Grid Transition and Performance

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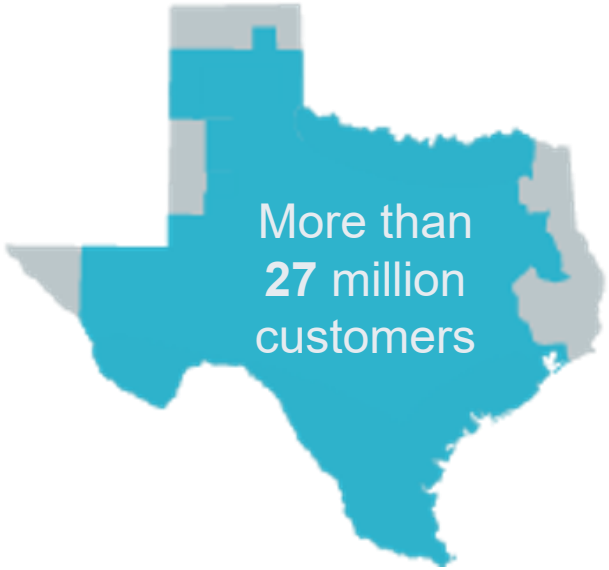
Quick Facts



85,508 MW

Record peak demand (August 10, 2023)

103,105+ MW

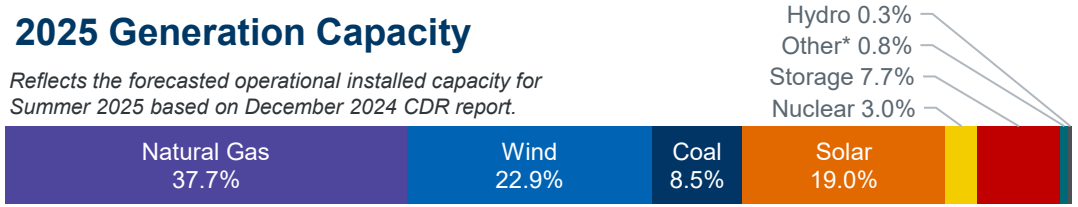
Expected capacity for Summer 2025 peak demand (December 2024 CDR)

$3.8 billion

Transmission projects endorsed in 2024

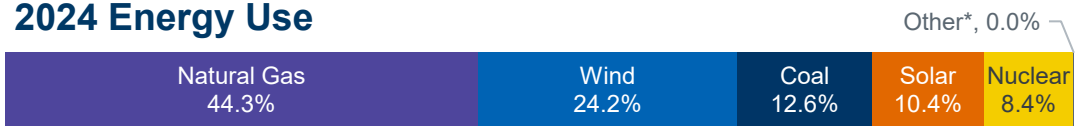
2025 Generation Capacity

Reflects the forecasted operational installed capacity for Summer 2025 based on December 2024 CDR report.



The sum of the percentages may not equal 100% dues to rounding.
**Other includes biomass-fired units and DC tie capacity.*

2024 Energy Use



** Other includes hydro, petroleum coke (pet coke), biomass, landfill gas, distillate fuel oil, net DC-tie and Block Load Transfer important/exports and an adjustment for wholesale storage load.*

1 MW of electricity is enough to serve about 250 residential customers during ERCOT peak hours.

40,566 MW

Wind

of installed wind capacity as of October 2025, the most of any state in the nation

28,550 MW
Generation Record (March 3, 2025)

69.15 %
Penetration Record (April 10, 2022)

35,123 MW

Solar

of utility-scale installed solar capacity as of October 2025

29,887 MW
Generation Record (September 9, 2025)

56.60 %
Penetration Record (March 20, 2025)

76% (36,966 MW)

Preliminary **Wind + Solar** Penetration Record (March 2, 2025)

15,485 MW

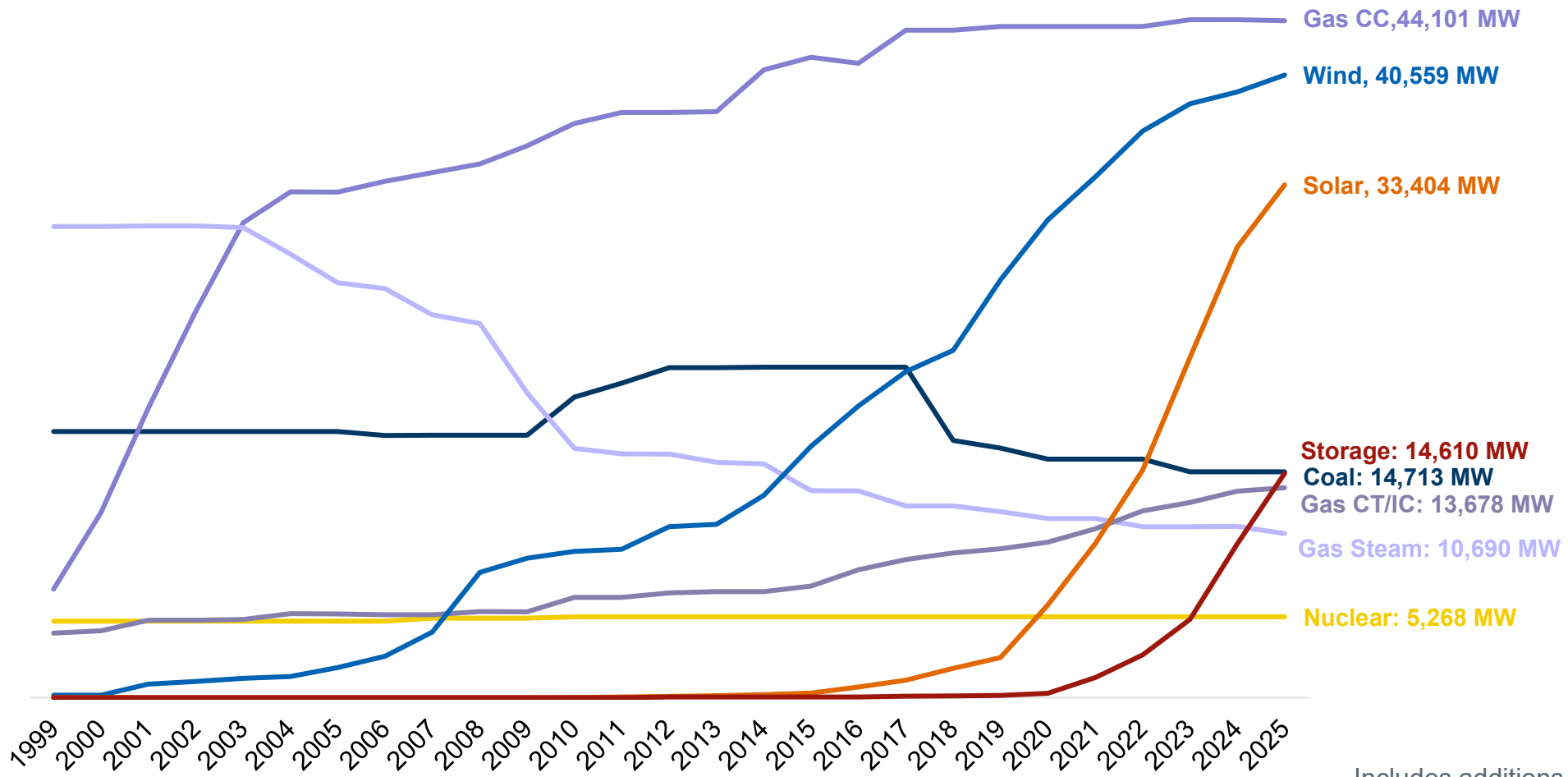
Battery Storage

of installed energy storage capacity as of October 2025

8,714 MW

Energy storage generation Record (October 30, 2025)

ERCOT Installed Net Generation Capacity as of August 1, 2025



Includes additions and retirements

Notes: Capacity totals are based on the Installed Capacity Ratings for generating units. "Other" comprises of Biomass, Hydro, and Diesel. Planned generation projects are added to installed capacity after approval for synchronization to ERCOT Grid. Totals include Private-Use Network generators that export to the ERCOT grid, Distribution Generation Resources, Settlement-Only Distribution Generators, Unavailable Switchable Capacity, Extended Outage Units, and Seasonal Mothballed Units but not Indefinite Mothballed Units.

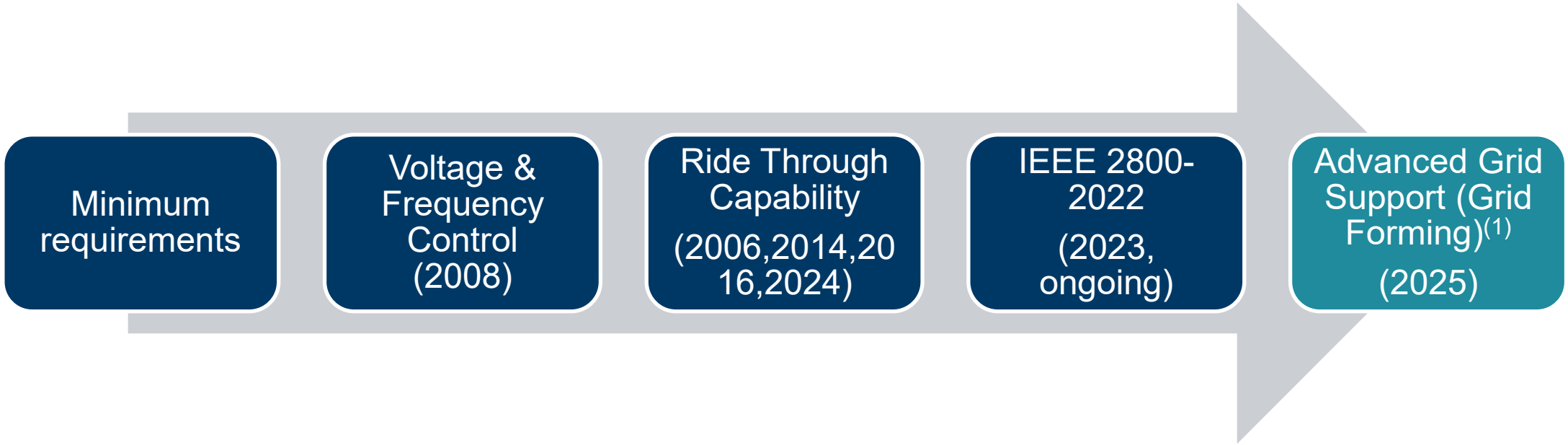
ERCOT Grid Changes and Notable Options Adopted to Support Grid – Grid dynamic performance perspective

Synchronous condensers	• 2*150 MVA were installed in 2018 • 6*350 MVA are scheduled by 2027
IEEE 2800-2022 Adoption	• Adopt voltage/frequency ride through and section 5,7,9 • Plan to adopt other applicable requirements in the future
Dynamic Model Validation and Verification	• Establish requirements to ensure accurate dynamic models • Plan to adopt applicable IEEE 2800.2 requirements in the future
Generic Stability Constraints	• Establish and enforce operational stability constraints in real time operations • Implement online stability assessment
Situational Awareness	• Establish PMU and DFR requirements • Enhance real time monitoring and event detection (steady state and PMU)

Although these improvements facilitate the existing IBR integration in the ERCOT grid, additional options will be needed to facilitate integration of new Resources and Loads

ERCOT IBR Performance Requirement Overview

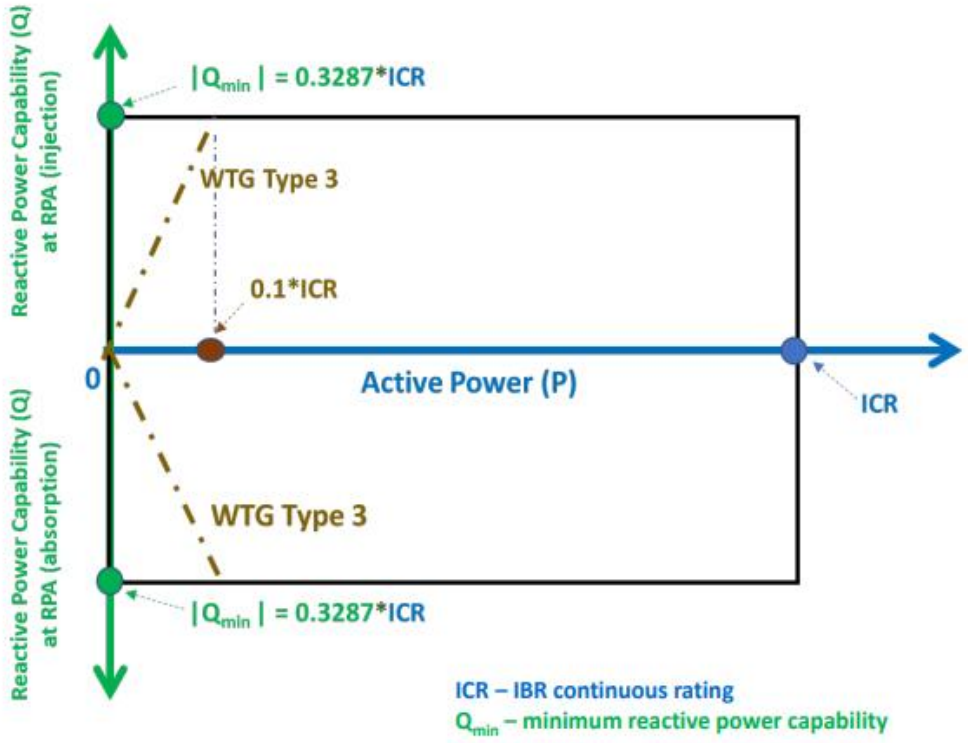
- With the advanced IBR development and grid reliability support needs, several IBR performance requirements were adopted to support resource integration and grid operation
- The advanced grid support (grid forming like) IBR technology has been increasing considered and adopted in the industry and globally in recent years to enable further IBR integration



(1) Revision requests were submitted in October 2024, currently are in the stakeholder process for review and approval

Voltage and Frequency Support

IEEE Std 2800-2022
IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems



NOTE 1—Exchange of reactive power may require the *IBR plant* to consume active power from the grid due to losses when there is no available *primary energy source*.

NOTE 2—The figure shows the minimum range for the reactive power capability required by this standard. The *IBR plant*'s actual capability may be outside of the black box.

Figure 6—Minimum range for reactive power capability—Q versus P for active power injection capability at the RPA (generator sign convention)

Table 1: Maximum Governor Dead-Band Settings

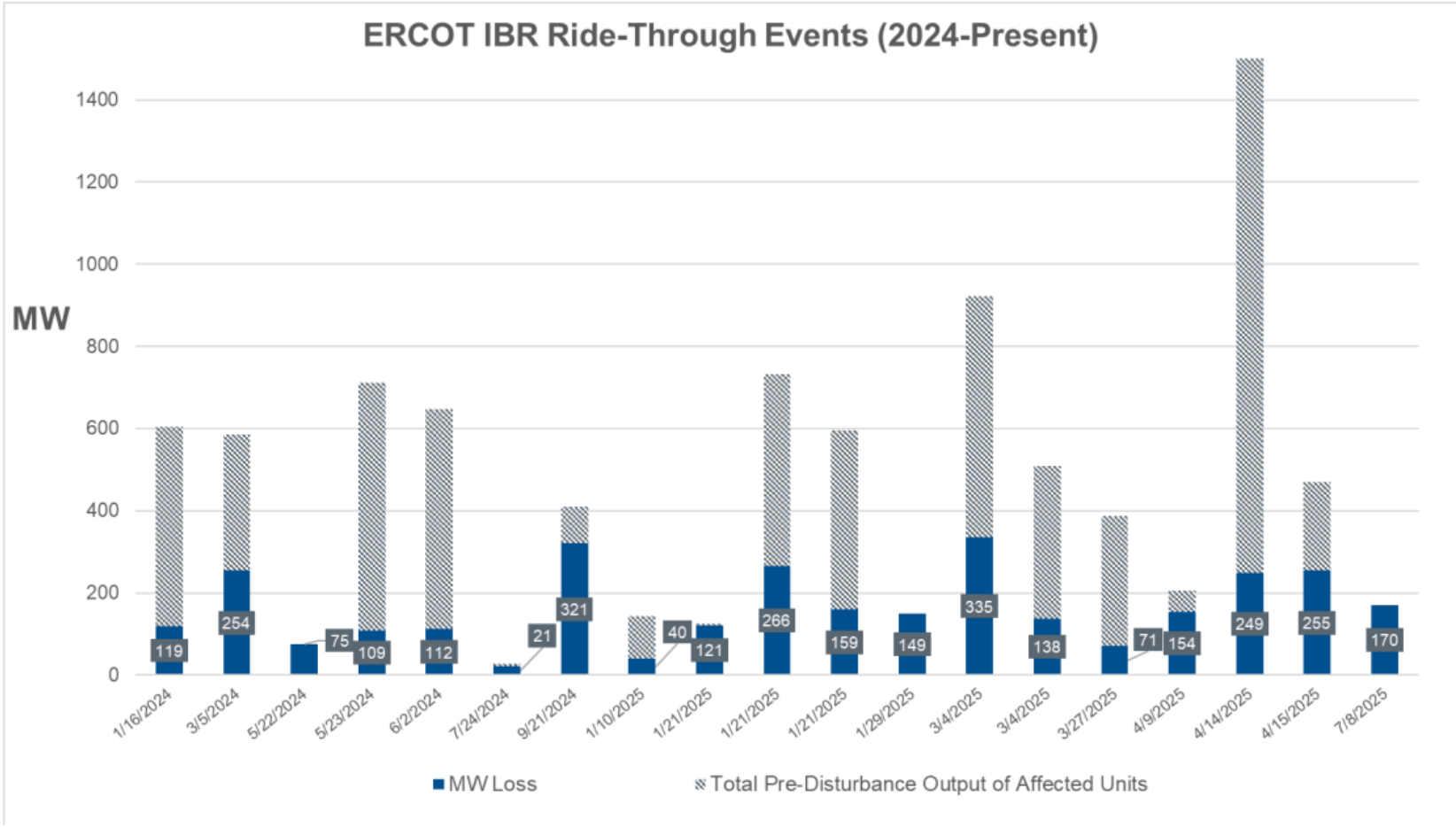
Resource Type	Max. Deadband
Steam Turbines with Mechanical Governors	+/- 0.034 Hz
Hydro Turbines with Mechanical Governors	+/- 0.034 Hz
All Other Generating Units/Generating Facilities/ESRs	+/- 0.017 Hz
Controllable Load Resources (CLRs)	+/- 0.036 Hz

Table 2: Maximum Governor Droop Settings

Generator Type	Max. Droop % Setting
Combustion Turbine (Combined Cycle)	4%
All Other Generating Units/Generating Facilities/ESRs/CLRs	5%

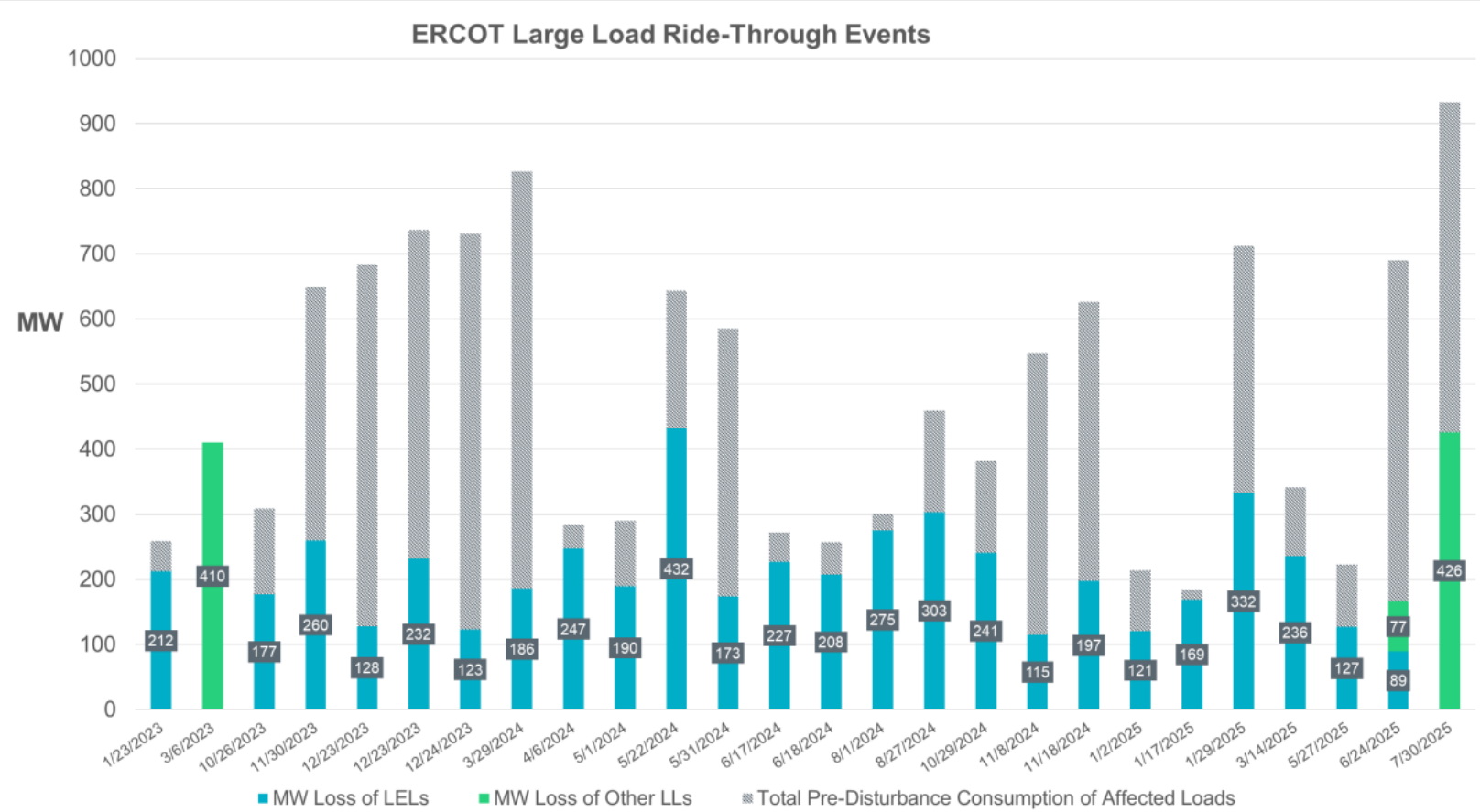
All the transmission connected generation resources (including wind, solar, and ESRs) are required to provide voltage support in AVR mode and frequency support within the defined deadband and droop.

IBR Ride Through Performance



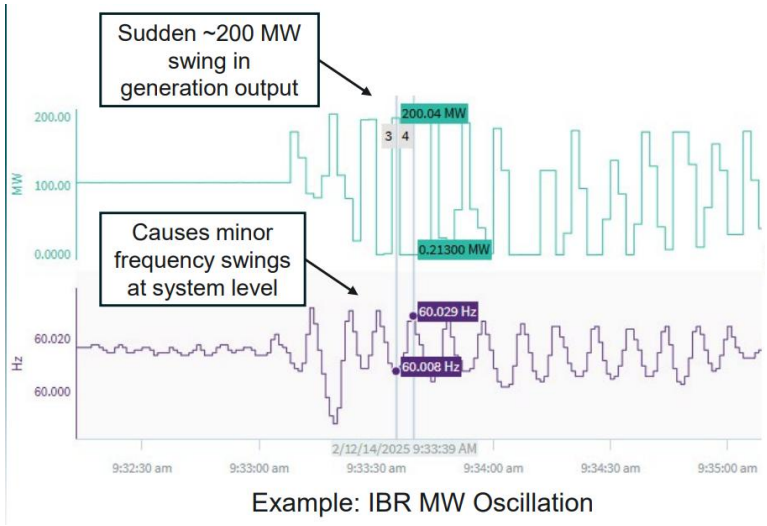
ERCOT continues to have IBR ride-through events, although the magnitude of events has remained below 500 MW. Several initiatives were approved to enhance IBRs' ride through capability and real time performance monitoring and evaluation.

Large Electronic Load Ride Through and Oscillations Events

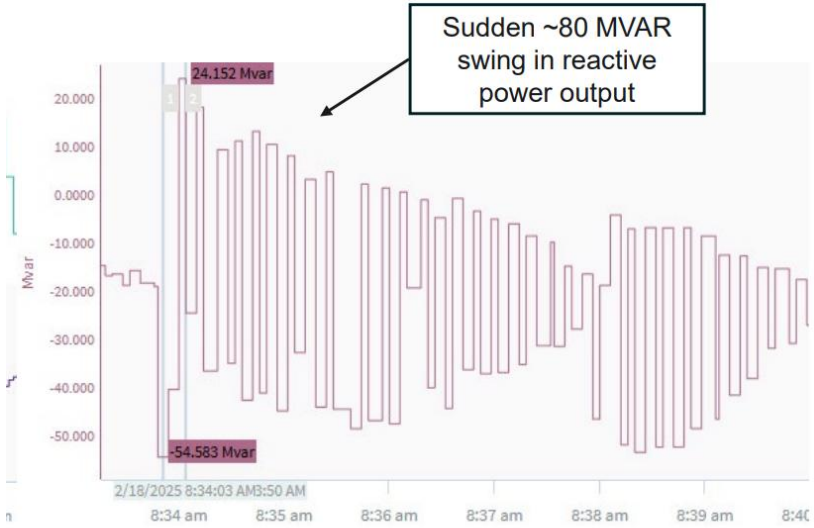


Large Electronic Loads reduce consumption quickly when system faults occur in their area. The magnitude and frequency of these events will likely increase as more of these types of loads are connected to the system, especially when they are concentrated in an area.

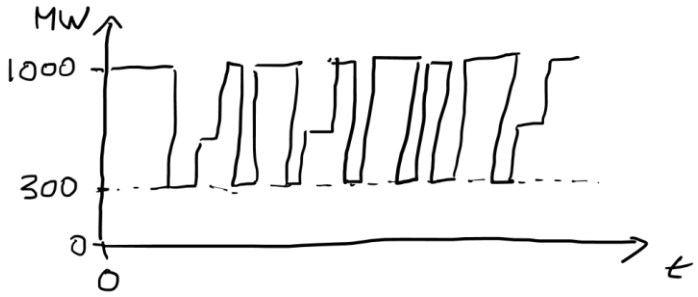
Event Investigation and Analysis

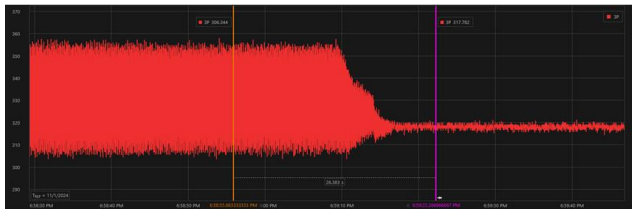


Example: IBR MW Oscillation

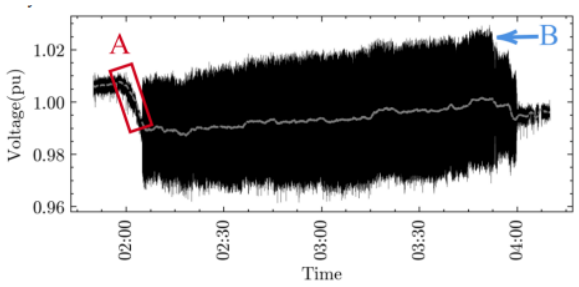


Example: IBR MVAR Oscillation





- ERCOT 23 Hz Event (July-October 2024)



- Dominion Energy 14.7-14.8 Hz Event

ERCOT Event Analysis team investigates each event to keep the system reliable and prevent reoccurring issues.

What do we do

Notable Issues	ERCOT Practices and Requirements
Oscillation	• Identify and implement Generic Transmission Constraints (GTCs) to maintain stable operations of impacted Resources • ERCOT synchronous Generation Resources (GRs) are required to install Power System Stabilizers to provide oscillation dampening support • ERCOT has some streaming PMUs and tools to diagnose real-time oscillations • ERCOT has ordered generators offline until they fix the source of their oscillations
Voltage Management	• All GRs and Energy Storage Resources (ESR) are required to provide dynamic voltage support, maintain voltage profile, and frequency support • ERCOT routinely review and assess resources' voltage control and frequency support performance
Lack of Ride Through	• GRs and ESRs are required to meet voltage and frequency ride through requirements. These are minimum operational requirements, not protection set-points • Reinforces IBR ride through capability for existing units and improves capability for future units • Enhance event detection and investigation capability to keep the system reliable and prevent reoccurring issues

April 28 Spain & Portugal Blackout

Notable Issues	ERCOT Practices and Requirements
Prevent large power imbalance	• To reinforce IBR ride-through capability for existing units and improve that capability for future units – to limit the number of generators that trip due to a single fault • Project to install synchronous condensers at key locations across West Texas to limit the number of generators that are affected by a single fault • Improved event analysis and data collection from smaller events such as IBR ride-through failures and generation/load oscillation • Adopt new technology such as requiring grid-forming capability for all future Energy Storage Resources • ERCOT is investigating ride-through capabilities and requirements for large electronic loads
Mitigate large power imbalance	• Routinely review and revise the Ancillary Service requirements and needs ➢ Including Load Resources controlled by high set under frequency relay (59.7 Hz in 30 cycles) and Resources providing fast frequency response (59.85 Hz in 15 cycles) • Procure enough ERCOT Contingency Reserve Service to restore reserve within 15 minutes to prepare for another loss • For many years, this UFLS program included 3 stages; after winter storm Uri, this was adjusted to 5 stages over the same frequency range • An “anti-stall” system is also being added to restore frequency if frequency stays below 59.5 Hz for an extended period