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

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| **Date** | September 4, 2023 |

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| **Market Segment** | Independent Generators |

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| **Comments** |

1. **Introduction and Summary**

Invenergy submits these comments in response to the August 18, 2023, ERCOT comments in NOGRR 245, Inverter-Based Resource (IBR) Ride-Through Requirements.[[1]](#footnote-2) Invenergy’s comments are focused on existing Inverter-Based Resources (IBRs) in ERCOT.

While Invenergy appreciates the continued dialogue and is committed to ensuring reliability in ERCOT, ERCOT’s August 18th Revisions do not fully address the “Original Equipment Manufacturer” (OEM) and Market Participant concerns about technical and timing feasibility. In addition, ERCOT’s August 18th Revisions ignore other core issues raised in prior Market Participant comments, including the cost of compliance, among others.

In addition, Invenergy recommends a change to avoid requiring existing IBRs to meet more stringent “preferred” voltage ride-through requirements intended for new and certain repowered IBRs. Lastly, Invenergy outlines why it is premature to presuppose that IBRs otherwise unable to meet the requirements of NOGRR245 will choose to repower in response.

Invenergy writes here to encourage the adoption of a reasonable alternative proposal that accounts for these concerns.

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1. **ERCOT’s August 18th Revisions Do Not Fully Address the Earlier Raised Technical Feasibility and Timing Feasibility Concerns of OEM and Market Participants**

ERCOT’s August 18th Revisions do not fully address concerns raised by OEM and Market Participants. The table, beginning on the next page, identifies for selected ERCOT August 18th Revisions remaining technical or timing issues for IBRs:

| **#** | **ERCOT’s Proposed Requirement** | **Requirement Description** | **Technical Or Timing Issues[[2]](#footnote-3)** |
| --- | --- | --- | --- |
| 1 | Voltage Ride-Through (VRT) multi-fault ride-through and phase angle in 2.9.1.2(7), (8), and (9) | ERCOT “may\* allow a temporary extension for upgrades or retrofits to confirm (*sic*) capability specified” up to 12/31/2028 at the latest. | \*2.9.1.2(9) says only that "ERCOT may temporarily allow an extension," (emphasis added) not that it shall allow one.  For at least one wind OEM, this extension is not currently expected to be long enough for most of its existing turbine models to determine the current capability, develop the upgrades needed (if upgrades are even technically feasible), and to deploy those upgrades. For some turbine models, the OEM has no plan or line of sight for determining the current turbine capability, let alone improving it to the levels proposed by ERCOT. |
| 2 | VRT table in 2.9.1.2(1) | ERCOT proposed no change to Table A from its previous round of comments on June 22nd. | At least one wind OEM has turbine models that cannot meet the VRT table in 2.9.1.2(1), Table A, today. Of these models, the OEM expects some to be able to meet them in the future, but for at least one model it has no plan or line of sight for getting the turbines to meet the table. |
| 3 | Frequency Ride-Through (FRT) in 2.6.2.1.1 (“Temporary” requirements) | ERCOT’s latest revision imposes a performance requirement (“IBRs…shall ride through”) in place of the existing relay setting requirement (“relays installed and activated…relays shall perform”), though the tables of frequency ranges and delays to trip in 2.6.2.1.1 (2) remain unchanged. | This fundamental change would be effective on the Effective Date of NOGRR 245.  Notwithstanding the wording in 2.6.2.1(8) that should prohibit ERCOT from restricting or not permitting the IBR subject to the “temporary” requirements from operating, the change from relay setting to performance introduces a new risk of an IBR failing to meet ERCOT’s requirements in a case where the relay setting meets the current protocol requirements but the generator does not ride through an event. |
| 4 | FRT minimum ride-through times in 2.6.2.1(1) | ERCOT may\* allow for shorter minimum ride-through times for specific frequency bands for existing generators that provide documented evidence that there is no technical option to enable them to meet the durations in the table in 2.6.2.1(1). | \*2.6.2.1(6)(d) says only that "ERCOT may allow an exception," (emphasis added) not that it shall allow one.  At least one wind OEM has multiple existing turbine models that cannot meet the proposed FRT table today. Of these models, the OEM expects some to be able to meet them in the future.  If ERCOT grants the exception for IBRs with turbine models that request one, then that wind OEM expects the turbine models will be able to meet the shorter duration at the generator terminal. This would be an improvement over ERCOT’s June 22nd comments.  Note that each IBR would still have to evaluate the balance of plant to determine if it could meet the shorter duration at the Point of Interconnection Bus as required. |
| 5 | Modifications and corresponding increases in VRT requirements in 2.9.1(1)(a)(ii) | ERCOT now allows generators with a modification that is “fully implemented” before 1/1/2028 to comply with the “legacy” VRT requirements (2.9.1.2) instead of being forced to step-up to the more stringent “preferred” VRT requirements (2.9.1.1). | This is an improvement over ERCOT’s June 22nd comments. However, as the comments in row #1 above explain, a 1/1/2028 is an early and arbitrary cutoff date that does not account for at least one wind OEM’s expected timeline.  More generally, the modifications for IBRs described in paragraph 1(c) in Planning Guide 5.2.1 are too low a threshold for triggering new requirements, as explained in a subsection further below. |
| 6 | Resource Entity report on VRT capability and improvement plans to ERCOT in 2.9.1.2(10) | ERCOT requires a report by 6/1/2024 or 12/1/2024 depending on the SGIA execution date | ERCOT’s reporting requirement does not account for real-world OEM timelines.  For example, see the comments in row #1, above. At least one wind OEM is not currently expected to be able to determine the existing multi-fault ride-through capability and minimum phase angle jump for its existing turbine models by the end of 2024, let alone provide a plan for “upgrades or retrofits” by then as required in 2.9.1.2(10). |
| 7 | Resource Entity report on FRT capability and improvement plans to ERCOT in 2.6.2.1(6) | ERCOT requires a report by 6/1/2024 or 12/1/2024 depending on the SGIA execution date | It is unclear whether the OEMs will have all the information required for the report by these deadlines. |

The above table highlights:

* ERCOT’s proposal still ignores cases where the OEMs have no path to a technical solution. See rows 1 and 2.
* ERCOT’s proposal still includes compliance timelines that are arbitrary and do not align with the OEMs’ estimated development durations. See rows 1, 5, 6, and 7.
* An OEM estimate is not a commitment to develop or deliver a technical solution by a given deadline. Where OEMs have indicated that a technical solution may exist in the future, ERCOT’s proposal makes generators bear both the risk of the OEM’s ability to develop a technically feasible solution and the risk that the OEM cannot meet its estimated timeline for delivering any such solution. See rows 1, 2, 4, 5, 6, and 7.
* Even where ERCOT implicitly recognizes the need to tailor a technical requirement or extend a timeline, ERCOT’s proposal includes no obligation for it to do so. See rows 1 and 4.

1. **ERCOT’s Proposed Threshold For Requiring A Change From The “Legacy” To “Preferred” Voltage Ride-Through Requirements Should Be Higher.**

As drafted, ERCOT’s trigger for requiring existing generators to change from “legacy” requirements to the more stringent “preferred” requirements is “any modification, as described in paragraph (1)(c) of Planning Guide Section 5.2.1...”[[3]](#footnote-4) (*See* 2.9.1(1)(a)(ii)). Depending on how one interprets the ERCOT proposal, it seems possible that amendments to the interconnection agreement on or after June 1, 2023 may also subject IBRs to the more stringent standard.

In both cases, the threshold for triggering the more stringent VRT requirement is too low. Here is paragraph 1(c) of Planning Guide Section 5.2.1:

*Any Resource Entity seeking to modify a Generation Resource, ESR, or SOG that is connected to the ERCOT System by:*

*(i) Increasing the real power rating from that shown in the latest Resource Registration data by one MW or greater within a single year;*

*(ii) Changing the inverter, turbine, generator, or power converter associated with a facility with an aggregate real power rating of ten MW or greater, unless the replacement is in-kind;*

*(iii) Changing or adding a Point of Interconnection (POI) to a facility with an aggregate real power rating of ten MW or greater; or*

*(iv) Increasing the aggregate nameplate capacity of a generator less than ten MW to ten MW or greater.*

These thresholds are too low. For example, it is not reasonable for an IBR that increases nameplate capacity by 1 MW in one year at a 150 MW generator to then be required to meet the more stringent “preferred” VRT requirements.

Similarly, interconnection amendments should not necessarily trigger the more stringent “preferred” VRT requirements, either. For example, an existing IBR may add behind-the-meter load (like a data center) and may amend its interconnection agreement as a result. In that case, there is no reason the existing IBR should be held to a higher VRT standard because of that change.

As an alternative, Invenergy proposes the following changes to raise the threshold to include only those repowers where it is technically feasible and commercially reasonable for the repower to meet the higher VRT standard. Specifically:

* Replace the reference to “paragraph 1(c) of the Planning Guide Section 5.2.1” with a reference to repowers where it is technically feasible and commercially reasonable to meet the preferred VRT requirements.
* “Repower” is defined as “substantial changes to an IBR that at a minimum include the replacement of the set of major components generally recognized in the industry as constituting a repower.”

Specifically, for interconnection agreement amendments entered into after the effective date of NOGRR245, apply the increase to the IBR’s ride-through requirements only to those interconnection amendments that result from a repower where it is technically feasible and commercially reasonable to meet the preferred VRT requirements.

1. **ERCOT’s Proposal Ignores Other Core Issues Raised In Prior Market Participant Comments.**

Beyond the narrow issues of technical feasibility and timelines, core issues and comments previously raised by Invenergy remain.[[4]](#footnote-5) A few of the most salient are:

* the technology necessary for some older generation models to meet the new standards does not currently exist and is not likely to exist in time to meet the proposed deadline;
* the proposed rule does not take into account the potentially significant costs required for older generation assets to meet the new standards, and whether such costs would render existing generation assets uneconomic;
* the proposed rule does not take into account the impact on overall system reliability should the new standard cause existing assets to be taken offline;
* ERCOT still proposes a new right to “restrict, or not permit to operate” IBRs; and
* ERCOT has not undertaken a systemic analysis to determine the most efficient, least detrimental (*i.e.*, narrowly tailored) approach, including using grid-forming inverters, synchronous condensers, and other transmission improvements or upgrades. In fact, ERCOT’s own recent study results on synchronous condensers[[5]](#footnote-6) and grid-forming inverter-based energy storage resources[[6]](#footnote-7) suggest that these existing technologies could reduce the claimed need for more stringent IBR ride-through requirements for existing IBRs.

1. **Presupposing Repowering As An Alternative Is Premature**

According to GE Vernova (formerly GE Renewable Energy), “Wind turbine repowering involves replacing older units with new, higher capacity turbines or retrofitting them with more efficient components.” [[7]](#footnote-8) For a wind IBR, repowering typically involves the replacement of major components including the rotor, gearbox, main shaft, and main bearing assembly. Other components may be replaced or upgraded as well, to the point of completely replacing equipment other than the tower itself. Repowering may also require replacements and upgrades to the balance of plant.

For some turbines, even repowering will not enable an IBR to meet ERCOT’s proposed “legacy” requirements. There are repowered turbines in ERCOT today that cannot meet them. For other turbines, it is possible that repowering may ultimately prove to be the only technically feasible solution to comply with ERCOT’s proposed requirements.[[8]](#footnote-9) Technical feasibility is necessary but not sufficient to repower.

Repowering is expensive. The significant capital investment repower requires will only be made if it can be justified after the consideration of the full range of factors that affect the business case over decades of expected operation, including but not limited to: technical feasibility, existing offtake obligations, new offtake opportunities, expected incremental revenue (including the effects of transmission constraints and congestion) and cost, the ability to qualify for federal tax credits, legislative and regulatory risks and requirements, and other factors. Project-specific combinations of these factors may lead some projects to repower and others not to.

Retroactive application of new regulatory requirements, especially ones that impose the risk of increased costs, unfettered restrictions up to disconnection, and premature retirements, does not encourage capital providers to make the additional investments repower requires.

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| **Revised Cover Page Language** |

None

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| **Revised Proposed Guide Language** |

None

1. *See* NOGRR245 Comment of ERCOT (August 18, 2023) (*hereinafter* “ERCOT’s August 18th Revisions.” *Available at* <https://www.ercot.com/mktrules/issues/NOGRR245#keydocs>. [↑](#footnote-ref-2)
2. For clarity, “technical and timing” issues raised here temporarily ignore the critical issue of commercial reasonableness. For example, if the current expectation is that a significant retrofit would be required in order to comply, and if that retrofit would be expected to be developed and deployed by the deadline ERCOT proposed, then that solution would be considered “feasible” from a technical and timing perspective, *even if* it would not be commercially reasonable. [↑](#footnote-ref-3)
3. *See Current Planning Guide*, *available at* <https://www.ercot.com/mktrules/guides/planning/current>. [↑](#footnote-ref-4)
4. *See* NOGRR245 Comment of Invenergy (May 1, 2023); and NOGRR245 Comment of Invenergy (July 31, 2023). *Available at* <https://www.ercot.com/mktrules/issues/NOGRR245#keydocs>. [↑](#footnote-ref-5)
5. *See* “*Item 8.1.2: West Texas Synchronous Condenser Project*,*”* as presented to ERCOT’s Reliability and Markets Committee by Woody Rickerson, ERCOT Vice President, System Planning and Weatherization (August 30, 2023). *Available at* [8-1-2-west-texas-synchronous-condenser-project.pdf (ercot.com).](https://www.ercot.com/files/docs/2023/08/23/8-1-2-west-texas-synchronous-condenser-project.pdf)  [↑](#footnote-ref-6)
6. *See* “*Preliminary Assessment of Grid-forming Inverter-based Energy Storage Resources (GFM-IBR-ESR) in the ERCOT Grid*,” as presented at the Inverter-Based Resources Working Group by Yunzhi Cheng, ERCOT Manager of Operations Analysis (August 11, 2023). *Available* *at* <https://www.ercot.com/files/docs/2023/08/10/GFM_ERCOT_IBRWG(08112023).pdf>. [↑](#footnote-ref-7)
7. *See, e.g.*, “*Upgrades and Refurbishment for your Onshore Wind* Assets,” (GE Renewable Energy’s description of their “RePower Wind Energy Program.)” *Available at* [Upgrades Refurbishment | GE Renewable Energy](https://www.ge.com/renewableenergy/wind-energy/onshore-wind/services/upgrades-refurbishment). [↑](#footnote-ref-8)
8. Technical feasibility starts with the turbine OEM having a commercially available product but extends well beyond that to include all the other technical factors that could prohibit a repower, including permitting and setback requirements and balance of plant capability, to name a few. [↑](#footnote-ref-9)