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Item 16.1: System Operations and Winter Weather Update

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Vice President, System Operations

Board of Directors

December 8-9, 2025

- **Purpose**
  - Provide an update on key operational metrics to the Board of Directors
  - Provide information on recent Ancillary Services performance
  - Provide information on hot topics

- **For Information Only**

  No action is requested of the Board; for discussion only

Key Takeaways

- On average, winter temperatures are expected to be near normal to slightly above normal, which would be cooler than last few winters, with below normal precipitation.
- ERCOT sent a Request for Information to TDSPs with existing Large Electronic Loads (LEL) Customers and LELs with approval to energize to assess the reliability risk of data centers and crypto mining facilities to the grid during normal voltage dips.
- ERCOT has completed the annual Black Start training cycle.
- All key operational metrics are trending well, and all Ancillary Services are performing well.

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Winter Preview

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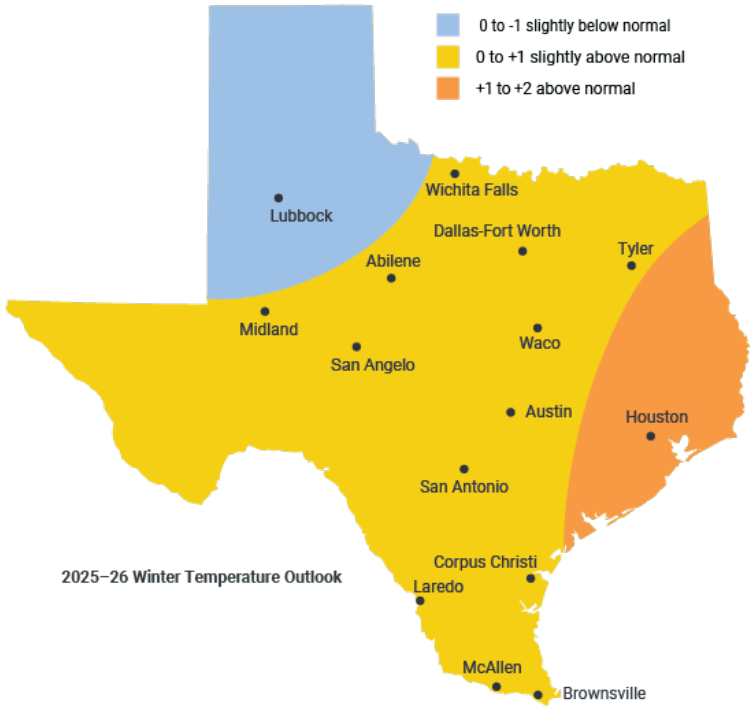
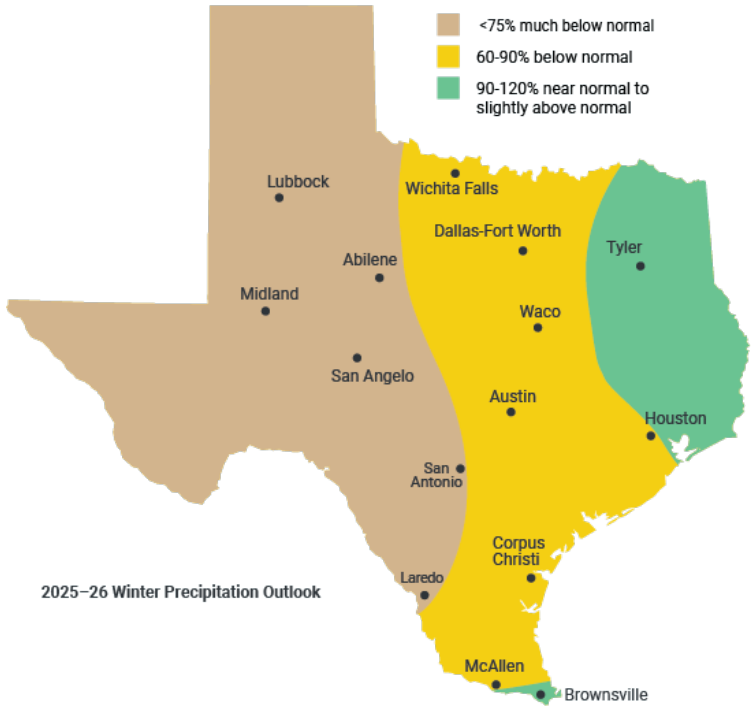
Winter Weather Outlook

- **Temperature:** While a warmer scenario remains possible, this winter looks less likely to be as warm as any of the past 4 winters – but still at least slightly above normal, on average across the state. However, high uncertainty of any potential impacts of the polar vortex mid-to-late-winter has resulted in a lower forecast confidence.
    - A colder scenario is also possible. 2 of the 12 historically similar years (analogs) were very cold winters in Texas: 2013-14 and 2000-01 (neither winter had a period of extreme cold, but both had frequent cold fronts and a lack of warm days).
- **Precipitation:** La Niña is in place for the upcoming winter. 4 of the past 5 winters have been under the influence of La Niña. The four La Niña winters all ranked in the driest half of all historical winters. This winter is very likely to trend drier than normal – and drier than last winter.



2025–26 Winter Temperature Outlook



2025–26 Winter Precipitation Outlook

Key Takeaway: The Winter Weather Outlook has a cooler temperature outlook than the preliminary forecast, but still slightly above normal, primarily due to the effect of the polar vortex early in the winter. This winter is likely to rank among the driest of winters.

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Large Electronic Load Request for Information Summary

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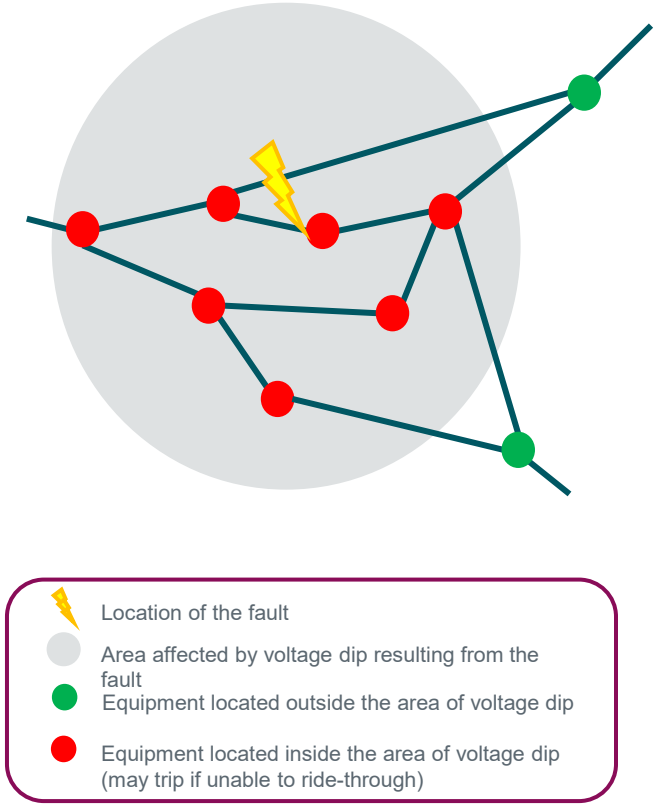
Need for Better Data on Large Electronic Load (LELs) Ride-through Capability

Background

- As discussed last meeting, to assess the reliability risk of data centers and crypto mining facilities (“Large Electronic Loads”) failing to stay connected (“ride-through”) to the grid during normal voltage dips, ERCOT will need to identify clusters of LELs that have insufficient voltage ride-through (VRT) capability, such that a single fault could cause frequency instability.
- Before performing this analysis, ERCOT sent a Request for Information to TDSPs with existing LELs in operation or have received approval to energize.
- ERCOT issued a Market Notice on June 23, 2025, requesting Customers with energized or approved LELs to coordinate with their interconnecting TDSP to complete the ERCOT DWG Large Load Survey and submit updated dynamic models to ERCOT by August 31, 2025.

Lack of VRT Cluster



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Large Electronic Load Request for Information Summary

Summary of Responses

- 24 RFIs sent to TDSPs with identified LEL customers in operation or approved to energize.
- 9 responses received (including one combined response for a site with both a data center and a crypto mining facility). So total 10 individual LEL survey responses reviewed.
- 15 RFIs had no response – Large Loads are not Market Participants and thus have no obligation to respond. ERCOT will assume minimal ride-through capability for these Loads in future studies.

Findings

- 2 data center sites submitted model information showing some ride-through capability.
- All other responses showed very little ride-through capability.

Key Takeaway: ERCOT will use RFI response information in studies going forward and will assume minimal ride-through capability for LELs for which no RFI response was received.

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Annual Black Start Training

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Annual Black Start Training

- Started on October 7th, 2025
- Annual requirement from Nodal Operating Guide 1.5.4(5).
- ERCOT Black Start training attendance is mandatory for all TOs, QSEs identified in a Black Start restoration plan, Resource Entities that represent Black Start Resources, and other Entities who are notified by ERCOT that their participation is required.
- Training takes place for 2.5 days for 6 consecutive weeks, consists of a mixture of Computer Based Training, lectures, and simulation.
- Training covers:
    - Hot line call after initial Blackout conditions.
    - Communications.
    - ERCOT Black Start plan with ERCOT System Operators.
    - Off-site power to Nuclear Sites.
    - Critical Facilities and Critical Loads.
    - All stages of Black Start and modes of Frequency Control.
- Approximately 750 Market Participants are involved.

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Appendix
Operational Metrics and Ancillary Services (AS) Performance

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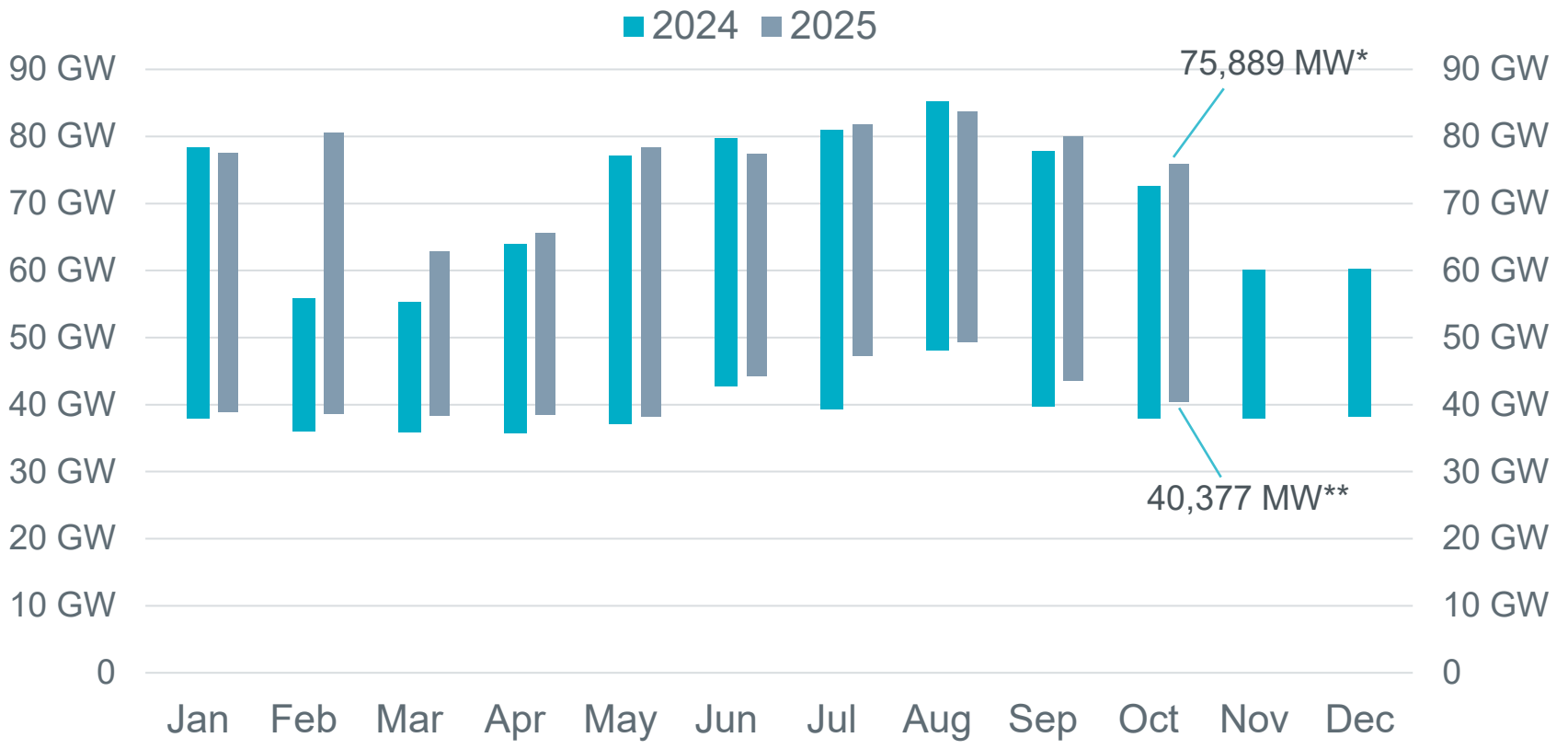
Demand



*Based on the maximum net system hourly value from July release of Demand and Energy 2025 report.

**Based on the minimum net system 15-minute interval value from July release of Demand and Energy 2025 report.

Data for latest two months are based on preliminary settlements.

Key Takeaway: ERCOT set a new record of 75,889 MW* for the month of October on 10/9/2025. This is 3,339 MW more than the October 2024 demand of 72,550 MW on 10/3/2024.

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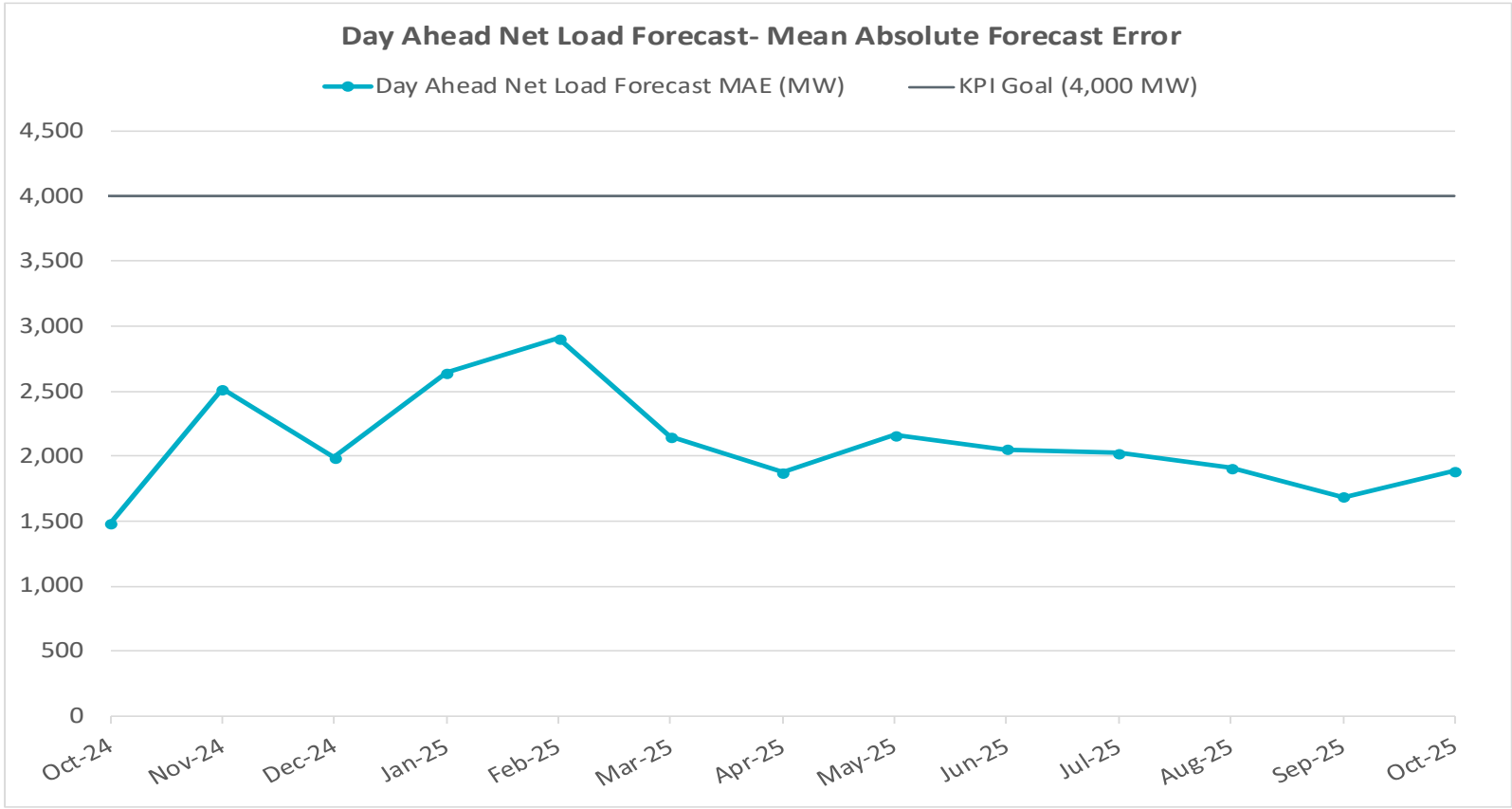
Forecast Performance



Key Takeaway: Day Ahead Net Load Forecast Mean Absolute Forecast Error has met the target and has been trending well.

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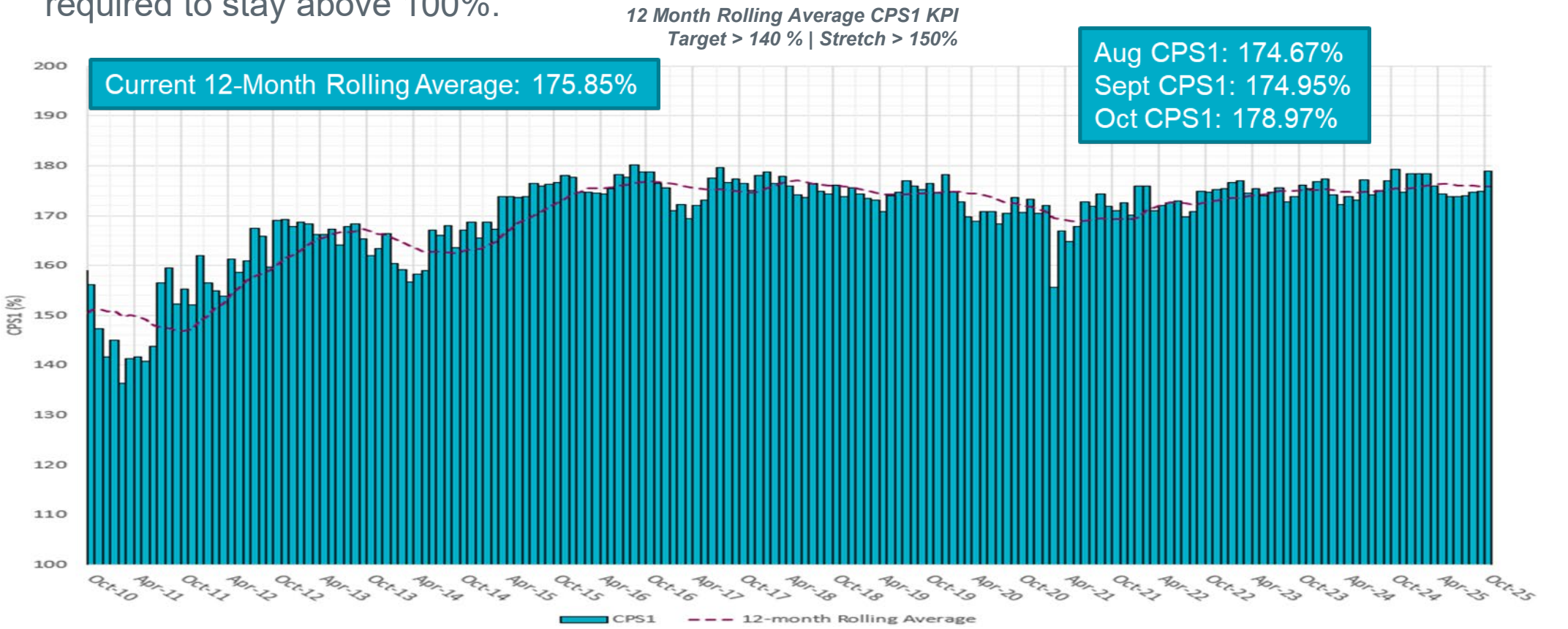
Frequency Control

- Control Performance Standard 1 (CPS-1) is a measure of the frequency control on a power system, pursuant to NERC Standard BAL-001. The 12-month rolling-average of this measure is required to stay above 100%.



Key Takeaway: Frequency control has been performing extremely well.

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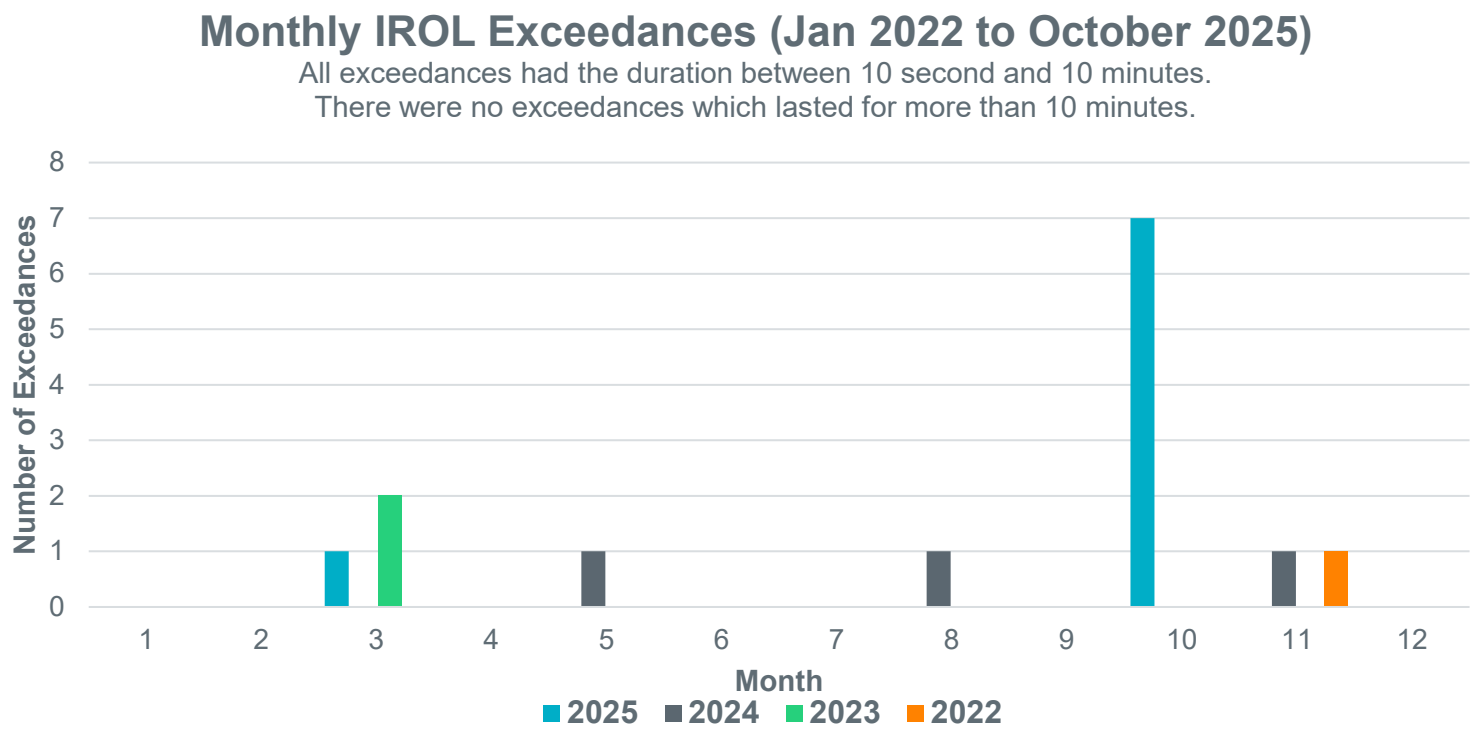
Transmission Limit Control

The most-recent Interconnection Reliability Operating Limit (IROL) exceedance occurred in October 2025.



Notes:

- 10/11/25: McCamy IROL Exceedance for 30 secs at 1:25 PM, likely due to basepoint deviations by multiple units contributing to IROL exceedance.
- 10/20/25: I_FW_N IROL Exceedance at 1:01 AM for ~9 min and at 1:52 AM for ~5 min was from a wind resource(s) deviating from negative basepoint to back down gen on both units.
- 10/28/25: I_FW_N IROL Exceedances at 12:16 PM and 2:26 PM for ~2min, as well as at 3:52 PM for ~4min was due to Limit and loading fluctuation needing manual SCED runs, due to the conflicting shift factors on two IROLs alleviating one exceeds the other as well as high IBR generation in WESTEX.
- 10/28/25: I_FW_N IROL Exceedance at 6:04 PM for ~6min was due to a wind resource(s) not following SCED curtailed basepoint, resulting in Operating instruction to take unit(s) offline until further notice due to inability to follow SCED curtailed basepoint.

Key Takeaway: In October, ERCOT had 7 IROL exceedances occur. None of these events exceeded 10 minutes or met the NERC Reportable IROL time of exceedance of 30 minutes.

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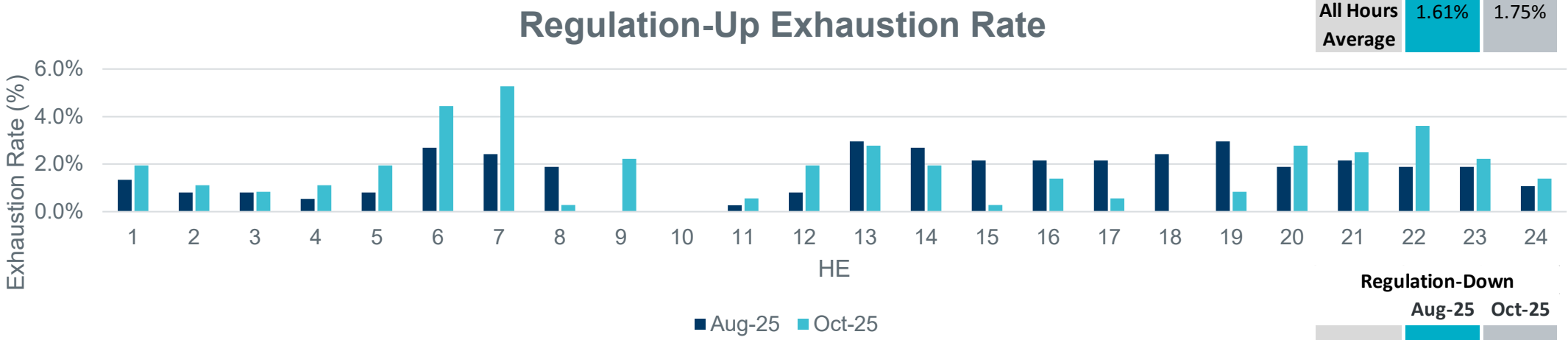
Regulation Service Deployments for Aug– Oct 2025

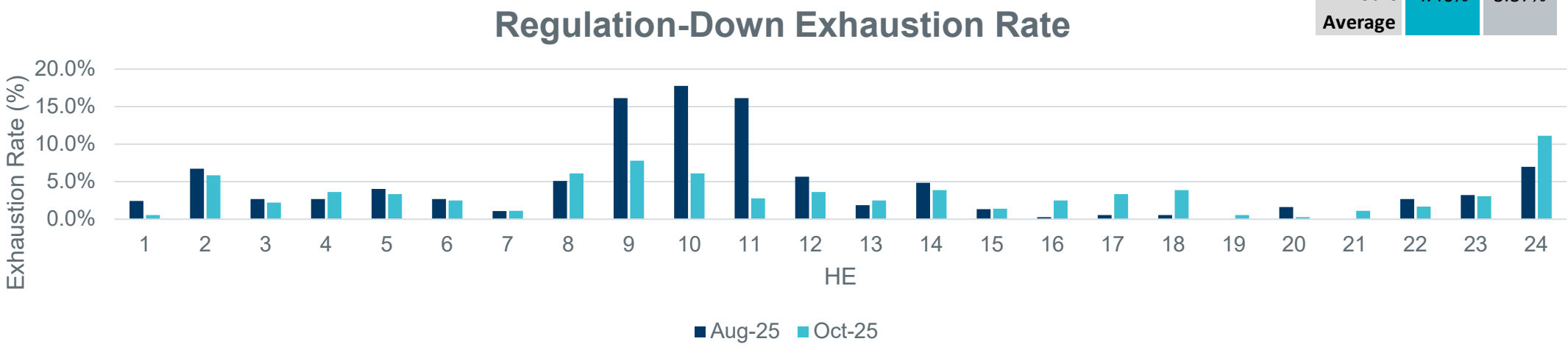
Regulation-Up

	Aug-25	Oct-25
All Hours Average	1.61%	1.75%



Regulation-Down

	Aug-25	Oct-25
All Hours Average	4.46%	3.37%



Key Takeaway: Average Regulation Up and Down exhaustion rates were similar in 2024.

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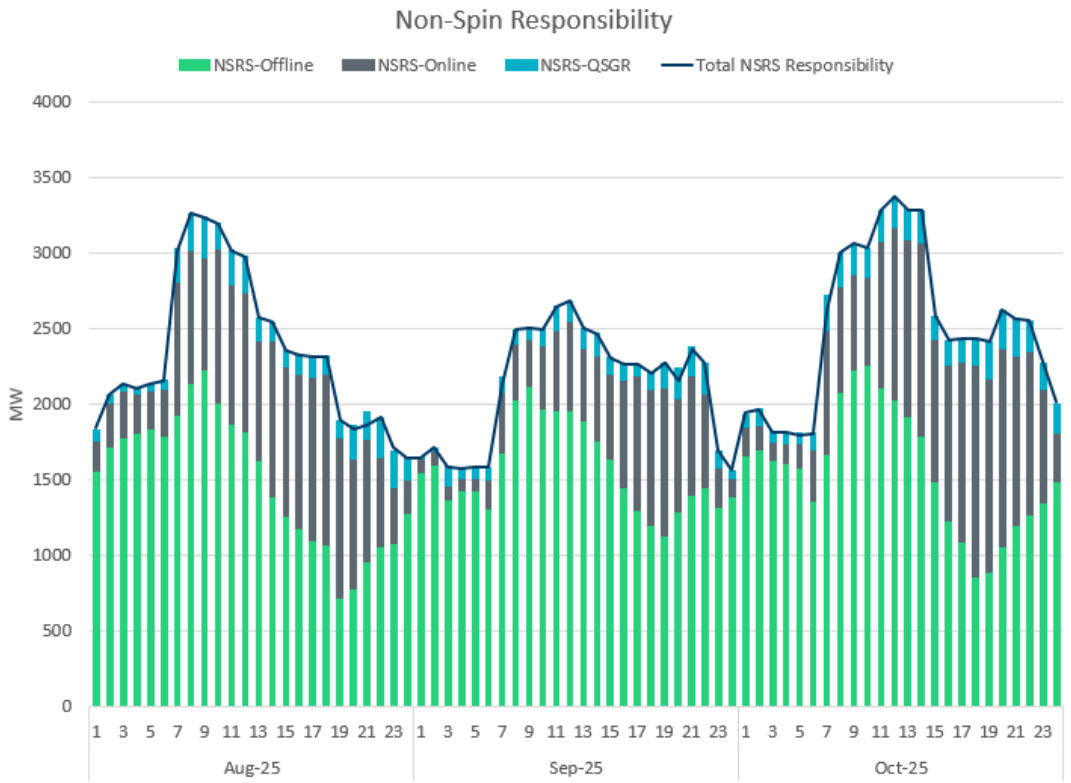
Non-Spinning Reserve Service (Non-Spin) Deployments for Aug - Oct 2025

From Aug to Oct 2025, there were 3 events that resulted in deployment of offline Non-Spin.

During this time, an average of ~32% of Non-Spin was provided using online capacity and by Quick Start Generation Resources. This type of Non-Spin is always available to SCED to dispatch (with an offer floor of $75) and no operator action is needed to deploy this capacity.

Deployment Start Time	Deployment Duration	Max Deployment (MW)
9/4/2025 18:50	01:29:47	1031.1
9/26/2025 18:34	00:48:43	1408.9
10/21/2025 17:45	02:38:30	596.7



Key Takeaway: All recent Non-Spin deployments were to meet 30-minute ramping needs. Non-Spin performed well in all deployments.

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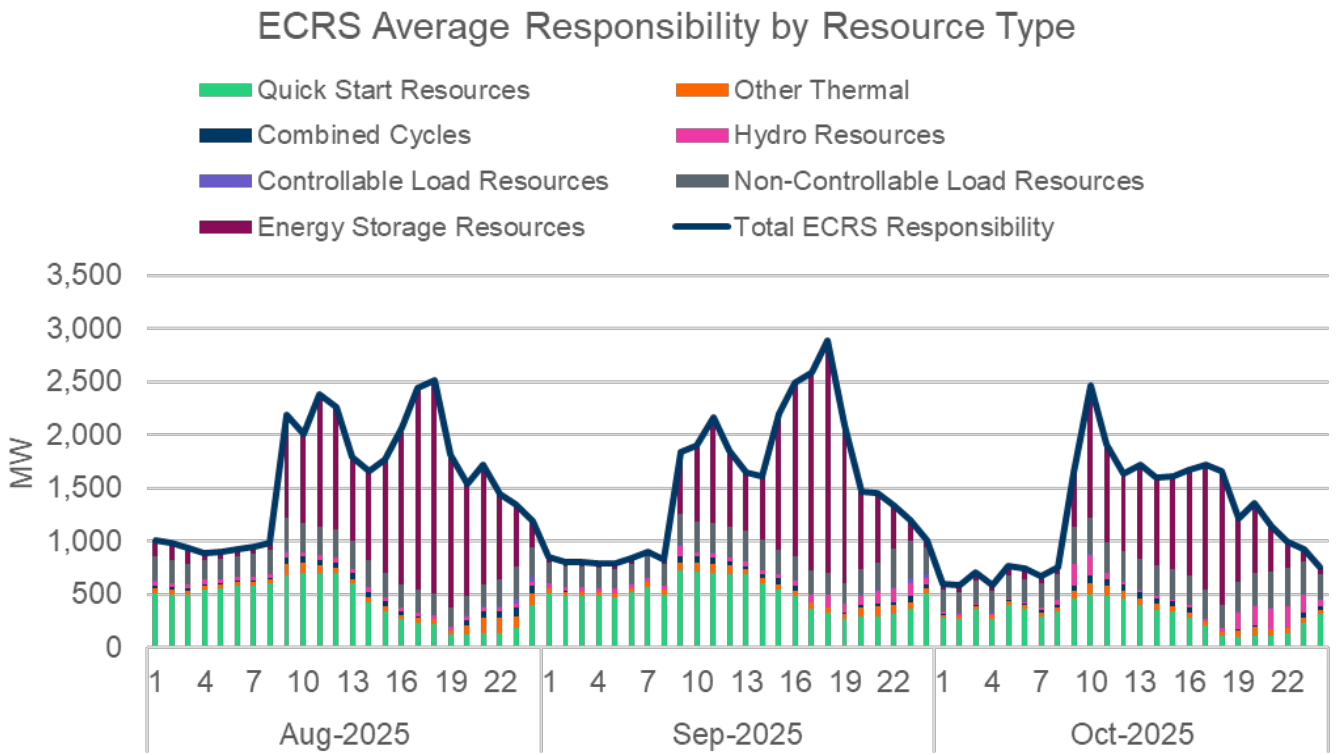
ERCOT Contingency Reserve Service (ECRS) Release for Aug-Oct 2025

From Aug to Oct 2025, there were no events that resulted in the release of SCED dispatchable ECRS.

Deployment Start Time	Deployment Duration	Maximum SCED Dispatchable MW Released	Reason
N/A	N/A	N/A	N/A



Key Takeaway: There were no events that resulted in events that triggered ECRS deployments.

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Responsive Reserve Service (RRS) Released for August-October 2025

From August to October 2025, there was no manual release of RRS.

With the implementation of ECRS, RRS capacity autonomously deploys when frequency exceeds the frequency dead-band. RRS may be manually released to SCED during scarcity events when additional capacity is needed.

Key Takeaway: There was no manual RRS release from August-October 2025.

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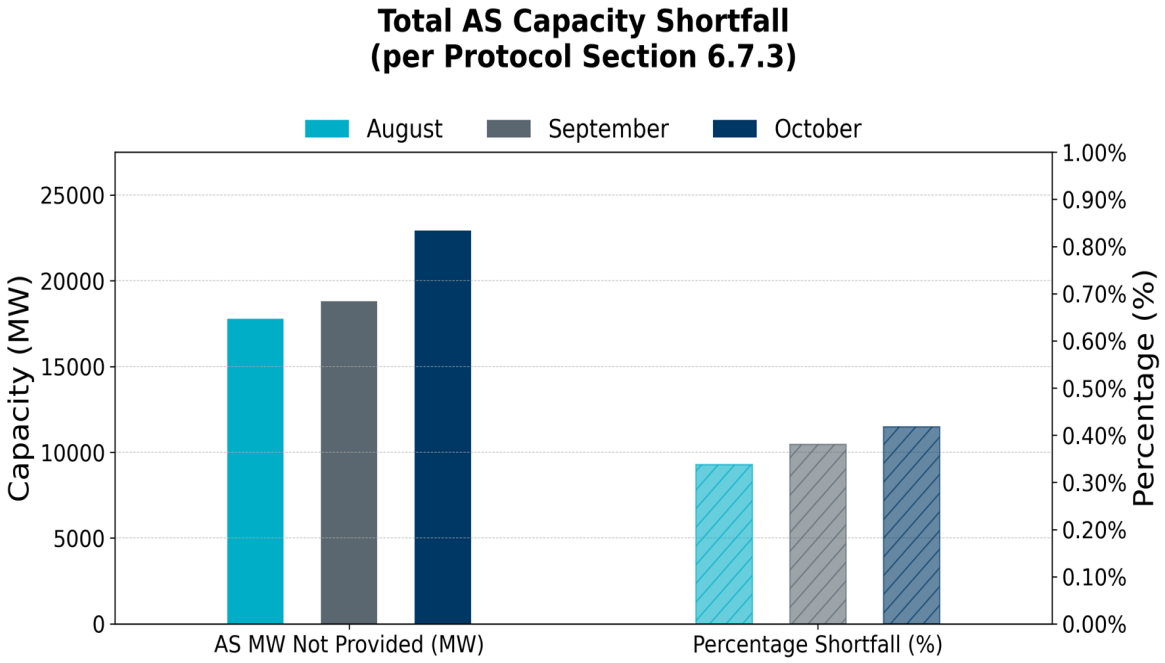
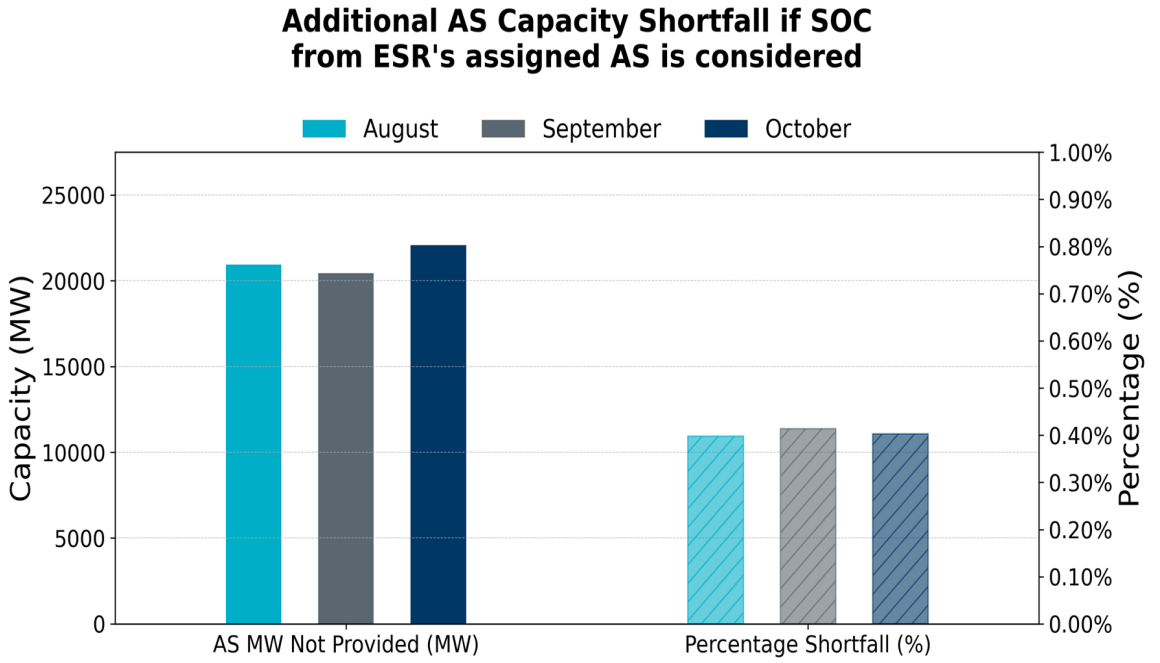
AS MW Shortfall Analysis





Key Takeaways: A (small) portion of the procured AS is not being assigned to resources (regardless of technology type) by QSEs and is not available in Real Time. The magnitude of AS capacity unavailable in Real Time increases further if SOC from ESRs that are assigned AS is considered.

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2025 Year-to-Date (YTD) Event Analysis Summary

Event Type	Number of Events (YTD)	Number of Events (Since Last BOD)
NERC Reportable by ERCOT*	0	0
Inverter Based Resource (IBR) Ride-Through Events	12	0
Large Load Ride-Through Events	11	4
Large Load Oscillation Events	1	1
IBR Oscillation Events	23	7
IBR Large MW Change Events (no fault associated)	32	13
Miscellaneous (Transmission or Telemetry Event)	4	0

Key Takeaway: Numerous events have occurred in 2025, and the Event Analysis team investigates each event to keep the system reliable and prevent reoccurring issues. Have previously talked about IBR and Large Load Ride Through Events; will provide examples of IBR Oscillations and Large MW Changes.

*Meeting the criteria for NERC's Electric Reliability Organization Event Analysis Process and requiring ERCOT to submit a report.

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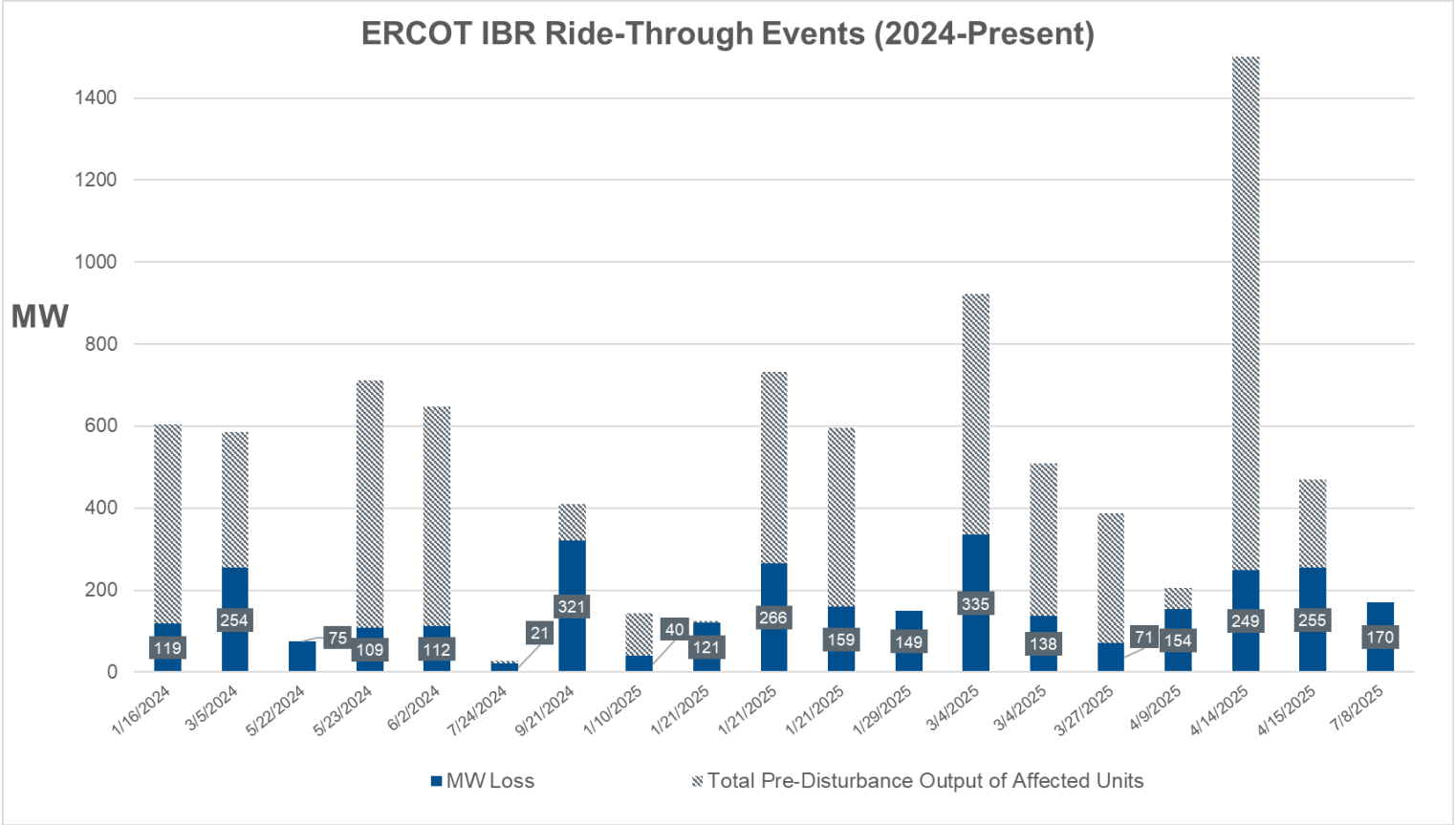
IBR Ride-Through Events



Key Takeaway: ERCOT continues to have IBR ride-through events, although the magnitude of events has remained below 500 MW. No ride-through events have occurred since July 2025. The most common cause of ride-through failure has been individual turbines tripping on a variety of different fault codes such as UPS failure, crowbar circuit failure, vibration sensors, etc. Also, improper frequency measurements during fault events have caused Power Plant Controllers to inhibit proper ride-through operation of turbines and inverters.

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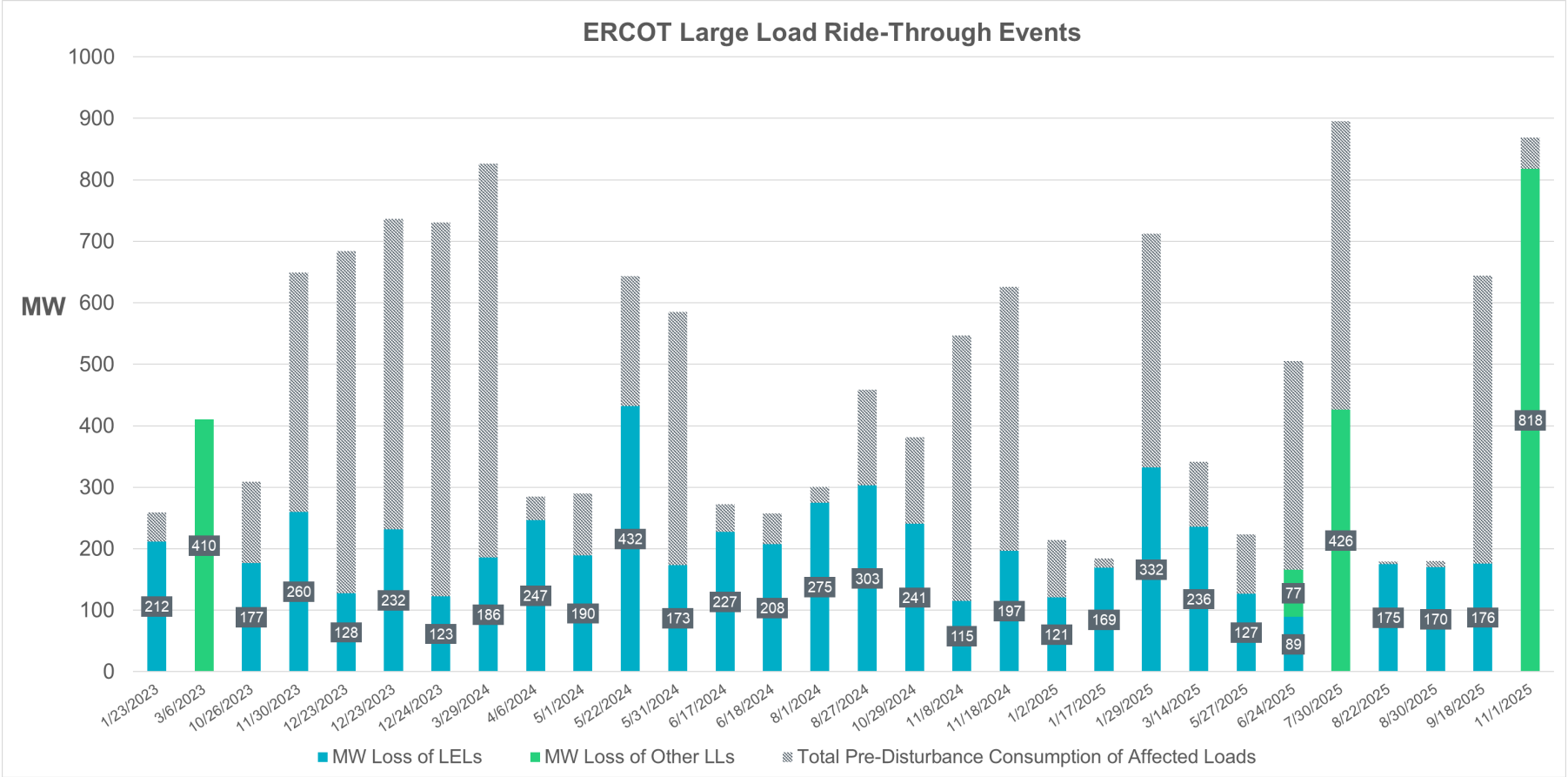
Large Load Ride-Through Events



Key Takeaway: 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.