Item 9.2: System Operations Update

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Reliability and Markets Committee

ERCOT Public
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Overview

- **Purpose**
  - Provide an update on key operational metrics to the R&M Committee
  - Provide information on recent Ancillary Services performance
  - Provide information on hot topics

- **Voting Items / Requests**
  - No action is requested of the R&M Committee; for discussion only

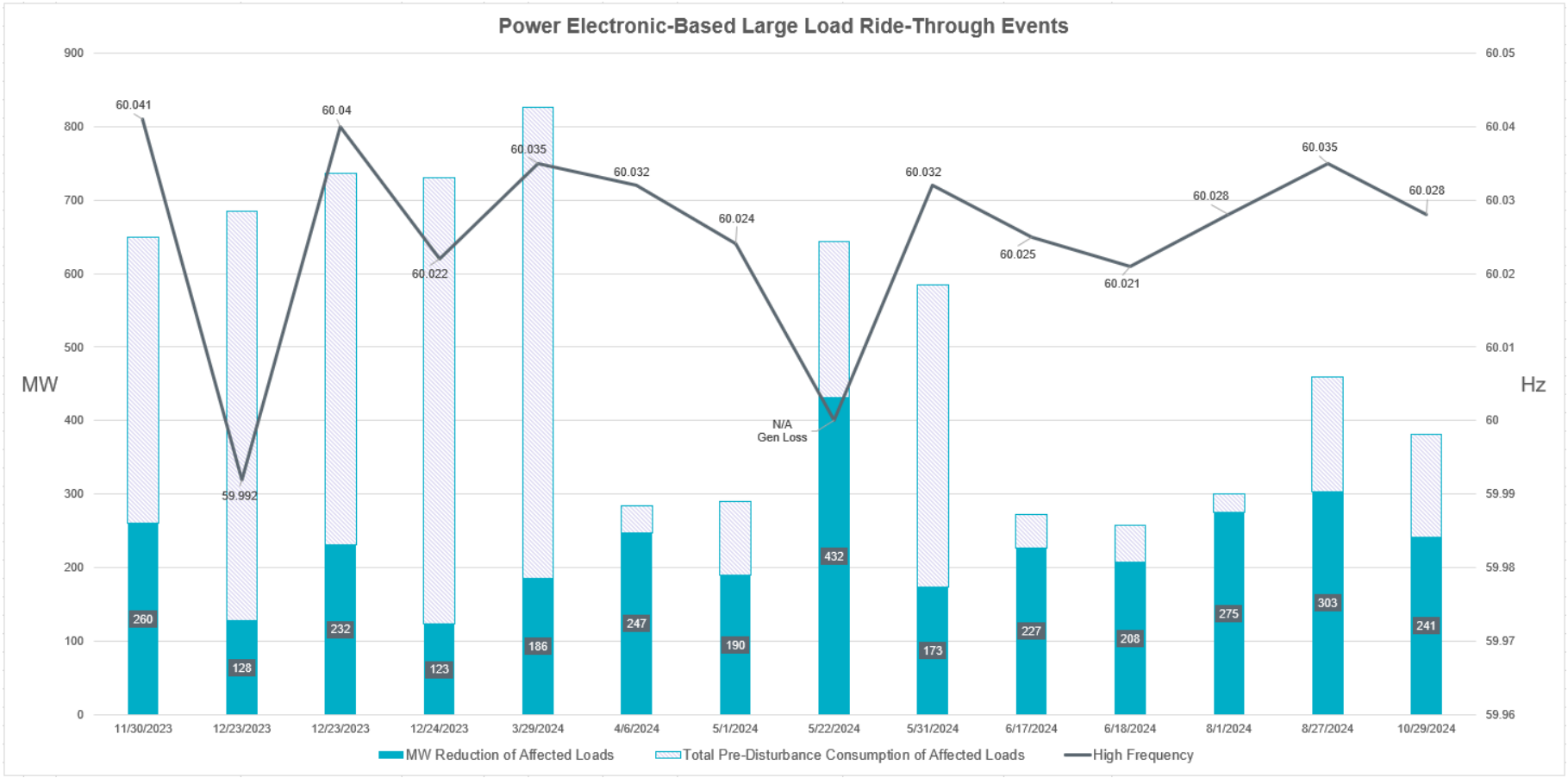
- **Key Takeaways**
  - Two topics this month to provide background on upcoming revision requests:
    - Power electronic Large Loads reduce consumption instantly when system faults occur in their area. The magnitude and frequency of these events will likely increase as more of these types of loads are connected to the system.
    - Subsynchronous Resonance (SSR) events continue to occur despite ERCOT requirements for SSR mitigation to dampen oscillations before unit(s) trip. SSR can cause equipment damage, loss of generation, and loss of load.

Overview (continued)

- **Key Takeaways (continued)**
  - Non-IRR forced and planned outages were relatively similar throughout the fall of 2023 and 2024. There was a spike in Non-IRR forced outages in October 2024.
  - The EV forecast is growing slightly slower than anticipated due to a decline in EV sales.
  - ERCOT has an updated White Paper on Inertia in the ERCOT Region
  - This winter is forecasted to see above normal temperatures and below normal precipitation across most-to-all of Texas. Recent trends suggest the potential for a period of cold extremes this winter is greater than normal.
  - All key operational metrics are trending well, and all Ancillary Services are performing well.

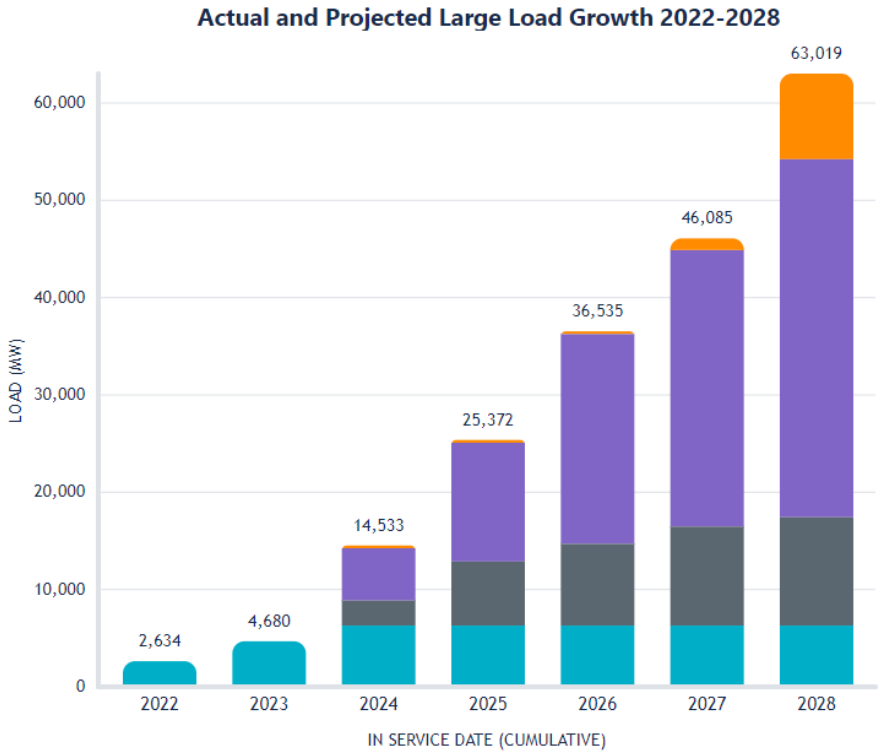
Large Load Events

Power Electronic Large Load Ride-Through Events



Key Takeaway: Power electronic Large Loads reduce consumption instantly 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.

Tracking Large Loads with Short Timelines to Interconnect



Project Status	2022	2023	2024	2025	2026	2027	2028
No Studies Submitted	-	-	290	290	290	1,190	8,802
Under ERCOT Review	-	-	5,375	12,205	21,554	28,424	36,788
Planning Studies Approved	-	-	2,571	6,580	8,394	10,174	11,133
Approved to Energize	2,634	4,680	6,297	6,297	6,297	6,297	6,297
Total (MW)	**2,634**	**4,680**	**14,533**	**25,372**	**36,535**	**46,085**	**63,019**

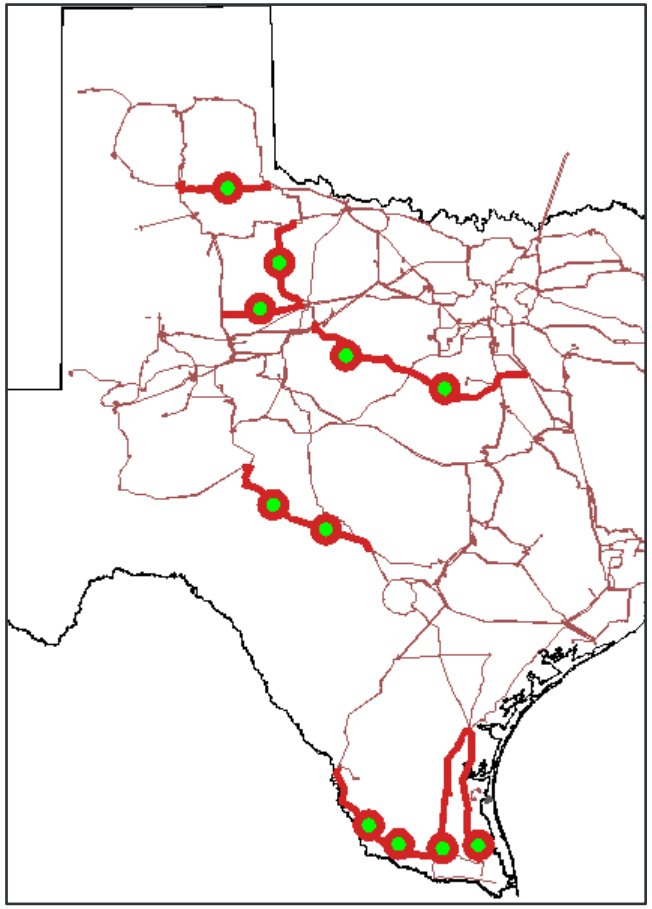
- This chart does not include Large Load projects with longer interconnection timelines (such as most hydrogen/electrofuels projects)

Key Takeaway: Large Loads are projected to continue to rapidly interconnect in ERCOT. ERCOT has proposed PGRR 122 to limit the increase in magnitude of lack of ride-through events of as more power electronic-based Large Loads connect in certain areas like Far West Texas.

Subsynchronous Resonance (SSR) Events

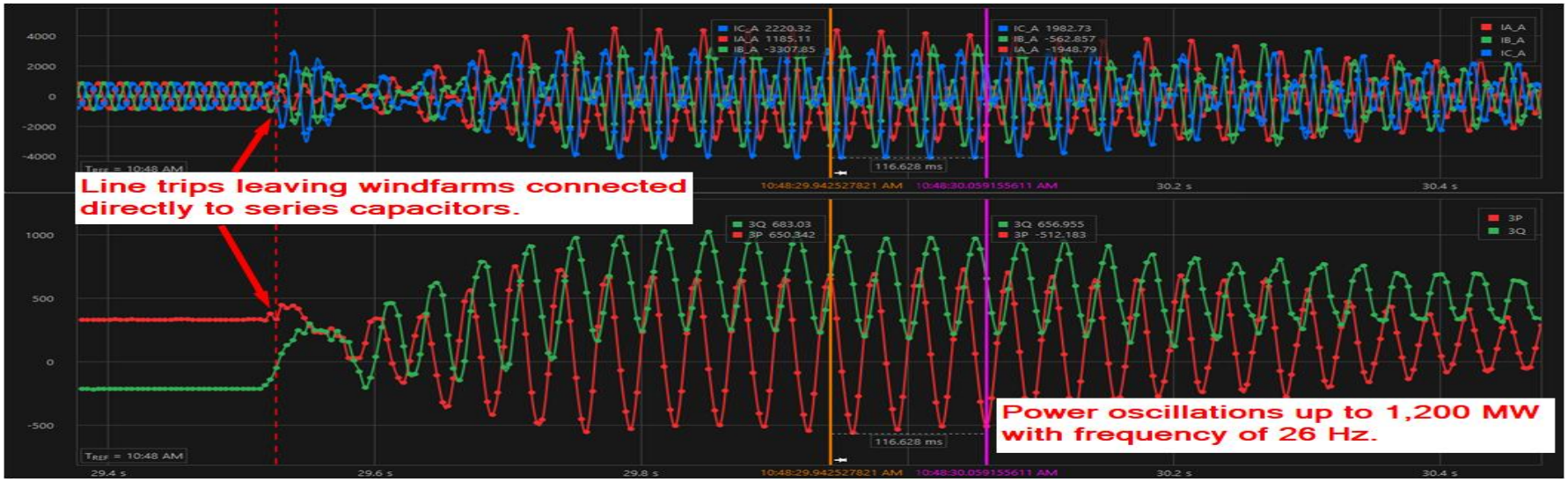
ERCOT Series Capacitor Background

- The ERCOT system has 11 TSP-owned series capacitors.
- Series capacitors in West Texas help transfer renewable generation and were constructed in 2013 as part of the CREZ transmission plan.
- Series capacitors in South Texas were constructed to increase transfers to serve load in the Valley.



Subsynchronous Resonance (SSR) Background

- SSR can occur when a Generation Resource becomes directly connected to a series capacitor.



- ERCOT requires SSR mitigation to dampen oscillations before unit(s) trip. SSR mitigation can be hardware, controller adjustment, or a procedure.
- Some Generation Resources are locating directly on series compensated circuits; SSR mitigation becomes significantly more complex in these cases.

Key Takeaway: SSR mitigation is more complex for Generation Resources connected to series compensated lines.

Historical SSR Events in ERCOT

- Real-time SSR events continue to occur in ERCOT, despite SSR mitigation being in place.

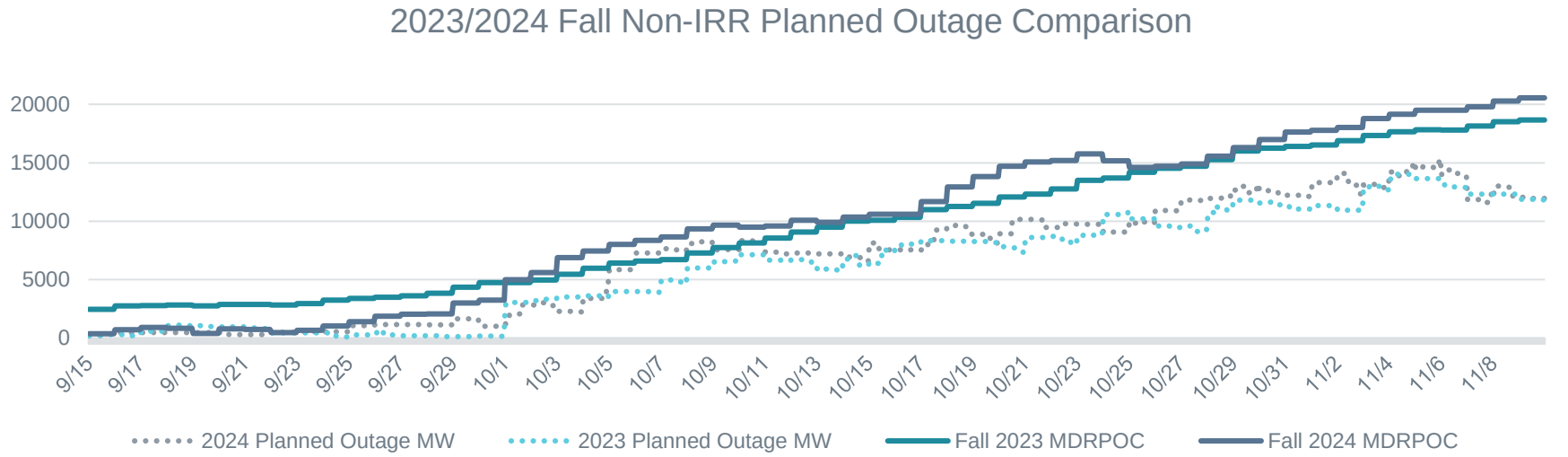
Year	Area of SSR Events	Number of SSR Events
2009	South TX	1
2017	South TX	2
2018	South TX	1
2023	South TX	3
	North TX	1

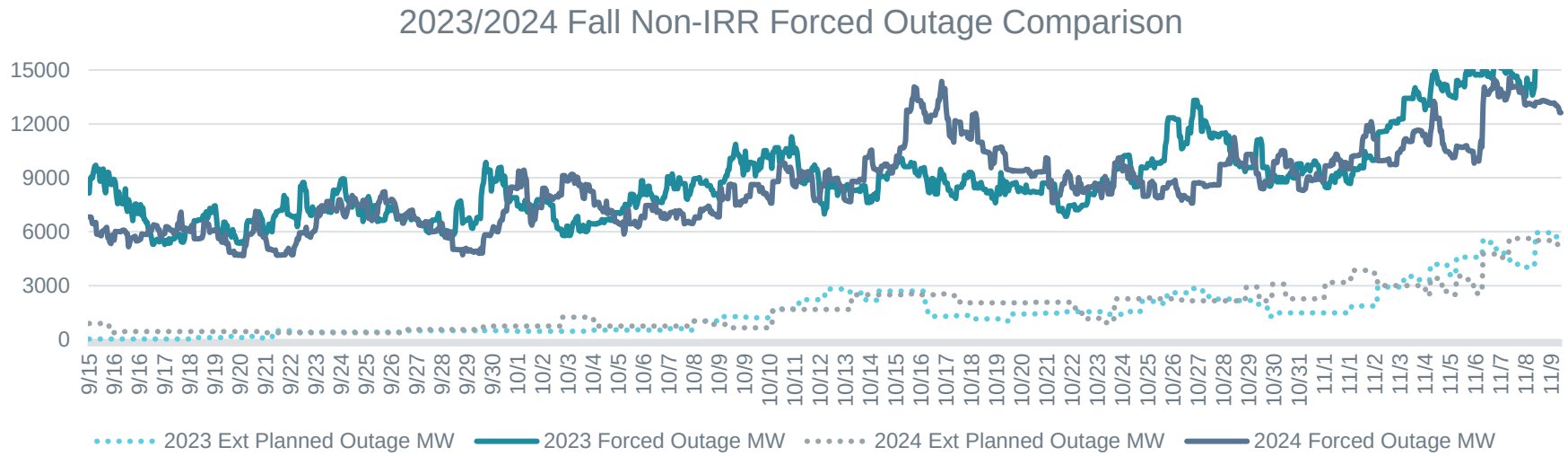
- The 2009 SSR event resulted in damage to a wind farm.
- PGRR120 SSO Prevention for Generator Interconnection was submitted by ERCOT on 10/14/2024 to avoid future direct connection to series compensated circuits.

Key Takeaway: SSR events continue to occur despite current ERCOT requirements; ERCOT has proposed PGRR 120 to better mitigate this risk.

2023 and 2024 Fall Outage Comparison

Fall Outage Comparison

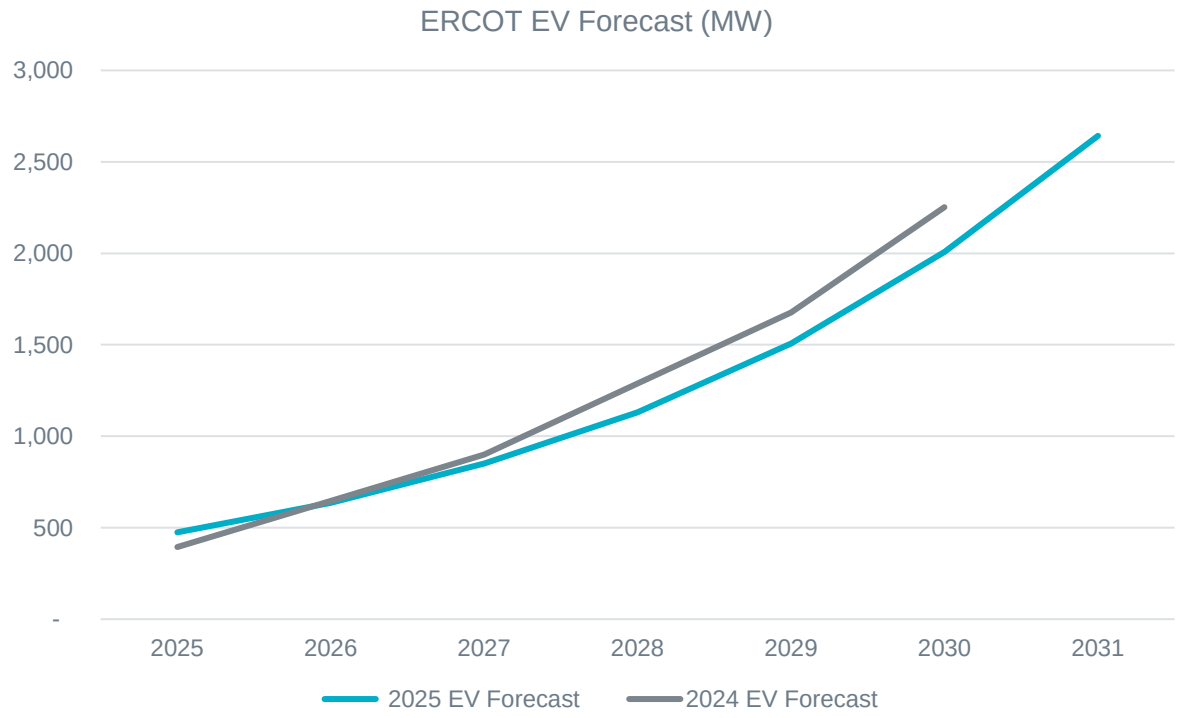




Key Takeaway: Non-IRR forced and planned outages were relatively similar throughout the fall of 2023 and 2024.
Extended Planned Outages account for most of the difference between Planned Outages and MDRPOC.

Electric Vehicle (EV) Forecast Update

Electric Vehicle (EV) Forecast

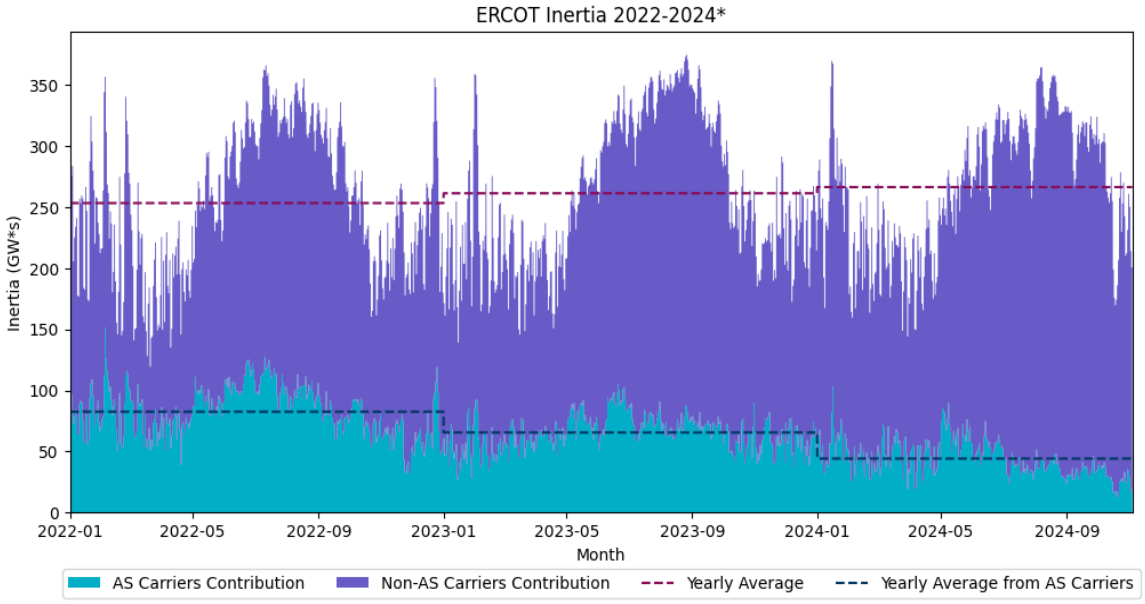


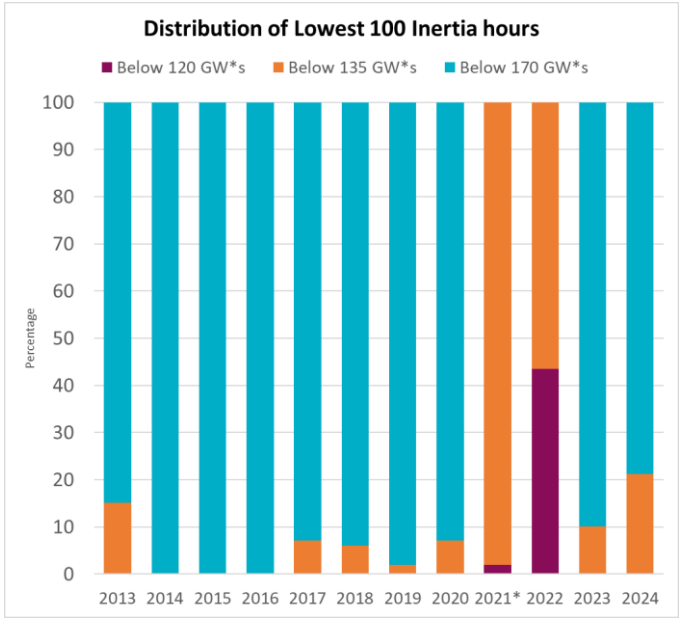
Year	2025 ERCOT EV Forecast (MW)
2025	475
2026	636
2027	852
2028	1,130
2029	1,507
2030	2,007
2031	2,642

Key Takeaway: The EV forecast is growing slightly slower than anticipated due to a decline in EV sales.

Inertia White Paper Updated

Updated Inertia Whitepaper





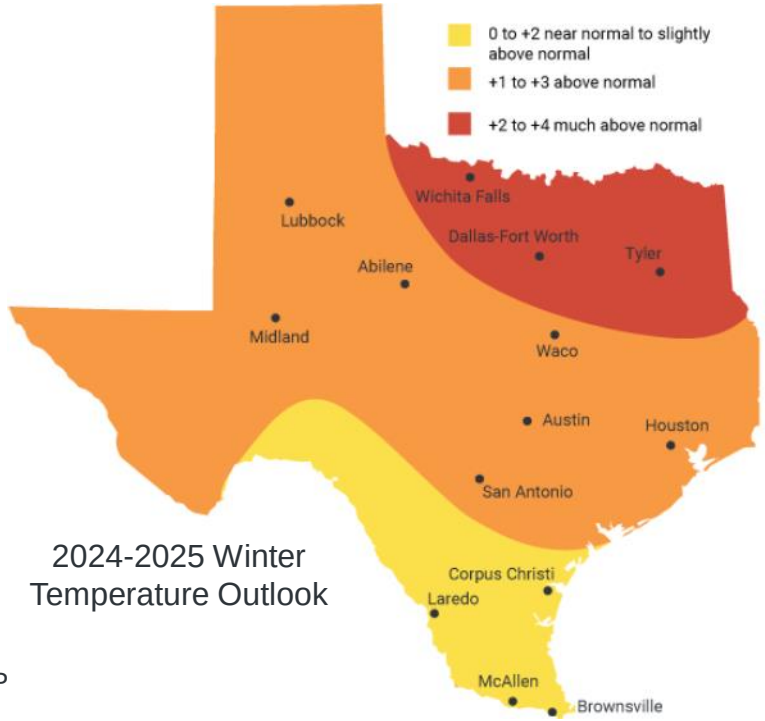
- While installed renewable capacity tripled in the ERCOT region from 2013-2020, so far, the overall range and yearly minimum inertia have not changed drastically.
- Factors such as growth in ERCOT's minimum load, transmission constraints that limit renewable production and relatively low fuel prices have influenced the thermal unit commitments and total system inertia.

Key Takeaway: ERCOT has posted an updated Inertia Whitepaper to the Trending Topic section of ercot.com. The document reviews inertia trends over recent years.
Overall minimum inertia has not seen a decline, but it is important to continue monitoring the trends in inertia.

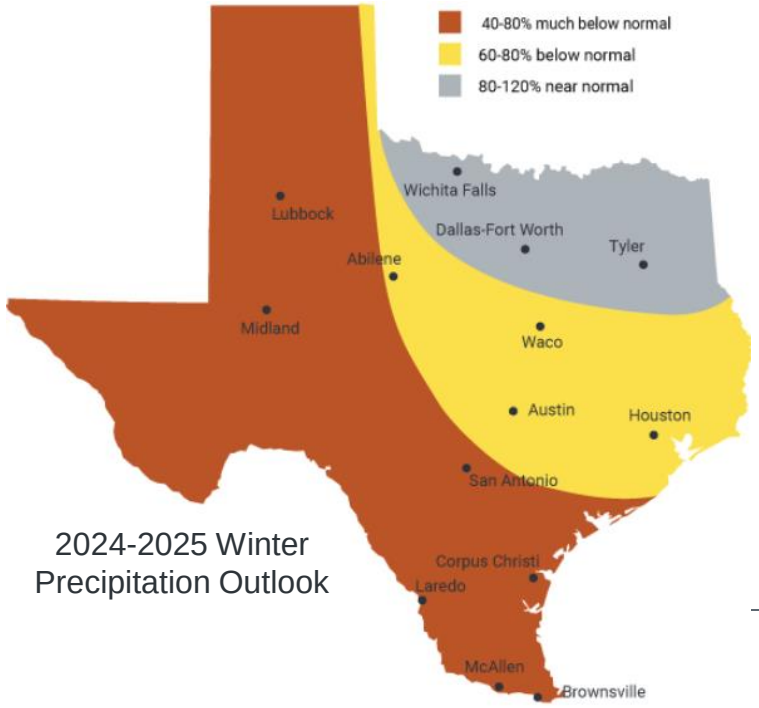
Winter Weather Outlook

Winter 2024-2025 Weather Outlook

- This winter is forecasted to generally see above normal temperatures and below normal precipitation across most-to-all of Texas.
- Recent trends suggest the potential for a period of cold extremes this winter is greater than normal. It doesn't mean that it will happen, but most of the same ingredients from recent winters with cold outbreaks are still in place.
- Drought is becoming an increasing concern. The winter outlook suggests it could be even worse heading into next spring. Currently, 68% of the state's area is in moderate or worse drought (most in over a year).



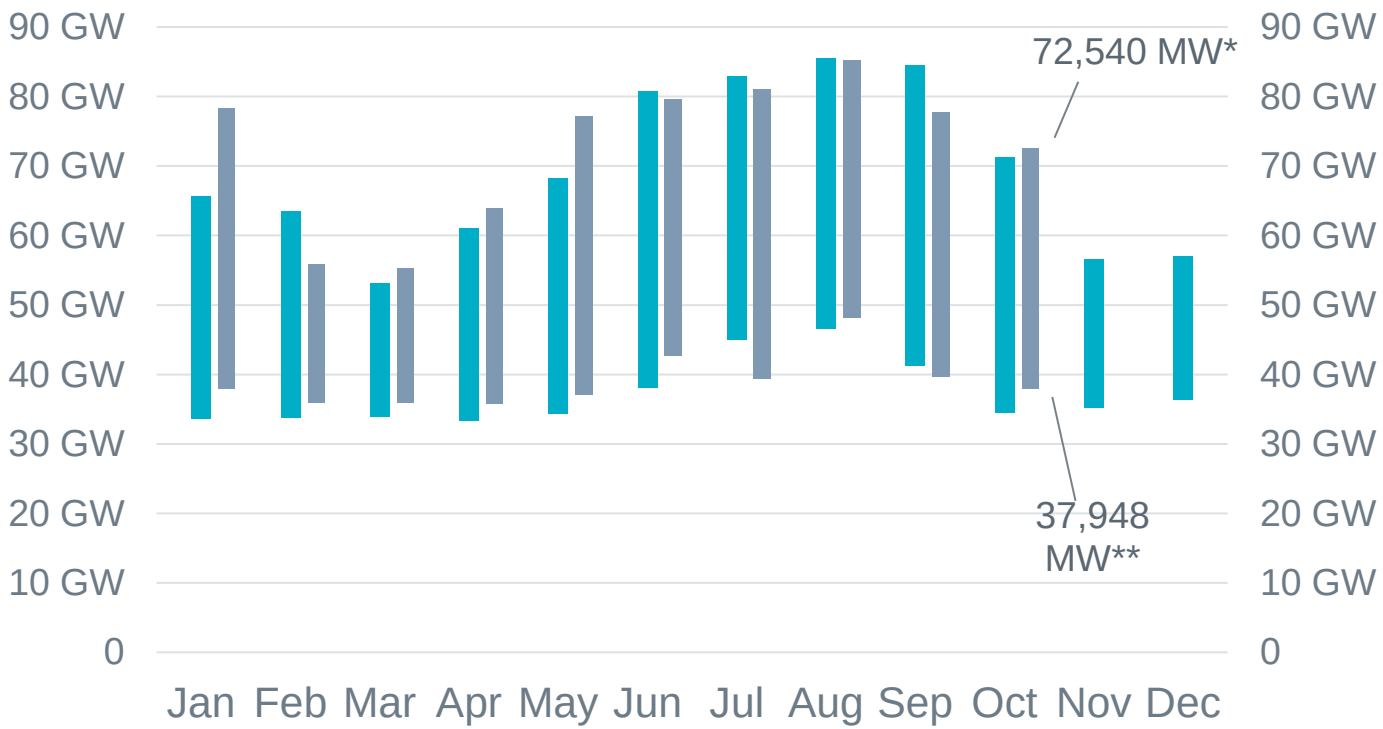
2024-2025 Winter Temperature Outlook



2024-2025 Winter Precipitation Outlook

Appendix
Operational Metrics and AS Performance

Demand



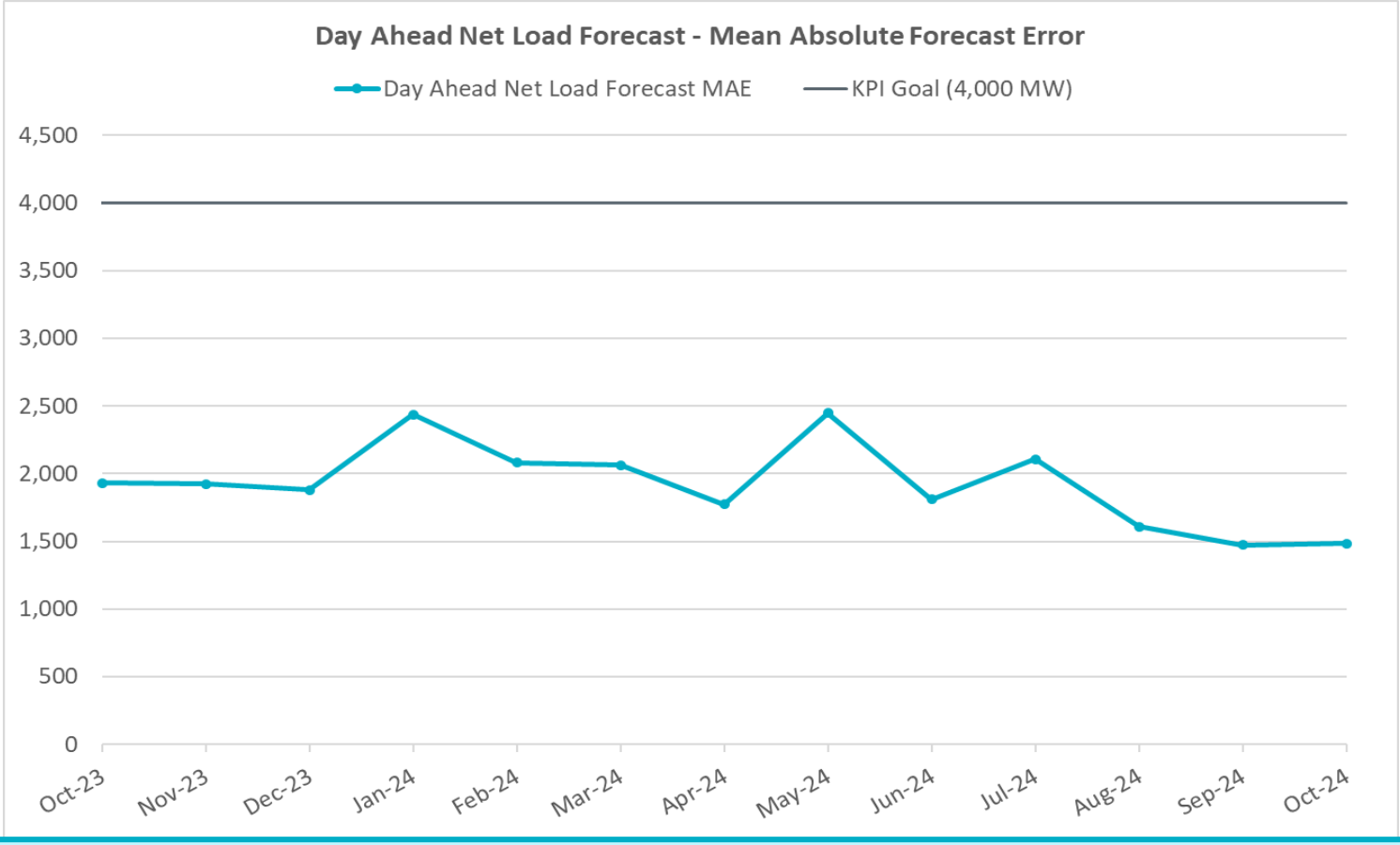
*Based on the maximum net system hourly value from October release of Demand and Energy 2024 report.

**Based on the minimum net system 15-minute interval value from October release of Demand and Energy 2024 report.

Data for latest two months are based on preliminary settlements.

Key Takeaway: ERCOT set a new all-time record of 72,540 MW* for the month of October on 10/03/2024; This is 1,306 MW more than the October 2023 demand of 71,234 MW.

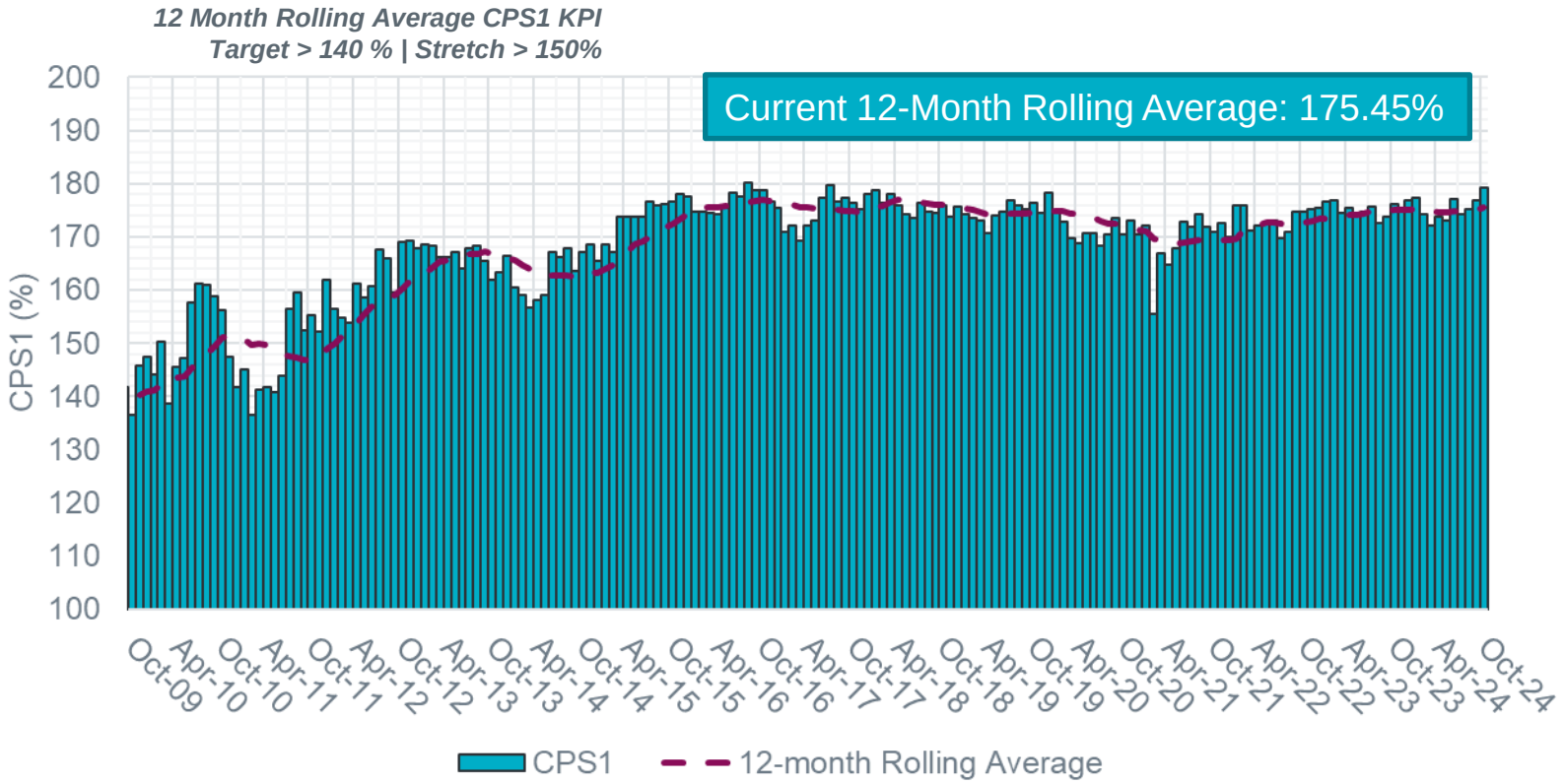
Forecast Performance



Key Takeaway: Day Ahead Net Load Forecast Mean Absolute Forecast Error is a new Key Performance Indicator from 2023. This metric has met the target and has been trending well.

Frequency Control

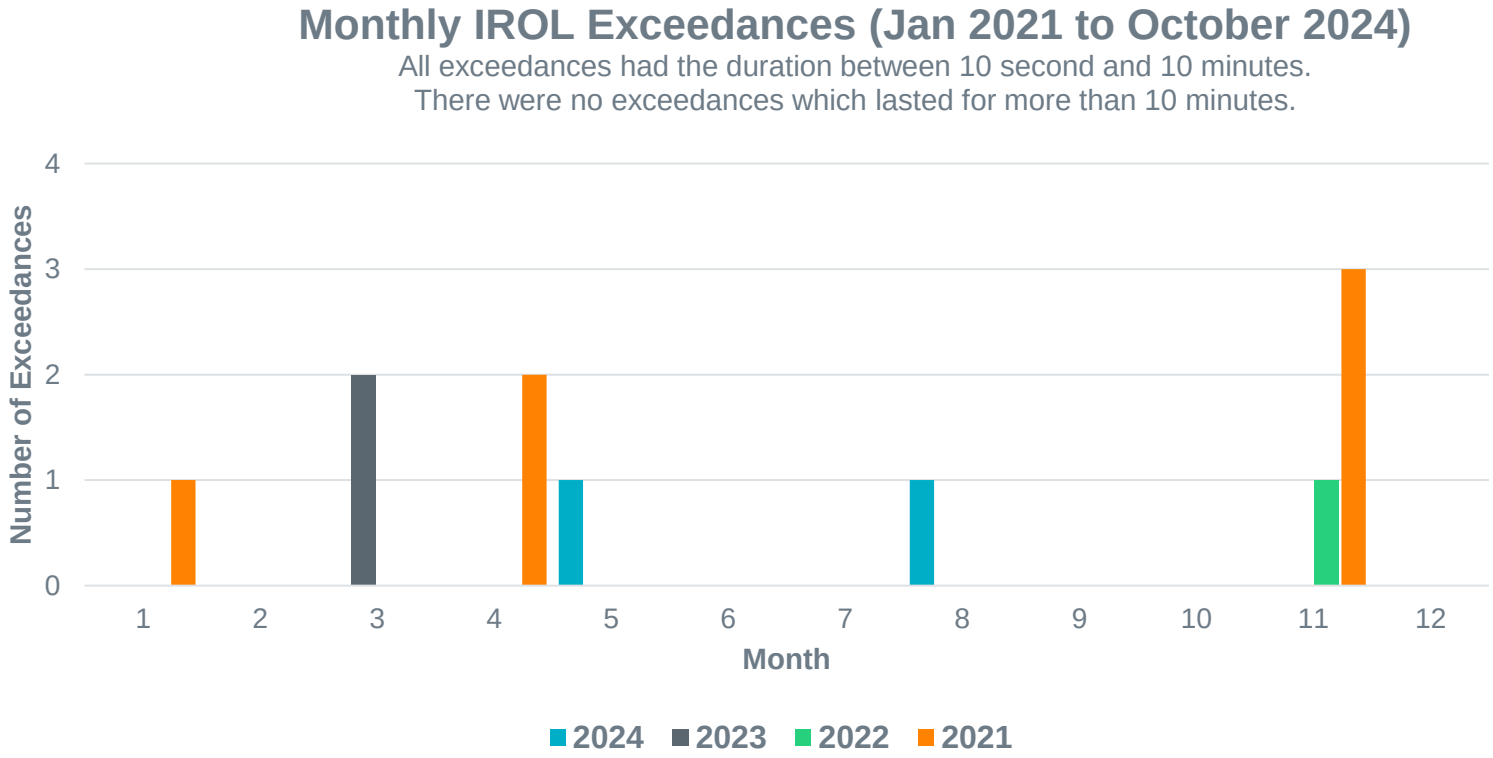
- Control Performance Standard 1 (CPS-1) is a measure of the frequency control on a power system, pursuant to NERC Standard BAL-001. The 12-month rolling-average of this measure is required to stay above 100%.



Key Takeaway: Frequency control has been performing extremely well.

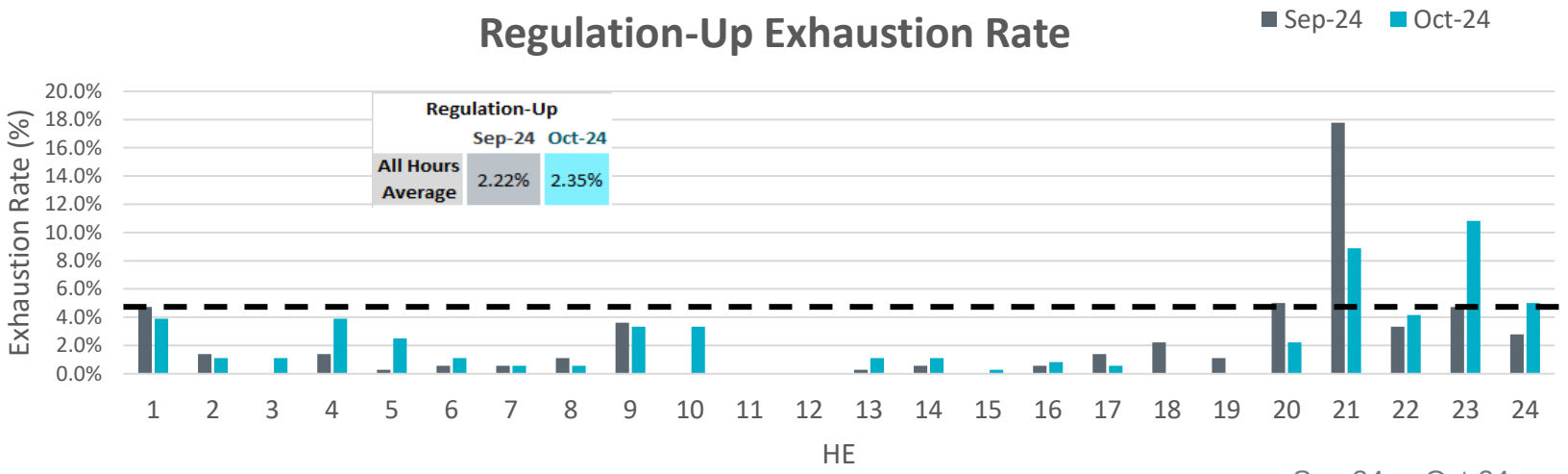
Transmission Limit Control

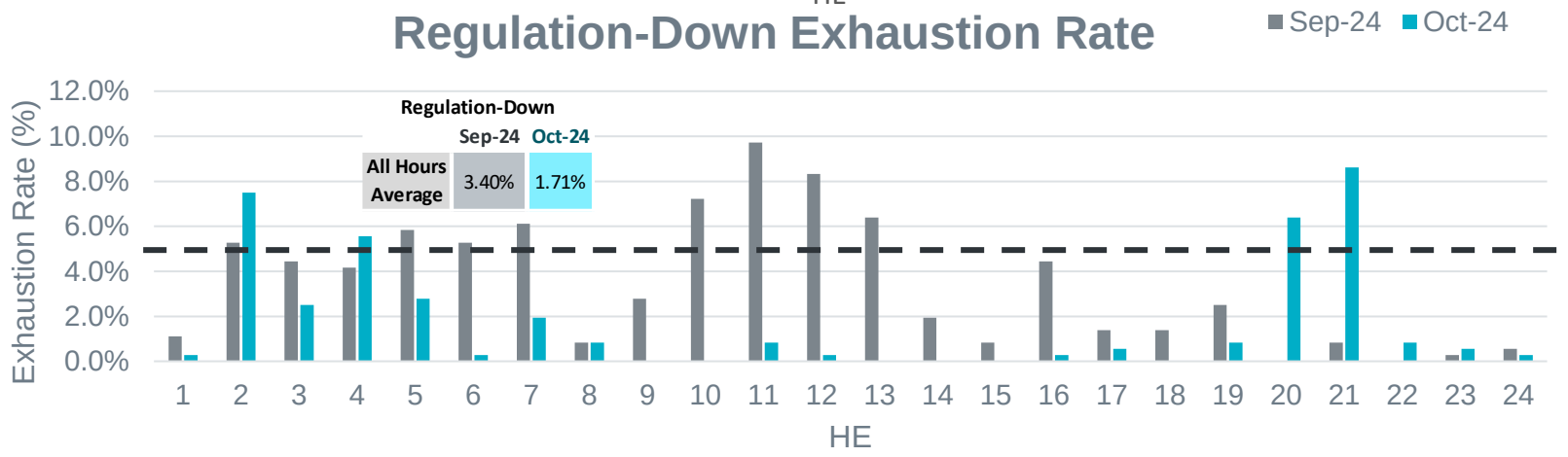
- The most-recent Interconnection Reliability Operating Limit (IROL) exceedance occurred in August 2024.



Key Takeaway: E_PASP IROL exceeded on August 14, 2024 for approximately 1 minute due to limit dropping.

Regulation Service Deployments for September-October 2024





Exhaustion Rate = % of 5 min intervals when all available Reg is less than 5 MW

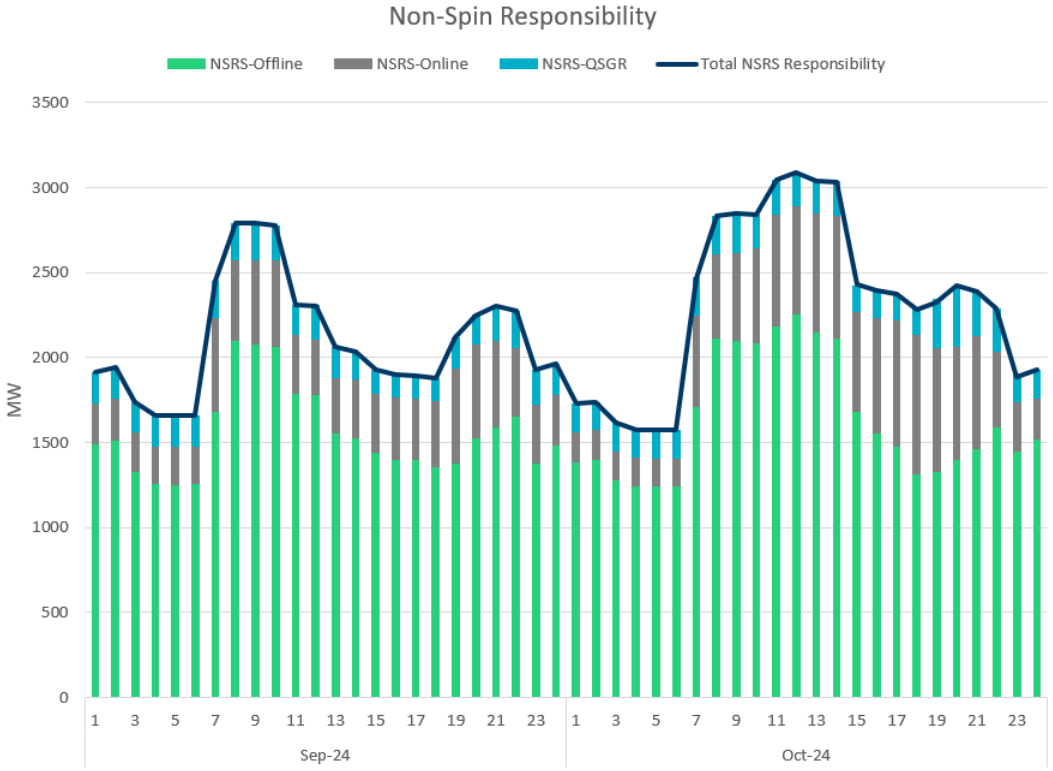
Key Takeaway: Average Regulation Up and Down exhaustion rates were similar in 2023.

Non-Spinning Reserve Service (Non-Spin) Deployments for Sep-Oct 2024

From September to October 2024, there were 13 events that resulted in deployment of offline Non-Spin.

During this time, an average of ~28% 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)
9/29/2024 18:28	01:51:39	1153.5
10/2/2024 18:08	01:27:39	1340.7
10/6/2024 18:26	00:38:48	448.69
10/11/2024 18:19	00:52:25	867.9
10/12/2024 17:53	00:56:58	627.3
10/13/2024 17:41	01:37:42	1122.9
10/14/2024 17:35	01:39:43	1033.7
10/15/2024 17:34	01:40:27	1037.7
10/20/2024 17:52	00:58:54	599.5
10/22/2024 17:58	01:02:11	556.2
10/23/2024 17:24	01:55:20	547.25
10/26/2024 17:44	01:39:47	840.68
10/27/2024 17:36	01:38:50	1332.3

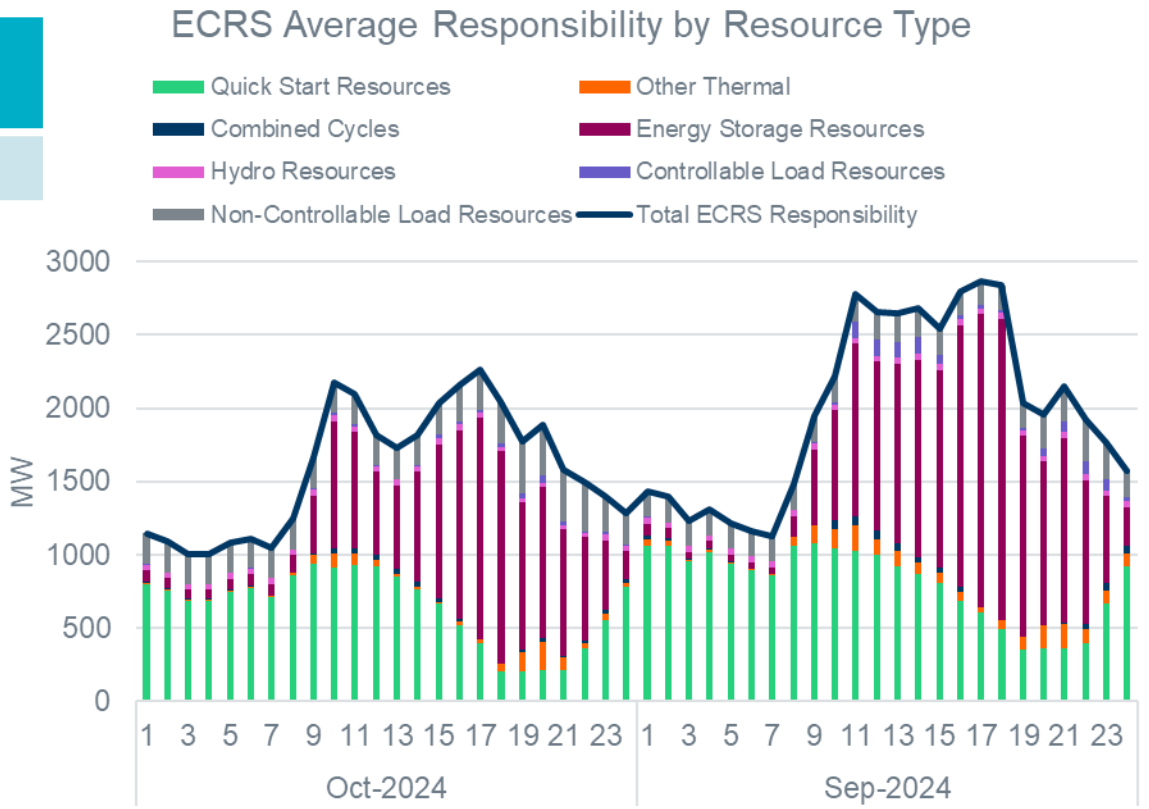


Key Takeaway: All recent Non-Spin deployments were to meet 30-minute ramping needs. Non-Spin performed well in all deployments.

ERCOT Contingency Reserve Service (ECRS) Release for Sep-Oct 2024

From September to October 2024, there were 0 events that resulted in the release of ECRS.

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



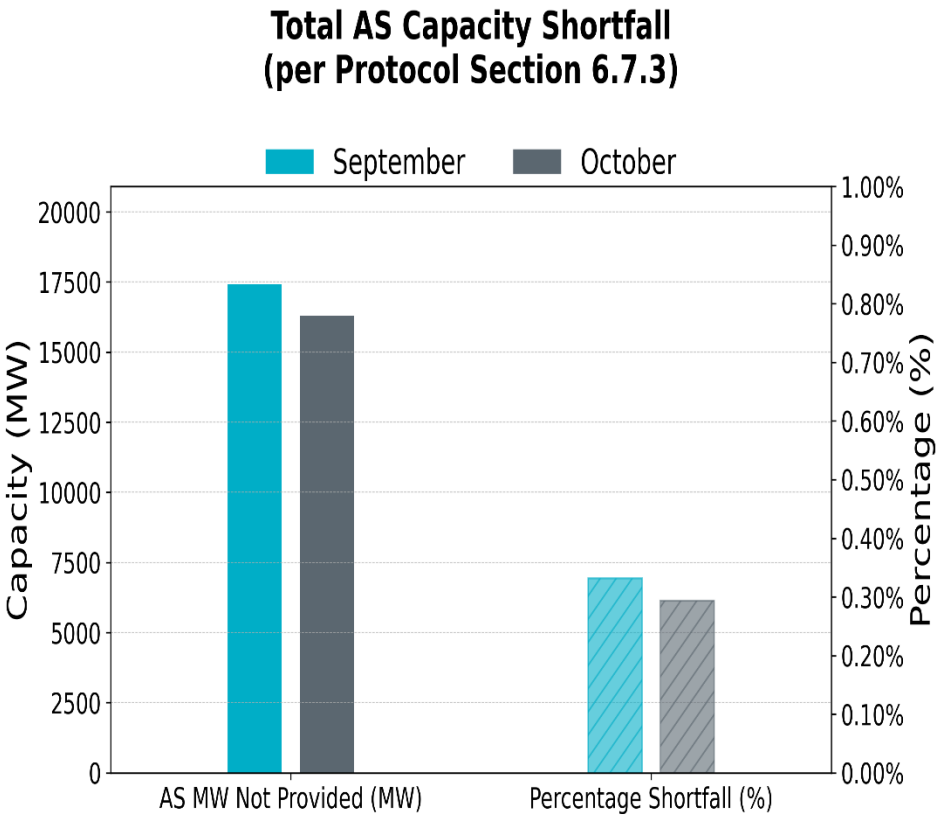
Key Takeaway: No ECRS Release from Sep-Oct 2024.

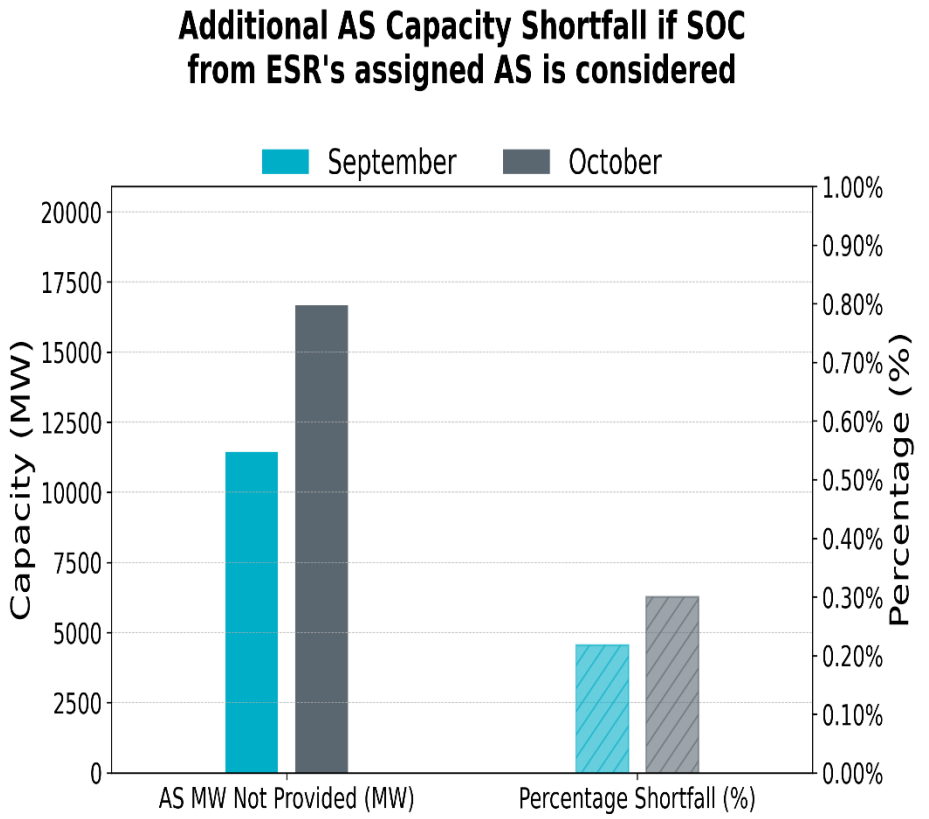
Responsive Reserve Service (RRS) Released for Sep-Oct 2024

- From September to October 2024, 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: No Manual RRS Release from Sep-Oct 2024.

AS MW Shortfall Analysis





Key Takeaway: 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.

****Capacity data (MW) is plotted on primary y-axis and percentage shortfall (%) is plotted with a pattern format on secondary y-axis. Percentages in both graphs are based on total AS procured.*