



Real-Time Co-optimization Plus Batteries (RTC+B) Program

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How ERCOT's shift to simultaneous energy and reserve clearing changes the way electricity markets work — and what it means for batteries as market resources.

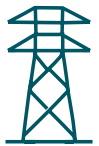
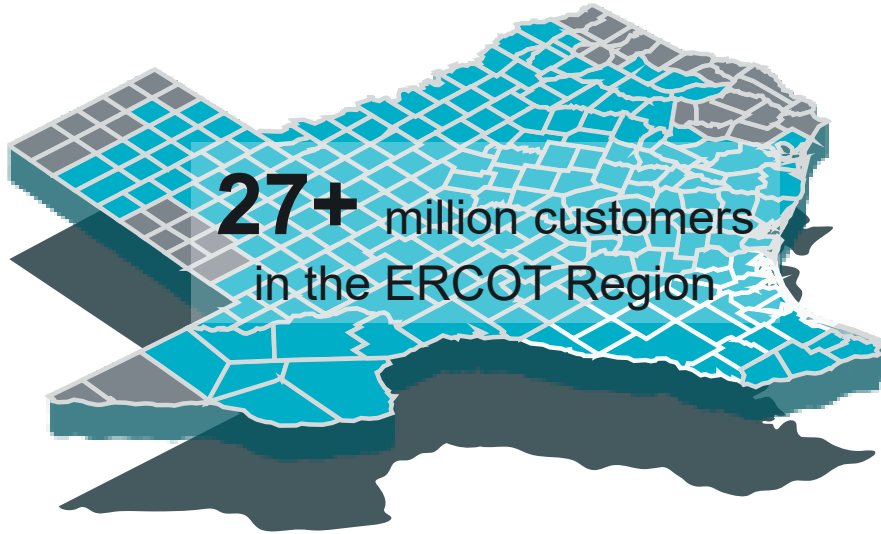
Outline:

- How the ERCOT market structured energy and reserve procurement before RTC+B
- What real-time co-optimization changes — and why it matters
- Early observations following RTC+B implementation

Key Takeaways

- RTC+B went live on December 5, 2025.
- Thus far, it is providing the benefits that we expected.
- Further stakeholder consultation will be necessary to refine certain parameters once we complete stabilization activities.

ERCOT Facts



~\$14 billion Transmission projects endorsed in 2025



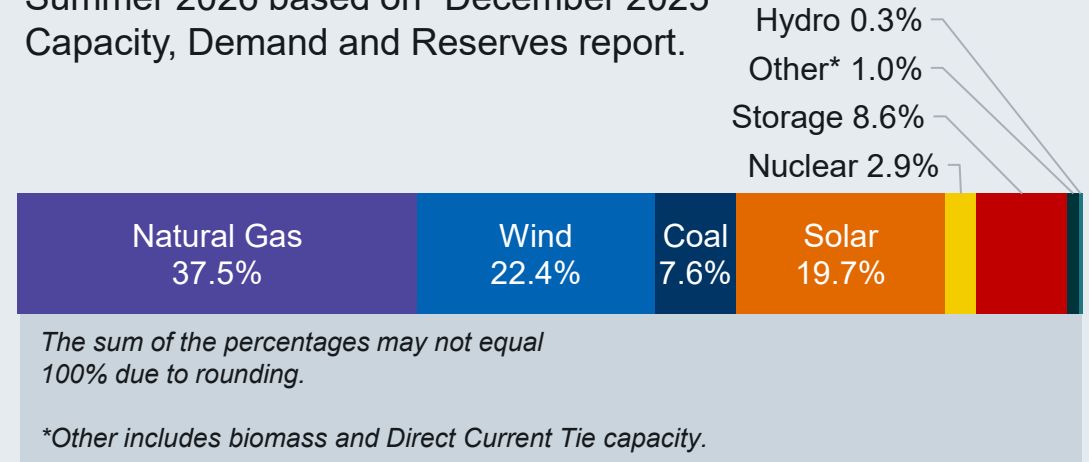
1,460+ generating units, including PUNs



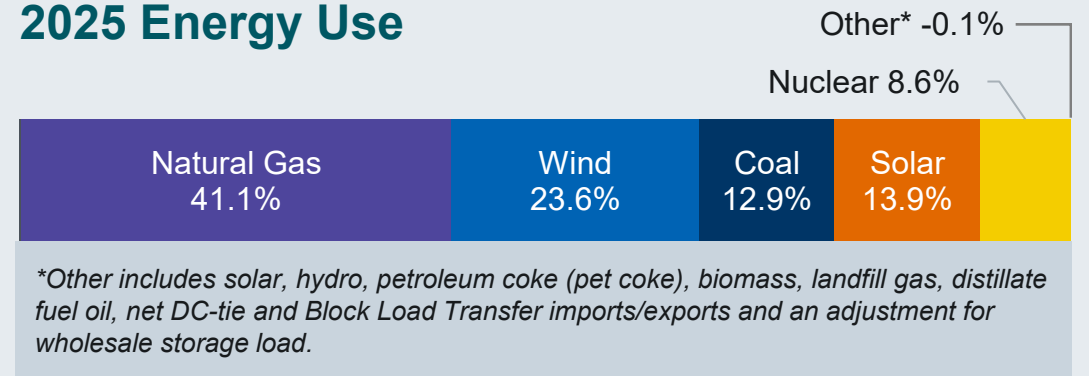
1,928+ active Market Participants that generate, move, buy, sell, or use wholesale electricity

Summer 2026 Installed Capacity

Reflects operational installed capacity for Summer 2026 based on `December 2025 Capacity, Demand and Reserves report.



2025 Energy Use



ERCOT Records

Peak Demand Record

85,508 MW
(Aug 10, 2023)

Weekend Peak Demand Record

85,116 MW
(Aug 20, 2023)

Expected Capacity for Summer 2026

104,850+ MW
Peak Demand (December 2025 Capacity, Demand and Reserves report)

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

Wind, Solar, & Energy Storage by the numbers



40,719 MW

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

28,550 MW

Generation Record (March 3, 2025)

23.6%

Penetration Record (April 10, 2022)



37,824 MW

of utility-scale installed solar capacity as of March 2026

31,350 MW

Generation Record (February 28, 2026)

61.64 %

Penetration Record (February 7, 2026)



18,795 MW

of installed energy storage capacity as of March 2026

9,737 MW

Energy Storage Generation Record (December 23, 2025)

Before RTC+B: Energy and reserves were procured in separate processes — one looking ahead, one in real time.

Day-Ahead Market

- Co-optimized energy and ancillary services
- Energy awards purely financial, no obligation in real-time
- Ancillary service (AS) awards are binding obligations on a market participant, not resource-specific

Supplemental Ancillary Services Market (SASM)

- If a market participant couldn't fulfill its AS obligation, a SASM would be held to reallocate the awards

Real-Time Market

- Optimized energy dispatch
- Ancillary services fixed from day-ahead, assigned to individual resources

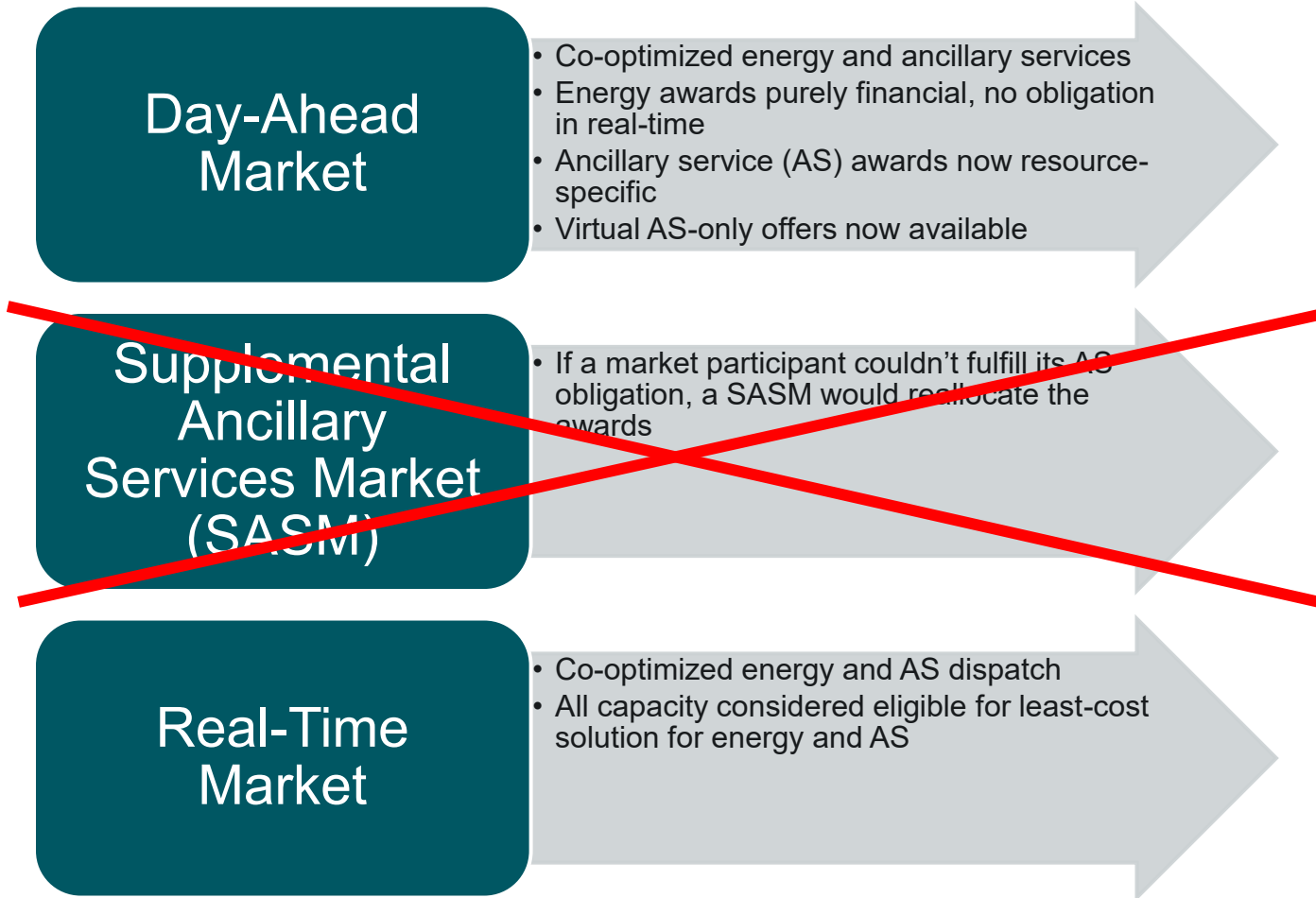
Energy and ancillary service prices were set independently in real-time. Neither fully reflected the real-time opportunity cost of a MW committed to one purpose over the other.

No mechanism existed in real-time to dynamically trade off the value of a megawatt as energy versus its value as a reserve..

Energy Storage Resources (ESRs)

Batteries were modeled as two independent resources: dispatchable generation and controllable load. Offer curves and bid curves were submitted separately for each resource.

After RTC+B: Every five minutes, energy and reserves priced simultaneously.



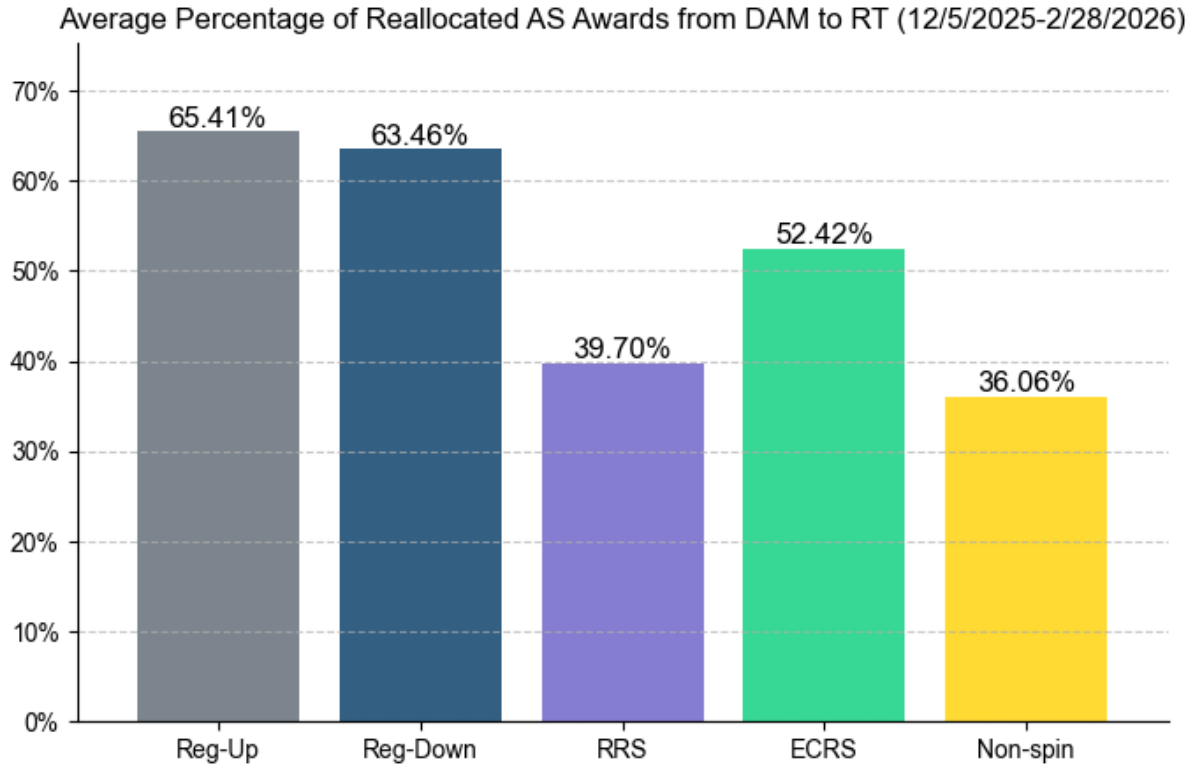
The real-time market now simultaneously determines how much of each reserve product to award, and at what price, using a unified objective function.

For every dispatchable resource, SCED asks in real time: *given current conditions, is this MW worth more as energy or as a reserve?* The answer drives both dispatch and pricing.

Energy Storage Resources (ESRs)

A battery is now modeled as a unified resource for charging and discharging. The engine can simultaneously award it energy and ancillary services, optimizing the split in real time based on relative market value.

Day-Ahead Market awards frequently changed in Real-Time Market



How we measured award changes:

Example: A generator awarded 100 MW in Day-Ahead Market but only 60 MW in Real-Time Market

- Reallocated amount = 40 MW (the difference)

If a resource was awarded more Ancillary Services in real-time than in day-ahead, then there is no reallocation (0 MW).

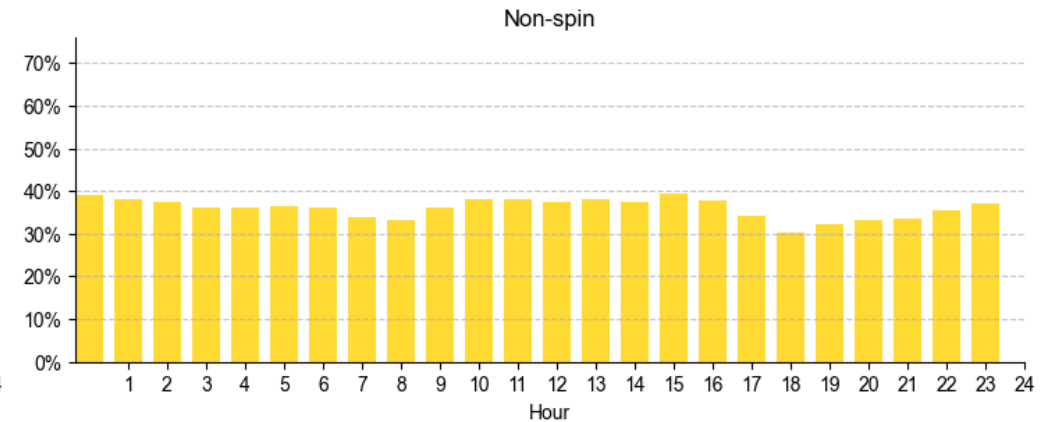
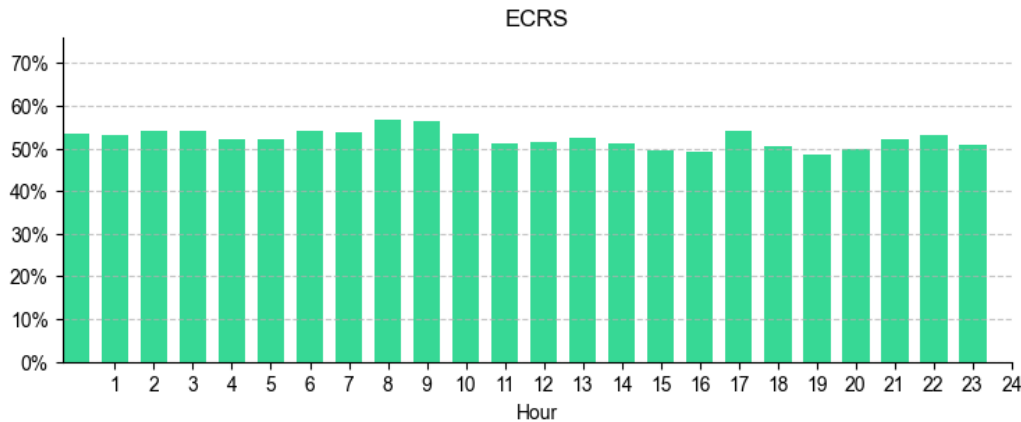
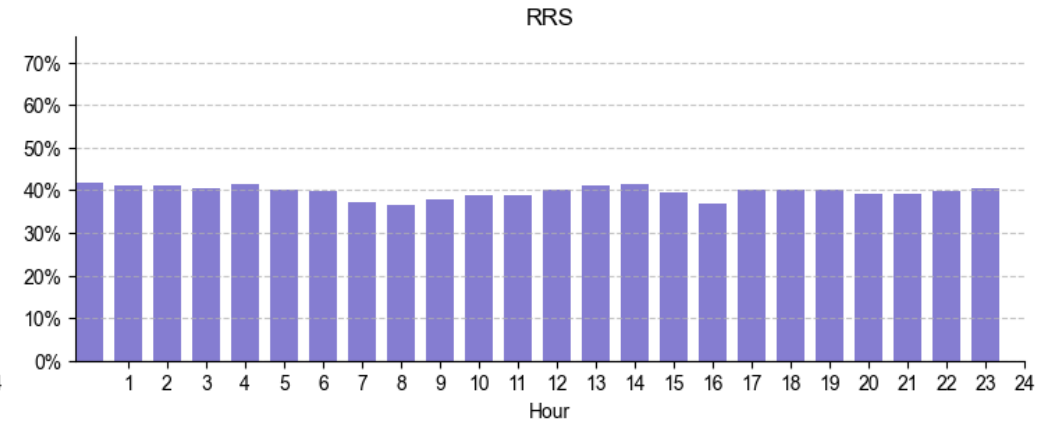
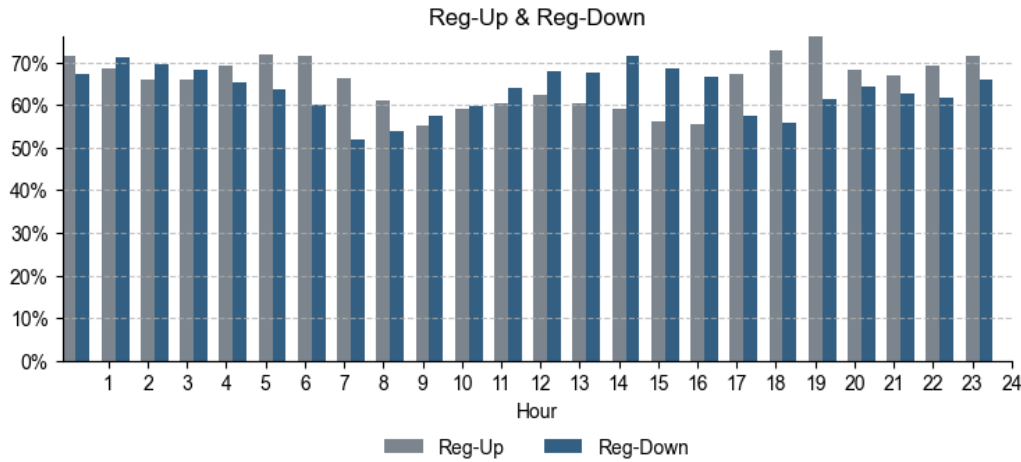
Reallocated AS Awards% :

$$= \frac{\text{Sum of Reallocated AS Awards for each resource}}{\text{Total DAM Awards}}$$

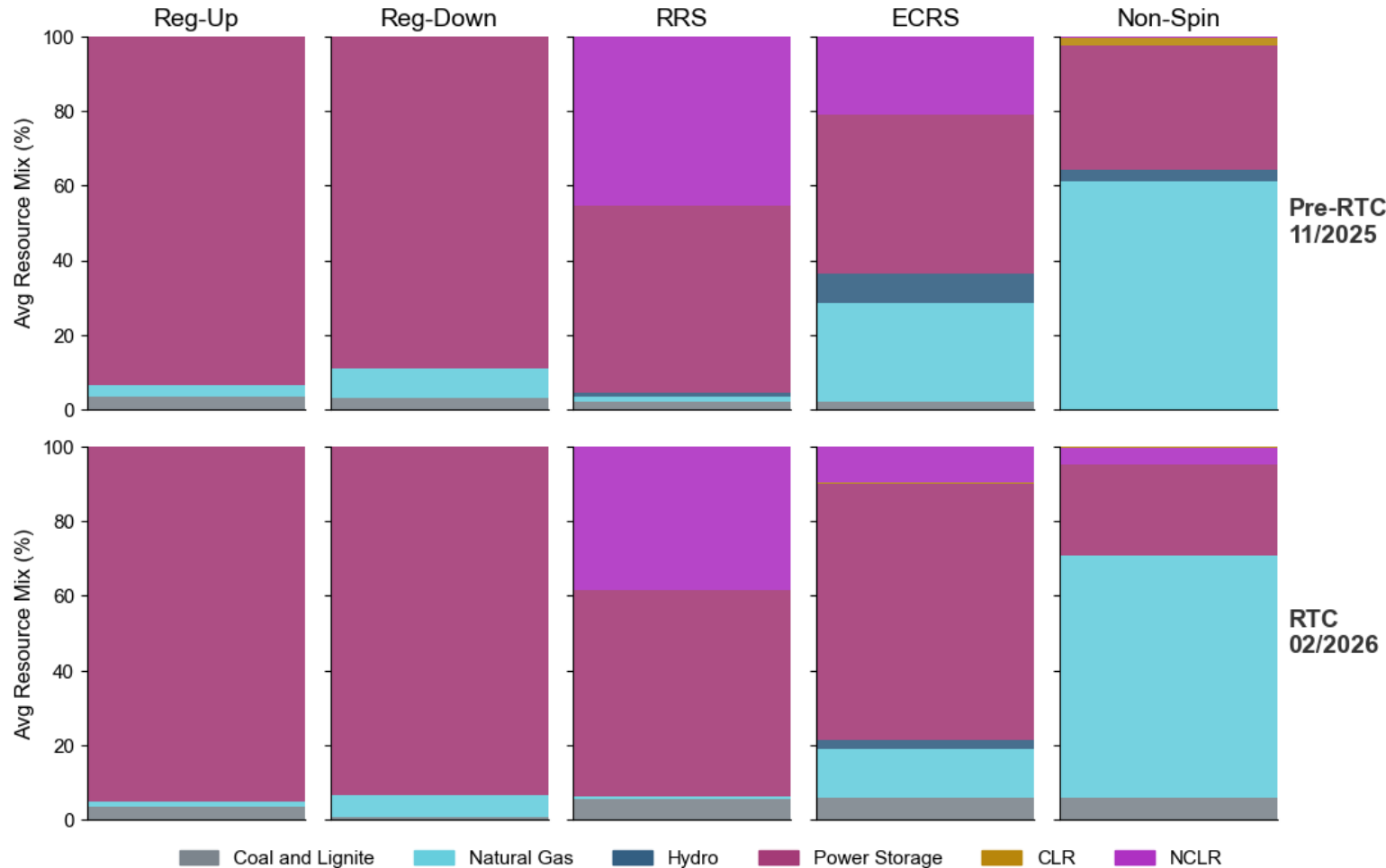
Day-Ahead Market awards frequently changed to different resources in the Real-Time Market, especially for Regulation Up (Reg-Up) and Regulation Down (Reg-Down) services. Similar outcomes, though less frequent, were seen in Responsive Reserve Service (RRS), ERCOT Contingency Reserve Service (ECRS) and Non-Spinning Reserves (Non-Spin).

Redispatch between day-ahead and real-time varies slightly across different hours

Hourly Average Percentage of Reallocated AS Awards from DAM to RT (12/5/2025-2/28/2026)



The supply mix in each Ancillary Service has evolved since the introduction of Real-Time Co-optimization

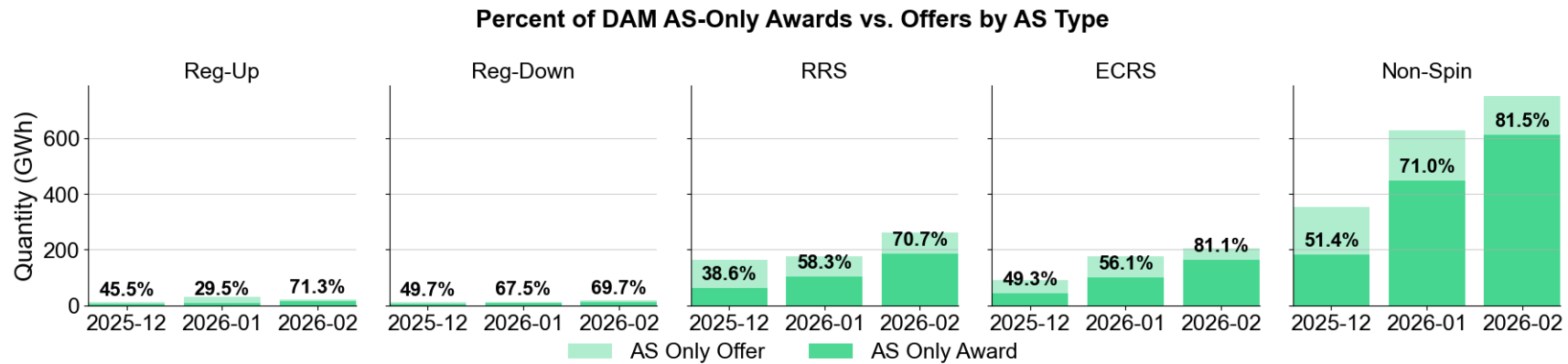
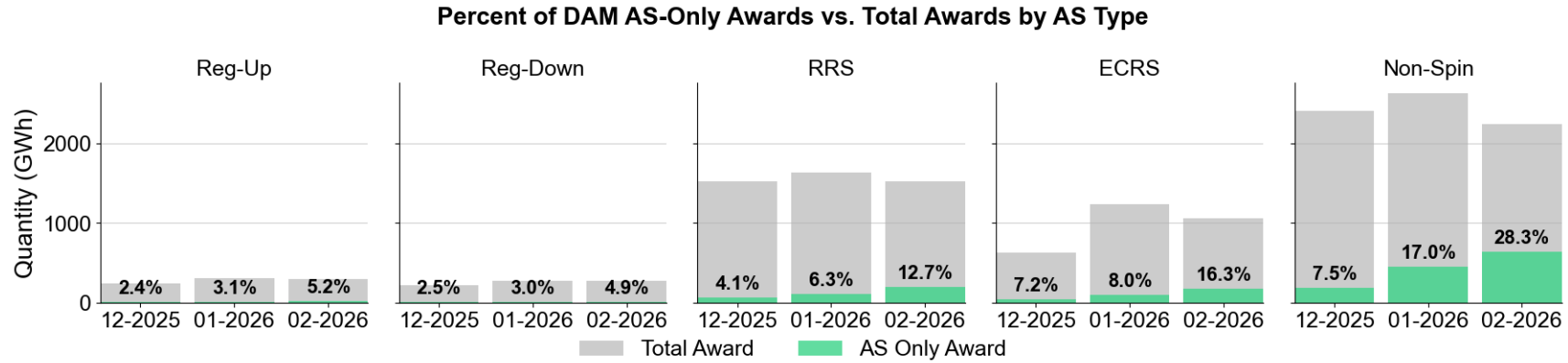


Since RTC+B implementation, Energy Storage Resources (ESRs) have captured a larger share of ECRS, displacing Non-controllable Load Resources (NCLR), Hydro, and Natural Gas.

In contrast, the ESR share in Non-Spin has slightly declined in favor of longer duration resources such as Coal, Natural Gas, and NCLR.

Note: CLR and NCLR refer to Controllable Load Resources and Non-controllable Load Resources, respectively.

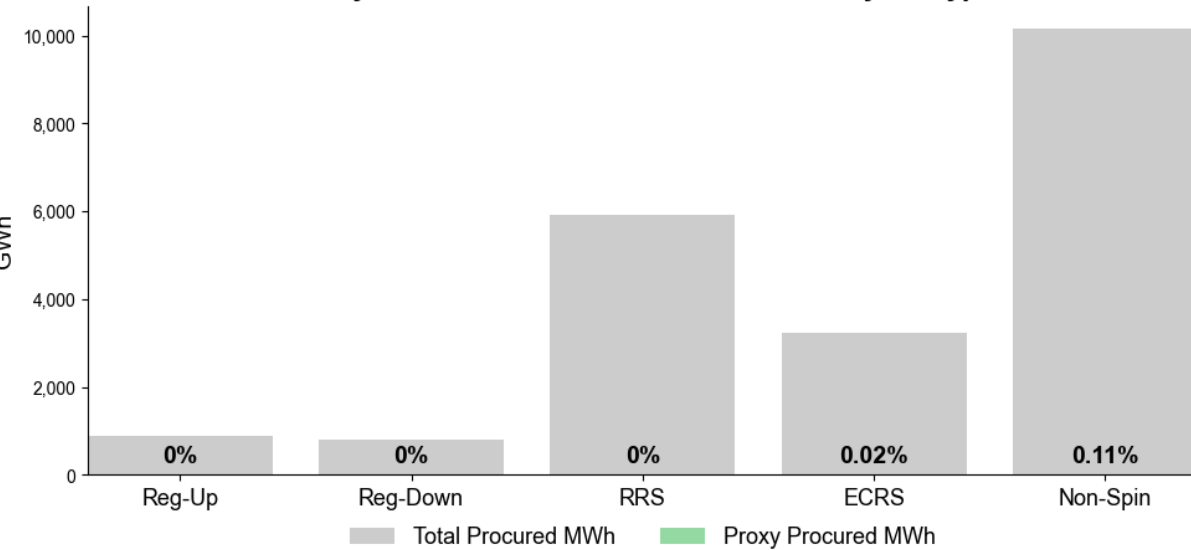
Market Participants are making use of Ancillary Service-Only Offers in the DAM and they are being awarded economically



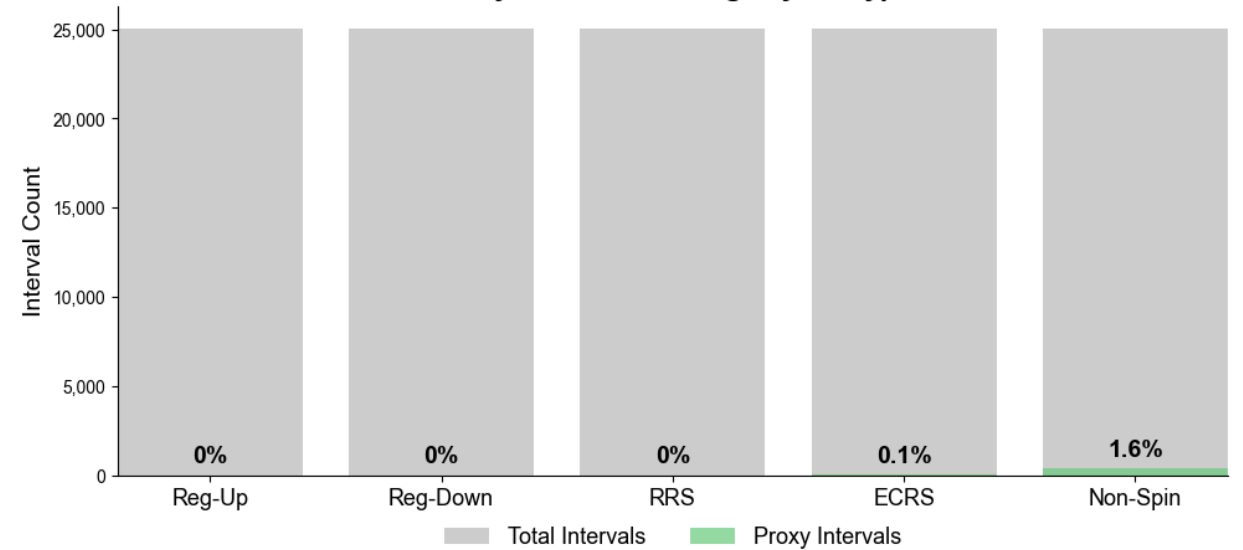
While still early, some Qualified Scheduling Entities have started to use the new Ancillary Service-Only Offers in the DAM, particularly for Responsive Reserve Service (RRS), ERCOT Contingency Reserve Service (ECRS) and Non-Spinning Reserve Service (Non-Spin).

In real-time, ancillary service awards to proxy offers have been rare and minimal

Proxy Award MWh as % of Procured MWh by AS Type

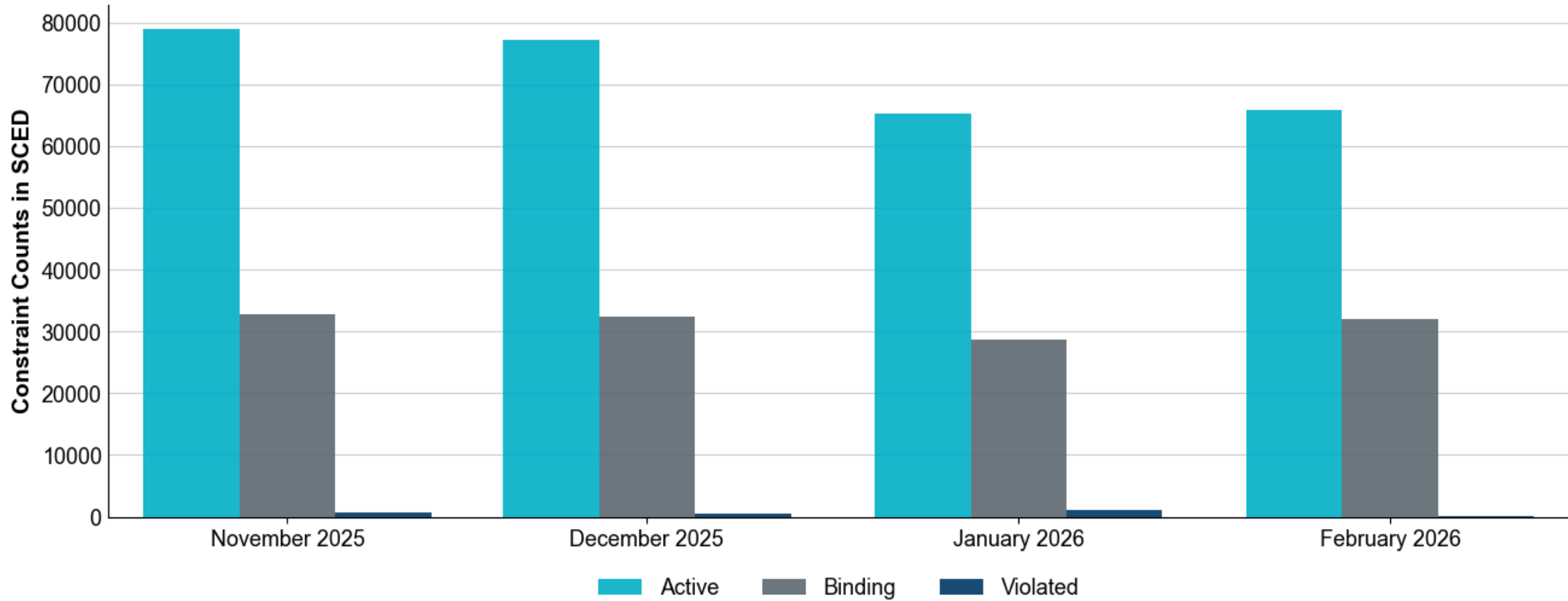


Proxy Award Percentage by AS Type



Since RTC implementation, only a very small fraction of proxy Ancillary Service offers have been awarded, occurring rarely in ECRS and Non-Spin, and in minimal amounts. Proxy offers were just under \$15/MW/h for both ECRS and Non-Spin.

The number of active transmission constraints considered in real-time declined, as did the number of binding constraints



A key benefit of Real-Time Co-optimization is greater flexibility to redispatch energy and ancillary Services to resolve transmission constraints. Post-RTC outcomes show a decline in the frequency of both active and binding transmission constraints in real-time, when compared to November.

While we are pleased with the results, there is more work to be done

System Stabilization

We continue to monitor market outcomes to identify any unintended consequences arising from RTC+B implementation.

Some issues already addressed include:

- Tightened MIP Gap tolerances
- Change of solver model
- Missed data in reporting

Stakeholder Engagement

The Real-Time Co-optimization plus Batteries Task Force (RTCBTF), we accumulated certain issues to revisit after RTC+B implementation, including:

- A review of the Ancillary Service Demand Curves (ASDCs), their individual shapes, and the shape of the aggregate ASDC shape
- Parameters such as the energy market price cap, real-time offer price caps, and proxy offer price floor values.
- Duration requirements for each ancillary service, especially ERCOT Contingency Reserve Service and Non-Spinning Reserves

The RTCBTF has proposed a work plan, adopted by the Technical Advisory Committee, which outlines all the issues, the appropriate stakeholder forum, and tentative timing.

Thank you!

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