Questionnaire and Guideline for new Inverter Based Resources Interconnecting in ERCOT

**DISCLAIMER: This document is a draft meant to facilitate discussion for the appropriate framework and content of such a questionnaire and guidelines for IBRs and is not a vetted draft ready for formal proposal. It is the hope that awareness of this document to be provided as part of the ERCOT Generator Interconnection process will spur participation in an IBRTF sub team to collaborate on a formal proposal draft that achieves the intended reliability objective in a reasonable manner.**

# Introduction:

Inverter Based Resources (IBRs) are quickly becoming the dominant Generation Resource (GR)technology in the ERCOT Interconnection. These Generation Resources bring new and evolving technology that must be safely and reliably interconnected to the ERCOT system. In recent years, several events on different electrical systems in the United States have been observed, investigated, and reported on while identify several Recommendations to minimizing and or preventing future events from occurring on the system. This Questionnaire and Guideline for new Inverter Based Resources Interconnecting in ERCOT is meant to educate and raise awareness for developers seeking to build and energize new IBRs to the relevant rules and recommendations made by NERC Reliability Standards and Guidelines, ERCOT Protocols and Operating Guides, and IEEE standards. It is also meant to provide reasonable assurance that these rules and recommendations have or will be implemented prior to energization of the IBR. The ERCOT Inverter Based Resource Task Force (IBRTF) is actively working on formally implementing the relevant recommendation into ERCOT Protocols and Guides. This document will also help prevent the need to retrofit equipment later when these rules become mandatory and effective in the months to come. ERCOT retains the right as the NERC Reliability Coordinator and ERCOT Control Area Authority to take actions necessary to protect reliability of the ERCOT system up to and including delaying energization of new IBRs until reasonable assurances that these rules and recommendations have or will be implemented prior to energization of the IBR.

# References

### NERC Guidelines

* <https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Guideline_IEEE_1547-2018_BPS_Perspectives.pdf>
* <https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Reliability_Guideline_BESS_Hybrid_Performance_Modeling_Studies_.pdf>
* <https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Item_4a._Integrating%20_Inverter-Based_Resources_into_Low_Short_Circuit_Strength_Systems_-_2017-11-08-FINAL.pdf>
* <https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Inverter-Based_Resource_Performance_Guideline.pdf>

### Event Reports with Recommendations

* <https://www.nerc.com/pa/rrm/ea/Documents/Odessa_Disturbance_Report.pdf>
* <https://www.nerc.com/pa/rrm/ea/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_Interruption_Final.pdf>
* <https://www.nerc.com/pa/rrm/ea/April_May_2018_Fault_Induced_Solar_PV_Resource_Int/April_May_2018_Solar_PV_Disturbance_Report.pdf>
* <https://www.nerc.com/pa/rrm/ea/Documents/San_Fernando_Disturbance_Report.pdf>

### IEEE standards

* IEEE – 1547- <https://standards.ieee.org/ieee/1547/5915/>
* IEEE – 2800 - <https://standards.ieee.org/ieee/2882/10401/>

### NERC Standards

* PRC-024-2 - <https://www.nerc.com/files/PRC-024-2.pdf>

### ERCOT Protocols, Nodal Operating Guides, and Planning Guides

* ERCOT Protocols - <https://www.ercot.com/mktrules/nprotocols/current>
* ERCOT Nodal Operating Guides - <https://www.ercot.com/mktrules/guides/noperating/current>
* ERCOT Planning Guides - <https://www.ercot.com/mktrules/guides/planning>

# Questionnaire:

1. Has the developer of the new IBR GR, read and implemented each of the NERC Guidelines related to Inverter Based Resources into its design? If not, please identify which specific guidelines are not incorporated into its design and why it does not apply or is not technically feasible to do so.
2. Has the developer of the new IBR GR, read and implemented each of the NERC Event Reports with Recommendations related to Inverter Based Resources into its design? If not, please identify which specific Recommendations are not incorporated into its design and why it does not apply or is not technically feasible to do so.
3. Is the new IBR GR a distribution level resource? If no, then mark NA. If yes, then has the developer of the new distribution IBR GR, read and implemented IEEE 1547 related to distribution level Inverter Based Resources into its design? If not, please identify which specific requirements are not incorporated into its design and why it does not apply or is not technically feasible to do so.
4. Is the new IBR GR a transmission level resource (69kV POI or above)? If not, then mark NA. If yes, then has the developer of the new distribution IBR GR, read and implemented IEEE 2800 related to transmission level Inverter Based Resources into its design? If not, please identify which specific requirements are not incorporated into its design and why it does not apply or is not technically feasible to do so.
5. Has the developer of the new IBR GR, read and implemented PRC-024-2 and Nodal Operating Guides Section 2.6.2 and 2.9 into its design? This includes the understanding that performance is based on voltages and frequency at the Point of Interconnection Bus and that the no trip zones do not mandate tripping when outside the no trip zone. If not, please identify what is being done to ensure compliance with the requirements.

# Guideline:

**Core Performance Principle #1:** IBR GRs are expected to ride through with no loss of real or reactive power output during system disturbances whose frequencies and voltages at the Point of Interconnection Bus (POIB) are within the curves identified in Attachment 1 and Attachment 2 of NERC Reliability Standard PRC-024-2 and ERCOT Nodal Operating Guide Sections 2.6.2 and 2.9. Any temporary reduction in real power to provide reactive power for a system fault shall return to its pre-disturbance output within 1 second.

This goes beyond protective relay settings and must also be designed, and controls set to meet this performance expectation.

**Core Performance Principle #2:** IBR GRs are expected to provide and maintain positive sequence PSSE, TSAT, and EMT models that match their actual performance. Any actual performance that does not match modeled performance must be corrected with updates. Field verification of settings compared to the models should be performed prior to energization and models updated accordingly.

**Core Performance Principle #3:** Minimum capability performance requirements does not necessitate tripping at just beyond those settings. Protection settings should be set to utilize the maximum capability available while still protecting equipment, even if well beyond the minimum capability performance requirements.

# FAQs:

Version History:

|  |  |  |
| --- | --- | --- |
| Version | Comments | Effective Date |
| Draft 0.1 | Initial Draft |  |