

PRR 151- Establish Minimum
Interconnection Standards for Large
Facilities Inverter Based Resources (IBR)
based on IEEE Standard 2800-2022

NYSRC Presentation to NYSRC Executive Committee

April 14, 2023

Scope of Presentation

- Need for New York Control Area (NYCA) IBR Interconnection Standard
 - National Regulatory Actions
 - IEEE 2800-2022 - Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems, April 9, 2022
 - NERC Report Odessa Disturbance, December 2022 (June 4, 2022 Event)
 - FERC IBR NOPR RM-22-12, November 17, 2022
 - NERC Level II Alert - Inverter-Based Resource Performance Issues for Generator Owners, March 4, 2023
 - NERC MRC/BOT - Recap of Inverter-Based Resource Panel, February 2023 (Released March 28, 2023)
 - NYS CLCPA mandates
 - NYISO Interconnection Queue
- NYSRC Stakeholder Process to Date
- Proposed New York State Reliability Council Rule - PRR 151
 - Establish Minimum Interconnection Standards for Large Facilities Inverter Based Resources (IBR), March 13, 2023
- NYSRC Policy 1 for Rule Changes
 - Procedure for Reviewing, Developing, Modifying and Disseminating NYSRC Reliability Rules

National Regulatory Actions

[IEEE Standard 2800-2022 - Interconnection and Interoperability of Inverter-Based Resources \(IBRs\) Interconnecting with Associated Transmission Electric Power Systems, April 9, 2022](#)

- Consensus-based performance requirements
 - Steady-state reactive power-voltage control
 - Steady-state active power-frequency control
 - Response to abnormal conditions (voltage & frequency ride-through, return to service)
 - Protection
 - Modeling data
 - Measurement data for performance monitoring & validation
 - Test & verification
- Applicable to entities responsible for IBR interconnection process: TS Owner; TS Operator; Load Balancing Entity; IBR Owner; IBR Operator; IBR Developer
- Enforcement by adoption by Authority Governing Interconnection Requirements (AGIR) - NYSRC in New York

National Regulatory Actions

[NERC Odessa Disturbance Report, December 2022](#) (June 4, 2022 Event)

- 2,555 MW of synchronous and solar PV plant tripped over a wide area for normally cleared fault
- *“The concurrent and unexpected tripping of synchronous generation in addition to the abnormal reduction of power from many solar PV facilities poses a significant risk to BPS reliability.”*
- *“The combined loss of generation nearly exceeded the Texas Interconnection Resource Loss Protection Criteria.”*
- *“Need for immediate industry action to ensure reliable operation of the BPS with increasing penetrations of inverter-based resources. The unexpected and unplanned loss of generation poses an increasing and significant risk to BPS reliability.”*
- Recommendations include:
 - Immediate need to mitigate abnormal performance issues
 - IBR risk-profile needs to be elevated
 - Immediate need for IBR standards addressing performance, analysis & mitigation
 - Immediate need for ride-through standard
 - Need for Electromagnetic Transient (EMT) IBR models
 - Significant need for updates to FERC pro-forma Interconnection Agreements

National Regulatory Actions

[FERC IBR NOPR RM-22-12, November 17, 2022](#) (FERC Order pending)

- Proposed FERC Rule directing NERC to develop new or modified Reliability Standards addressing four reliability gaps pertaining to IBRs: data sharing; model validation; planning/operational studies; and performance requirements
- Application to new & existing IBRs: registered IBRs; unregistered IBRs; and IBR-DERs
- References twelve events where existing IBRs have demonstrated common-mode failures, acted unexpectedly and adversely in response to normally cleared faults. The twelve events reported an average of ~1,000 MW of IBRs entering momentary cessation or tripping
- Cites IEEE 2800-2022 and notes that the NOPR is intended to complement AGIR efforts, e.g. PRR 151
- NYSRC asked for clarification on NOPR statement: *“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.”*

National Regulatory Actions

NERC Level II Alert - Inverter-Based Resource Performance Issues for Generator Owners, March 4, 2023

- *“Alert comes after NERC analyzed multiple large-scale disturbances involving widespread loss of inverter-based resources (IBRs), which resulted in abnormal performance across several BES solar PV generating resources.”*
- *“As the penetration of BPS-connected IBRs continues to rapidly increase, it is paramount that any performance deficiencies with existing and future generating resources be addressed in an effective and efficient manner.”*
- *“Applicable GOs are strongly encouraged to consult their inverter- and plant-level controller manufacturers, review inverter settings and controls currently installed in the field, and implement the recommendations”, which include:*
 - Protection settings & coordination
 - Documentation of protection system failures
 - Ensure that facility control modes, fault ride through modes and parameters, and protections are set and coordinated
 - Proactive corrective actions
 - Utilize full dynamic reactive capability

National Regulatory Actions

NERC Member Representative Committee/Board of Trustees - Recap of Inverter-Based Resource Panel, February 2023 (Released on March 28, 2023)

- Paradigm Shift for Inverter Technology
 - *“BPS-connected inverter-based resources must provide essential reliability services, support the BPS during normal and disturbance conditions, and provide sufficient information and data to ensure transmission entities can reliably and effectively operate the grid.”*
- Interconnection Requirements
 - *“The lack of uniformity, clarity, consistency, enforcement, and detail in the interconnection requirements and processes has led to unreliable operation of BPS-connected inverter-based resources and the widespread abnormal performance of resources during grid disturbances.”*
- Equipment Standardization, Modeling & Reliability Studies
 - *“Lack of equipment standards have challenged the interconnection of inverter-based resources.”*
 - *“IEEE 2800-2022 outlines minimum performance specifications and is based on state-of-the-art IBR capabilities. Development and implementation of this standard is necessary but not sufficient to address ongoing reliability risk issues in this area”*
 - *“The need for more detailed and accurate modeling while performing reliability studies during interconnection studies and annual planning assessments are challenging Transmission Planners and Planning Coordinators.”*
 - *“Industry will need to quickly upskill existing resources and/or hire additional expertise in this area to ensure reliable operation of the BPS under increasingly higher penetration of inverter-based resources.”*
 - *“Implementation of this standard (IEEE 2800-2022) solely for newly interconnecting resources (“grandfathering” existing facilities) will not address systemic risks posed to BPS reliability today.”*

Stakeholder Outreach to Date

- NYSRC White Paper - “[Proposed NYSRC Reliability Rule: Transition to Intermittent Resources & Energy Storage Systems per CLCPA Renewable Resource Capacity Mandates](#)”
 - NYSRC EC Approval July 8, 2022
- [NYSRC IEEE 2800-2022 Workshop at NYISO, September 13, 2022](#)
 - IEEE 2800-2022 Standard Review
 - Review of Proposed Requirements for NYCA IBR Interconnection
 - Regional Application Experience
 - Stakeholder Considerations (NYISO, Transmission Owner, OEM/Developer)
- NYSRC Reliability Rules Subcommittee meetings
 - Monthly from RRS 266 (March 31, 2022 to date, ~12 meetings)
- NYSRC IBR Working Group
 - Bi-weekly/Weekly (November 8, 2022 – February 7, 2023, ~6 meetings)
- NYSRC EC vote to approve Proposed Reliability Rule PRR 151 to post for stakeholder comments
 - Approval on March 13, 2023
 - Comments due April 27, 2023
- Assistance from IBR subject matter expert - Walling Energy Systems, LLC

IBR Penetration in New York State

- Climate Leadership & Community Protection Act – CLCPA Goals
 - 70% renewable electricity by 2030
 - 100% zero-emission electricity by 2040
 - 40% reduction in statewide GHG emissions from 1990 levels by 2030
 - 85% reduction in statewide GHG emissions from 1990 levels by 2050
 - Net zero emissions statewide by 2050

NYISO Interconnection Queue IBRs

- ~115,000 MW as of April 2, 2023
 - 1,400 MW Co-Located Storage Resource – Energy Storage + Wind
 - 3,863 MW Co-Located Storage Resource – Energy Storage + Solar
 - 25,759 MW Energy Storage
 - 15,339 MW Solar
 - 68,541 MW Wind
- NYISO Class Year IBRs
 - ~ 1,900 MW Existing BPS Renewables (NYISO 2022 Gold Book – Wind & Large Scale Solar)
 - ~ Plus 3,000 MW CY2021 (NYISO Notice of Class Year 2021 Completion, January 12, 2023)
 - ~ Plus 18,000 MW CY2023 (Potential – NYISO April 2, 2023 Interconnection Queue with SRIS approval or FS pending)

Proposed NYSRC Rule - PRR 151

PRR 151: Establish minimum interconnection standards for Large Inverter Based Resources (IBR) Generating Facilities based on IEEE Standard 2800-2022

- New Rule: NYISO's Interconnection Studies for Large (>20 MW) IBR Generating Facilities shall include applicable IBR models, data bases, model validation methods and performance criteria
- PRR 151 is based upon a critical subset of IEEE Standard 2800-2022 requirements, as amended for NYCA
- Implementation is within six months following EC approval of PRR 151 subject to comments received during the 45-day posting process but no later than CY2024 start date
- PRR 151 in its current form applies only to new resources, as a starting point, since the level of IBR installations is relatively low in New York

Proposed NYSRC Rule - PRR 151

PRR 151 Requirements (All subject to Compliance Measures)

- R1. The NYISO shall prepare and maintain procedures for Large IBR Generating Facility interconnection studies based on uniform technical minimum requirements for interconnection, capability and performance of IBRs interconnecting with Transmission Systems, as follows:
 - R1.1 IEEE Standard 2800-2022: Section 1 “Overview”; Section 2 “Normative references”; Section 3 “Definitions, acronyms and abbreviations”; Section 4 “General interconnection technical specifications and performance requirements”, as amended for NYCA application in Attachment A
 - R1.2 IEEE Standard 2800-2022: Section 5 “Reactive power-voltage control requirements within the continuous operation region”; Section 6 “Active power-frequency response requirements”; Section 7 “Response to TS abnormal conditions”; Section 9 “Protection”, as amended for NYCA application in Attachment A
 - R1.3 IEEE Standard 2800-2022: Section 10 “Modeling data”; Section 11 “Measurement data for performance monitoring and validation”; Section 12 “Test and verification requirements”, as amended for NYCA application in Attachment A

Proposed NYSRC Rule - PRR 151

PRR 151 Requirements (All subject to Compliance Measures)

- R2. The NYISO shall develop procedures for ensuring each Transmission Owner's IBR interconnection requirements are coordinated with requirements R1.1, R1.2 and R1.3
- R3. The NYISO shall develop procedures for ensuring each Large IBR Generating Facility Owner's compliance with requirements R1.1, R1.2 and R1.3
- R4. The NYISO shall annually submit a technical report documenting the assumptions, models and methodology of Large IBR Generating Facility interconnection studies in accordance with requirements R1.1, R1.2, R1.3, R2 and R3
- R5. Each Transmission Owner shall provide their local IBR interconnection requirements to the NYISO
- R6. Each Large IBR Generating Facility Owner shall provide all applicable IBR models, data bases, model validation methods and performance criteria per requirements R1.1, R1.2 and R1.3 to the NYISO

Proposed NYSRC Rule - PRR 151

Proposed Study Interconnection Responsibilities

- NYISO - Interconnection Studies
 - System studies using verified plant-level models
 - Application of NERC, NPCC & NYSRC transmission planning criteria
 - Verified models and data for plant-level power flow, transient stability and short-circuit analyses based on IEEE 2800 recommendations, to be provided by IBR Owner
 - Verified plant-level EMT models, to be provided by IBR Owner
- Transmission Owner - TO's IBR interconnection requirements
 - incorporated in NYISO's interconnection studies following normal procedures
- IBR Owner - Plant Design Evaluation Studies
 - Modeling & simulation of IBR plant and its interactions with the transmission system
 - IBR Owner shall attest to Modeling Data compliance in accordance with IEEE 2800, Clause 10, as modified by Attachment A of PRR 151. IBR Owner shall provide the NYISO with verified plant-level models and supporting documentation
 - IBR Owner shall attest to compliance with Plant Design Evaluation Studies in accordance with IEEE 2800, Clause 12.2.3, as modified by Attachment A of PRR 151. IBR Owner shall provide the NYISO with supporting documentation

Proposed NYSRC Rule - PRR 151

IEEE 2800 Exclusions in PRR 151

- Section 9 - Power Quality
- Section 12 - Test & Verification Requirements, excluded clauses
 - 12.2.4 - As-built installation evaluation
 - 12.2.5 - Commissioning tests
 - 12.2.6 - Post-commissioning model validation
 - 12.2.7 - Post-commissioning monitoring
 - 12.2.8 - Periodic tests
 - 12.2.9 - Periodic verifications
- Exclusions to be addressed in subsequent PRRs and subject to NYSRC rulemaking process

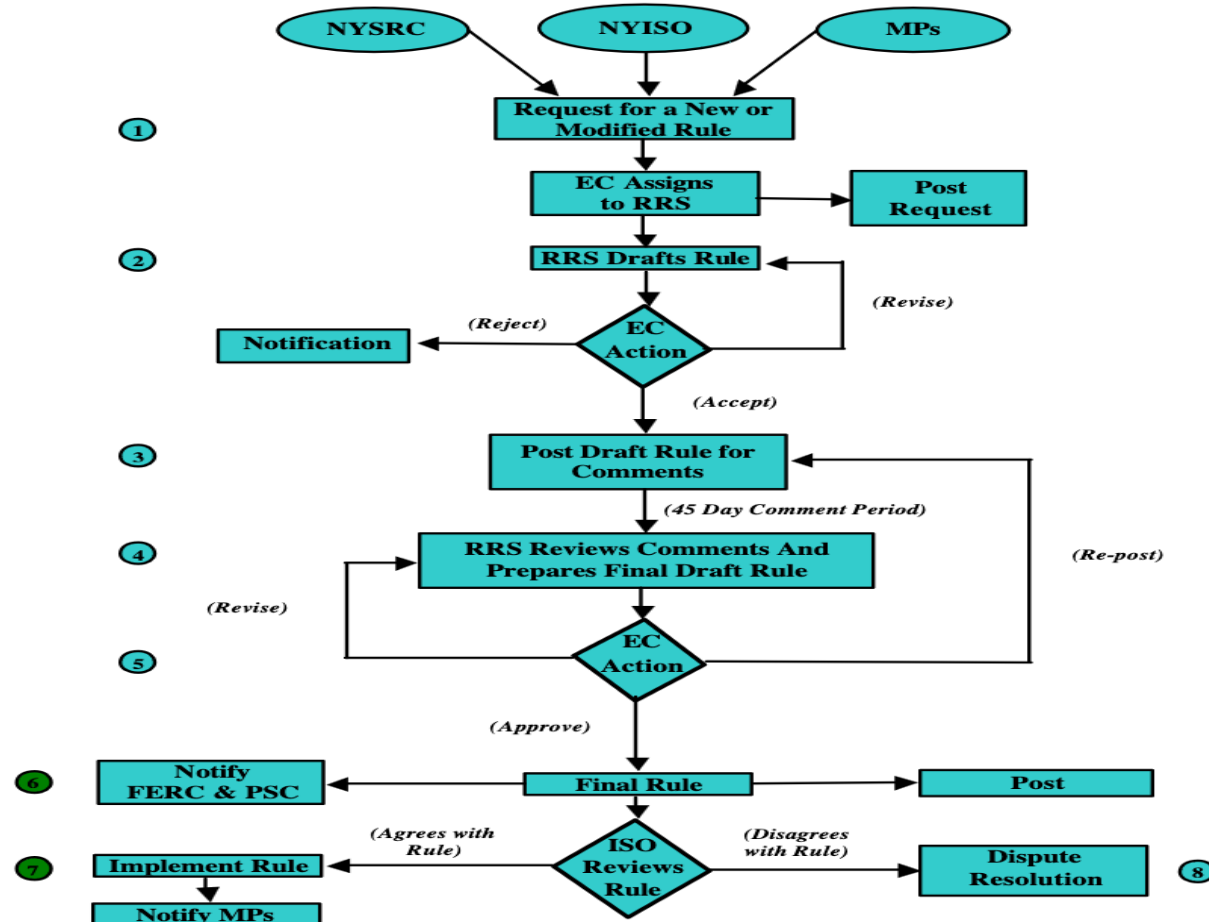
Proposed NYSRC Rule - PRR 151

NYSRC response to comments received at ESPWG/TPAS Stakeholder meeting, March 24, 2023

- Proposed Implementation
 - Following approval, PRR 151 will apply to:
 - Eligible projects providing notice to NYISO that wish to participate in CY2024 and all future Class Years
 - All IBR projects that submit an Interconnection Request after PRR 151 becomes effective and with PRR 151 applying to all subsequent steps in the NYISO's interconnection process (Study Scope, System Reliability Impact Study, Class Year Study, Large Facility Interconnection Agreement)
 - PRR 151 will not apply to:
 - Projects in previous Class Years that have accepted their cost allocation, posted security and executed Large Facility Interconnection Agreements
 - Projects already having SRIS study or SRIS scope approvals
 - Would not require SRIS re-study or SRIS scope revisions per PRR 151 requirements
 - However, PRR 151 would apply to above projects if they elect to participate in CY2024 studies or any future Class Year studies
 - In consideration of FERC's and NERC's actions and to maintain NYCA reliability, voluntary compliance with PRR 151 for all projects in the NYISO interconnection study process and all existing projects is encouraged

NYSRC Policy 1 for Rule Changes

Procedure for Reviewing, Developing, Modifying and Disseminating NYSRC Reliability Rules



Conclusion & Next Steps

PRR 151 is a Draft Reliability Rule posted for comment

- We strongly encourage stakeholder input
- Comments are due by April 27, 2023 to NYSRC Secretary Herb Schrayshuen at herb@poweradvisorsllc.com
- All comments received will be posted on the NYSRC website.
- Comments will be thoroughly reviewed by NYSRC, RRS & subject matter experts
- Final decision to approve the Draft Rule or repost for a second round of comments rests with the NYSRC Executive Committee
- We appreciate your attention to this matter and look forward to your input
- Our goal collectively is to assist the Clean Energy Transition while ensuring that system reliability is maintained for all New York energy consumers.