|  |  |  |  |
| --- | --- | --- | --- |
| **NOGRR Number** | [**245**](https://www.ercot.com/mktrules/issues/NOGRR245) | **NOGRR Title** | **Inverter-Based Resource (IBR) Ride-Through Requirements** |

|  |  |
| --- | --- |
| **Date** | September 6, 2023 |

|  |  |
| --- | --- |
| **Submitter’s Information** | |
| **Name** | John Schmall |
| **E-mail Address** | [John.Schmall@ercot.com](mailto:John.Schmall@ercot.com) |
| **Company** | ERCOT |
| **Phone Number** | 512-248-4243 |
| **Cell Number** |  |
| **Market Segment** | Not Applicable |

|  |
| --- |
| **Comments** |

ERCOT files these comments to highlight its reliability concerns expressed in various stakeholder forums over the past several months regarding the inability of Inverter-Based Resources (IBRs) and Type 1 and Type 2 Wind-powered Generation Resources (WGRs) to ride-through system disturbances.

While ERCOT appreciates the feedback stakeholders provided on this Nodal Operating Guide Revision Request (NOGRR) to date, ERCOT continues to believe the revisions reflected in its August 18, 2023 comments appropriately balance the need to mitigate reliability risk on the ERCOT System with addressing feasibility concerns raised by original equipment manufacturers (“OEMs”) (as well as providing clarifications requested by stakeholders regarding Type 1 and Type 2 WGRs). Although ERCOT’s latest proposal allows greater technical feasibility, certain stakeholders continue to ask for additional flexibility that ERCOT simply cannot support due to the potential for serious consequences stemming from putting system reliability at risk.

Some stakeholders have taken the position ERCOT needs to conduct studies to frame the issue and develop solutions. ERCOT does not agree. ERCOT and other systems have had numerous ***actual*** system events (see below) caused by the failure of large numbers of IBRs and Type 1 and Type 2 WGRs to ride through disturbances, clearly demonstrating the need for immediate action to address this unreliable performance.

This unreliable performance, if left unaddressed, threatens to cause uncontrolled loss of firm Load, instability, or cascading outages up to a complete ERCOT System blackout. This reliability risk is not localized as some stakeholders have commented. While voltage collapse can be localized in some events, this unreliable performance has manifested itself beyond localized areas and, in the case of sufficient quantities of lost generation, may trigger the first stage of Under-Frequency Load Shed (UFLS) sending the ERCOT System into a swing that could trigger additional generation and Load that could result in a system-wide event. Such an event would be catastrophic and should clearly be avoided as its impact and costs would far outweigh any commercial impacts to generators. NOGRR245 arose from the inability of IBRs and Type 1 and Type 2 WGRs to ride-through normal system disturbances, as such, this unreliable and unacceptable performance needs to be mitigated as soon as practicable.

Some stakeholders’ comments would define ERCOT’s proposal as “infeasible” because OEMs have not yet fully engineered a solution or because bringing their units into compliance would be costly. ERCOT does not agree. ERCOT does not interpret *commercial* impacts (e.g., retrofits, repowers, converter changeouts, supplemental equipment) as *technical* infeasibility. The decision to invest to meet new reliability requirements falls on the owners, whether it be the replacement of equipment or investment in new capabilities, but those financial decisions do not equate to *technical* feasibility. To categorize an OEM’s technically feasible solution (given sufficient time to implement) as “infeasible” due to cost impact or other commercial impacts creates a false impression for decision-making. ERCOT has carefully attempted to reasonably adjust the requirements to minimize impact while meeting the core objective of addressing the critical reliability risk. ERCOT has not proposed any specific actions for generators to meet the necessary performance requirements (e.g., retrofits or repowers), but rather has sought to accommodate what Resource Entities and OEMs have identified as potential needed actions to ensure the ride-through requirements are met. Resource Entities can determine the most cost-effective way to ensure reliable performance to meet the ride-through requirements.

Stakeholder comments to further extend timelines is untenable. Due to the critical and urgent reliability risks presented by poor ride-through performance of IBRs and Type 1 and Type 2 WGRs, ERCOT has consistently stated all mitigation activities should not be delayed and should be implemented as soon as practicable. ERCOT cannot reasonably support any continued extensions. ERCOT already revised timelines from December 31, 2024 (with potential extension to December 31, 2025) to December 31, 2025 (with potential extension to December 31, 2027 for more significant mitigation activities) and even December 31, 2028 for Type 3 WGRs requiring additional time to meet phase angle jump or multiple fault ride-through requirements. While the current requirements may present challenges for a small subset of older WGRs, continuing to extend timelines for all Resources beyond December 31, 2027 (or December 31, 2028) would increase risk to an unacceptable level and continue to encourage delay in implementing mitigation activities. Such delays do not foster reliability and ignore the urgency ERCOT has highlighted throughout this process. Additionally, as described in multiple stakeholder meetings, ERCOT supported the extended timelines only if coupled with clear language giving ERCOT authority to impose operational restrictions if an IBR or Type 1 or Type 2 WGR fails to meet legacy IBR requirements. ERCOT’s proposal provides a mechanism to remove unacceptable reliability risk from the ERCOT System until IBR owners can implement the needed changes:

*“Alternative framework hinges on performance failure restrictions and removal of exemptions to allow additional time frames and reduction of requirements for the majority of existing IBRs.” Slide 9 of the NOGRR 245 Alternative framework proposal\_IBRTF(051223)(9).pptx.*

Recent stakeholder comments propose to remove ERCOT’s discretion to impose operational restrictions on IBRs for performance failures or non-compliance with the ride-through requirements. As cited above, ERCOT does not support extending compliance timelines without having the ability to remove reliability risk due to ride-through performance failures or non-compliance. As such, ERCOT insists that any approved language must contain provisions that allows it to exercise reasonable discretion to ensure the reliability of its system. ERCOT provides additional clarification that, if an entity cannot meet the deadlines, whether ERCOT applies operational restrictions, the owner would be out of compliance and would have to submit a mitigation plan to address the non-compliance.

After the Odessa 2 disturbance in 2022 and as the IEEE 2800-2022 standard was being approved, ERCOT alerted developers to develop IBR plants capable of meeting the IEEE-2800-2022 standard. ERCOT continued to reiterate this message in numerous stakeholder meetings (IBRTF, OWG, and ROS). ERCOT believes, concurrent with EPRI’s gap analysis presented to IBRTF, adoption of the IEEE-2800-2022 standard will assist with preventing or minimizing future events as this robust set of capability requirements will help ensure system stability. ERCOT already deferred the adoption date from January 1, 2023 to June 1, 2023 and does not support any further delays. While some OEMs have only recently developed new models capable of meeting the IEEE 2800-2022 standard, several models that can meet the IEEE 2800-2022 standard have already been shipped. Input from OEMs clearly indicates adoption of the IEEE 2800-2022 standard is technically feasible and developers can retrofit IBRs if they chose to purchase older models.

ERCOT submitted revised proposals to mitigate reliability risk on the ERCOT System from certain Resources’ failure to ride-through system disturbances while acknowledging stakeholder concerns regarding the challenges in applying the voltage ride-through curves in the IEEE 2800-2022 standard. ERCOT believes the revised proposal in its August 18, 2023 comments allows greater technical feasibility while providing additional specificity for Resource Entities to improve ride-through performance and mitigate critical risk to the ERCOT System. ERCOT stands by its proposal as presented in its August 18th comments. ERCOT has gone as far as it can to accommodate stakeholder concerns and does not support the approaches filed in recent comments submitted by certain stakeholders seeking additional flexibility, including the September 4, 2023 Invenergy comments, September 5, 2023 Southern Power comments and the September 5, 2023 NextEra comments. However, ERCOT is amenable to incorporating the revisions in GE Vernova’s September 5, 2023 comments.

Specifically, ERCOT reiterates the following reliability concerns:

1. Failure of IBRs to ride-through normal frequency and voltage deviations on the ERCOT System can lead to severe consequences such as system voltage recovery issues, instability, cascading Outages, or triggering an Under-Frequency Load Shed (UFLS) event up to an including a system blackout.
2. Installing additional synchronous condensers as transmission assets to compensate for the performance deficiency of an individual resource is not a viable solution.
   1. Synchronous condensers will never prevent a normal fault from triggering its voltage ride-through modes which properly occur at RMS voltages below .9 to .85 pu.
   2. Installing synchronous condensers on the transmission system may reduce the number of IBRs and Type 1 and Type 2 WGRs that enter ride-through mode after a disturbance but the IBRs still must ride-through or the loss of real and reactive current on the system due to the ride-through failure will continue to compound the impact of the disturbance up to and including the conditions identified above.
   3. Installing synchronous condensers in locations near very old WGRs could lead to wasted investment if the legacy turbines are near the end of their useful life.
   4. Installing synchronous condensers shifts the cost of complying with the Protocols and Operating Guides to ratepayers – Resource Entities should shoulder the cost of making their equipment support system stability.
   5. With more and more IBRs coming on-line, risk will continue to shift/increase.
3. The industry has experienced numerous reliability issues associated with a failure to ride-through system disturbances, for example:
   1. Blue Cut Fire (WECC) 2016
   2. Canyon 2 (WECC) 2017
   3. NERC Alert on Loss of Solar Resources during Transmission Disturbances due to Inverter Settings (6/20/2017)
   4. Angeles Forest (WECC) 2018
   5. Palmdale Roost (WECC) 2018
   6. Second NERC Alert on Loss of Solar Resources during Transmission Disturbances due to Inverter Settings (5/1/2018)
   7. San Fernando (WECC) 2020
   8. Odessa 1 (ERCOT) 2021
   9. Victorville (WECC) 2021
   10. Tumbleweed (WECC) 2021
   11. Windhub (WECC) 2021
   12. Lytle Creek Fire (WECC) 2021
   13. Panhandle (ERCOT) 2022
   14. Odessa 2 (ERCOT) 2022
   15. Southwest Utah (WECC) 2023
   16. Several other lower-magnitude events
4. ERCOT believes the proposed requirements will help improve several of the major failure modes identified in the Odessa disturbances in 2021 and 2022.
5. In its guidance document *Inverter-Based Resource Strategy*, the North American Reliability Corporation (NERC) noted it supported development of the IEEE 2800-2022 standard (and continues to support the IEEE P2800.2, *Recommended Practice for Test and Verification Procedures for Inverter-based Resources (IBRs) Interconnecting with Bulk Power Systems*). Among other things, the document also highlights:
   1. New technology can introduce significant risks if not integrated properly which could result in high impact and high likelihood events that require substantive action
   2. Inverter and plant controls and protection systems must support the reliable operation of the bulk power system during system disturbances
   3. Disturbance reports, alerts, guidelines, and other deliverables have shown that abnormal IBR performance issues pose a significant risk to bulk power system reliability
   4. Analyzed events identified new performance issues such as momentary cessation, unwarranted inverter or plant-level tripping issues, controller interactions and instabilities, and other critical performance risks that must be mitigated
   5. Generation ride-through and provision of essential reliability services is a core principle for reliable operation of the bulk power system.
6. Several commenters continue to state the proposed NOGRR245 requirements could require a large number of retrofits and pose a significant reliability risk due to potential retirements of Resources because of the technical infeasibility. However, ERCOT’s discussions with major wind turbine original equipment manufacturers indicate the proposed revisions posted on August 18, 2023 should allow far wider adoption of original equipment manufacturers solutions for their equipment while meeting ERCOT’s reliability improvement objectives.

ERCOT believes NOGRR 245 has been thoroughly discussed and appropriately modified based on stakeholder comments. ERCOT strongly urges ROS to recommend approval of ERCOT’s proposal as modified by its August 18, 2023 comments.