirements:* The Reliability Standards should ensure that registered IBRs provide frequency and voltage support during frequency and voltage excursions in a manner necessary to contribute toward the overall system needs for essential reliability services.[17] The Reliability Standards should establish clear and reliable technical limits and capabilities for registered IBRs to ensure that all registered IBRs are operated in a predictable and reliable manner during: (1) normal operations; and (2) contingency event conditions. The Reliability Standards should require that the engineering and operational aspects of registered IBRs necessary to contribute toward the overall system needs for essential reliability services include registered IBR post-disturbance ramp rates and phase-locked loop synchronization.

6. In proposing to direct that NERC develop one or more new Reliability

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[11] *See, e.g.,* NERC, *2013 Long-Term Reliability Assessment,* 22 (Dec. 2013), *https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/2013_LTRA_FINAL.pdf* (2013 LTRA Report) (finding that reliably integrating high levels of variable resources into the Bulk-Power System would require ''significant changes to traditional methods used for system planning and operation,'' including requiring ''new tools and practices, including potential enhancements to . . . Reliability Standards or guidelines to maintain [Bulk-Power System] reliability.'').

[12] The 12 events report an average of approximately 1,000 MW of IBRs entering into momentary cessation or tripping in the aggregate. The 12 Bulk-Power System events are: (1) the Blue Cut Fire (August 16, 2016); (2) the Canyon 2 Fire (October 9, 2017); (3) Angeles Forest (April 20, 2018); (4) Palmdale Roost (May 11, 2018); (5) San Fernando (July 7, 2020); (6) the first Odessa, Texas event (May 9, 2021); (7) the second Odessa, Texas event (June 26, 2021); (8) Victorville (June 24, 2021); (9) Tumbleweed (July 4, 2021); (10) Windhub (July 28, 2021); (11) Lytle Creek (August 26, 2021), and (12) Panhandle Wind Disturbance (March 22, 2022).

[13] The Bulk-Power System's sensing devices usually respond slowly, and therefore, are likely underreporting the size of the IBR generation loss during disturbances. *See, e.g.,* NERC and Western Electricity Coordinating Council (WECC), *900 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report,* 1 n.6 (Feb. 2018), *https://www.nerc.com/pa/rrm/ea/October%209%202017%20Canyon%202%20Fire%20Disturbance%20Report/900%20MW%20Solar%20Photovoltaic%20Resource%20Interruption%20Disturbance%20Report.pdf* (Canyon 2 Fire Event Report) (explaining that MW loss values are based on supervisory control and data acquisition (SCADA), which does not capture momentary cessation). NERC only tracks ''Category 1'' events, which are unexpected outages of three or more bulk electric system facilities, including interruptions of IBRs aggregated to a 500 MW threshold (Category 1aii and Category 1i). NERC, *ERO Event Analysis Process—Version 4.0,* 2 (Dec. 2019), *https://www.nerc.com/pa/rrm/ea/ERO_EAP_Documents%20DL/ERO_EAP_v4.0_final.pdf.*

[14] *See* 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* (Resource Loss Protection Whitepaper) (demonstrating the impacts of momentary cessation risks to Bulk-Power System reliability through simulations).

[15] Various NERC reports do not always differentiate between IBRs based on type, or between those subject to Reliability Standards and those located on the distribution system. Where necessary to qualify our proposed directives, however, we differentiate between IBRs registered with NERC and therefore subject to the Reliability Standards because they fall within the bulk electric system definition (registered IBRs) from those connected directly to the Bulk-Power System but not registered with NERC and therefore not subject to the Reliability Standards (unregistered IBRs), and those connected to the distribution system (IBR–DER). NERC's Commission-approved bulk electric system definition is a subset of the Bulk-Power System and defines the scope of the Reliability Standards and the entities subject to NERC compliance. *Revisions to Electric Reliability Org. Definition of Bulk Elec. Sys. & Rules of Proc.,* Order No. 773, 78 FR 804 (Jan. 4, 2013), 141 FERC ¶ 61,236 (2012) *order on reh'g,* Order No. 773–A, 78 FR 29209 (May 17, 2013), 143 FERC ¶ 61,053 (2013) *rev'd sub nom. People of the State of N.Y.* v. *FERC,* 783 F.3d 946 (2d Cir. 2015); NERC, *Glossary of Terms Used in NERC Reliability Standards,* 5–7 (Mar. 29, 2022), *https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf* (NERC Glossary).

[16] NERC identifies and registers Bulk-Power System users, owners, and operators who are responsible for performing specified reliability functions to which requirements of mandatory Reliability Standards are applicable. *See* NERC Rules of Procedure, Section 500 (Organization Registration and Certification).

[17] *See, e.g.,* NERC, *A Concept Paper on Essential Reliability Services that Characterizes Bulk Power System Reliability,* vi (Oct. 2014), *https://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/ERSTF%20Concept%20Paper.pdf* (Essential Reliability Services Concept Paper) (listing the essential reliability services necessary to maintain Bulk-Power System reliability).

Standards or modify currently effective Reliability Standards to address the gaps identified in this rulemaking, we are not proposing specific requirements. Instead, we identify concerns that we believe the Reliability Standards should address. In its petition accompanying any new or modified Reliability Standards, NERC should explain how the new or modified Reliability Standards address the Commission's concerns.[18] We invite comments on these concerns and whether there are other concerns related to planning for and integrating IBRs that the Commission should direct NERC to address in this or a future proceeding.

7. We propose to direct NERC to submit a compliance filing within 90 days of the effective date of the final rule in this proceeding. That compliance filing shall include a detailed, comprehensive standards development and implementation plan explaining how NERC will prioritize the development and implementation of new or modified Reliability Standards. In its compliance filing, NERC should explain how it is prioritizing its IBR Reliability Standard projects to meet the directives in the final rule, taking into account the risk posed to the reliability of the Bulk-Power System, standard development projects already underway, resource constraints, and other factors if necessary.

8. We seek comment on the proposal to direct NERC to use a staggered approach that would result in NERC submitting new or modified Reliability Standards in three stages: (1) new or modified Reliability Standards including directives related to registered IBR failures to ride through frequency and voltage variations during normally cleared Bulk-Power System faults shall be filed with the Commission within 12 months of Commission approval of the plan; (2) new or modified Reliability Standards addressing the interconnected directives related to registered IBR, unregistered IBR, and IBR–DER data sharing, registered IBR disturbance monitoring data sharing, registered IBR, unregistered IBR, and IBR–DER data and model validation, and registered IBR, unregistered IBR, and IBR–DER planning and operational studies shall be filed with the Commission within 24 months of Commission approval of the plan; and (3) new or modified Reliability Standards including the remaining directives for post-disturbance ramp rates and phase-locked loop synchronization shall be filed with the Commission within 36 months of Commission approval of the plan. We believe this staggered approach to standard development may be necessary based on the scope of work anticipated and that specific target dates will provide a valuable tool and incentive to NERC to timely address the directives in the final rule. This proposal strikes a reasonable balance between the need to timely implement identified improvements to the Reliability Standards that will further Bulk-Power System reliability and the need for NERC to develop modifications with appropriate stakeholder input using its open stakeholder process.

9. In view of the rapid growth of IBRs connected to the Bulk-Power System, we are issuing this NOPR concurrently with a separate order in Docket No. RD22–4–000 directing NERC to address the registration of owners and operators of unregistered IBRs that may have a material impact on the reliable operation of the Bulk-Power System.[19] That order addresses the registration of unregistered IBRs that individually fall outside of the bulk electric system definition, are connected directly to the Bulk-Power System, and that in the aggregate have a material impact on the reliable operation of the Bulk-Power System.

II. Background

A. Legal Authority

10. Section 215 of the FPA provides that the Commission may certify an ERO, the purpose of which is to establish and enforce Reliability Standards, which are subject to Commission review and approval. Reliability Standards may be enforced by the ERO, subject to Commission oversight, or by the Commission independently.[20] Pursuant to section 215 of the FPA, the Commission established a process to select and certify an ERO,[21] and subsequently certified NERC as the ERO.[22]

11. The Commission has the authority pursuant to section 215(d)(5) of the FPA and consistent with § 39.5(f) of the Commission's regulations, upon its own motion or upon complaint, to order the ERO to submit to the Commission a proposed Reliability Standard or a modification to a Reliability Standard that addresses a specific matter if the Commission considers such a new or modified Reliability Standard appropriate to carry out section 215 of the FPA.[23] Further, pursuant to § 39.5(g) of the Commission's regulations, when ordering the ERO to submit to the Commission a proposed or modified Reliability Standard that addresses a specific matter, the Commission may order a deadline by which the ERO must submit such Reliability Standard.[24]

B. Reliability Impacts of IBR Technologies

12. Until recently, the Bulk-Power System generation fleet was composed almost exclusively of synchronous generation resources [25] that convert mechanical energy into electric energy through electromagnetic induction. By virtue of their large rotating elements, these synchronous generation resources inherently resist changes in system frequency due to the kinetic energy in their rotating components, providing time for other governor controls (when properly configured) to maintain supply and load balance. Similarly, synchronous generation resources can provide voltage support during voltage disturbances.

13. In contrast, IBRs do not use electromagnetic induction from machinery that is directly synchronized to the Bulk-Power System. Instead, IBRs predominantly use grid-following inverters, which rely on sensed information from the grid (*e.g.,* a voltage waveform) in order to produce the desired AC real and reactive power

[18] *See, e.g., Mandatory Reliability Standards for the Bulk-Power Sys.,* Order No. 693, 72 FR 16416 (Apr. 4, 2007), 118 FERC ¶ 61,218, at PP 186, 297, *order on reh'g,* Order No. 693–A, 72 FR 40717 (July 25, 2007), 120 FERC ¶ 61,053 (2007) (''where the Final Rule identifies a concern and offers a specific approach to address the concern, we will consider an equivalent alternative approach provided that the ERO demonstrates that the alternative will address the Commission's underlying concern or goal as efficiently and effectively as the Commission's proposal'').

[19] *See Registration of Inverter-based Resources,* 181 FERC ¶ 61,124 (2022).

[20] 16 U.S.C. 824o(e).

[21] *Rules Concerning Certification of the Elec. Reliability Org. & Procs. for the Establishment, Approval, & Enf't of Elec. Reliability Standards,* Order No. 672, 71 FR 8662 (Feb. 17, 2006), 114 FERC ¶ 61,104, *order on reh'g,* Order No. 672–A, 71 FR 19814 (Apr. 18, 2006), 114 FERC ¶ 61,328 (2006).

[22] *N. Am. Elec. Reliability Corp.,* 116 FERC ¶ 61,062, *order on reh'g and compliance,* 117 FERC ¶ 61,126 (2006), *aff'd sub nom. Alcoa, Inc.* v. *FERC,* 564 F.3d 1342 (DC Cir. 2009).

[23] 16 U.S.C. 824o(d)(5); 18 CFR 39.5(f).

[24] 18 CFR 39.5(g).

[25] The Reliability Standards use both terms ''generation resources'' and ''generation facilities'' to define sources of electric power on the transmission system. In this NOPR, we use the terms ''generation resources'' and ''generation facilities'' interchangeably.

output.[26] IBRs can track grid state parameters (*e.g.,* voltage angle) on the order of milli-seconds and react nearly instantaneously to changing grid conditions. Some IBRs, however, are not configured or programmed to support grid voltage and frequency and, as a result, will reduce power,[27] exhibit momentary cessation, or trip in response to variations in system voltage or frequency.[28] In other words, under certain conditions some IBRs cease to provide power to the Bulk-Power System due to how they are configured and programmed even though some models and simulations predict that IBRs maintain real power output and provide voltage and frequency support consistent with Reliability Standard PRC–024–2 (Generator Frequency and Voltage Protective Relay Settings).

14. IBRs are also more dispersed across the Bulk-Power System compared to synchronous generation resources, and both localized and interconnection-wide IBR issues must be identified, studied, and mitigated to preserve Bulk-Power System reliability. Although IBRs are typically smaller-megawatt (MW) facilities, they are at greater risk than synchronous generation resources of being lost (*i.e.,* ceasing to provide power to the Bulk-Power System) in the aggregate in response to a single fault on the transmission or sub-transmission systems. Such response can occur when individual IBR controls and equipment protection settings are not configured to ride through system disturbances.[29] Thus, the impact of IBRs is not restricted by the size of a single facility or an individual balancing authority area, but rather by the number of IBRs or percent of generation made up by IBRs within an interconnection. In areas of high IBR saturation, this type of aggregate response may have an impact much greater than the most severe single contingency (*i.e.,* the traditional worst-case N–1 contingency)[30] of a balancing authority area, potentially adversely affecting other balancing authority areas across an interconnection.[31] Unless IBRs are configured and programmed to ride through normally cleared transmission faults, the potential impact of losing IBRs individually or in the aggregate will continue to increase as IBRs are added to the Bulk-Power System and make up an increasing proportion of the resource mix.

15. Further, simulations conducted by the NERC Resource Subcommittee demonstrate that the risks to Bulk-Power System reliability posed by momentary cessation are greater than any of the IBR disturbances NERC has documented as being experienced thus far. These simulations indicate the potential for: (1) normally-cleared, three-phase faults at certain locations in the Western Interconnection that could result in upwards of 9,000 MW of solar PV IBRs entering momentary cessation across a large geographic region; (2) transient instability caused by excessive transfer of inter-area power flows during and after momentary cessation; and (3) a drop in frequency that falls below the first stage of under frequency load shedding in WECC, traditionally studied as the loss of the two Palo Verde nuclear units in Arizona (approximately 2,600 MW).[32] These simulation results indicate that IBR momentary cessation occurring in the aggregate can lead to instability, system-wide uncontrolled separation, and voltage collapse.

16. Although IBRs present risks that Bulk-Power System planners and operators must account for, IBRs also present new opportunities to support the grid and respond to abnormal grid conditions.[33] When appropriately programmed, IBRs can operate during greater frequency deviations (*i.e.,* a wider frequency range) than synchronous generation resources.[34] This operational flexibility, and the ability of IBRs to perform with precision and speed, offers increased Bulk-Power System performance capabilities and controls that could mitigate disturbances on the Bulk-Power System. For Bulk-Power System operators to harness the unique performance and control capabilities of IBRs, these resources must be properly configured and programmed to support grid voltage and frequency during normal and abnormal grid conditions and be accurately modeled and represented in transmission planning and operations models.

C. Actions To Address the Reliability Impact of IBR Technologies

17. NERC has begun to address some of the reliability risk posed by IBRs. Specifically, since the first documented disturbance event on the Bulk-Power System demonstrating common mode failures of IBRs in 2016, NERC has: (1) published seven reports on 12 disturbance events;[35] (2) issued two

[26] *See, e.g., NERC, 2021 Long Term Reliability Assessment Report,* 6 (Dec. 2021), *https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2021.pdf* (2021 LTRA Report) (''IBRs respond to disturbances and dynamic conditions based on programmed logic and inverter controls, not mechanical characteristics.''); *see also generally,* Denholm et al., National Renewable Energy Laboratory, *Inertia and the Power Grid: A Guide Without the Spin,* NREL/TP–6120–73856, v (2020), *https://www.nrel.gov/docs/fy20osti/73856.pdf.*

[27] NERC and WECC, *San Fernando Disturbance,* 2 (Nov. 2020), *https://www.nerc.com/pa/rrm/ea/Documents/San_Fernando_Disturbance_Report.pdf* (San Fernando Disturbance Report).

[28] *See Essential Reliability Servs. & the Evolving Bulk-Power Sys. Primary Frequency Response,* Order No. 842, 83 FR 9636 (Mar. 6, 2018), 162 FERC ¶ 61,128 , at P 19 (2018) (describing NERC's comment that increased IBR deployment alongside retirement of synchronous generation resources has contributed to the decline in primary frequency response); *see also* NERC, *Fast Frequency Response Concepts and Bulk Power System Reliability Needs,* 5 (Mar. 2020), *https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/Fast_Frequency_Response_Concepts_and_BPS_Reliability_Needs_White_Paper.pdf* (Fast Frequency Response White Paper) (explaining that as the instantaneous penetration of IBRs with little or no inertia continues to increase, system rate of change of frequency after a loss of generation will increase and the time available to deliver frequency responsive reserves will shorten, and illustrating the steeper rate of change of frequency and the importance of speed of response).

[29] *See, e.g.,* Canyon 2 Fire Event Report at 19 (finding momentary cessation as a major cause for the loss of IBRs when voltages rose above 1.1 per unit or decreased below 0.9 per unit).

[30] The most severe single contingency, or the N–1 contingency, generally refers to the concept that a system must be able to withstand an unexpected failure or outage of a single system component and maintain reliable service at all times. *See, e.g.,* NERC Glossary at 17 (defining ''most severe single contingency'').

[31] *See, e.g.,* San Fernando Disturbance Report at vi (stating that ''[t]his event, as with past events, involved a significant number of solar PV resources reducing power output (either due to momentary cessation or inverter tripping) as a result of normally-cleared [Bulk-Power System] faults. The widespread nature of power reduction across many facilities poses risks to [Bulk-Power System] performance and reliability.'').

[32] Resource Loss Protection Whitepaper at 1–2, key findings 4, 7, 8.

[33] *See, e.g.,* IBR Performance Guideline at vii (finding that the power electronics aspects of IBRs ''present new opportunities in terms of grid control and response to abnormal grid conditions.'').

[34] *See, e.g.,* Fast Frequency Response White Paper at 11.

[35] The seven reports on the 12 disturbances are:

(1) NERC, *1,200 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report* (June 2017), *https://www.nerc.com/pa/rrm/ea/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_Interruption_Final.pdf* (Blue Cut Fire Event Report) (covering the Blue Cut Fire event (August 16, 2016));

(2) Canyon 2 Fire Event Report (covering the Canyon 2 Fire event (October 9, 2017));

(3) NERC and WECC, *April and May 2018 Fault Induced Solar Photovoltaic Resource Interruption Disturbances Report* (Jan. 2019), (Angeles Forest and Palmdale Roost Events Report), *https://www.nerc.com/pa/rrm/ea/April_May_2018_Fault_Induced_Solar_PV_Resource_Int/April_May_2018_Solar_PV_Disturbance_Report.pdf* (Angeles Forest and Palmdale Roost Events Report) (covering the Angeles Forest (April 20, 2018) and Palmdale Roost (May 11, 2018) events);

(4) San Fernando Disturbance Report (covering the San Fernando event (July 7, 2020));

(5) NERC and Texas RE, *Odessa Disturbance* (Sept. 2021), *https://www.nerc.com/pa/rrm/ea/Documents/Odessa_Disturbance_Report.pdf* (Odessa Disturbance Report) (covering events in Odessa, Texas on May 9, 2021 and June 26, 2021);

Continued

NERC Alerts addressing the loss of solar PV IBRs; [36] (3) issued three reliability guidelines; [37] (4) formed the IBR performance task force (IRPTF) [38] and a system planning impacts of distributed energy resources working group (SPIDERWG); (5) issued various technical reports regarding IBR data collection and performance; [39] and (6) issued an IBR strategy document.[40] The NERC materials (*e.g.,* guidelines, whitepapers, reports, alerts, etc.) cited in this NOPR are also listed in Appendix A as a reference. Appendix A will not appear in the **Federal Register**. Appendix A will be available separately on the Commission's website.[41]

18. The only NERC actions that required a response from entities are the two NERC alerts addressing the loss of solar PV IBRs (both alerts were level 2 alerts, ''Recommendation to Industry'').[42] These NERC level 2 alerts recommended specific voluntary action to be taken by registered IBRs and required that the registered IBRs provide responsive information to NERC. While unregistered IBRs could also voluntarily take the specific actions set out in the level 2 alert, there was no reporting requirement for unregistered IBRs due to NERC's authority to require reporting responses only from registered IBRs. NERC issued these alerts to assess the scope of and recommend performance actions to address registered IBR reliability risks to the Bulk-Power System. NERC issued its first alert in 2017 after the Blue Cut Fire Event to collect data to assess the extent of the condition and to provide recommended performance improvements for existing and newly interconnecting solar PV IBRs connected to the Bulk-Power System.[43] NERC issued its second alert in 2018 after the Canyon 2 Fire event to recommend performance improvements including eliminating momentary cessation for registered IBRs already in operation.[44]

19. NERC formed the IRPTF in response to the findings and recommendations of the Blue Cut Fire Event Report in order to explore the performance characteristics of Bulk-Power System connected IBRs. The IRPTF is composed of subject matter experts and representatives from a variety of companies, registered entities, and trades groups familiar with IBR issues and reliability risks. Among other activities, the IRPTF has developed a variety of whitepapers and reliability guidelines.[45] For example, the Modeling and Studies Report documented the failure of industry to mitigate IBR-related momentary cessation, tripping, and modeling issues.[46] In March 2020, the IRPTF issued a white paper evaluating the applicability of certain Reliability Standards to IBRs and identifying seven Reliability Standards with potential gaps or areas for improvement.[47]

20. NERC formed the SPIDERWG to, among other things, identify potential gaps in the Reliability Standards and address IBR–DER modeling and performance.[48] For example, on December 30, 2019, the SPIDERWG submitted a standard authorization request proposing to address gaps in Reliability Standard MOD–032–1 (Data for Power System Modeling and Analysis) requirements for data collection for the purposes of modeling and interconnection-wide planning case models.[49] Based on the extensive record created by the IRPTF and SPIDERWG on the need for the Reliability Standards to address IBR impacts on the reliable operation of the Bulk-Power System, NERC initiated several standards projects [50] to consider discrete changes

(6) NERC and WECC, *Multiple Solar PV Disturbances in CAISO* (April 2022), *https://www.nerc.com/pa/rrm/ea/Documents/NERC_2021_California_Solar_PV_Disturbances_Report.pdf* (2021 Solar PV Disturbances Report) (covering four events: Victorville (June 24, 2021); Tumbleweed (July 4, 2021); Windhub (July 28, 2021); and Lytle Creek (August 26, 2021)); and

(7) NERC and Texas RE, *March 2022 Panhandle Wind Disturbance Report* (August 2022), *https://www.nerc.com/pa/rrm/ea/Documents/Panhandle_Wind_Disturbance_Report.pdf* (Panhandle Report) (covering the Texas Panhandle event (March 22, 2022)).

[36] NERC, *Industry Recommendation: Loss of Solar Resources during Transmission Disturbances due to Inverter Settings* (June 2017), *https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC%20Alert%20Loss%20of%20Solar%20Resources%20during%20Transmission%20Disturbance.pdf* (Loss of Solar Resources Alert I); NERC, *Industry Recommendation Loss of Solar Resources during Transmission Disturbances due to Inverter Settings—II* (May 2018), *https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC_Alert_Loss_of_Solar_Resources_during_Transmission_Disturbance-II_2018.pdf* (Loss of Solar Resources Alert II).

[37] *See IBR Performance Guideline;* NERC, *Reliability Guideline: Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources* (Sept. 2019), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_IBR_Interconnection_Requirements_Improvements.pdf* (IBR Interconnection Requirements Guideline); NERC, *Reliability Guideline: Performance, Modeling, and Simulations of Bulk-Power System-Connected Battery Energy Storage Systems and Hybrid Power Plants* (Mar. 2021), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_BESS_Hybrid_Performance_Modeling_Studies_.pdf (BESS Performance Modeling Guideline).*

[38] The task force later became the IBR Performance Working Group in October 2020, and most recently became the IBR Performance Subcommittee in March 2022. For consistency, this NOPR uses ''IRPTF'' to refer to all three iterations.

[39] *See, e.g.,* NERC, *Technical Report, Bulk-Power System-Connected Inverter-Based Resource Modeling and Studies,* (May 2020), *https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/NERC-WECC_2020_IBR_Modeling_Report.pdf* (Modeling and Studies Report); NERC and WECC, *WECC Base Case Review: Inverter-Based Resources* (Aug. 2020), *https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/NERC-WECC_2020_IBR_Modeling_Report.pdf* (Western Interconnection (WI) Base Case IBR Review).

[40] NERC IBR Strategy, (July 2021), *https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/2022-2024%20RSDP%20FERC%20Filing.pdf.*

[41] Federal Energy Regulatory Commission, *Table of Cited NERC IBR Resources (RM22–12–000), https://www.ferc.gov/media/table-cited-nerc-ibr-resources-rm22-12-000.*

[42] NERC uses level 2 alerts to recommend specific actions to be taken by registered entities (*i.e.,* ''Recommendation to Industry''). A response from recipients, as defined in the alert, is required. NERC, *About Alerts* (2022), *https://www.nerc.com/pa/rrm/bpsa/Pages/About-Alerts.aspx.* NERC also uses level 1 alerts (*i.e.,* ''Industry Advisory'') to advise registered entities of issues or potential problems, which does not require a response. In addition, NERC uses level 3 alerts (*i.e.,* ''Essential Action'') to identify actions that registered entities are required to take because they are deemed to be ''essential'' to reliability.

[43] Loss of Solar Resources Alert I at 4–6 (noting that although the alert pertains directly to registered IBRs, the ''same potential susceptibility to frequency and voltage perturbations during transmission faults exist for all utility grade, and perhaps some larger commercial grade solar installations, regardless of the interconnection voltage.'').

[44] Loss of Solar Resources Alert II at 1–5 (finding again that ''[a]lthough this NERC Alert pertains specifically to [bulk electric system] solar PV resources, the same characteristics may exist for non-[bulk electric system] solar PV resources connected to the [Bulk-Power System] regardless of installed generating capacity or interconnection voltage.'' (footnote omitted)).

[45] *See* NERC, *Reliability Guidelines, Security Guidelines, Technical Reference Documents, and White Papers,* (2022), *https://www.nerc.com/comm/Pages/Reliability-and-Security-Guidelines.aspx* (providing links to all IRPTF resources).

[46] Modeling and Studies Report at iv–v, 1–8.

[47] Specifically, the white paper identified Reliability Standards: (1) FAC–001–3; (2) FAC–002–2; (3) MOD–026–1; (4) MOD–027–1; (5) PRC–002–2; (6) TPL–001–4/-5; and (7) VAR–002–4.1. NERC, *IRPTF Review of NERC Reliability Standards White Paper,* 1, (Mar. 2020), *https://www.nerc.com/pa/Stand/Project202104ModificationstoPRC0022DL/Review_of_NERC_Reliability_Standards_White_Paper_062021.pdf* (Reliability Standards Review White Paper).

[48] NERC, *System Planning Impacts from DER Working Group (SPIDERWG),* (2022) *https://www.nerc.com/comm/RSTC/Pages/SPIDERWG.aspx.*

[49] NERC, *Standard Authorization Request,* Project 2020–01 Modifications to MOD–032–1 (Dec. 2021), *https://www.nerc.com/pa/Stand/Project202202ModificationstoTPL00151andMOD0321DL/2022-02_MOD-032%20SAR%20SPIDERWG_020122.pdf.*

[50] *See* NERC Rules of Procedure, app. 3A (Standard Processes Manual) (providing the process for developing, modifying, withdrawing, or retiring a Reliability Standard. One of the first steps in the process is initiating a standards authorization request, which is a form used to document the scope and benefit of a proposed standards drafting project).

to the Facilities Design, Connections and Maintenance (FAC), Modeling, Data and Analysis (MOD), Protection and Control (PRC), Transmission Planning (TPL), and Voltage and Reactive Control (VAR) Reliability Standards.[51]

21. Other NERC technical committees have also met to review recommendations of the Odessa Disturbance Report, including recommendations for Reliability Standards addressing, among other IBR-related issues: (1) ride through; (2) performance validation; (3) analysis and reporting for abnormal inverter options; (4) monitoring; and (5) inverter-specific performance requirements.[52]

22. Concurrently with this NOPR, we are also approving revisions to Reliability Standards FAC–001–3 (Facility Interconnection Requirements) and FAC–002–3 (Facility Interconnection Studies).[53] The revisions were responsive to IRPTF recommendations to modify the standards to: (1) clarify the registered entity responsible for determining which facility changes require study (a ''qualified change''); and (2) clarify that a generator owner should notify affected registered entities before making a qualified change. As a part of its petition, NERC included examples of qualified changes specific to IBRs, such as a change in inverter settings that may result in a difference in frequency or voltage support.[54]

23. In addition to NERC's efforts, there are voluntary industry standards and manufacturer certification efforts related to IBRs in place or underway, such as the Institute of Electrical and Electronics Engineers (IEEE) standard 2800–2020 [55] for transmission connected IBRs, and IEEE 1547–2018 [56] and Underwriters Laboratory (UL) standard UL 1741 [57] for IBR–DERs. These efforts may enhance the operating performance and control capabilities of IBRs; however, these efforts remain at relatively early stages, do not apply to all relevant IBRs, and require adoption by state or other regulatory authorities.[58] The proposed directives to NERC to develop new or modify existing Reliability Standards are intended to complement existing voluntary efforts underway and are not intended to supersede or interfere with these efforts.

III. The Need for Reform

A. Recent Events Show IBR-Related Adverse Reliability Impacts on the Bulk-Power System

24. A number of events have demonstrated the challenges to transmission planning and operations of the Bulk-Power System posed by gaps in the Reliability Standards specific to IBRs in the areas of: (1) IBR data sharing; (2) IBR model validation; (3) IBR planning and operational studies; and (4) registered IBR performance requirements.

25. The first documented large-scale disturbance event related to IBRs occurred in August of 2016 during the Blue Cut Fire event in California. Until this event, the potential for IBRs to affect the reliability of the Bulk-Power System by tripping or momentarily ceasing during faults was unknown.[59] A NERC/WECC joint task force determined that a single 500 kV line-to-line fault caused the widespread loss of 1,200 MW of primarily solar PV IBRs, which adversely affected the balance of generation and load needed to maintain Interconnection frequency near a nominal value of 60 Hz.[60] The task force found that the solar PV generation loss was primarily due to the unexpected tripping and unanticipated momentary cessation of IBRs.[61] The report indicated that planning studies incorrectly predicted that IBRs would ride through the disturbance and would provide power during the event. Once aware of the potential for IBRs to trip or enter momentary cessation in response to faults, Southern California Edison (SoCal Edison) and the California Independent System Operator Corporation (CAISO) reviewed the supervisory control and data acquisition (SCADA) data from SoCal Edison energy management system and discovered that this was not an isolated incident.[62]

26. Despite NERC's efforts to date, events involving registered IBRs, unregistered IBRs, and IBR–DERs have continued to occur in areas of the country with large penetrations of IBRs.[63] Noting the continuing need to address IBR concerns, the NERC Board of Trustees has stated that ''the risk of unreliable performance from [Bulk-

[51] *See* NERC, Informational Filing of Reliability Standards Development Plan 2022–2024, Docket No. RM05–17–000, et al., attach. A (*Reliability Standards Development Plan 2022–2024*), 3–4 (filed Nov. 30, 2021) (NERC 2022–2024 Reliability Standards Development Plan). However, several of these projects lack IBR-specific considerations or reporting requirements (*e.g.,* MOD–026–1, MOD–027–1, and PRC–002–2), lack requirements to assess IBR aggregate impacts (*e.g.,* VAR–002–4.1), or are identified in the Reliability Standards development plan as ''low priority.'' *See also* NERC, *IBR Strategy, https://www.nerc.com/comm/Documents/NERC_IBR_Strategy.pdf* (providing a milestone plan of proposed SARs, reliability guidelines, and whitepapers).

[52] NERC, *Odessa Disturbance Follow-up White Paper,* 3–8 (Oct. 2021), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/White_Paper_Odessa_Disturbance_Follow-Up.pdf* (Odessa Disturbance White Paper).

[53] *See North American Electric Reliability Corporation,* 181 FERC ¶ 61,126 (2022).

[54] NERC, Petition for Approval of Proposed Reliability Standards FAC–001–4 and FAC–002–4, Docket No. RD22–5–000, at 9–13 (filed June 14, 2022) (including examples of IBR-related qualified changes: (1) a change of 10% or more in nameplate capacity of the IBR; and (2) a change in the IBR's control settings that cause a difference in (a) frequency or voltage support or (b) when the IBR stops injecting power into the transmission system).

[55] IEEE *Standard for Interconnection and Interoperability of Inverter-Based Resources (IBR) Interconnecting with Associated Transmission Electric Power Systems* (IEEE 2800–2022), *https://standards.ieee.org/ieee/2800/10453/* (explaining that 2800–2020 standard establishes ''[u]niform technical minimum requirements for the interconnection, capability, and lifetime performance of [IBRs] interconnecting with transmission and sub-transmission systems . . . [and includes] . . . performance requirements for reliable integration of [IBRs] into the [B]ulk [P]ower [S]ystem.'').

[56] IEEE, *Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces* (IEEE 1547–2018), *https://sagroups.ieee.org/scc21/standards/1547rev/.* The IEEE 1547–2018 and more recent 2020 amendment of this standard enhance operating performance and control capabilities of IBR–DER. For example, future IBR–DER will be equipped with the capability to ride through voltage and frequency fluctuation in support of the reliable operation of Bulk-Power System.

[57] UL Standard 1741 Edition 3, *Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources Scope, https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=40673.*

[58] While the IEEE–2800–2020 was approved in September 2022, it has yet to be adopted by any transmission entity. For IEEE–1547, states have made varied progress in adopting the IBR–DER. Adoption of IEEE Standard 1547™-2018. Further, *IEEE 1547–2018* inverter products are not expected to be generally available to the market until April 2023. IEEE, *IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces, https://sagroups.ieee.org/scc21/standards/1547rev/.*

[59] Blue Cut Fire Event Report at 15–16.

[60] *Id.* at 1.

[61] *Id.* at 9 (identifying momentary cessation as a major cause for the loss of IBRs when voltages rose above 1.1 per unit or decreased below 0.9 per unit. NERC also identified IBRs that tripped due to erroneous frequency calculations and concluded that a more accurate representation of the system frequency measurement should be used for inverter controls, and a minimum delay for frequency detection and/or filtering should be implemented. NERC reported that the Blue Cut fire IBR erroneous frequency calculation issue was successfully mitigated).

[62] SoCal Edison/CAISO identified seven other instances of solar PV IBRs either tripping or entering momentary cessation. *Id.* at 3. *See also* Modeling and Studies Report at 3–4 (explaining that SoCal Edison and CAISO attempted to collect updated generation dynamic models from generator owners and discussing their challenges in obtaining the data).

[63] Since the first Blue Cut Fire event in August 2016, there have been at least 11 additional events throughout the last six years, including the most recently reported event in March 2022. NERC, *Major Event Analysis Reports, https://www.nerc.com/pa/rrm/ea/Pages/Major-Event-Reports.aspx, see supra* note 12 (listing the IBR-related events).

Power System]-connected inverter-based resources remains high'' and that NERC and the Regional Entities ''remain[] concerned with [Bulk-Power System] performance, modeling, planning and study approaches, and is urging immediate industry action.'' [64] As the resource mix trends towards higher penetrations of IBRs, the need to reliably integrate these resources into the Bulk-Power System is expected to grow.[65] Although groups such as IEEE and entities like CAISO have attempted to address these issues at the state, local, or individual entity level, the continuing events across the Bulk-Power System and the risks that they pose to its reliable operation underscore the need for mandatory Reliability Standards to address these issues on a nationwide basis.

B. Reliability Standards Do Not Adequately Address IBR Reliability Risks

1. Data Sharing

27. The Reliability Standards do not ensure that planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities receive accurate and complete data on the location, capacity, telemetry, steady-state, dynamic and short circuit modeling information, control settings, ramp rates, equipment status, disturbance analysis data, and other information about IBRs (collectively, IBR data). IBR data is necessary to properly plan, operate, and analyze performance on the Bulk-Power System.[66] As evidenced by the Modeling and Studies Report, the Reliability Standards do not ensure that IBR generator owners and operators consistently share IBR data, as at least a portion of the information that is shared is inaccurate or incomplete.[67] For example, in the Modeling and Studies Report, the IRPTF found that Reliability Standard MOD–032–1 ''does not prescribe the details that the modeling requirements must cover; rather, the standard requirements leave the level of detail and data formats up to each TP [transmission planner] and PC [planning coordinator] to define.'' Further, the IRPTF found that many of the dynamic models submitted in response to an IBR-related NERC Alert ''that were intended to represent the existing settings and controls currently installed in the field either did not match the data provided by the [generator owner] for actual settings or did not meet the [transmission planner and planning coordinator] requirements for model performance, (*i.e.,* incorrect models used, incorrect parameters, or inability of model to initialize).'' [68]

28. Without accurate and complete IBR data, planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities are not able to develop accurate system models that account for the behavior of IBRs on their system, nor are they able to facilitate the analysis of Bulk-Power System disturbances.[69]

a. Registered IBR Data Sharing

29. The Reliability Standards do not ensure that transmission planners and operators receive modeling data and parameters from all bulk electric system generation resources necessary to create and maintain valid individual registered IBR models used to perform steady-state, dynamic, and short circuit studies. While Reliability Standard MOD–032–1(Data for Power System Modeling and Analysis), Requirement R2, requires generator owners to submit modeling data and parameters to their transmission planners and planning coordinators, it does not require generator owners to submit registered IBR-specific modeling data and parameters, such as control settings for momentary cessation and ramp rates, necessary for modeling steady state and dynamic registered IBR performance for purposes of planning the Bulk-Power System.[70] Similarly, Reliability Standard TOP–003–4 (Operational Reliability Data) does not require generator owners to submit registered IBR-specific modeling data and parameters transmission operators or balancing authorities, such as control settings for momentary cessation and ramp rates, necessary for modeling steady state and dynamic registered IBR performance for purposes of operating the Bulk-Power System.

b. Unregistered IBR and IBR–DER Data Sharing

30. The Reliability Standards do not ensure that transmission planners and operators receive modeling data and parameters regarding unregistered IBRs and IBR–DERs that, individually or in the aggregate, are capable of adversely affecting the reliable operation of the Bulk-Power System. As shown by various reports and guidelines,[71] planners and operators do not currently have the data to accurately model the behavior of unregistered IBRs as well as IBR–DERs in the aggregate for steady-state, dynamic, and short circuit studies.

c. Disturbance Monitoring Data Sharing

31. The Reliability Standards do not ensure that transmission planners and operators receive disturbance

[64] NERC, *Members Representatives Committee Agenda Package,* 2 (May 2022), *https://www.nerc.com/gov/bot/Agenda%20highlights%20and%20Mintues%202013/Policy-Input-Package-May-2022-PUBLIC-POSTING.pdf.*

[65] *See* Reliability Standards Review White Paper at 1 (finding that the ''electric industry is still experiencing unprecedented growth in the use of inverters as part of the bulk power system and growth is possibly creating new circumstances where current standards may not be sufficiently addressing those needs.'').

[66] Loss of Solar Resources Alert II at 7–8 (describing examples of planning and operational IBR data) and Odessa Disturbance Report at 20–21; *see generally* WI Base Case IBR Review, NERC, *Reliability Guideline: DER Data Collection for Modeling in Transmission Planning Studies,* (Sept. 2020) (IBR–DER Data Collection Guideline).

[67] *See* Modeling and Studies Report at 33 (finding that a ''significant number of inverter-based resources, particularly solar PV resources, have submitted [root-mean-square] positive sequence dynamic models for the interconnection-wide case creation process (*i.e.,* MOD–032–1) that do not accurately represent the control settings programmed into the inverters installed in the field.''). *See also* Western Interconnection (WI) Base Case IBR Review at 27 (describing comments from transmission planners and planning coordinators relaying concerns regarding generator owners' lack of timely responses (or any response in many cases) regarding modeling-related issues on the use of generic manufacturer-supplied data, and failure to update models consistent with Reliability Standard MOD–032–1).

[68] Modeling and Studies Report at 33.

[69] *E.g.,* Commission Staff, *Distributed Energy Resources Technical Considerations for the Bulk Power System Staff Report,* Docket No. AD18–10–000 (filed Feb. 15, 2018) (Commission Staff IBR–DER Reliability Report); Modeling and Studies Report at 33 (recommending that generator owners, for both registered and unregistered IBRs, ''should submit updated models to the [transmission planners and planning coordinators] as quickly as possible to accurately reflect the large disturbance behavior of [Bulk-Power System]-connected solar PV resources in the interconnection-wide base cases used for planning assessments.'').

[70] *See* Modeling and Studies Report at 35 (stating that Reliability Standard MOD–032–1 ''does not prescribe the details that the modeling requirements must cover; rather, the standard requirements leave the level of detail and data formats up to each [transmission planner] and [planning coordinator] to define.'' (footnote omitted)).

[71] *See, e.g.,* Commission Staff IBR–DER Reliability Report at 11–13 (explaining that absent adequate data, many Bulk-Power System models and operating tools will not fully represent the effects of IBR–DERs in aggregate. The report also noted the lack of a formal process to provide static IBR–DER data to Bulk-Power System operators and planners as well as the limited visibility that operators and planners have into IBR–DER telemetry data); *see also* IBR–DER Data Collection Guideline at 2 (recommending that transmission planners and planning coordinators update their data reporting requirements for Reliability Standard MOD–032–1, Requirement R1 to explicitly describe the requirements for aggregate IBR–DER data in a manner that is clear and consistent with their modeling practices. The guideline also recommended that transmission planners and planning coordinators establish modeling data requirements for steady-state IBR–DERs in aggregate and coordinate with their distribution providers to develop these requirements).

monitoring data regarding all generation resources capable of having a material impact on the reliable operation of the Bulk-Power System, including IBRs, to adequately assess disturbance events (*e.g.,* a fault on the line, a generator tripped off-line) and their behavior during those events. Without adequate monitoring capability, the disturbance analysis data for a system event is not comprehensive enough to effectively determine the causes of the system event.[72] Further, the absence of adequate monitoring capability leads to the potential for unreliable operation of resources due to the inability to effectively gather disturbance analysis data and develop mitigation strategies for abnormal resource performance during disturbance events.

32. Limitations on the availability of event data have hampered efforts by NERC and industry to determine the causes of various events since 2016, explained in more detail below. In many instances, data was limited and disturbance monitoring equipment was absent because registered IBRs generally do not fall within the thresholds of the current Reliability Standard PRC–002–2 (Disturbance Monitoring and Reporting Requirements) Attachment 1 methodology requirements for equipment installation given that they often interconnect at lower voltages and are typically smaller compared to synchronous generators.[73] While Reliability Standard PRC–002–2 requires the installation of disturbance monitoring equipment at certain key nodes (*e.g.,* stability limited interfaces), and such limited placements were adequate to provide the data necessary to analyze major system events in the past, they are not sufficient to analyze the distributed system events that have become more common since 2016.[74]

2. IBR and IBR–DER Data and Model Validation

33. IBR-specific modeling data and parameters are necessary to ensure that the registered entities responsible for planning and operating the Bulk-Power System can validate both the individual registered IBR and unregistered IBR data as well as IBR–DER data in the aggregate by comparing the provided data and resulting models with actual performance and behavior.[75] Therefore, even if the Reliability Standards did ensure planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities receive registered IBR modeling data from registered IBR generator owners and operators, the Reliability Standards would still need to include unregistered IBR modeling data and parameters and IBR–DER aggregate modeling data and parameters to ensure reliability. The bulk electric system definition, which delineates the entities required to comply with the Reliability Standards, does not include unregistered IBRs or IBR–DERs. Therefore, the current Reliability Standards do not address the provision of either unregistered IBR or IBR–DER aggregate modeling data and parameters. Further, the Reliability Standards do not include IBR-specific modeling data and parameters (*e.g.,* performance and control settings). As a result, the planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities need to coordinate with: (1) registered IBR generator owners and operators, (2) transmission owners that have unregistered IBRs connected to their systems, (3) and the distribution providers that have IBR–DERs to obtain IBR specific modeling data and parameters so that the transmission planners and operators can validate the accuracy of such data to create meaningful models of steady-state and dynamic registered IBR, unregistered IBR, and aggregate IBR–DER performance.[76]

34. System planners and operators need accurate planning, operational, and interconnection-wide models to ensure reliable operation of the system. Planners and operators use electrical component models to build the generation, transmission, and distribution facility models that form the planning and operational area models, and these area models are combined with the models of their neighboring footprints to form the interconnection-wide models. Each of the planning, operational, and interconnection-wide models consist separately of steady state, dynamic, and short circuit models.

35. Without planning, operational, and interconnection-wide models that accurately reflect the resource (*e.g.,* generators and loads) behavior in steady state and dynamic conditions; otherwise, planners and operators are unable to adequately predict resources' behaviors, including momentary cessation from both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate and subsequent impacts

[72] 2021 Solar PV Disturbances Report at 13. The report explains that the ''analysis team had significant difficulty gathering useful information for root cause analysis at multiple facilities . . . [and] this led to an abnormally large number of 'unknown' causes of power reduction for the plants analyzed.''

[73] Reliability Standard PRC–002–2, Attachment 1 includes a methodology for selecting which buses require sequence of events recording and fault recording data—IBRs do not meet the threshold for this methodology.

[74] *See, e.g.,* Angeles Forest and Palmdale Roost Events Report at 23 (explaining that the lack of data visibility and poor data quality continue to be a concern for comprehensive event analysis after large Bulk-Power System disturbances, as well as how the quality of event reporting is negatively affected by data acquisition resolution issues as a lack of high speed data captured at the IBR controller hinders a complete analysis of IBR behavior in response to Bulk-Power System fault events); San Fernando Disturbance Report at 7 (explaining that many facilities have data archiving systems that only record, store, and retrieve information with a one-minute resolution (or a five-minute resolution in some cases) and that no facilities recorded electrical quantities with sufficient resolution to observe their on-fault behavior, limiting the ability to perform a more detailed analysis of the event.); Odessa Disturbance Report at 11 (indicating some improved monitoring data, but noting the monitoring capability at solar PV facilities is not comprehensive enough to effectively perform root cause analysis and is leading to unreliable operation of these resources due to the inability to effectively develop mitigations for abnormal performance). *See generally* Odessa Disturbance White Paper; NERC, *San Fernando Disturbance Follow-Up NERC Inverter-Based Resource Performance Working Group White Paper,* (June 2021), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/IRPWG_San_Fernando_Disturbance_Follow-Up_Paper%20(003).pdf* (San Fernando Disturbance White Paper).

[75] Modeling and Studies Report at 37 (recommending revising Reliability Standards MOD–026–1 (Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions) and MOD–027–1 (Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions) to ''ensure that large disturbance behavior of [IBRs] is verified.''). In addition, the task force recommended that transmission planners and planning coordinators ''should be required to verify the appropriateness of all dynamic model parameters to ensure suitability of these parameters to match actual performance for all operating conditions.'' *Id. See also* WI Base Case IBR Review at v (recommending that IBR owners ensure that all data fields are reported correctly, that transmission planners and planning coordinators ''should verify that the data fields are submitted correctly,'' and that the Regional Entity ''should ensure that data quality checks are being performed on all incoming data from [transmission planners] and [planning coordinators] for their areas.'').

[76] Static or steady-state models represent electrical component state variables as constant with respect to the time variable of the simulation. Steady-state models are used to represent a single snapshot of balanced system conditions as observed during normal Bulk-Power System operations and serve as a basis of subsequent time-variant technical studies. Dynamic models represent electrical component state variables that vary with time depending on the course of the simulation. Dynamic models are built upon steady-state models and may be validated to ensure they adequately reflect actual historic performance and/or field-testing data. Dynamic models are used by the industry to evaluate resource (*i.e.,* generation and load) performance during simulated events and event investigations.

on the Bulk-Power System.[77] Accordingly, to be able to adequately predict resources' behaviors, planners and operators must validate and update resource models by comparing the provided data and resulting models against actual operational behavior.[78] When accuracy and validation of models are combined, these planning, operational, and interconnection-wide models enable planners and operators to perform valid planning, operational, and interconnection-wide studies.

a. Approved Component Models

36. The starting points for an accurate planning, operational, and interconnection-wide model are the steady state, dynamic, and short circuit models of the elements that make up generation, transmission, and distribution facilities. To this end, NERC has worked with its stakeholders to develop, validate, and maintain a library of standardized approved component models (*e.g.,* generator elements) and parameters for powerflow and dynamic cases.[79] NERC's approved component model list is a collection of generic industry steady-state and dynamic models (*e.g.,* excitor, governor, load, etc.) that when combined accurately reflect the steady-state and dynamic performance of a resource.[80] Despite these efforts, some resource owners still provide modeling data that is based on a proprietary model rather than an approved industry-vetted model.[81] The use of proprietary models in interconnection-wide models can be problematic because their internal model components cannot be viewed or modified, and thus produce outputs that cannot be explained or verified.[82] Without using approved generator models that accurately reflect the generator behavior in steady state and dynamic conditions, planners and operators are unable to adequately predict IBR behavior and subsequent impact on the Bulk-Power System.[83] The Reliability Standards do not require the use of NERC's approved component models; instead, models are referred to generally in Reliability Standard MOD–032–1 Attachment 1.[84]

b. IBR Plant Dynamic Model Performance Verification

37. Once each generator provides a NERC and industry-approved generator model, the model performance must be verified by real-world data.[85] The currently effective Reliability Standards MOD–026–1 [86] and MOD–027–1 [87] require the generator owner to verify models and data for specific components of synchronous resources (*e.g.,* generator excitation control systems, plant volt/var control functions, turbine/governor and load controls, and active power/frequency controls), but they do not require a generator owner to provide verified models and data for IBR-specific controls (*e.g.,* power plant central controller functions and protection system settings). Further, the Reliability Standards neither require verified dynamic models from the transmission owner for unregistered IBRs nor require verified IBR–DER dynamic models in the aggregate from distribution providers.

38. Transmission planners and operators need dynamic models (*i.e.,* models of equipment that reflect the equipment's behavior during changing grid conditions and disturbances) that accurately represent the dynamic performance of all generation resources, including momentary cessation when applicable. As discussed in several NERC analyses,[88] current IBR dynamic models do not accurately represent disturbance behavior due to model deficiencies and because certain key parameters that govern large disturbance response are incorrect; thus, planners are not able to rely on these IBR dynamic models. Unless IBR models are verified to ensure that the models accurately reflect IBR performance during testing or actual events, planners' and system operators' unverified models may indicate that the IBRs will behave reliably when studied in planning and operational analyses, even if ride through operation modes such as momentary cessation persist in actual operations, as observed during

[77] *See* IBR Interconnection Requirements Guideline at 24 (stating that a systemic modeling issue was uncovered regarding the accuracy of the inverter-based resource dynamic models submitted in the interconnection-wide base cases following the issuance of the NERC Alert related to the Canyon 2 Fire disturbance).

[78] *See* Modeling and Studies Report at 35 (explaining that assessments on the accuracy or reasonableness of modeling parameter values are not typically performed and standardized validity testing for dynamic models of newer generation inverter-based resources is not readily available to planners; therefore, contributing to inaccuracies in the interconnection-wide base cases).

[79] NERC Libraries of Standardized Powerflow Parameters and Standardized Dynamics Models version 1 (Oct. 2015), *https://www.nerc.com/comm/PC/Model%20Validation%20Working%20Group%20MVWG%202013/NERC%20Standardized%20Component%20Model%20Manual.pdf* (NERC Standardized Powerflow Parameters and Dynamics Models).

[80] The models are specific to the power flow software. NERC communicates the approved models list by issuing modeling notifications and guidelines. NERC annually assesses the interconnection-wide case quality and publishes a report to help entities responsible for complying with Reliability Standard MOD–032–1 to resolve model issues and improve the cases. *See* NERC, *Reliability Assessment and Performance Analysis Department Modeling Assessments, https://www.nerc.com/pa/RAPA/ModelAssessment/Pages/default.aspx.*

[81] NERC Standardized Powerflow Parameters and Dynamics Models at 1 (explaining that ''[s]ome of the model structures have information that is considered to be proprietary or confidential, which impedes the free flow of information necessary for interconnection-wide power system analysis and model validation.'') *See also* NERC, *Events Analysis Modeling Notification Recommended Practices for Modeling Momentary Cessation Initial Distribution,* n.4 (Feb. 2018), *https://www.nerc.com/comm/PC/NERCModelingNotifications/Modeling_Notification_-_Modeling_Momentary_Cessation_-_2018-02-27.pdf* (explaining that more detailed vendor-specific models may be used for local planning studies; however, they are generally not allowed or recommended for the interconnection-wide cases).

[82] *See, e.g.,* Electric Power Research Institute, *Model User Guide for Generic Renewable Energy System,* 2 (June 2015), *https://www.epri.com/research/products/000000003002006525* (explaining that the ''models presented here were developed primarily for the purpose of general public use and benefit and to eliminate the long standing issues around many vendor-specific models being proprietary and thus neither publicly available nor easily disseminated among the many stakeholders. Furthermore, using multiple user-defined non-standard models within large interconnection studies, in many cases, presented huge challenges and problems with effectively and efficiently running the simulations.'').

[83] NERC Standardized Powerflow Parameters and Dynamics Models (explaining that there is a growing need for accurate interconnection-wide powerflow and dynamics simulations that analyze phenomena such as: frequency response, inter-area oscillations, and interactions between the growing numbers of wide-area control and protections systems).

[84] Reliability Standard MOD–032–1, Attachment 1 (explaining that if a user-written model(s) is submitted in place of a generic or library model, it must include the characteristics of the model, including block diagrams, values and names for all model parameters, and a list of all state variables).

[85] NERC Standardized Powerflow Parameters and Dynamics Models at 1 (explaining that the NERC Modeling Working Group was tasked to develop, validate, and maintain a library of standardized component models and parameters for powerflow and dynamics cases. The standardized models in these libraries have documentation describing their model structure, parameters, and operation. This information has been vetted by the industry and thus deemed appropriate for widespread use in interconnection-wide analysis.).

[86] Reliability Standard MOD–026–1 (Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions).

[87] Reliability Standard MOD–027–1 (Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions).

[88] WI Base Case IBR Review at 18, 25 (finding that the models are not parameterized with as-built settings and that verification of dynamic models is not capturing errors); *see also* Modeling and Studies Report at 34 (finding that a significant number of generator owners submitted data in response to the Loss of Solar Resources Alert II ''indicating that they could eliminate the use of [momentary cessation] for existing resources; however, either no model of proposed changes was provided, or the provided model did not meet [transmission planner] and [planning coordinator] requirements for model performance.'').

the Blue Cut Fire and Canyon 2 Fire events. Additionally, the 2017 NERC DER Report explained that accurate IBR–DER dynamic models are needed where ''[IBR-]DERs are expected to have a significant impact on the modeling results.'' [89]

39. NERC has issued multiple recommendations for: (1) generator owners of IBRs to ensure that their dynamic models accurately represent the behavior of the actual installed equipment; [90] (2) transmission planners and planning coordinators to work with generator owners and operators of IBRs connected to their system to ensure that the dynamic models correctly represent the large disturbance behavior of the actual installed equipment; [91] and (3) transmission planners and planning coordinators to develop updated dynamic models of their systems that accurately represent momentary cessation and to study the impacts of IBRs on the Bulk-Power System.[92]

c. Validating and Updating System Models

40. Transmission planners and operators must validate and update system models by comparing the provided data and resulting system models against actual system operational behavior. While Reliability Standard MOD–033–2 requires data validation of the interconnection-wide system model, [93] the Reliability Standards lack clarity as to whether models of registered IBRs, unregistered IBRs, and IBR–DERs in the aggregate are required to represent the real-world behavior of the equipment installed in the field for interconnection-wide disturbances that have demonstrated common mode failures of IBRs.[94]

41. In addition, Reliability Standard MOD–032–1 lacks clarity on whether generator owners are required to communicate to planners and operators if there are any changes to registered IBRs, including settings, configurations, and ratings. Additionally, transmission owners are not required to communicate to planners and operators if there are any changes to unregistered IBRs for modeling, including settings, configurations, and ratings. Similarly, distribution providers are not required to communicate to planners and operators if there are any changes to IBR–DERs in the aggregate for modeling, including settings, configurations, and ratings. While Reliability Standards MOD–032–1 and MOD–033–2 have iterative updating and validation processes, Reliability Standard MOD–032–1 lacks IBR-specific modeling data and parameters and Reliability Standard MOD–033–2 does not contemplate the technology-specific performance characteristics of registered IBRs, unregistered IBRs, and IBR–DERs. As NERC explained in its petition for approval of the proposed Reliability Standards MOD–032–1 and MOD–033–2, the lack of generator model verification can result in ''the use of inaccurate models [that] could result in grid underinvestment, unsafe operating conditions, and ultimately widespread power outages.'' [95]

42. In the November 2020 San Fernando Disturbance Report, NERC and WECC found that the previously identified modeling issues in the interconnection-wide planning base cases and modeling challenges continued to be an issue.[96] The San Fernando Disturbance Report again recommended that generator owners and generator operators take steps to ensure communication of changes to various settings, topologies, and ratings to their relevant transmission planner, planning coordinator, balancing authority, and reliability coordinator.[97]

d. Lack of Coordination When Creating and Updating Planning, Operational, and Interconnection-Wide Models

43. Planners and operators need to coordinate planning, operational, and interconnection-wide models so that they represent all generation resources—including registered IBRs, unregistered IBRs, IBR–DERs in the aggregate and synchronous generation—and load. When coordinated properly, these sets of models ensure enough detail for planners and operators to perform valid planning, operational, and interconnection-wide studies.

44. Reliability Standard MOD–032–1 Requirement R4 requires planning coordinators to make available models for their planning areas to the ERO or its designee [98] to support creation of interconnection-wide cases.[99] Two reliability gaps lead to interconnection-wide cases that do not reflect the large disturbance behavior that NERC identified in its analyses of IBR disturbance events. The first gap is the use of incorrect and unvalidated registered IBR, unregistered IBR, and IBR–DER models (discussed above) that do not accurately represent performance and behavior of both individual and

[89] NERC, *Distributed Energy Resources: Connection Modeling and Reliability Considerations,* 7 (Feb. 2017), *https://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/Distributed_Energy_Resources_Report.pdf (*NERC DER Report) at 6 (explaining that ''[a]n assessment of the expected impact will have to be scenario-based, and the time horizon of interest may vary between study types. For long-term planning studies, expected DER deployment levels looking 5–10 years ahead may reasonably be considered.''). The NERC DER Report also noted that modeling the modern Bulk-Power System ''with a detailed representation of a large number of [IBR-]DER[s] and distribution feeders can increase the complexity, dimension, and handling of the system models beyond practical limits in terms of computational time, operability, and data availability.'' *Id.*

[90] *See, e.g.,* Loss of Solar Resources Alert II at 2 (generators should ''[e]nsure that the dynamic model(s) being used accurately represent the dynamic performance of the solar facilities.'' The generator owners should ''update the dynamic model(s) to accurately represent momentary cessation and provide the model(s) to the Transmission Planner and Planning Coordinator (to support . . . Reliability Standard TPL–001–4 studies) and to the Reliability Coordinator, Transmission Operator, and Balancing Authority (in accordance with . . . Reliability Standards TOP–003–3 and IRO–010–2).''); *see also* WI Base Case IBR Review at 18, 25 (recommending that the IBR generator owners update their generic models as soon as possible).

[91] *See, e.g.,* Modeling and Studies Report at 33 (recommending that ''[Generator owners] should submit updated models to the [transmission planners] and [planning coordinators] as quickly as possible to accurately reflect the large disturbance behavior of [Bulk-Power System]-connected solar PV resources in the interconnection-wide base cases used for planning assessments. This applies to [bulk electric system] resources as well as non-[bulk electric system] resources connected to the [Bulk-Power System].''). NERC further recommended that ''[transmission planners] and [planning coordinators] should proactively work with all [Bulk-Power System]-connected solar PV resources connected to their system to ensure that the dynamic models correctly represent the large disturbance behavior of the actual installed equipment. [Generator owners] should verify the dynamic model parameters with actual equipment and control settings. These activities should occur on a regular basis.'' *Id.*

[92] *Id.* at 34; *see also* Loss of Solar Resources Alert II at 3.

[93] Reliability Standard MOD–033–2 (Steady State and Dynamic System Model Validation), Requirements R1, R2.

[94] NERC annually assesses the interconnection-wide case quality and publishes a report to help entities responsible for complying with Reliability Standard MOD–032 to resolve model issues and improve the cases. As NERC's 2021 Case Quality Metrics Assessment asserts, currently planners are neither able to develop accurate system models that account for the IBRs on their system, nor facilitate the analysis of Bulk-Power System disturbances. *See* NERC, *Case Quality Metrics Annual Interconnection-wide Model Assessment,* (Oct. 2021), *https://www.nerc.com/pa/RAPA/ModelAssessment/ModAssessments/2021_Case_Quality_Metrics_Assessment-FINAL.pdf.*

[95] NERC, Petition for Approval of Proposed Reliability Standards MOD–032–1 and MOD–033–1, Docket No. RD14–5–000, at 2, 9–10 (filed Feb. 25, 2014).

[96] San Fernando Disturbance Report at ix; Odessa Disturbance Report at 22–28, 29–31.

[97] San Fernando Disturbance Report at ix.

[98] *See* Reliability Standard MOD–032–1, Requirement R4.

[99] In this NOPR, the terms ''interconnection-wide case'' and ''interconnection-wide model'' are interchangeable. Both refer to a collection of electric power system models and requisite data developed to represent either a snapshot of the electric power system at a particular point of time (*e.g.,* year, season) or to represent the power system at a particular operating condition (*i.e.,* normal or abnormal).

aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate. Planners and operators incorporate incorrect and unvalidated IBR models within the footprint of the planner and operator area models. These registered IBR, unregistered IBR, and IBR–DER model inaccuracies from the planning and operation area models then propagate into the interconnection-wide cases.

45. Secondly, there is a coordination gap among registered entities that build and verify interconnection-wide cases. Reliability Standards MOD–032–1 and MOD–033–2 do not obligate the applicable entities to work collaboratively to create interconnection-wide cases that accurately reflect real-world interconnection-wide IBR performance and behavior.[100] In the Western Interconnection, for example, a single MOD–032–1 designee, WECC, collects a set of planning models from the planning authority and builds an interconnection-wide case on the behalf of the registered entities. Having a single MOD–032–1 designee helps in efficiently building an interconnection-wide case. However, the process does not contain requirements for the MOD–032–1 designee to coordinate and verify with MOD–033–2 functional entities (*e.g.,* the system operators) that the interconnection-wide cases reflect real-world IBR behaviors. For example, the Modeling and Studies Report indicates that the MOD–032–1 feedback loops are not being used to correct modeling issues.[101] Further, NERC's 2020 annual assessment of interconnection-wide case quality report explains that there is a need to compare the interconnection-wide models against actual measured system conditions and encourages planning coordinators to consider performing the comparison during MOD–033 evaluation, but such a comparison is not required by a standard.[102] The Reliability Standards should ensure registered entities coordinate to build interconnection-wide cases that reflect the large disturbance behavior of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate (*i.e.,* tripping offline or momentary cessation individually or in the aggregate in response to a single fault on a transmission or sub-transmission system).

46. NERC and WECC identified the impacts of these two reliability gaps in the WI Base Case IBR Review. Specifically, NERC and WECC found that IBR dynamic models used for interconnection-wide planning and operating studies do not properly represent the behavior of the equipment installed in the field, as current interconnection-wide cases contain many inaccurate and unverified IBR models, and many wind and solar PV IBRs are not represented.[103]

3. IBR and IBR–DER Planning and Operational Studies

47. The Reliability Standards do not ensure that planning and operational studies assess the performance and behavior (*e.g.,* IBRs tripping or entering momentary cessation individually or in the aggregate) of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate. Planning and operational studies must use validated registered IBR, unregistered IBR, and IBR–DER aggregate modeling and operational data (as discussed in above Section III.B.1. Data Sharing and Section III.B.2. IBR and IBR–DER Data and Model Validation) to ensure studies account for the actual behavior of registered IBRs, unregistered IBRs, and IBR–DERs in the aggregate. Planning and operational studies must assess the performance and behavior of individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate, during normal and contingency conditions for the reliable operation of the Bulk-Power System.

a. Planning Studies

48. Transmission planning (TPL) Reliability Standards are intended to ensure that the transmission system is planned and designed to meet an appropriate and specific set of reliability criteria. The TPL Reliability Standards, however, do not require planners to study in planning assessments the performance and behavior specific to both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate, under normal operations and contingency event conditions. This reliability gap in planning assessments may lead to false expectations that system performance requirements are met and may inadvertently mask potential reliability risks in planning and operations. NERC's 2021 Battery Storage and Hybrid Plants Guideline further identifies reliability gaps in planning assessments related to newer technologies and provides recommendations to address some of the aforementioned concerns.[104] Nevertheless, as reliability guidelines are voluntary, the gap remains.

49. Reliability Standard TPL–001–4 (Transmission System Planning Performance Requirements) requires planning to ensure reliable operations over a broad spectrum of system conditions and following a wide range of probable contingencies.[105] The 2021 Solar PV Disturbances Report explains that ''many of the reliability issues observed in real-time [*e.g.,* solar PV resources tripping off line and momentary cessation] and identified in the numerous disturbance reports are not being captured in planning studies.'' [106] The Odessa Disturbance Report explains that IBR plants are ''abnormally responding to [Bulk-Power System] disturbance events and ultimately tripping themselves off-line'' and that these issues are not being

[100] Reliability Standard MOD–032–1 is applicable to the following entities: (1) balancing authority, (2) generator owner, (3) load serving entity, (4) planning authority/planning coordinator, (5) resource planner, (6) transmission owner, (7) transmission planner, and (8) transmission service provider.

[101] *See* Modeling and Studies Report at 27 (finding that ''[t]he feedback loops developed in MOD–032–1 are not being used by [transmission planners] and [planning coordinators] to correct modeling issues, nor are [transmission planners] and [planning coordinators] being proactive to address identified issues on a widespread basis.'').

[102] NERC, *Case Quality Metrics Annual Interconnection-Wide Model Assessment,* vii (Oct. 2020), *https://www.nerc.com/pa/RAPA/ModelAssessment/ModAssessments/2020_Case_Quality_Metrics_Assessment-FINAL_postpubs.pdf* (explaining that the report focuses solely on the case data quality of the individual component models comprising the base case and that validation of an interconnection-wide case or overall model performance requires comparison of the cases to actual measured system conditions and are not included in the report. Nevertheless, the report does encourage planning coordinators ''to consider these metrics in their MOD–033 evaluation and to also include metrics on case fidelity.'').

[103] WI Base Case IBR Review at 1–4.

[104] *See* BESS Performance Modeling Guideline, ix Recommendation S1 and S2 (explaining study process enhancements and expansion of study conditions are needed for both interconnection-wide and annual planning assessments to ensure that the variability and uncertainty of renewable energy resources (*e.g.,* registered IBRs, unregistered IBRs, and IBR–DERs in the aggregate) are reflected in planning analyses with appropriate dispatch conditions and under stressed operating conditions. NERC further explained that renewable energy resources have led to different operating conditions than were previously used in planning assessments and ''indicates that developing suitable and reasonable study assumptions will become a significant challenge for future planning analyses.'').

[105] Reliability Standard TPL–001–5.1 (Transmission System Planning Performance Requirements) was approved by the Commission to become effective on July 1, 2023. *See N. Am. Elec. Reliability Corp.,* Docket No. RD20–8–000 (June 10, 2020) (delegated letter order) (approving a NERC-proposed erratum to Reliability Standard TPL–001–5); *Transmission Planning Reliability Standard TPL–001–5,* Order No. 867, 85 FR 8155 (Feb. 13, 2020), 170 FERC ¶ 61,030 (2020) (approving Reliability Standard TPL–001–5).

[106] 2021 Solar PV Disturbances Report at 8 and 21.

properly detected by the models and studies conducted during annual planning assessments.[107] In addition, the Panhandle Report found that ''many [Bulk-Power System]-connected inverter-based resources (and distributed energy resources) will significantly reduce active power for depressed voltages'' that will change grid dynamics and should be accurately modeled in simulations and studied during planning assessments.[108]

50. The NERC DER Report found that many IBR–DERs are generally not visible to Bulk-Power System planners and stated that Bulk-Power System plans must account for this lack of visibility.[109] The report recommended that IBR–DERs be ''modeled in an aggregated and/or equivalent way to reflect their dynamic characteristics and steady-state output.'' [110] The report also found that planners face a challenge with respect to forecasting the adoption of IBR–DER types over long-term planning horizons with ''sufficient locational granularity for identifying and planning needed [Bulk-Power System] infrastructure upgrades.'' [111]

51. Similarly, in the WI Base Case IBR Review, NERC and WECC observed that IBR–DERs are not widely included in WECC base cases and noted that this could pose a ''risk for the creation of a reasonable starting case for entities neighboring those with notable [IBR–] DER penetrations.'' [112] NERC and WECC also observed that planners and operators do not have enough information about generators (including IBR information) to develop a complete and accurate base case.[113]

b. Operational Studies

52. Operators must perform various operational studies, including operational planning analyses, real-time monitoring, real-time assessments and other analyses that include all resources necessary to adequately assess the performance of the Bulk-Power System for normal and contingency conditions.[114] The Reliability Standards do not require operators to include the performance and behavior of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate (*e.g.,* IBRs tripping or entering momentary cessation individually or in the aggregate) in operational studies used to identify potential system operating limits and interconnection reliability operating limit exceedances and to identify any potential reliability risks related to instability, cascading, or uncontrolled separation. In addition, models of registered IBRs, unregistered IBRs, as well as models of IBR–DERs in the aggregate are generally not accurate (as discussed above), which invalidates the operational studies, as evidenced by numerous Bulk-Power System IBR disturbance events seen since 2016.[115] For example, in the FERC, NERC, and Regional Entity Joint Report on Real-time Assessments, ''[s]everal participants expressed concern that Contingencies may now change seasonally because of the decline in system inertia due to the growing number of Inverter-Based Resources in the generation mix. This placed a greater onus on the participant to conduct in-depth and up-to-date studies to ensure all stability Contingencies on its system are identified.'' [116]

53. In the Loss of Solar Resources Alert II, NERC recommended that reliability coordinators, transmission operators, and balancing authorities ''[t]rack, retain, and use the updated IBR dynamic model(s) . . . of existing resource performance that are supplied by the Generator Owners to perform assessments and system analyses to identify any potential reliability risks related to instability, cascading, or uncontrolled separation . . . .'' [117] In addition, the NERC DER Report explained that IBR–DERs do not follow a dispatch signal and are generally not visible to Bulk-Power System operators.[118] The NERC DER Report recommended that all components of the Bulk-Power System, including IBR–DERs, be modeled either directly or in aggregate, with sufficient fidelity to enable dynamic and steady-state models to provide meaningful and accurate simulations of actual system performance.[119]

4. IBR Performance

54. Essential reliability services, such as frequency and voltage support, serve as the basis for reliably operating the Bulk-Power System. Without the availability of essential reliability services, the system would experience instability, voltage collapse, or uncontrolled separation.[120] NERC's Essential Reliability Services Concept Paper initially identified two essential reliability services building blocks—voltage support and frequency support.[121] Some components of these services are provided automatically by synchronous generation due to their physical and mechanical properties. By contrast, IBRs must be configured and programmed to provide these services, and the Reliability Standards do not require registered IBRs to provide such services.

55. The Commission previously revised the *pro forma* Large Generator Interconnection Agreement and the *pro forma* Small Generator Interconnection Agreement to require newly interconnecting generating facilities to address certain issues related to essential reliability services. In Order No. 827, the Commission required all newly interconnecting non-synchronous generating facilities to provide dynamic reactive power within the range of 0.95 leading to 0.95 lagging at the high-side of the generator substation as a condition of interconnection unless the transmission provider establishes a different power factor range, eliminating an earlier exemption for wind generation.[122] In Order No. 828, the Commission required newly interconnecting small generating facilities to have the capability to ''ride through abnormal frequency and voltage events and not disconnect during such events.'' [123] Finally, in Order No. 842,

[107] Odessa Disturbance Report at 43.

[108] Panhandle Report at 8.

[109] NERC DER Report at 3.

[110] *Id.* at 9.

[111] *Id.* at 35.

[112] WI Base Case IBR Review at 2.

[113] *Id.* at 1–4.

[114] *See* Reliability Standard TOP–001–5 (Transmission Operations), Requirements R10, R11, R13; Reliability Standard TOP–002–4 (Operations Planning), Requirements R1, R4; Reliability Standard IRO–008–2 (Reliability Coordinator Operational Analyses and Real-time Assessments), Requirements R1, R4; Reliability Standard IRO–002–7 (Reliability Coordination—Monitoring and Analysis), Requirement R5.

[115] *See* Modeling and Studies Report at iv (finding that ''Many of the dynamic models that were supplied by [generator owners] as part of the NERC Alert process had modeling errors or inaccuracies and were unusable to the [transmission planner] and [planning coordinator].''); *see also* NERC DER Report at vi (expressing that ''Today, the effect of aggregated [IBR-]DER is not fully represented in [Bulk-Power System] models and operating tools.'').

[116] FERC, NERC, Regional Entities, *Joint Report on Real-time Assessments,* 13–14 (July 2021), *https://www.ferc.gov/media/ferc-and-ero-enterprise-joint-report-real-time-assessments.*

[117] Loss of Solar Resources Alert II at 4–5.

[118] NERC DER Report at 3; *see also* IBR Performance Guideline at 65.

[119] NERC DER Report at iv, 9.

[120] Essential Reliability Services Concept Paper at iii.

[121] *Id.*

[122] *Reactive Power Requirements for Non-Synchronous Generation,* Order No. 827, 81 FR 40793 (June 23, 2016), 155 FERC ¶ 61,277, at PP 1–2 (2016).

[123] *Requirements for Frequency & Voltage Ride Through Capability of Small Generating Facilities,* Order No. 828, 81 FR 50290 (Aug. 1, 2016), 156 FERC ¶ 61,062, at P 1 (2016). The Commission went on to explain that it ''continues to affirm that this Final Rule is not intended to interfere with state interconnection procedures or agreements in any way. The *pro forma* SGIA applies only to interconnections made subject to a jurisdictional open access transmission tariff (OATT) for the

Continued

the Commission required newly interconnecting generating facilities ''to install, maintain, and operate equipment capable of providing primary frequency response as a condition of interconnection.'' [124]

a. Frequency Ride Through

56. The Reliability Standards do not account for the difference between registered IBRs' and synchronous facilities' responses during normal and contingency conditions. IBR technology is different than synchronous generation technologies. For instance, IBR ride through capability must be configured and programmed for IBRs to be able to ride through frequency disturbances. Synchronous resources will automatically ride through a disturbance because they are synchronized (*i.e.,* connected at identical speeds) to the electric power system and physically linked to support the system frequency during frequency fluctuations by continuing to produce real and reactive power. The frequency of an interconnection depends on the instantaneous balance between load and generation resources to which all resources must contribute during both normal and contingency conditions. This requires generation resources to remain connected to the grid and continue to support grid frequency (*i.e.,* ride through) for either loss of generation (underfrequency) or loss of load (overfrequency) related frequency deviations.

57. Reliability Standard PRC–024–3 (Frequency and Voltage Protection Settings for Generating Resources) does not include frequency ride through performance requirements that address the unique protection and control functions of IBRs. In particular, the Reliability Standard PRC–024–3 requirement for specific relay protection frequency settings does not address momentary cessation. As a result, registered IBRs are not required to continually produce real power and support frequency inside the ''no trip zone'' during a frequency excursion.[125]

58. In the Blue Cut Fire Event Report, NERC and WECC found that inverters that ''trip instantaneously based on near instantaneous frequency measurements are susceptible to erroneous tripping during transients generated by faults'' on the Bulk-Power System.[126] In response, NERC and WECC recommended a review of Reliability Standard PRC–024–2 to determine whether to modify it for clarity and to ensure a more accurate representation of Bulk-Power System frequency measurement.[127] Shortly after the Blue Cut Fire Event Report, NERC also issued the Loss of Solar Resources Alert I identifying and recommending corrective action to prevent similar IBR responses in the future.[128]

59. On July 9, 2020, the Commission approved Reliability Standard PRC–024–3, which addressed some of the reliability gaps in Reliability Standard PRC–024–2 that NERC found contributed to the outages during the August 2016 Blue Cut Fire event system disturbance.[129] For example, Reliability Standard PRC–024–3 clarifies that the ''applicable protection does not cause the generating resource to trip or cease injecting current within the 'no trip zone' during a frequency excursion. . . .'' [130] In addition, Reliability Standard PRC–024–3 requires that frequency be calculated over a window of time and clarifies that instantaneous trip settings based on instantaneously-calculated frequency measurement are not permissible.[131] However, Reliability Standard PRC–024–3 does not require registered IBRs (or any generator) to remain connected to the Bulk-Power System and to continue to produce real power and support frequency inside the ''no trip zone.'' This reliability gap led to NERC and Texas RE recommending in the 2021 Odessa Disturbance Report the development of a new ride through standard to replace Reliability Standard PRC–024–3 focusing specifically on generator-ride through performance.[132]

b. Voltage Ride Through

60. The Reliability Standards do not require registered IBRs to continually produce real power and support voltage inside the ''no trip zone'' during a voltage excursion. The Reliability Standards also do not have voltage ride through performance requirements that address the unique protection and control functions of registered IBRs that can cause tripping and momentary cessation, even when the IBR voltage protection settings are compliant with Reliability Standard PRC–024–3. Keeping generation resources connected to the grid during and after a Bulk-Power System disturbance is critical to maintaining reliability. During both Bulk-Power System fault and post-fault periods, the transmission system experiences voltage depressions. Additionally, the transmission system may experience high voltages during post-fault recovery periods. Voltage fluctuations during system disturbances may lead to IBRs tripping and momentary cessation, which can exacerbate Bulk-Power System recovery.

61. Since first identifying that IBRs momentarily cease current injection or trip in response to voltage fluctuations during system disturbances, NERC has continued to find that the majority of installed inverters fail to continuously inject active or reactive current during abnormal voltages (*i.e.,* ride through).[133] Through event reports, NERC and WECC have recommended that momentary cessation should not be used for new IBRs and ''should be eliminated or mitigated to the greatest extent possible for existing [IBRs] connected to the [Bulk-Power System].'' and WECC also noted that for existing IBRs with an equipment limitation that requires momentary cessation, ''active current injection following voltage recovery should be restored very quickly (within 0.5 seconds).'' [134]

62. In addition to event reports, NERC has also recommended in the Loss of Solar Resources Alert II that registered IBR owners and operators as well as unregistered IBR owners and operators take action to address voltage ride through and ensure the timely restoration of current injection following momentary cessation by all inverter-based resources connected to the Bulk-Power System.[135] NERC also recommended that solar PV IBR owners should ''[w]ork with their inverter manufacturer(s) to identify the changes that can be made to eliminate momentary cessation of current injection to the greatest extent possible, consistent with equipment capability.'' [136]

purposes of jurisdictional wholesale sales.'' *Id.* P 12.

[124] *Essential Reliability Servs. & the Evolving Bulk-Power Sys.—Primary Frequency Response,* Order No. 842, 162 FERC ¶ 61,128 at P 1.

[125] Reliability Standard PRC–024–3, Attachment 1, nn.8, 9. There is no explicitly stated expected performance requirements for IBRs while system operating conditions are within the no-trip zone. Therefore, IBRs could continue to act adversely in response to normally cleared faults by continuing to exhibit momentary cessation and power reduction behaviors.

[126] Blue Cut Fire Event Report at v, 15.

[127] *Id.*

[128] Loss of Solar Resources Alert I at 1–2.

[129] *N. Am. Elec. Reliability Corp.,* Docket No. RD20–7–000 (July 9, 2020) (delegated letter order).

[130] Cessation of current injection was not included in Reliability Standard PRC–024–2. *See also* Reliability Standard PRC–024–3, Requirement R1 & Attachment 1, n.9.

[131] Reliability Standard PRC–024–3, Attachment 1, n.9.

[132] Odessa Disturbance Report at 30.

[133] Blue Cut Fire Event Report at 9; Canyon 2 Fire Event Report at 14, 16–17, 20; Angeles Forest and Palmdale Roost Events Report at 13, 15, 19; San Fernando Disturbance Report at iv, 2–9.

[134] Canyon 2 Fire Event Report at 19.

[135] Loss of Solar Resources Alert II at 1.

[136] *Id.* at 2–3.

63. For IBRs for which momentary cessation cannot be eliminated entirely, NERC recommended that generator owners should identify the changes that can be made to inverter settings to minimize the impact of momentary cessation on the Bulk-Power System.[137] NERC also recommended that solar PV IBR owners should ''consult with their inverter manufacturer(s) and their PV panel manufacturer(s) to implement inverter DC reverse current protection settings based on equipment limitations, such that the resource will not trip unnecessarily during high voltage transients on the [Bulk-Power System.]'' [138] Also in the IBR Performance Guideline, NERC recommends reducing the recovery delay on the order of one to three electrical cycles and return to full active power within one second. The only exception to the return to service recommendation is when the transmission planner or generation interconnection studies specify a longer period to return to normal operations. Longer restoration periods would require other essential reliability services from other generators to be deployed to arrest frequency decline and provide voltage support when IBRs trip or do not return to service in a timely manner.[139]

c. Post-Disturbance IBR Ramp Rate Interactions

64. The Reliability Standards do not ensure that all generation resources that momentarily cease operation following a system disturbance return to pre-disturbance output levels without impeded ramp rates. In the Canyon 2 Fire Event Report, NERC and WECC explained that impeded ramp rates need to be ''remediated to ensure [Bulk-Power System] transient and frequency stability.'' [140] Further, NERC and WECC found that IBR ramp rates are artificially bounded, resulting in IBRs returning to pre-disturbance outputs slower than desired—ranging from seconds to several minutes—because plant-level controller ramp rate limits used for balancing generation and load are being applied to IBRs following momentary cessation.[141] For IBRs that cannot eliminate momentary cessation, NERC and WECC recommended that active current injection should not be restricted by a plant-level controller or other limits on ramp rates.[142] NERC and WECC also recommended that IBR owners should remediate post-disturbance ramp rate limitations in close coordination with their balancing authority and inverter manufacturers while ensuring that ramp rates are enabled appropriately to control generation-load balance.[143]

d. Phase Lock Loop Synchronization

65. The Reliability Standards do not require that all generation resources maintain voltage phase angle synchronization with the Bulk-Power System grid voltage during a system disturbance. IBRs will momentarily cease current injection into the grid due to protection and control settings during Bulk-Power System disturbance events if IBRs lose synchronization with grid voltage (*i.e.,* phase lock loop loss of synchronism). The Odessa Report explained that phase lock loop loss of synchronism was the largest contributor to the reduction of solar PV output during the reported Bulk-Power System disturbance event.[144]

66. For IBRs, an inverter phase lock loop ''continually monitors the phase angle difference between the inverter [AC] voltage command and the grid-side [AC] voltage.'' [145] The phase lock loop also ''adjusts the internal phase angle of current injection to remain synchronized with the [AC] grid.'' [146] Synchronous generation resources do this automatically through electromagnetic coupling whereby mechanical energy from the turbine is converted to electrical energy in the magnetic field of the generator, which is synchronized with the system.[147] For certain disturbances, a ''rapid change in inverter terminal phase angle can pose challenges for the [phase lock loop] to track the terminal voltage angle.'' [148] In some instances, a phase lock loop ''loss of synchronism'' may occur.[149] Proper tracking of voltage phase angle is required for a successful and effective synchronization of the inverter with the grid.

67. The Canyon 2 Fire Event Report found that some IBRs experienced a momentary loss of synchronism with the AC grid waveform during the disturbance, which resulted in protective action opening the primary circuit breaker followed by a five-minute restart action.[150] NERC and WECC recommended that IBRs should ''ride through momentary loss of synchronism'' during Bulk-Power System disturbances and that they should continue to inject current into the Bulk-Power System during the disturbance.[151]

IV. Proposed Directives

68. We preliminarily find that the Reliability Standards do not adequately address the impacts of IBRs on the reliable operation of the Bulk-Power System. Informed by the IBR events, reports, alerts, and guidelines discussed above, we preliminarily find that changes to the Reliability Standards are necessary to appropriately address IBRs and their impacts on Bulk-Power System operations.

69. Pursuant to section 215(d)(5) of the FPA and § 39.5(f) of the Commission's regulations, we therefore propose to direct NERC to develop and submit new or modified Reliability Standards that address the impacts of IBRs on the reliable operation of the Bulk-Power System as described in more detail below. Given the current and projected increased proportion of IBRs within the Bulk-Power System generation fleet,[152] we propose to direct NERC to develop new or modified Reliability Standards that address: (1) IBR data sharing; (2) IBR model validation; (3) IBR planning and operational studies; and (4) registered IBR performance requirements.

70. We appreciate that NERC has initiated several standard drafting projects relating to IBRs,[153] but we

[137] *Id.* at 3.

[138] *Id.* at 4.

[139] NERC IBR Performance Guideline at 13, 68.

[140] Canyon 2 Fire Event Report at 9.

[141] *Id.* at 9–11, 19; *see also* Blue Cut Fire Event Report at 15 (observing that during the Blue Cut Fire Event, some inverters that went into momentary cessation mode returned to pre-disturbance levels at a slow ramp rate).

[142] Canyon 2 Fire Event Report at v.

[143] *Id. See also* Loss of Solar Resources Alert II at 3 (recommending that IBR solar PV generators owners ensure that inverter restoration from momentary cessation should not be impeded by plant-level control ramp rates); *see also* Angeles Forest and Palmdale Roost Events Report at 14–15 (reiterating the findings and recommendations from the Loss of Solar Resources Alert II); *see also* San Fernando Disturbance Report at iv (explaining that some IBRs returned to pre-disturbance power output levels quickly (*i.e.,* around one second) while the majority of IBRs had longer ramp rates and required substantially more time to return to pre-disturbance power output levels).

[144] Odessa Report at 8.

[145] IBR Interconnection Requirements Guideline at 9 (footnotes omitted).

[146] *Id.*

[147] Edvard, *Mysterious Synchronous Operation of Generator Solved,* Electrical-Engineering-Portal.com, (Jun. 2013), *https://electrical-engineering-portal.com/mysterious-synchronous-operation-of-generator.*

[148] IBR Interconnection Requirements Guideline at 9.

[149] *Id.* at 10 (this is a protective function that operates when the angle difference between the phase generated by the phase lock loop and the grid phase exceeds a threshold for a predetermined period, typically on the order of a couple of milliseconds).

[150] Canyon 2 Fire Event Report at 15–16, 20.

[151] *Id.*

[152] *See, e.g.,* 2020 LTRA Report at 9.

[153] NERC 2022–2024 Reliability Standards Development Plan.

believe that a comprehensive review and development of new or modified Reliability Standards to address IBRs is necessary to assure that IBRs are properly considered in Bulk-Power System planning and that their operational characteristics—such as momentary cessation—are addressed.[154] Developing new or modified Reliability Standards to comprehensively address the reliability impacts of IBRs will help ensure the reliable operation of the Bulk-Power System as the transition to a future resource mix that includes a high level of IBR penetration continues.

71. Given the variety of concerns related to IBRs, there may be efficiencies in developing a new IBR-specific Reliability Standard or Standards that address IBR issues in a comprehensive manner. Further, considering the directives in the related IBR registration order issued concurrently with this NOPR,[155] a new Reliability Standard or Standards may also be more easily developed for the newly registered IBR-only generator owners and operators of currently unregistered IBRs that fall outside the current bulk electric system definition but that, in the aggregate, materially impact the reliable operation of the Bulk-Power System.[156] We do not propose to direct any specific method for addressing the reliability concerns discussed herein; rather, NERC has the discretion, subject to Commission review and approval, to address the reliability concerns by developing one or more new Reliability Standards or modifying currently effective Reliability Standards.

72. We propose to direct NERC to submit a compliance filing within 90 days of the effective date of the final rule in this proceeding. That compliance filing shall include a detailed, comprehensive standards development and implementation plan explaining how NERC will prioritize the development and implementation of new or modified Reliability Standards. In its compliance filing, NERC should explain how it is prioritizing its IBR Reliability Standard projects to meet the directives in the final rule, taking into account the risk posed to the reliability of the Bulk-Power System, standard development projects already underway, resource constraints, and other factors as necessary.

73. We propose to direct NERC to use a staggered approach that would result in NERC submitting new or modified Reliability Standards in three stages: (1) new or modified Reliability Standards including directives related to registered IBR failures to ride through frequency and voltage variations during normally cleared Bulk-Power System faults shall be filed with the Commission within 12 months of Commission approval of the plan; (2) new or modified Reliability Standards addressing the interconnected directives related to registered IBR, unregistered IBR, and IBR–DER data sharing, registered IBR disturbance monitoring data sharing, registered IBR, unregistered IBR, and IBR–DER data and model validation, and registered IBR, unregistered IBR, and IBR–DER planning and operational studies shall be filed with the Commission within 24 months of Commission approval of the plan; and (3) new or modified Reliability Standards including the remaining directives for post-disturbance ramp rates and phase-locked loop synchronization shall be filed with the Commission within 36 months of Commission approval of the plan. We believe this staggered approach to standard development may be necessary based on the scope of work anticipated and that specific target dates will provide a valuable tool and incentive to NERC to timely address the directives in the final rule.

74. NERC should also reflect in its compliance filing that the proposed directives for individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate, related to data sharing, validation, and use in studies are interdependent. For example, data models and validation build and rely upon the data sharing directives. Similarly, the planning and operational study directives require the use of validated models and data sharing. We believe that this proposal strikes a reasonable balance between the need to timely implement identified improvements to the Reliability Standards that will further Bulk-Power System reliability and the need for NERC to develop modifications with industry input using its open, stakeholder process.

75. We seek comments from NERC and other interested entities on this staggered approach, including the 90-day timeframe to submit a compliance filing with a development and implementation plan, and on all other proposals in this NOPR.

A. IBR and IBR–DER Data Sharing

76. We preliminarily find that the current Reliability Standards are inadequate to ensure that sufficient data of registered IBRs and unregistered IBRs, and IBR–DER data in the aggregate is provided to the registered entities responsible for planning, operating, and analyzing disturbances on the Bulk-Power System. The currently effective Reliability Standards, such as TOP–003–4 (Operational Reliability Data) and IRO–010–3 (Reliability Coordinator Data Specification and Collection), require the data recipient (*e.g.,* transmission operator, reliability coordinator) to specify a list of data to be provided, and obligates other identified registered entities (*e.g.,* generator owner, generator operator, transmission owner, distribution provider) to provide the specified data. Although Reliability Standards TOP–003–4 and IRO–010–3, along with other data-related Reliability Standards (including MOD–032–1 and PRC–002–2) are effective and enforceable, we preliminarily find that these Reliability Standards do not require generator owners, generators operators, transmission owners, and distribution providers to provide data that represents the behavior of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate, at a sufficient level of fidelity for planners and operators to accurately plan, operate, and analyze disturbances on the Bulk-Power System.

77. To address this gap in the Reliability Standards, we propose to direct NERC to develop new or modified Reliability Standards that identify: (1) the registered entities that must provide certain data of registered IBRs and unregistered IBRs, as well as IBR–DER data in the aggregate; (2) the recipients of that registered IBR, unregistered IBR, and IBR–DER data; (3) the minimum categories or types of registered IBR, unregistered IBR, and IBR–DER related data that must be provided; and (4) the timing and periodicity for the provision of registered IBR, unregistered IBR, and IBR–DER data needed for modeling, operations, and disturbance analysis to the appropriate registered entities and the review of that data by those entities.

78. Further, we propose to direct NERC to ensure that the new or modified Reliability Standards require registered generator owners and generator operators of registered IBRs to provide registered IBR-specific

[154] *See* 2021 Solar PV Disturbances Report, vi, 30 (stating that the report ''strongly reiterates the recommendations in the Odessa Disturbance Report regarding the need to modernize and update the . . . Reliability Standards.'').

[155] *See Registration of Inverter-based Resources,* 181 FERC ¶ 61,124 at P 32 (directing that NERC 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 [bulk electric system] definition.'').

[156] *Id.* P 33 (''NERC may determine that the full set of Reliability Standard Requirements otherwise applicable to generator owners and operators need not apply to currently unregistered IBR generator owners and operators when they are registered.'' (citation omitted)).

modeling data and parameters (*e.g.,* steady-state, dynamic and short circuit modeling information, and control settings for momentary cessation and ramp rates) that are complete and accurate to their planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities that are responsible for planning and operating the Bulk-Power System. This approach would provide the registered entities responsible for planning and operating the Bulk-Power System with accurate data on registered IBRs. We propose to direct NERC to include technical criteria for having disturbance monitoring equipment at buses and elements of registered IBRs to ensure disturbance monitoring data is available to the planners and operators for analyzing disturbances on the Bulk-Power System and to validate registered IBR models.

79. We also preliminarily find that planning coordinators and other entities also need modeling data and parameters from both unregistered IBRs as well as IBR–DERs in the aggregate to assure greater accuracy in modeling. We propose to direct that the new or modified Reliability Standards addressing IBR data sharing require transmission owners to provide modeling data and parameters (*e.g.,* steady-state, dynamic and short circuit modeling information, and control settings for momentary cessation and ramp rates) for unregistered IBRs in their transmission owner areas where the unregistered IBRs that individually or in the aggregate materially affect the reliable operation of the Bulk-Power System. Similarly, where entities that own or operate IBR–DERs that, in the aggregate, materially affect the reliability of the Bulk-Power System and are not subject to compliance with Reliability Standards, we propose to direct that the new or modified Reliability Standards addressing IBR data sharing require that the distribution provider provide modeling data and parameters for IBR–DERs in the aggregate connected in its distribution provider area.[157]

80. This approach would be similar to other Reliability Standards that require transmission owners and distribution providers to provide certain planning and operational data received from unregistered entities.[158] Moreover, given the small size and location of many of the IBR–DERs on the distribution system, we recognize that it may not be practical for distribution providers to provide modeling data and parameters to model individual IBR–DERs directly. Instead, the new or modified Reliability Standards should permit distribution providers to provide IBR–DER modeling data and parameters in the aggregate or equivalent for IBR–DERs interconnected to their distribution systems (*e.g.,* IBR–DERs in the aggregate and modeled by resource type such as wind or solar PV, or IBR–DERs in the aggregate and modeled by interconnection requirements performance to represent different steady-state and dynamic behavior).[159]

81. We believe that these proposed directives will ensure that entities such as planning coordinators and reliability coordinators receive accurate and complete data about IBRs, both registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate to properly plan, operate, and analyze performance on the Bulk-Power System to ensure reliable operations.

B. IBR and IBR–DER Data and Model Validation

82. We preliminarily find that the existing Reliability Standards are inadequate to ensure that planners and operators: (1) have the steady state, dynamic, and short circuit models of the elements that make up generation, transmission, and distribution facilities that accurately reflect the generator behavior in steady state and dynamic conditions; (2) have dynamic models (*i.e.,* models of equipment that reflect the equipment's behavior during various grid conditions and disturbances) that accurately represent the dynamic performance of all generation resources, including momentary cessation when applicable; (3) validate and update resource models by comparing the provided data and resulting models against actual operational behavior to achieve and maintain necessary accuracy of their resource models; and (4) have interconnection-wide planning and operational models that represent all generation resources, including: registered IBRs, unregistered IBRs, and IBR–DERs; synchronous generation; and load resource models. System planners and operators need accurate planning, operational, and interconnection-wide models to ensure reliable operation of the system.

83. We therefore propose to direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that would ensure that all necessary models are validated. Specifically, NERC should ensure that the Reliability Standards require: (1) generator owners to provide validated registered IBR models to the planning coordinators for interconnection-wide planning and operational models; (2) require transmission owners to provide validated unregistered IBR models to the planning coordinators for interconnection-wide planning and operational models; and (3) require distribution providers to provide validated models of IBR–DERs in the aggregate (*e.g.,* IBR–DERs in the aggregate and modeled by resource type such as wind or solar PV, or IBR–DERs in the aggregate and modeled by interconnection requirements performance to represent different steady-state and dynamic behavior) to the planning coordinators for interconnection-wide planning and operational models. Further, NERC should ensure that the new or modified Reliability Standards require models of individual registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate to represent the dynamic behavior of these IBRs at a sufficient level of fidelity for planners and operators to perform valid facility interconnection, planning, and operational studies on a basis comparable to synchronous generation resources.

84. The Reliability Standards do not require a generator owner to provide verified models and data for IBR-specific controls (*e.g.,* power plant central controller functions and protection system settings) and do not require verified dynamic models from the transmission owner for unregistered IBRs or require verified IBR–DERs dynamic models in the aggregate from distribution providers. We therefore

[157] NERC, *Reliability Guideline: Parameterization of the DER A Model,* 8–16 (Sept. 2019), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_DER_A_Parameterization.pdf.*

[158] This approach is consistent with certain currently effective Reliability Standards. *See, e.g.,* Reliability Standard IRO–010–2 (Reliability Coordinator Data Specification and Collection) Requirement R1 (providing that ''[t]he Reliability Coordinator shall maintain a documented specification for the data . . . *including non-[bulk electric system] data*''(emphasis added)), Requirement R2 (providing that ''[t]he Reliability Coordinator shall distribute its data specification to entities''), Requirement R3 (providing that ''[e]ach . . . Transmission Owner, and Distribution Provider receiving a data specification in Requirement R2 shall satisfy the obligations of the documented specifications''); Reliability Standard PRC–006–3 (Automatic Underfrequency Load Shedding) Requirement R8 (requiring that a UFLS entity, *i.e.,* relevant transmission owner and distribution provider, ''provide data to its Planning Coordinator(s)'').

[159] NERC DER Report at 7 (explaining ''a certain degree of simplification may be needed either by model aggregation (*i.e.,* clustering of models with similar performance), by derivation of equivalent models (*i.e.,* reduced-order representation), or by a combination of the two.''). *See also* NERC, *Reliability Guideline: Parameterization of the DER A Model,* (Sept. 2019), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_DER_A_Parameterization.pdf.*

propose to direct that the proposed new or modified Reliability Standards account for the technological differences between Bulk-Power System IBRs and synchronous generation resources. We also propose to direct NERC to require generator owners of registered IBRs and transmission owners that have unregistered IBRs on their system to ensure that the dynamic models provided to the planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities accurately represent the dynamic performance of registered IBR and unregistered IBR facilities, including momentary cessation and/or tripping, including all ride through behavior. Further, we propose to direct NERC to require distribution providers that have IBR–DERs on their system to ensure that the aggregated dynamic models provided to the planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities accurately represent the dynamic performance of IBR–DER facilities in the aggregate, including momentary cessation and/or tripping, including all ride -through behavior (*e.g.,* IBR–DERs in aggregate modeled by interconnection requirements performance to represent different steady-state and dynamic behavior).

85. We also preliminarily find that there is a coordination gap among registered entities that build and verify interconnection-wide cases. Reliability Standards MOD–032–1 and MOD–033–2 functional entities and designees are not required to work collaboratively to create interconnection-wide cases that accurately reflect real-world interconnection-wide IBR performance and behavior. Therefore, we propose to direct NERC to ensure that the new or modified Reliability Standards require planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities to validate, coordinate, and keep up-to-date in a timely manner [160] the verified data and models of registered IBRs, unregistered IBRs, and IBR–DERs in the aggregate by comparing their data and resulting models against actual operational behavior to achieve and maintain necessary modeling accuracy of individual and aggregate registered IBR and unregistered IBR performance and behaviors, as well as performance and behaviors of IBR–DERs in the aggregate.

[160] Panhandle Report at 19 (recommending that the performance validation feedback loop is addressed in a timely manner).

86. Finally, without approved generator models that accurately reflect the generator behavior in steady state and dynamic conditions, we preliminarily find that planners and operators are unable to adequately predict IBR behavior and their subsequent impact on the Bulk-Power System.[161] The Reliability Standards do not require the use of NERC's approved component models, instead models are referred to generally in Reliability Standard MOD–032–1, Attachment 1.[162] We therefore propose to require that the new or modified Reliability Standards require the use of approved industry IBR models that accurately reflect the behavior of IBRs during both steady state and dynamic conditions. One way to do this would be to reference NERC's approved model list in the Reliability Standards and require that only those models be used when developing planning, operational, and interconnection-wide models. The proposed directives are consistent with the recommendations in NERC reports.[163]

C. IBR and IBR–DER Planning and Operational Studies

87. We preliminarily find that the existing Reliability Standards are inadequate to ensure planning and operational studies: (1) assess performance and behavior of both individual and aggregate registered IBRs and unregistered IBRs as well as IBR–DERs in the aggregate; (2) have and use validated modeling and operational data for individual registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate; and (3) account for the impacts of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate, within and across planning and operational boundaries for normal operations and contingency event conditions. Planning and operational studies must use validated IBR modeling and operational data to ensure studies account for the actual behavior of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate.

[161] NERC Standardized Powerflow Parameters and Dynamics Models (explaining that there is a growing need for accurate interconnection-wide powerflow and dynamics simulations that analyze phenomena such as: frequency response, inter-area oscillations, and interactions between the growing numbers of wide-area control and protections systems).

[162] Reliability Standard MOD–032–1, Attachment 1 (explaining that if a user-written model(s) is submitted in place of a generic or library model, it must include the characteristics of the model, including block diagrams, values and names for all model parameters, and a list of all state variables).

[163] *See, e.g.,* Modeling and Studies Report at 37 (recommending revising Reliability Standards to ensure that large disturbance behavior of IBRs is verified); WI Base Case IBR Review at v (recommending that IBR owners ensure that all data fields are reported correctly and that transmission planners and planning coordinators ''should verify that the data fields are submitted correctly'').

1. Planning Studies

88. We preliminarily find that the Reliability Standards do not ensure accurate planning studies of Bulk-Power System performance over a broad spectrum of system conditions and following a wide range of probable contingencies that includes all resources. Inaccurate planning assessments may lead to false expectations that system performance requirements are met and may inadvertently mask potential reliability risks in planning and operations. We therefore propose to direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that would require planning coordinators and transmission planners to include in their planning assessments the study and evaluation of performance and behavior of individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate, under normal and contingency system conditions in their planning area. We further propose that the planning assessments include the study and evaluation of the ride through performance (*e.g.,* tripping and momentary cessation conditions) of such IBRs in their planning area for stability studies on a comparable basis to synchronous generation resources. The proposed Reliability Standard(s) would also require planning coordinators and transmission planners to consider the individual and aggregate behavior of registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate, using planning models of their area, and, using interconnection-wide area planning models, IBR behavior in adjacent and other planning areas that adversely impacts a planning coordinator's or transmission planner's area during a disturbance event. We believe that this is needed because registered IBRs, unregistered IBRs, and IBR–DERs tend to act in the aggregate over a wide area during such an event.[164]

[164] 2021 Solar PV Disturbances Report at v (stating that ''The ongoing widespread reduction of solar PV resources continues to be a notable reliability risk to the [Bulk-Power System], particularly when combined with the additional loss of other generating resources on the [Bulk-Power System] and in aggregate on the distribution system.''); *see also* Odessa Disturbance Report at v (stating that ''[w]hile the ERO has analyzed

2. Operational Studies

89. We preliminarily find that the Reliability Standards do not require that the various operational studies (including operational planning analyses, real-time monitoring, real-time assessments and other analysis functions) include all resources to adequately assess the performance of the Bulk-Power System for normal and contingency conditions. We therefore propose to direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that would require reliability coordinators and transmission operators to include the performance and behavior of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate (*e.g.,* IBRs tripping or entering momentary cessation individually or in the aggregate) in their operational planning analysis,[165] real-time monitoring, and real-time assessments [166] including non-bulk electric system data and external power system network data identified in their data specifications.[167] We further propose to direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that would require balancing authorities to include the performance and behavior of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate (*e.g.,* resources tripping or entering momentary cessation individually or in the aggregate) in their operational analysis functions and real-time monitoring.[168] This proposal is consistent with the recommendations in the NERC DER Report, IBR Performance Guideline, IBR–DER Data Collection Guideline, and Loss of Solar Resources Alert II. These reports indicate that a significant amount of IBRs that have been involved in system disturbances were not adequately modeled in interconnection-wide cases and tools used to study the performance and behavior of both individual and aggregate registered IBRs and unregistered IBRs, as well as IBR–DERs in the aggregate.[169] Thus, neighboring operators may be unaware that faults in one operator's area can trigger controls actions and trip IBRs in another operator's area.

D. IBR Performance Requirements

90. We preliminarily find that the Reliability Standards should require registered IBRs to ride through system disturbances to support essential reliability services. Without the availability of essential reliability services, the system would experience instability, voltage collapse, or uncontrolled separation.[170] Therefore, we propose to direct NERC to develop new or modified Reliability Standards that would require generator owners and generator operators to ensure that their registered IBR facilities ride through system frequency and voltage disturbances where technologically feasible. Ride through performance during system disturbances is necessary for registered IBRs to support essential reliability services.[171] We propose to direct NERC to ensure that the proposed new or modified Reliability Standards clearly address and document the technical differences and technical capabilities between registered IBRs and synchronous generation resources in order for registered IBRs to provide support for these essential reliability services.[172]

91. We also propose to direct NERC to develop new or modified Reliability Standards to address other registered IBR performance and operational characteristics that can affect the reliable operation of the Bulk-Power System, namely, ramp rate interactions and phase-locked loop synchronization.

92. We believe the proposed directives would improve the reliable operation of the Bulk-Power System by helping to avoid instability, voltage collapse, uncontrolled separation, or islanding.

1. Frequency Ride Through

93. We preliminarily find that the currently effective Reliability Standards do not require registered IBR reliable frequency ride through performance during system disturbances. The frequency of an interconnection depends on the instantaneous balance between load and generation resources to which all resources must contribute during both normal and contingency conditions. However, the Reliability Standard PRC–024–3 requirement for specific relay protection frequency settings does not ensure adequate registered IBR performance because IBRs could have protection and control functions that can cause the resource to trip or momentarily cease operation even when the IBR frequency protection settings are compliant with the standard. We therefore propose to direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that would require registered IBR generator owners and registered IBR generator operators to use appropriate settings (*i.e.,* inverter, plant controller, and protection) that will assure frequency ride through during system disturbances and that would permit registered IBR tripping only to protect the registered IBR equipment. Under this proposal, any new or modified Reliability Standards should require registered IBRs to continue to produce power and perform frequency support during system disturbances. We believe this proposal is consistent with

multiple similar events in California, this is the first disturbance involving a widespread reduction of solar photovoltaic (PV) resource power output observed in the Texas Interconnection.''); Blue Cut Fire Event Report at 2 (explaining that the system disturbance event was ''impactful because of the widespread loss . . . of PV generation.'').

165 NERC defines operational planning analysis as ''An evaluation of projected system conditions to assess anticipated (pre-Contingency) and potential (post-Contingency) conditions for next-day operations. The evaluation shall reflect applicable inputs including, but not limited to, load forecasts; generation output levels; Interchange; known Protection System and Special Protection System status or degradation; Transmission outages; generator outages; Facility Ratings; and identified phase angle and equipment limitations. (Operational Planning Analysis may be provided through internal systems or through third-party services).'' NERC Glossary.

166 NERC defines real-time assessment as an ''evaluation of system conditions using Real-time data to assess existing (pre-Contingency) and potential (post-Contingency) operating conditions. The assessment shall reflect applicable inputs including, but not limited to: load, generation output levels, known Protection System and Special Protection System status or degradation, Transmission outages, generator outages, Interchange, Facility Ratings, and identified phase angle and equipment limitations. (Real-time Assessment may be provided through internal systems or through third-party services).'' *Id.*

167 *See, e.g.,* Reliability Standard IRO–010–2, Requirement R1, part 1.1 and Reliability Standard TOP–003–3 (Operational Reliability Data), Requirement R1, part 1.1.

168 *See, e.g.,* Reliability Standard TOP–003–3, Requirement R2, part 2.1.

169 Modeling and Studies Report iv–v.

170 Essential Reliability Services Concept Paper at iii.

171 NERC defines essential reliability services to include ''necessary operating characteristics'' provided by ''[c]onventional generation with large rotating mass,'' which are ''needed to reliably operate the North American electric grid.'' NERC explains that essential reliability services ''are an integral part of reliable operations to assure the protection of equipment, and are the elemental 'reliability building blocks' provided by generation.'' *Id.*

172 There are similar reliability impacts posed by tripping or momentary cessation of unregistered IBRs and IBR–DERs during Bulk-Power System disturbances; however, we are not proposing to direct NERC to develop new or modified Reliability Standards that would address unregistered IBR or IBR–DER performance requirements. We expect that any currently unregistered IBRs that become registered IBRs in the future following an approved NERC workplan in Docket No. RD22–4–000 would be required to comply with any applicable new or modified IBR performance Reliability Standards proposed in this NOPR once those Reliability Standards become enforceable.

recommendations from multiple event reports, including the Blue Cut Fire Event Report,[173] the Odessa Disturbance Report,[174] and most recently the 2021 Solar PV Disturbances Report.[175]

2. Voltage Ride Through

94. We preliminarily find that the currently effective Reliability Standards do not adequately address registered IBR protection and controls settings to allow for voltage ride through during system disturbances (as discussed above in Section III.B.4.b. Voltage Ride Through). We propose to direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that would require registered IBR generator owners and registered IBR generator operators to use appropriate and coordinated registered IBR protection and controls settings that will allow for voltage ride through during system disturbances and would permit registered IBR tripping only when necessary to protect the registered IBR equipment. Under this proposal, any new or modified Reliability Standard should require generator owners of registered IBR facilities to ensure that they prohibit momentary cessation in the no-trip zone during disturbances.[176]

95. We are aware that certain registered IBRs currently in operation may not be able to meet the requirements proposed above. Therefore, we propose to direct NERC to require transmission planners and operators to implement mitigation activities that may be needed to address any reliability impact to the Bulk-Power System posed by these existing facilities. We believe that planners and operators should be able to accommodate this limited number of affected existing registered IBRs, and we expect that the technology of newer IBRs will not require such accommodation.

3. Post-Disturbance IBR Ramp Rate Interactions

96. We preliminarily find that the current Reliability Standards do not sufficiently address registered IBR post-disturbance ramp rates following momentary cessation such that Bulk-Power System transient and frequency stability is supported during the system disturbances.[177] We propose to direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that would require registered IBR post-disturbance ramp rate not to be restricted or to artificially interfere with the resource returning to pre-disturbance output level in a quick and stable manner after a Bulk-Power System fault event. Further, we propose generator owners communicate to the relevant planning coordinators, transmission planners, reliability coordinators, transmission operators, and balancing authorities the actual post-disturbance ramp rates and the ramp rates to meet expected dispatch levels (*i.e.,* generation-load balance). The proposed Reliability Standards should account for the technical differences between registered IBRs and synchronous generation resources, such as registered IBRs' faster control capability to ramp power output down or up when capacity is available. We believe this proposal is consistent with the recommendations in various NERC reports discussed above.[178]

4. Phase Lock Loop Synchronization

97. We preliminarily find that the current Reliability Standards do not require that all generation resources maintain voltage phase angle synchronization with the Bulk-Power System grid voltage during a system disturbance (as discussed in above Section III.B.4.d. Phase Lock Loop Synchronization). In other words, the current Reliability Standards do not adequately address registered IBR's momentary loss of synchronism caused by phase jumps during Bulk-Power System disturbance events. This results in protective action to open the inverter primary circuit breaker (*i.e.,* phase lock loop loss of synchronism). We propose to direct NERC to submit to the Commission for approval one or more new or modified Reliability Standards that would require registered IBRs to ride through any conditions not addressed by the proposed Reliability Standards that address frequency or voltage ride through phase lock loop loss of synchronism. We note that NERC reported that phase lock loop loss of synchronism was a large contributor to the reduction of solar PV output during IBR related Bulk-Power System disturbance events that resulted in the unexpected loss of resources placing additional reliability risk on the Bulk-Power System.[179] We believe this proposal is consistent with the IBR Interconnection Requirements Guideline and Canyon 2 Fire Event Report recommendations. The proposed Reliability Standards should require registered IBRs to ride through momentary loss of synchronism during Bulk-Power System disturbances and require registered IBRs to continue to inject current into the Bulk-Power System at pre-disturbance levels during a disturbance.

V. Information Collection Statement

98. This NOPR proposes to direct the ERO to develop and submit to the Commission for approval one or more new or modified Reliability Standards and submit a compliance filing that includes a standards development plan for the new or modified reliability standards that address IBRs. The Paperwork Reduction Act (PRA) requires each federal agency to seek and obtain OMB approval before undertaking a collection of information directed to ten or more persons or contained in a rule of general applicability. Reliability Standards Development as described in FERC–725 covers standards development initiated by NERC, the Regional Entities, and industry, as well as standards the Commission may direct NERC to develop or modify.

99. The proposal to direct NERC to develop new, or to modify existing, Reliability Standards (and the corresponding burden) are covered by, and already included in, the existing OMB-approved information collection FERC–725 (Certification of Electric Reliability Organization; Procedures for Electric Reliability Standards; OMB Control No. 1902–0225), under Reliability Standards Development.[180] The reporting requirements in FERC–725 include the ERO's overall responsibility for developing Reliability Standards.

• *Necessity of the Information:* The proposed directive to the ERO to develop and submit to the Commission for approval one or more new or modified Reliability Standards, if adopted, would implement the Congressional mandate of the Energy Policy Act of 2005 to develop mandatory and enforceable Reliability Standards to better ensure the reliability of the nation's Bulk-Power System.

[173] Blue Cut Fire Report at 11–13.

[174] Odessa Disturbance Report at vii, 12–13.

[175] 2021 Solar PV Disturbances Report at vii, 15, 31.

[176] We note that Reliability Standard PRC–024–3, Attachments 1 and 2 clarify that the area outside the No Trip Zone is not a Must Trip Zone.

[177] *See* Canyon 2 Fire Event Report at 9.

[178] *See, e.g., id.* (explaining that impeded ramp rates need to be ''remediated to ensure [Bulk-Power System] transient and frequency stability''); Blue Cut Fire Event Report at 15 (observing that during the Blue Cut Fire Event, some inverters that went into momentary cessation mode returned to pre-disturbance levels at a slow ramp rate).

[179] *See* Section III.B.4.d.

[180] Reliability Standards Development as described in FERC–725 covers standards development initiated by NERC, the Regional Entities, and industry, as well as standards the Commission may direct NERC to develop or modify.

Specifically, the proposal would ensure that the ERO develops and submits for approval new or modified Reliability Standards that would require certain facilities to operate in support of the reliable operation of the Bulk-Power System.

- *Internal review:* The Commission has reviewed the proposed directive that the ERO revise its current Reliability Standards and determined that the proposal is necessary to meet the statutory provisions of the FPA requiring the Commission to ensure the reliability of the Bulk-Power System.

100. Interested persons may obtain information on the reporting requirements by contacting: Federal Energy Regulatory Commission, 888 First Street NE, Washington, DC 20426 [Attention: Ellen Brown, Office of the Executive Director, email: *DataClearance@ferc.gov,* Phone: (202) 502–8663, fax: (202) 273–0873]. Comments on the requirements of this rule may also be sent to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503 [Attention: Desk Officer for the Federal Energy Regulatory Commission]. For security reasons, comments should be sent by email to OMB at *oira_submission@omb.eop.gov.* Please reference OMB Control No. 1902–0225, FERC–725 and the docket number of this proposed rulemaking in your submission.

VI. Environmental Assessment

101. The Commission is required to prepare an Environmental Assessment or an Environmental Impact Statement for any action that may have a significant adverse effect on the human environment.[181] The Commission has categorically excluded certain actions from this requirement as not having a significant effect on the human environment. Included in the exclusion are rules that are clarifying, corrective, or procedural or that do not substantially change the effect of the regulations being amended.[182] The actions proposed here fall within this categorical exclusion in the Commission's regulations.

VII. Regulatory Flexibility Act Certification

102. The Regulatory Flexibility Act of 1980 (RFA) [183] generally requires a description and analysis of proposed rules that will have significant economic impact on a substantial number of small entities. By only proposing to direct NERC, the Commission-certified ERO, to develop modifications to Reliability Standards, this NOPR will not have a significant or substantial impact on entities other than NERC. The ERO develops and files with the Commission for approval Reliability Standards affecting the Bulk-Power System, which represents: (a) a total electricity demand of 830 GW (830,000 MW) and (b) more than $1 trillion worth of assets. Therefore, the Commission certifies that this NOPR will not have a significant economic impact on a substantial number of small entities.

103. Any Reliability Standards proposed by NERC in compliance with this rulemaking will be considered by the Commission in future proceedings. As part of any future proceedings, the Commission will make determinations pertaining to the Regulatory Flexibility Act based on the content of the Reliability Standards proposed by NERC.

VIII. Comment Procedures

104. The Commission invites interested persons to submit comments on the matters and issues proposed in this notice to be adopted, including any related matters or alternative proposals that commenters may wish to discuss. Comments are due February 6, 2023 and Reply Comments are due March 6, 2023. Comments must refer to Docket No. RM22–12–000, and must include the commenter's name, the organization they represent, if applicable, and their address in their comments.

105. The Commission encourages comments to be filed electronically via the eFiling link on the Commission's website at *http://www.ferc.gov.* The Commission accepts most standard word processing formats. Documents created electronically using word processing software should be filed in native applications or print-to-PDF format and not in a scanned format. Commenters filing electronically do not need to make a paper filing.

106. Commenters that are not able to file comments electronically must submit an original of their comments either by mail through the United States Postal Service to: the Secretary of the Commission, Federal Energy Regulatory Commission, 888 First Street NE, Washington, DC 20426,[184] or by any other method of delivery, including hand delivery, to the Federal Energy Regulatory Commission, 12225 Wilkins Avenue, Rockville, Maryland 20852.[185]

107. All comments will be placed in the Commission's public files and may be viewed, printed, or downloaded remotely as described in the Document Availability section below. Commenters on this proposal are not required to serve copies of their comments on other commenters.

IX. Document Availability

108. In addition to publishing the full text of this document in the **Federal Register**, the Commission provides all interested persons an opportunity to view and/or print the contents of this document via the internet through the Commission's Home Page (*http://www.ferc.gov*). At this time, the Commission has suspended access to the Commission's Public Reference Room due to the President's March 13, 2020 proclamation declaring a National Emergency concerning the Novel Coronavirus Disease (COVID–19).

109. From the Commission's Home Page on the internet, this information is available on eLibrary. The full text of this document is available on eLibrary in PDF and Microsoft Word format for viewing, printing, and/or downloading. To access this document in eLibrary, type the docket number excluding the last three digits of this document in the docket number field.

110. User assistance is available for eLibrary and the Commission's website during normal business hours from the Commission's Online Support at 202–502–6652 (toll free at 1–866–208–3676) or email at *ferconlinesupport@ferc.gov,* or the Public Reference Room at (202) 502–8371, TTY (202)502–8659. Email the Public Reference Room at *public.referenceroom@ferc.gov.*

By direction of the Commission. Commissioner Danly is concurring with a separate statement attached.

Issued: November 17, 2022.

Debbie-Anne A. Reese,

Deputy Secretary.

Note: The following appendix will not appear in the **Federal Register**

Appendix A

NERC IBR Resources Cited in the NOPR

NERC Guidelines

NERC Guidelines referenced in this NOPR are available here: *https://www.nerc.com/comm/Pages/Reliability-and-Security-Guidelines.aspx.*

NERC, *Reliability Guideline: BPS-Connected Inverter-Based Resource Performance* (Sept. 2018), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Inverter-Based_Resource_Performance_Guideline.pdf* (IBR Performance Guideline).

[181] *Reguls. Implementing the Nat'l Env't Pol'y Act of 1969,* Order No. 486, 52 FR 47897 (Dec. 17, 1987), FERC Stats. & Regs., ¶ 30,783 (1987) (cross-referenced at 41 FERC ¶ 61,284).

[182] 18 CFR 380.4(a)(2)(ii).

[183] 5 U.S.C. 601–612.

[184] 18 CFR 385.2001(a)(1)(i).

[185] 18 CFR 385.2001(a)(1)(ii).

NERC, *Reliability Guideline: Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources* (Sept. 2019), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_IBR_Interconnection_Requirements_Improvements.pdf* (IBR Interconnection Requirements Guideline).

NERC, *Reliability Guideline: Parameterization of the DER A Model,* (Sept. 2019), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_DER_A_Parameterization.pdf.*

NERC, *Reliability Guideline: DER Data Collection for Modeling in Transmission Planning Studies,* (Sept. 2020), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_DER_Data_Collection_for_Modeling.pdf* (IBR–DER Data Collection Guideline).

NERC, Reliability Guideline: Performance, Modeling, and Simulations of BPS-Connected Battery Energy Storage Systems and Hybrid Power Plants (Mar. 2021), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_BESS_Hybrid_Performance_Modeling_Studies_.pdf* (BESS Performance Modeling Guideline).

NERC White Papers

IRPTF white papers referenced in this NOPR are available here: *https://nerc.com/comm/PC/Pages/Inverter-Based-Resource-Performance-Task-Force.aspx.*

NERC, *A Concept Paper on Essential Reliability Services that Characterizes Bulk Power System Reliability* (Oct. 2014), *https://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/ERSTF%20Concept%20Paper.pdf* (Essential Reliability Services Concept Paper).

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* (Resource Loss Protection Whitepaper).

NERC, *Fast Frequency Response Concepts and Bulk Power System Reliability Needs* (Mar. 2020), *https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/Fast_Frequency_Response_Concepts_and_BPS_Reliability_Needs_White_Paper.pdf* (Fast Frequency Response White Paper).

NERC, *IRPTF Review of NERC Reliability Standards White Paper* (Mar. 2020), *https://www.nerc.com/pa/Stand/Project202104ModificationstoPRC0022DL/Review_of_NERC_Reliability_Standards_White_Paper_062021.pdf* (Reliability Standards Review White Paper).

NERC, *San Fernando Disturbance Follow-Up White Paper* (June 2021), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/IRPWG_San_Fernando_Disturbance_Follow-Up_Paper%20(003).pdf* (San Fernando Disturbance White Paper).

NERC, *Utilizing the Excess Capability of BPS-Connected Inverter-Based Resources for Frequency Support* (Sept. 2021), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/White_Paper_IBR_Hybrid_Plant_Frequency_Response.pdf* (Frequency Support White Paper).

NERC, *Odessa Disturbance Follow-up White Paper* (Oct. 2021), *https://www.nerc.com/comm/RSTC_Reliability_Guidelines/White_Paper_Odessa_Disturbance_Follow-Up.pdf* (Odessa Disturbance White Paper).

NERC Reports

NERC, *2013 Long-Term Reliability Assessment* (Dec. 2013), *https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/2013_LTRA_FINAL.pdf* (2013 LTRA Report).

NERC, *Distributed Energy Resources: Connection Modeling and Reliability Considerations* (Feb. 2017), *https://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/Distributed_Energy_Resources_Report.pdf* (NERC DER Report).

NERC, *2020 Long Term Reliability Assessment Report* (Dec. 2020), *https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2020.pdf* (2020 LTRA Report).

NERC, *2021 Long Term Reliability Assessment Report* (Dec. 2021), *https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2021.pdf* (2021 LTRA Report).

NERC Technical Reports

NERC technical reports referenced in this NOPR are available here: *https://nerc.com/comm/PC/Pages/Inverter-Based-Resource-Performance-Task-Force.aspx.*

NERC, *Technical Report, BPS-Connected Inverter-Based Resource Modeling and Studies* (May 2020), *https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/IRPTF_IBR_Modeling_and_Studies_Report.pdf* (Modeling and Studies Report).

NERC and WECC, *WECC Base Case Review: Inverter-Based Resources* (Aug. 2020), *https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/NERC-WECC_2020_IBR_Modeling_Report.pdf* (Western Interconnection (WI) Base Case IBR Review).

NERC Major Event Reports

NERC event reports referenced in this NOPR are available here: *https://www.nerc.com/pa/rrm/ea/Pages/Major-Event-Reports.aspx.*

NERC, *1,200 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report* (June 2017), *https://www.nerc.com/pa/rrm/ea/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_Interruption_Final.pdf* (Blue Cut Fire Event Report) (covering the Blue Cut Fire event (August 16, 2016)).

NERC and WECC, *900 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report* (Feb. 2018), *https://www.nerc.com/pa/rrm/ea/October%209%202017%20Canyon%202%20Fire%20Disturbance%20Report/900%20MW%20Solar%20Photovoltaic%20Resource%20Interruption%20Disturbance%20Report.pdf* (Canyon 2 Fire Event Report) (covering the Canyon 2 Fire event (October 9, 2017)).

NERC and WECC, *April and May 2018 Fault Induced Solar Photovoltaic Resource Interruption Disturbances Report* (Jan. 2019), *https://www.nerc.com/pa/rrm/ea/April_May_2018_Fault_Induced_Solar_PV_Resource_Int/April_May_2018_Solar_PV_Disturbance_Report.pdf* (Angeles Forest and Palmdale Roost Events Report) (covering the Angeles Forest (April 20, 2018) and Palmdale Roost (May 11, 2018) events)/

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United States of America

Federal Energy Regulatory Commission

Reliability Standards to Address Inverter-Based Resources

Docket No. RM22–12–000

(Issued November 17, 2022)

DANLY, Commissioner, *concurring:*

1. I concur in today's order.[1] I remain gravely concerned about the North American Electric Reliability Corporation's (NERC) inability to act swiftly and nimbly in response to emerging risks that threaten the reliability of the Bulk-Power System (BPS). This is due in no small part to the statutory framework of Federal Power Act (FPA) section 215.[2] According to NERC's Inverter-Based Resource (IBR) Strategy document,[3] ''[t]he [Electric Reliability Organization (ERO)] Enterprise has analyzed numerous widespread IBR loss events and identified many systemic performance issues with the inverter-based fleet *over the past six years.*'' [4] NERC explains that ''[t]he disturbance reports, alerts, guidelines, and other deliverables developed by the ERO thus far have highlighted that abnormal IBR performance issues pose a significant risk to BPS reliability.'' [5] Our actions today in this and another proceeding [6] propose firm deadlines by which NERC must act to register and hold IBR entities accountable for failure to comply with mandatory and enforceable Reliability Standards.

2. Better late than never, I suppose. Nevertheless, it could be at least four years before certain of the IBR entities are registered and another five years before the full suite of contemplated requirements are mandatory and enforceable. So, it will be about ten or eleven years *after* the significant reliability risk was definitively identified that we will have required registration and Reliability Standards in place. The reliability consequences that attend the rapid deployment of an unprecedented number of IBRs are, at this point, unarguable. As NERC's President and CEO explained last week: ''the pace of the transformation of the electric system needs to be managed and that transition needs to occur in an orderly way.'' [7] Mandatory reliability standards must be implemented as quickly as possible to ensure the reliable operation of the BPS. We at FERC are responsible for the reliability of the BPS under FPA section 215. I fear we may be taking too long to address reliability challenges that urgently need our attention.

For these reasons, I respectfully concur.

James P. Danly,
Commissioner.

[1] *Reliability Standards to Address Inverter-Based Resources,* 181 FERC ¶ 61,125 (2022).

[2] 16 U.S.C. 824o.

[3] NERC, *Inverter-Based Resource Strategy: Ensuring Reliability of the Bulk Power System with Increased Levels of BPS-Connected IBRs* (Issued Sep. 14, 2022), *https://www.nerc.com/comm/Documents/NERC_IBR_Strategy.pdf.*

[4] *Id.* at 3.

[5] *Id.* at 5.

[6] *Registration of Inverter-based Resources,* 181 FERC ¶ 61,124 (2022).

[7] Statement of James B. Robb, Annual Commissioner-led Reliability Technical Conference (Nov. 10, 2022), *https://www.ferc.gov/news-events/events/annual-commissioner-led-reliability-technical-conference-11102022.*

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DEPARTMENT OF HOMELAND SECURITY

Coast Guard

33 CFR Part 105

[Docket No. USCG–2022–0052]

RIN 1625–AC80

Transportation Worker Identification Credential (TWIC)—Reader Requirements; Second Delay of Effective Date

AGENCY: Coast Guard, DHS.

ACTION: Notice of proposed rulemaking.

SUMMARY: The Coast Guard proposes to further delay the effective date for certain facilities affected by the final rule entitled ''Transportation Worker Identification Credential (TWIC)—Reader Requirements,'' published in the **Federal Register** on August 23, 2016. The current effective date for the final rule is May 8, 2023. The Coast Guard proposes delaying the effective date for: facilities that handle certain dangerous cargoes in bulk, but do not transfer those cargoes to or from a vessel; facilities that handle certain dangerous cargoes in bulk, and do transfer those cargoes to or from a vessel; and facilities that receive vessels carrying certain dangerous cargoes in bulk, but do not, during that vessel-to-facility interface, transfer those bulk cargoes to or from those vessels. Specifically, we propose to delay the effective date for these facilities for 3 years from the original delay expiration date of May 8, 2023 to May 8, 2026, but invite comments as well on possibly extending the delay through as late as May 8, 2029. This delay will give the Coast Guard time to further analyze the potential effectiveness of the reader requirement in general as well as at these facilities.

DATES: Comments and related material must be received by the Coast Guard on or before January 5, 2023.

ADDRESSES: You may submit comments identified by docket number USCG–2022–0052 using the Federal Decision Making Portal at *http://www.regulations.gov.* See the ''Public Participation and Request for Comments'' portion of the **SUPPLEMENTARY INFORMATION** section for further instructions on submitting comments.

FOR FURTHER INFORMATION CONTACT: For information about this document or technical inquiries, call or email Lieutenant Commander Jeffrey Bender, U.S. Coast Guard; telephone 202–372–1114; email *Jeffrey.M.Bender@uscg.mil.* General information and press inquiries: Contact Chief Warrant Officer 3 Kurt Fredrickson, U.S. Coast Guard; telephone (202) 372–4619; email *Kurt.N.Fredrickson@uscg.mil.*

SUPPLEMENTARY INFORMATION:

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