Navigating ERCOT's NOGRR 245:
A critical shift for wind farms in Texas

AUTHORS

Wade Evans
Lead senior project engineer
wadee@naturalpower.com

Hitakshi Yeole
Senior project engineer
hitakshiy@naturalpower.com

Chris Ziesler
Commercial services lead, Advisory and Analytics
chrisz@naturalpower.com

Introduction

The Texas electrical grid, managed by the Electric Reliability Council of Texas (ERCOT), is a dynamic and complex system. As renewable energy sources, particularly wind and solar, expand their footprint, ensuring grid stability becomes more of a challenge. In this context, ERCOT's Nodal Operating Guide Revision Request (NOGRR) 245, which focuses on Inverter-Based Resource (IBR) Ride-Through Requirements, represents a significant regulatory development. Approved and effective as of October 1, 2024, NOGRR 245 is not just a technical update; it's a fundamental shift in how wind farms, solar plants and other IBRs operate within ERCOT. It has important implications for both existing renewable assets and for future projects still in development.

The imperative behind NOGRR 245: enhancing grid resilience

NOGRR 245 is a direct response to reliability issues identified in recent grid disturbance events, in particular the so-called Odessa disturbances in 2021 and 2022 (Footnote 1). During these incidents, many IBRs, including wind and solar facilities, failed to "ride through" system disturbances like voltage or frequency deviations. Instead of remaining connected and supporting the grid during transient conditions, they tripped offline, exacerbating the disturbance and posing a significant risk of instability, cascading outages, and even triggering involuntary load shedding.

ERCOT's primary objective with NOGRR 245 is to bolster the grid's resilience by ensuring that IBRs can withstand and contribute to system stability during abnormal conditions on the grid such as voltage sags or frequency excursions. This NOGRR replaces previous ride-through requirements for Intermittent Renewable Resources (IRRs) with more stringent and specific standards for IBRs and, critically, for Type 1 and Type 2 Wind-powered Generation Resources (WGRs) (Footnote 2). It aligns ERCOT's requirements with, and in some respects surpasses, the global industry benchmark set by the IEEE 2800-2022 standard, which provides comprehensive guidelines for the interconnection and interoperability of IBRs with respect to grid disturbances.

The new requirements mandate that IBRs and WGRs maximize their voltage and frequency ride-through capabilities. This involves implementing necessary software and settings changes to ensure that inverter and plant control systems support the reliable operation of the bulk power system. The aim is to reduce and mitigate the major failure modes identified in past disturbances and ensure that these generation assets actively contribute to grid stability rather than causing additional problems by tripping off when needed most.

Direct Impact on Wind Farms: A New Era of Operational Rigor

NOGRR 245's impact on wind farms in the ERCOT region is multifaceted and substantial, extending to both existing facilities and those under development.

Firstly, the NOGRR explicitly includes **Type 1, Type 2, and Type 3 WGRs** under its umbrella, considering Type 3 WGRs as IBRs. This broad applicability means a significant portion of the large wind fleet in ERCOT, regardless of its vintage, will be subject to the new ride-through performance standards.

For existing wind farms with Standard Generation Interconnection Agreements (SGIAs) executed prior to August 1, 2024, the requirements introduce a period of evaluation

Footnotes

1. During the Odessa 2021 disturbance (May 9, 2021) there was a single-line-to-ground fault on a generator step-up transformer at a combined-cycle power plant near Odessa, TX. While the fault itself was relatively minor and cleared quickly, a substantial amount of solar photovoltaic (PV) generation, totaling over 1,100 MW, unexpectedly tripped offline or significantly reduced output across a wide area. Just over a year later a similar and larger event occurred. This second disturbance was triggered by a lightning arrestor failure at a synchronous generation plant, leading to a fault. Again, the fault cleared quickly, but an even greater amount of IBRs, primarily solar PV, tripped offline. The total generation loss, including both IBRs and some synchronous generation, was over 2,500 MW.

2. The Type of a WGR refers to different classifications of turbines with Type 1 being the oldest and simplest fixed-speed generators, these are turbines from the mid-1980s to mid-1990s, an example would be a Vestas V29; Type 2 are wound-rotor induction generators with external resistance, an example would be a Vestas V66-1.65; Type 3 are Doubly-Fed Induction Generators (DFIGs) from the late-1990s through to the 2010s, examples being Vestas V110-2.0MW, GE 1.5sle or Nordex N163-5.X; Type 4 are full-converter turbines which are the modern type which are currently available on the market such as the Vestas V150, the GE Cypress platform, and the Siemens Gamesa SG series like the SG5.8-170.

and potential upgrades. These facilities are now tasked with maximizing their ride-through capability to meet or exceed the new voltage and frequency ride-through requirements. They must achieve compliance with relevant sections of IEEE 2800-2022, specifically Sections 5, 7, and 9, which cover critical aspects such as negative-sequence current injection for unbalanced faults, current blocking behavior, and ride-through performance during Rate of Change of Frequency (RoCoF) and phase angle jump events.

The NOGRR also outlines a clear compliance pathway and, importantly, potential consequences. Existing IBRs and WGRs that cannot meet the ride-through requirements must have submitted a request for an extension or a notice of intent to request an exemption by **April 1, 2025**. This submission requires comprehensive documentation of physical limitations and maximum ride-through capabilities. The ultimate deadline for transmission-connected IBRs to achieve full compliance or face operational restrictions is **December 31, 2025**, with potential extensions up to December 31, 2027, for more substantive modifications. Failure to comply by these deadlines, or by January 1, 2028, for projects undergoing major modifications, could result in operational restrictions or the loss of legacy exceptions, potentially impacting the ability to operate.

For new wind projects and those currently under development, NOGRR 245 sets a higher bar for design and commissioning. They are expected to incorporate the new ride-through capabilities from the outset, ensuring that the latest turbine and inverter technologies are designed to meet or exceed the IEEE 2800-2022 standards. This means that future wind farms in ERCOT must be designed and engineered with enhanced grid support functionalities.

The discussions around NOGRR 245 have not been without contention. Industry stakeholders, including wind farm owners and operators, have voiced concerns regarding the technical feasibility and significant financial implications of retrofitting older equipment. The challenge lies in upgrading or replacing components of existing wind turbines and inverters that were designed to meet less stringent standards, often leading to substantial capital expenditure. There are also concerns about unrealistic compliance timelines, particularly for projects that have long development cycles and commitments to specific turbine models. ERCOT, however, has emphasized that while it has no desire to disconnect resources, it may be necessary to restrict or disconnect IBRs that fail to perform during ride-through events to safeguard the broader grid.

Three Main Conclusions for the Wind Industry

Based on the implications of ERCOT's NOGRR 245, three main conclusions emerge for the wind energy sector:

1. **Enhanced Grid Contribution is Now a Prerequisite, Not an Option:** NOGRR 245 has redefined the operational responsibilities of wind farms in ERCOT. The era of simply generating power is over; wind farms are now explicitly required to be active participants in maintaining grid stability, especially during disturbances. This means a proactive approach to engineering, controls, and ongoing maintenance to ensure ride-through capabilities are not just met but maximized. This paradigm shift will necessitate deeper technical expertise within developers and asset management teams and closer collaboration with equipment manufacturers.
2. **Compliance Requires Significant Investment and Strategic Planning for Existing Assets:** For a substantial portion of the existing wind fleet, NOGRR 245 will demand considerable financial investment in upgrades, particularly software and firmware updates, and potentially hardware modifications. Owners of older wind farms face a critical decision matrix: invest in retrofits to comply, seek extensions or exemptions, or consider the economic viability of continued operation given potential restrictions. Strategic planning, including detailed technical assessments, financial modeling, and engagement with ERCOT and equipment suppliers, will be crucial to navigate these complex compliance pathways effectively.
3. **The Texas Market Reinforces a Global Trend Towards Stricter Grid Codes for Renewables:** ERCOT's aggressive stance with NOGRR 245 signals a clear trend that is gaining momentum globally. As renewable energy penetration increases, grid operators worldwide are implementing more stringent grid codes to ensure the reliability and resilience of power systems. Texas, with its high concentration of wind and solar, is at the forefront of this evolution. This NOGRR serves as a potent reminder for developers, investors, and operators that future renewable energy projects must be designed from the ground up with advanced grid-forming and grid-supporting capabilities, moving beyond basic interconnection requirements to meet the evolving demands of a modern, inverter-dominated grid. This trend will likely drive innovation in IBR technology, pushing manufacturers to develop more robust and intelligent inverter systems.

In conclusion, NOGRR 245 is a pivotal regulation that will reshape the operational landscape for wind farms in ERCOT. While it presents challenges in terms of compliance and investment, it is a necessary step towards building a more resilient and reliable grid capable of integrating a growing share of renewable energy. The wind industry's ability to adapt swiftly and strategically to these new requirements will determine its continued success and contribution to Texas's energy future.

At Natural Power, with our team of experienced electrical engineers, we can offer support for wind farm owners working to understand how ERCOT's NOGRR 245 affects them. We can conduct technical assessments of existing turbines (Type 1, 2, 3, 4), to help you identify specific compliance gaps against the IEEE 2800-2022 standards. Ultimately, Natural Power can help owners ensure grid reliability, minimize operational risks, and maintain the economic viability of their assets under the new regulations.

If you have any queries related to the content of this paper, please contact:

Chris Ziesler, Commercial services lead, A&A
chrisz@naturalpower.com