Discussion on Recent Trends in Reliability Unit Commitment (RUC)

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January 20, 2026

Agenda

- Summary of Findings

- Background

- Current Operating Plan (COP), Load Forecast and Intermittent Renewable Resource (IRR) Errors

- Short-Start Resources

- Additional Considerations

Summary of Findings

Multiple Inputs contribute to RUC Recommendations

- Dispatchable COP Error, ESR COP HBSOC Error, IRR Error, and Load Forecast Error collectively influence RUC recommendations.
- Influence on RUC recommendations can vary by magnitude of errors with no single input being more impactful than others

RUC Recommendation Acceptance Trends

- Most accepted RUC recommendations are for resources with longer start-up times.
  - Operators prioritize committing long-start resources during HRUC studies due to their smaller lead-time margin, reducing future availability.
- Treating RUC-recommended short-start resources as online would not materially change the accepted RUC recommendations.

Monitoring RUC under new RTC+B

- Understand new drivers and impacts
- Consider whether new heuristic rules are required after monitoring for a suitable period of time

Background

- At the 11/07/2025 CMWG, ERCOT presented a case study that outlined some of the drivers behind the increased RUC activity in 2025.

- One of the points made was that QSE COP submissions that underestimate future resource availability can contribute to potentially excessive RUC recommendations in the RUC engine.

  - RUC solves the system for future hours using the key input of Resource plans indicated by the COP snapshot at the time that RUC executes.

- For example, as indicated in Figure 1 and Figure 2, the COP snapshot used by the 10/21/25 07:00 HRUC underrepresented HE19 dispatchable resource availability by ~4 GW and HE19 ESR availability by ~4 GW.

  - Consequently, the HASL Margin* for HE19 in this HRUC study was very low (-7943 MW).

  - The engine responded by recommending every resource ~3500 MW HSL, of which the operators accepted 87 MW HSL.

    - Operators accepted only a small fraction of the RUC-recommended MW, highlighting that RUC engine results are only recommendations and operators rely on operational experience to decide which recommendations to accept.
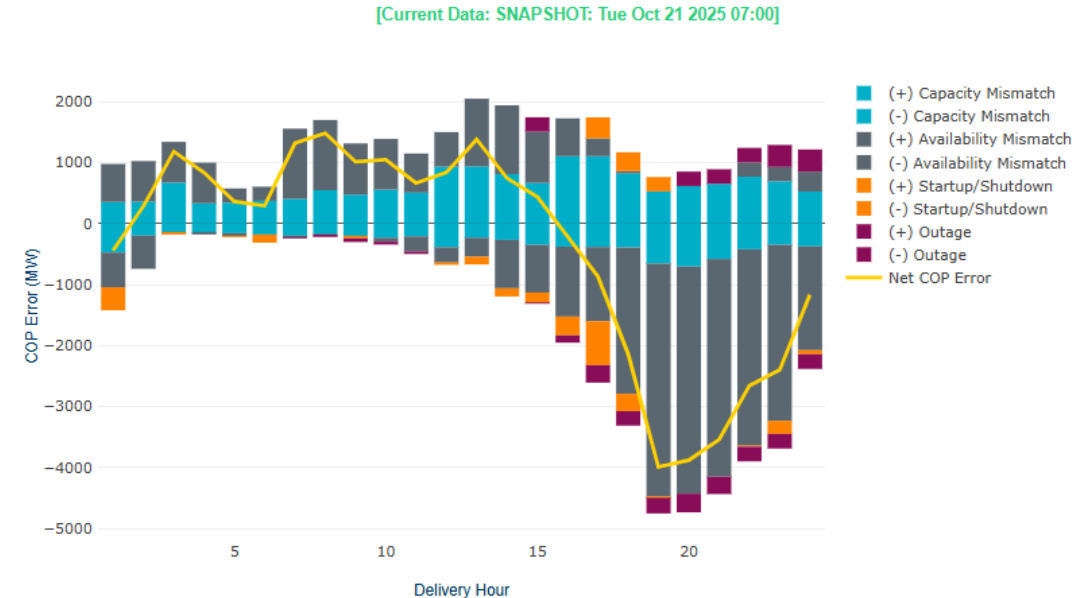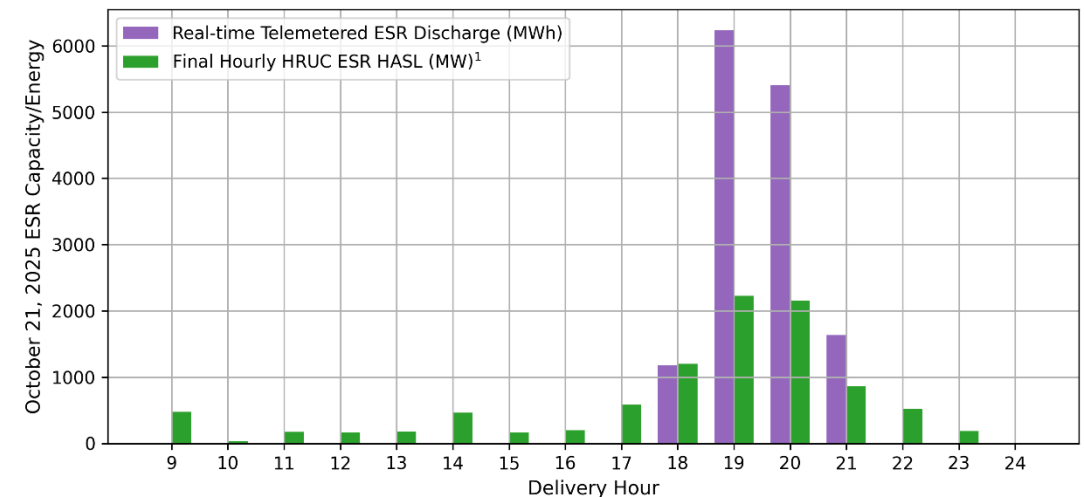
Figure 1

[Current Data: SNAPSHOT: Tue Oct 21 2025 07:00]

Figure 2

[1]HRUC ESR HASL is MW availability by hour in 10/21/2025 07:00 HRUC Execution and is equivalent to MWh

Background (Cont'd)

- Market Participants requested that ERCOT extend its analysis to include other potential drivers of RUCs including Load Forecast error and IRR error.

- Market Participants also requested that ERCOT consider short-start resources as online in RUC studies due to the expectation that most indicating offline status would self-commit in real time during tight system conditions.

COP, Load Forecast and IRR Forecast Errors

- A combination of Dispatchable COP Error, ESR COP HBSOC Error, IRR Error and Load Forecast Error can contribute to RUC recommendations without any single category being the exclusive driver.

- During the 06/26/25 13:00 HRUC at HE21:
  - HASL Margin: -2131MW
    - Dispatchable COP Error: +879MW[1]
    - ESR COP HBSOC Error: -2124MW
    - IRR Error: -2124MW
    - Load Forecast Error: -969MW
  - Operator Accepted RUC: 435MW

- During the 10/21/25 07:00 HRUC at HE19:
  - HASL Margin: -7943MW
    - Dispatchable COP Error: -3985MW
    - ESR COP HBSOC Error: -4011MW
    - IRR Error: +1017MW
    - Load Forecast Error: -1346MW
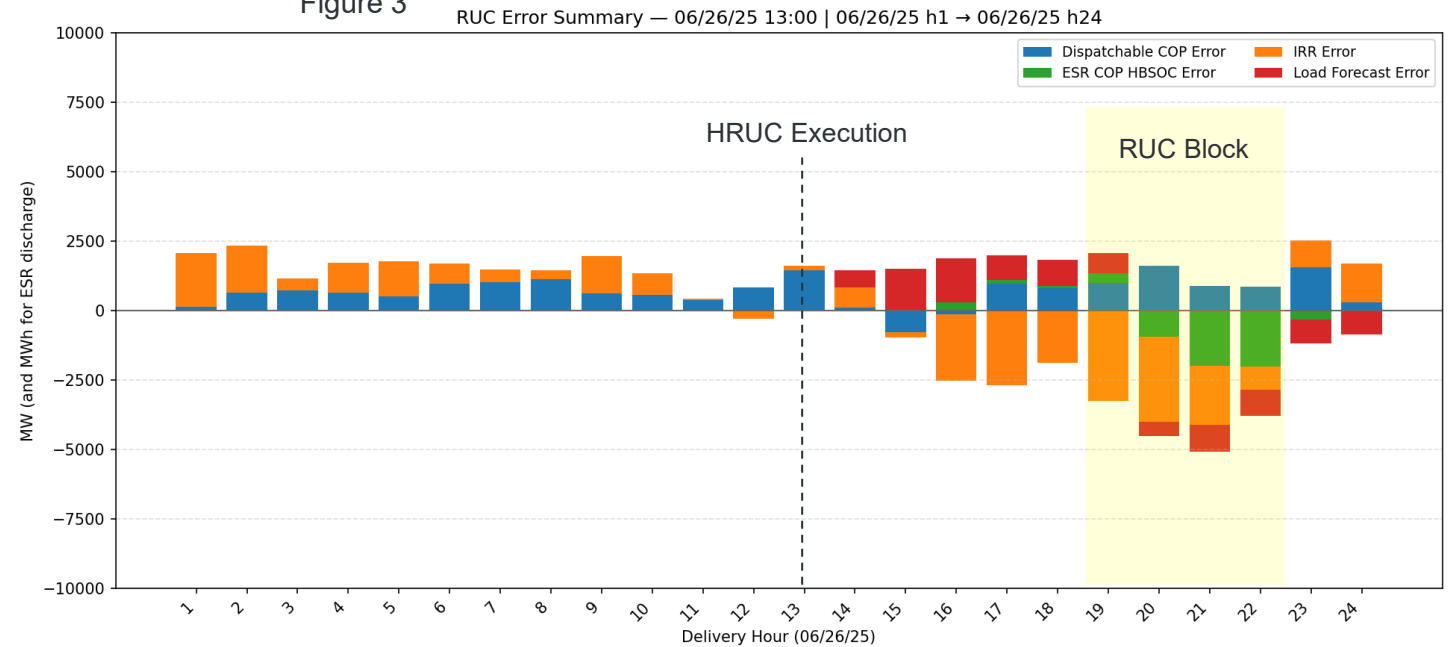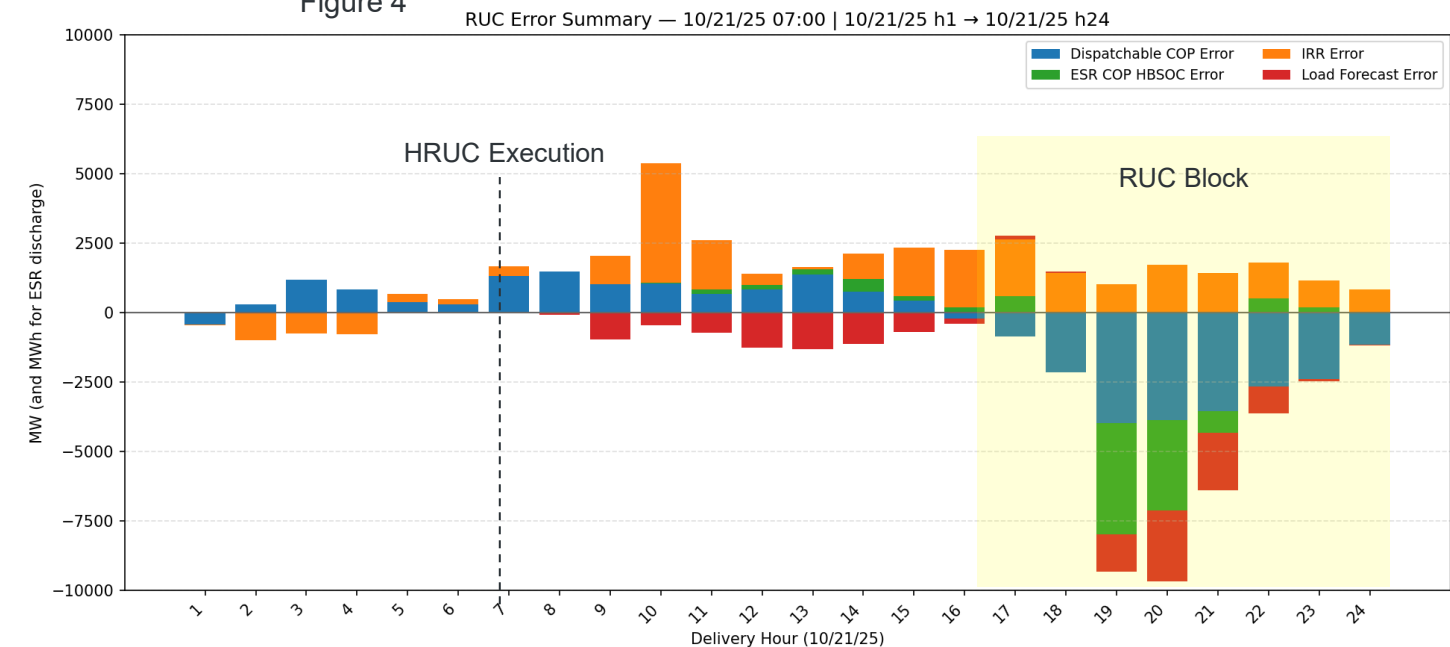 - Operator Accepted RUC: 87MW

Figure 3

Figure 4

1) Categories with negative values indicate under representations of what occurred in real-time. (Ex: a Dispatchable COP Error of -3985MW calculated for HE19 during the 07:00 HRUC means that an additional 3985MW were available at HE19 than what was indicated in the 07:00 HRUC)

Short-Start Resources

- As indicated in Figure 6, most RUC recommendations accepted by operators in October 2025 were resources with longer start-up times

  - When conducting HRUC studies, operators prioritize selecting the recommended commitments of resources with longer start-up times (see Figure 5 and 6). These units have a smaller lead-time margin[2], reducing their likelihood of being available in subsequent HRUC studies. This also allows more time for shorter start time resources to self-commit, even though they are often recommended to the operators.

  - Therefore, formulating RUC to consider RUC-recommended short-start resources as online **would not substantially change RUC outcomes**, as the current process effectively assumes that short-start resources recommended for RUC-commitment will self-commit.

- Within the RUC engine, ERCOT avoids assuming short-start resources will be available in real time during tight conditions, opting instead to rely on QSE-provided information rather than internal assumptions.
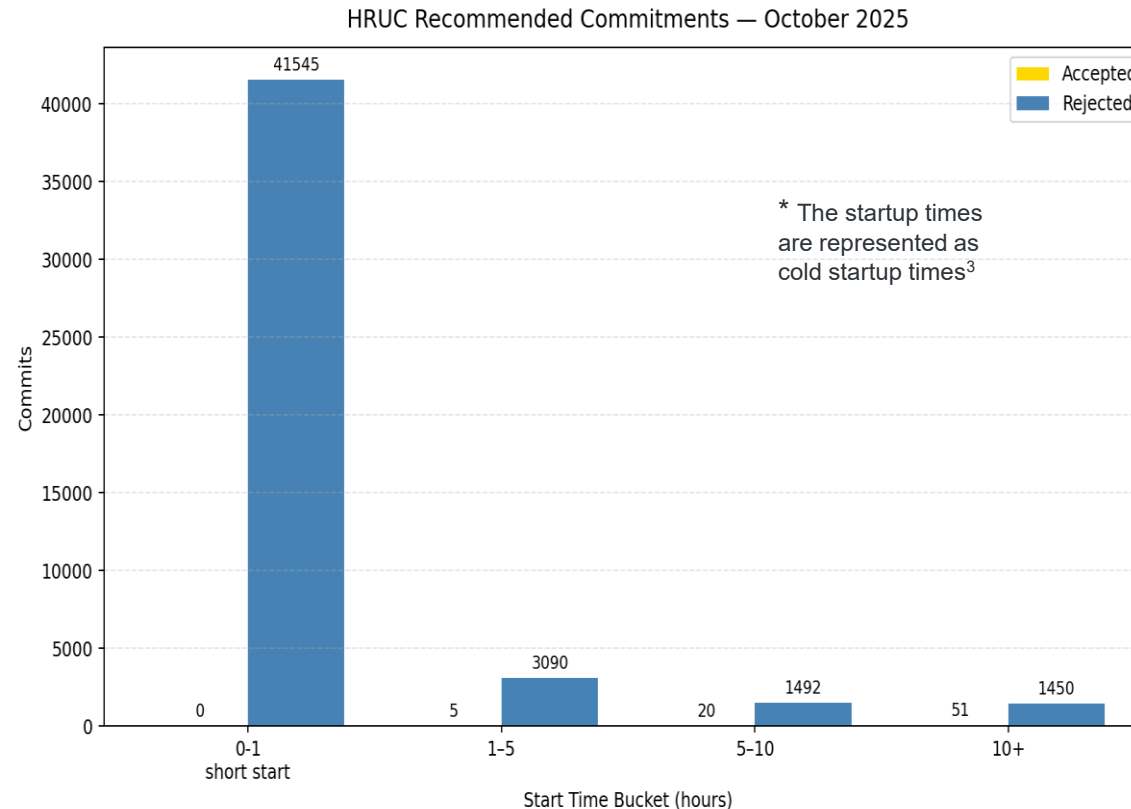
Figure 5
HRUC Recommended Commitments — October 2025

Legend: Accepted, Rejected

* The startup times are represented as cold startup times[3]

Data points: 41545, 3090, 1492, 1450 (Rejected values); 0, 5, 20, 51 (Accepted values)
Start Time Buckets: 0-1 short start, 1-5, 5-10, 10+

Figure 6: Operator-accepted RUC Commitments by start up time – October 2025

* The startup times are represented as cold startup times

Values: 0-1 short start = 0, 1-5 = 5, 5-10 = 20, 10+ = 51
Startup time (hr)
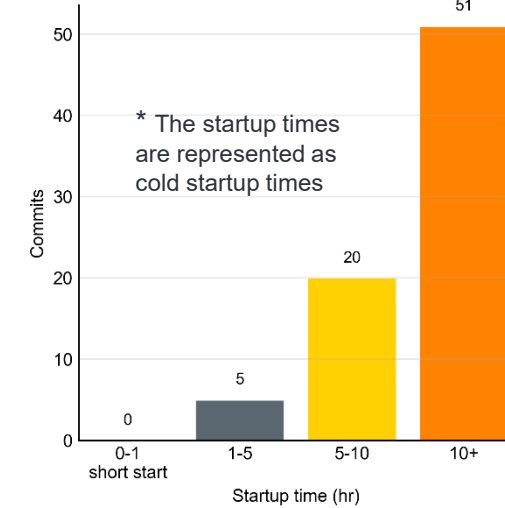
Figure 7: Operator accepted RUC Commitments by lead time margin – October 2025

Lead time margin (hr): 0-2, 2-4, 4-6, 6-8
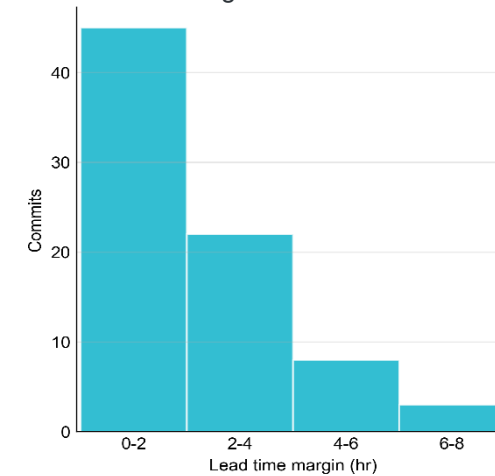
2) Lead time margin is the difference between lead time and the Resource's startup time. In cases where a Resource is committed for multiple back-to-back time blocks, lead time margin is calculated from the first instruction.

3) Not all HRUC-recommended units rely on their cold start time as the actual startup time

Additional Considerations

- Penalty Factors
  - During the 11/07/2025 CMWG, Market Participants requested clarification regarding the penalty factors applied to security constraints within the RUC engine
    - Pre-RTC RUC network constraint penalty costs are >=$100k/MWh.
      - These RUC network constraint penalty costs are much smaller than power balance constraint penalty costs ($5M/MWh).
- RUC commitments have decreased since the launch of Real-Time Co-optimization on December 5th, 2025. Factors that may contribute to this trend include:
  - The ability of RTC RUC to manage congestion by re-allocating both Energy and Ancillary Servies among Resources without committing additional offline Resources.
  - The ability of RTC RUC to fully utilize capacity capable of providing offline Non-Spin.
  - The ability of RTC RUC to trade off between energy and Ancillary Services.
  - Improved accuracy of COP Target HBSOC data since RTC go-live.
  - However: COP errors, IRR errors, and Load Forecast errors can still contribute to RUC recommendations.

Next Steps

- Next Steps

    - ERCOT will continue to monitor the impacts of COP errors, IRR errors and Load Forecast errors on RUC activity

    - As ERCOT continues to observe the outcomes of the RTC RUC engine, we will explore opportunities to improve classification of RUC selections, distinguishing whether they are driven by capacity needs, congestion management, or a combination of both.

        - This could involve refining diagnostic calculations for RUC recommendations, applying heuristic rules for classification, and enhancing operator displays to help provide clearer insights.
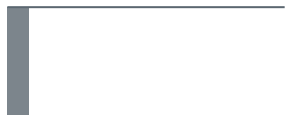
Appendix

04/04/2025
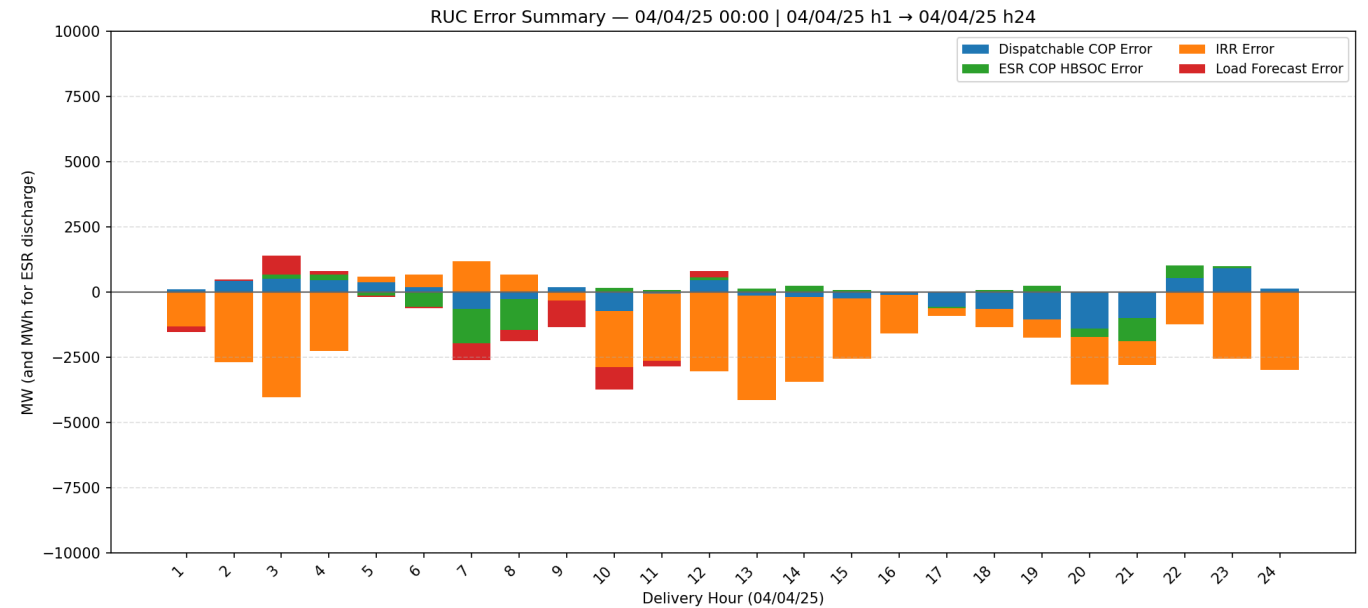
RUC Block: 04/04/25 HE8-11

Resource: HLSES_UNIT5

Listed Constraint: E_PATA

Commit Time: 4/4/2025 12:03:04 AM

Minimum HASL Margin: -585 MW (HE10)

Dispatchable COP Error: ~(-)200 MW during HE8

ESR COP HBSOC Error: ~(-)1200 MW during HE8

RUC Error Summary — 04/04/25 00:00 | 04/04/25 h1 → 04/04/25 h24

06/15/2025

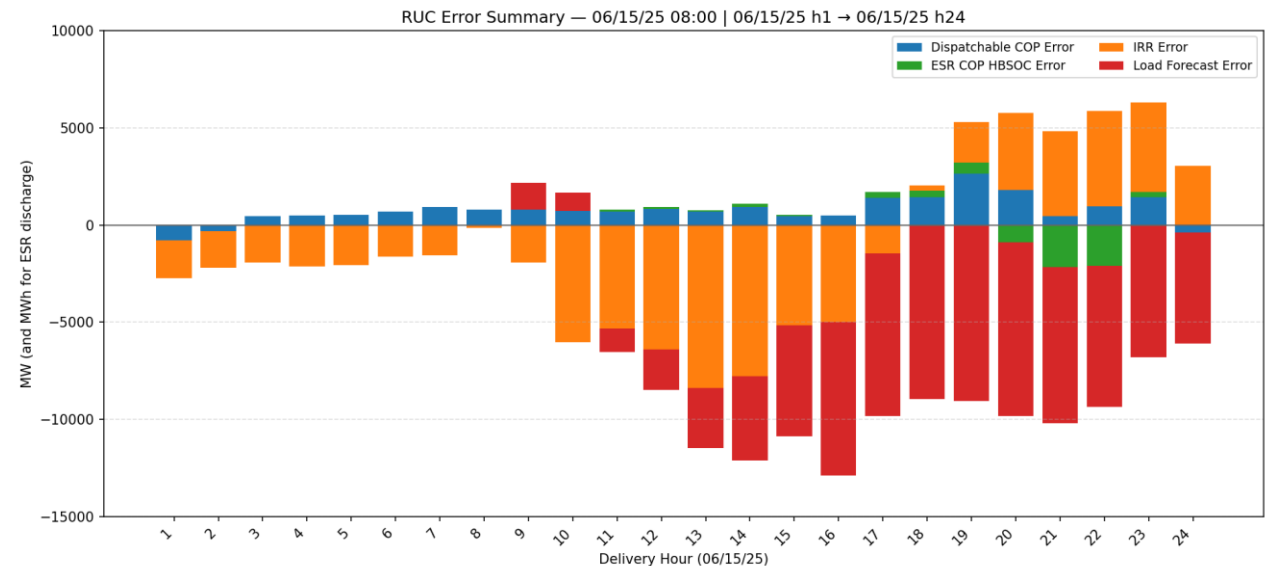RUC Blocks: 06/15/25 HE17-23

Resource: 11 unique units

Listed Constraint: E_PASP

Commit Time: 6 HRUC studies

Minimum HASL Margin: Every RUC had a negative HASL Margin during its RUC block.

Dispatchable COP Error: ~(+)500 MW during HE21

ESR COP HBSOC Error: ~(-)2200 MW during HE21

06/26/2025
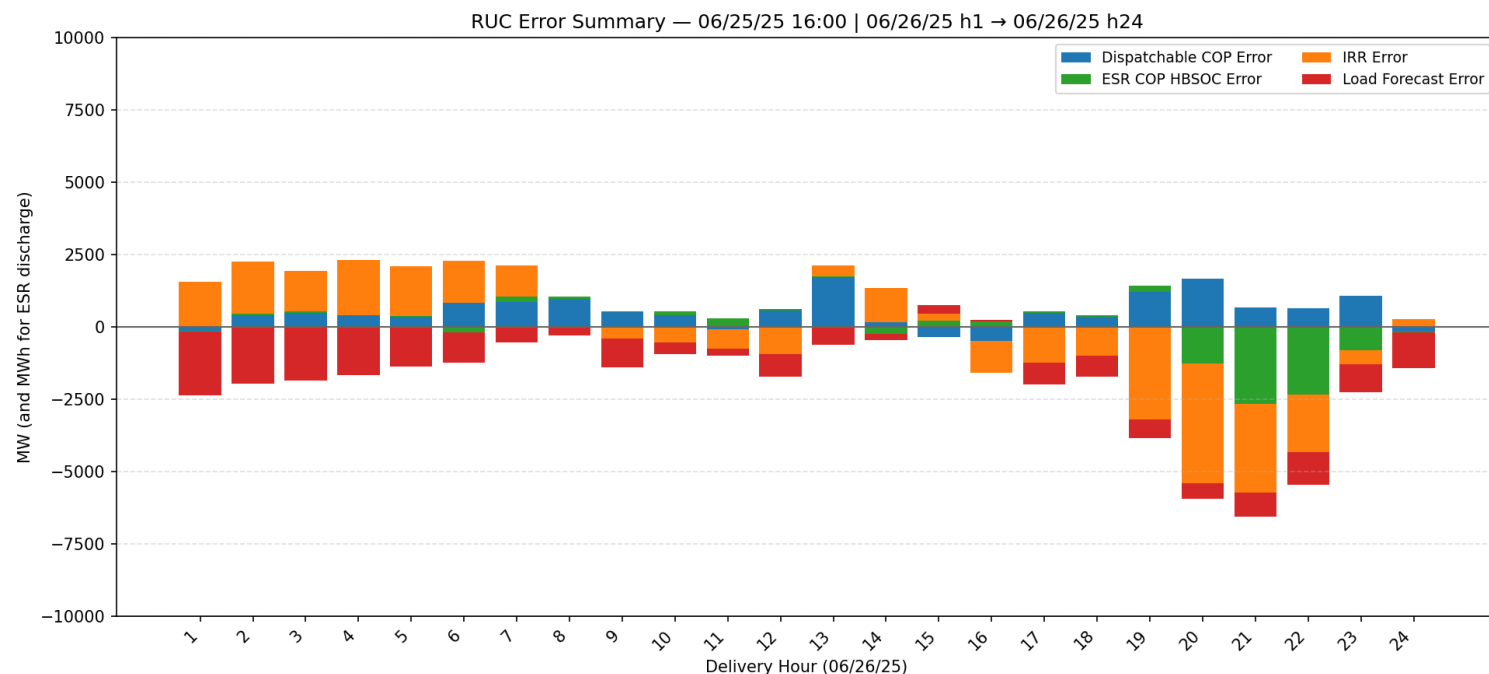
RUC Block: 06/26/25 HE1-24

Resource: HLSES_UNIT3

Listed Constraint: E_PASP

Commit Time: 6/25/2025 4:03:04 PM

Minimum HASL Margin: -3667 MW (HE21)

Dispatchable COP Error: ~(+)700 MW during HE21

ESR COP HBSOC Error: ~(-)2700 MW during HE21

RUC Error Summary — 06/25/25 16:00 | 06/26/25 h1 → 06/26/25 h24

Legend: Dispatchable COP Error, IRR Error, ESR COP HBSOC Error, Load Forecast Error

06/26/2025
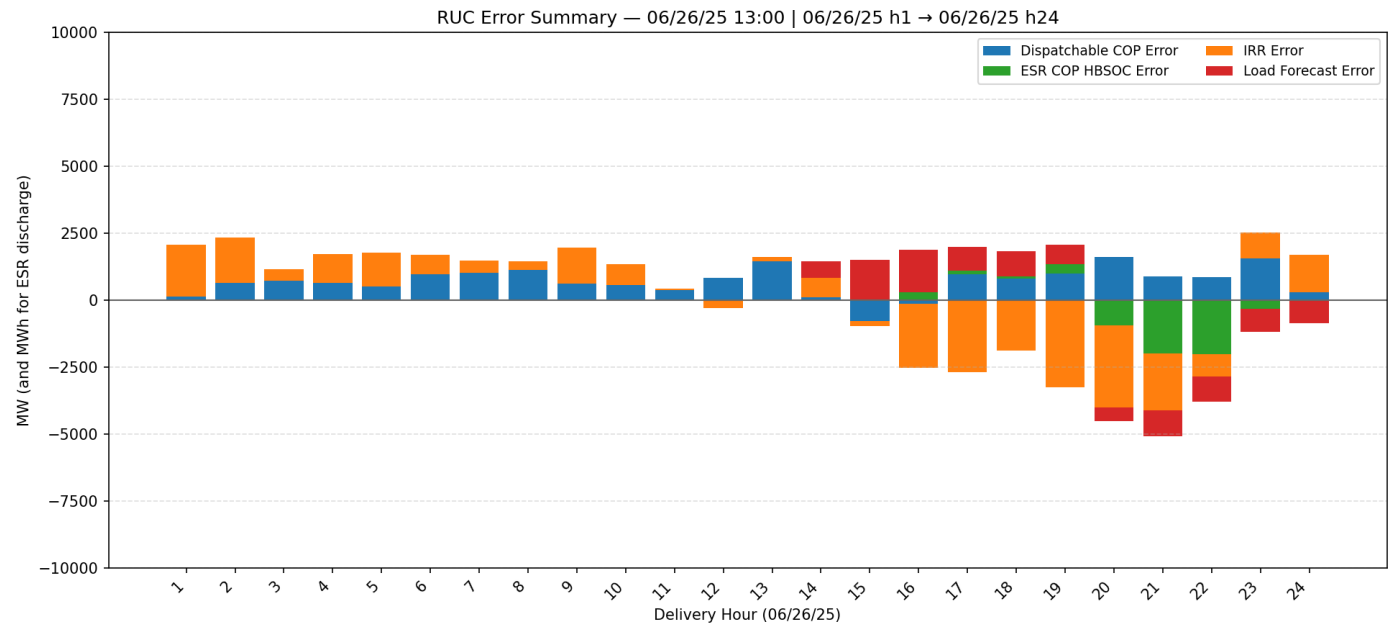
RUC Block: 06/26/25 HE19-22

Resource: HLSES_UNIT5

Listed Constraint: E_PASP

Commit Time: 6/26/2025 1:03:03 PM

Minimum HASL Margin: -2131 MW (HE21)

Dispatchable COP Error: ~(+)900 MW during HE22

ESR COP HBSOC Error: ~(-)2000 MW during HE22

RUC Error Summary — 06/26/25 13:00 | 06/26/25 h1 → 06/26/25 h24

06/24/2025
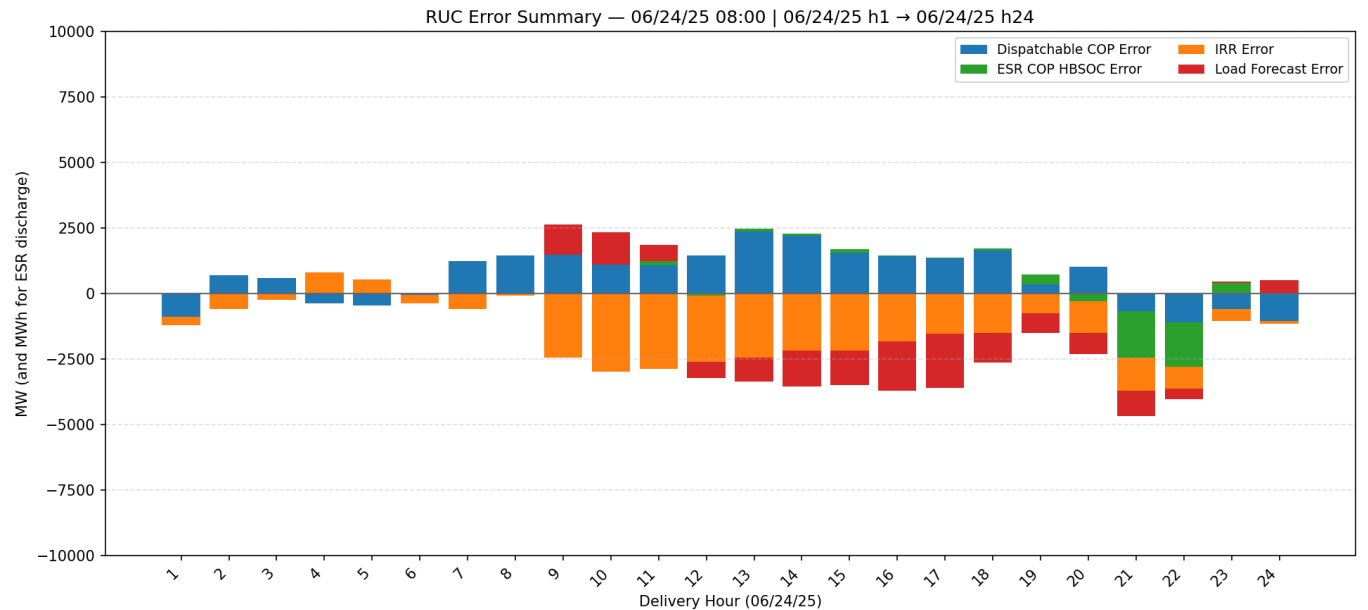
RUC Blocks: 06/24/25 HE20-24

Resource: 7 unique units

Listed Constraint: E_PASP

Commit Time: 6 HRUC studies

Minimum HASL Margin: All 7 RUCs spanned an HE22 that had a negative HASL Margin.

Dispatchable COP Error: ~(-)1100 MW during HE22

ESR COP HBSOC Error: ~(-)1700 MW during HE22

RUC Error Summary — 06/24/25 08:00 | 06/24/25 h1 → 06/24/25 h24

06/26/2025
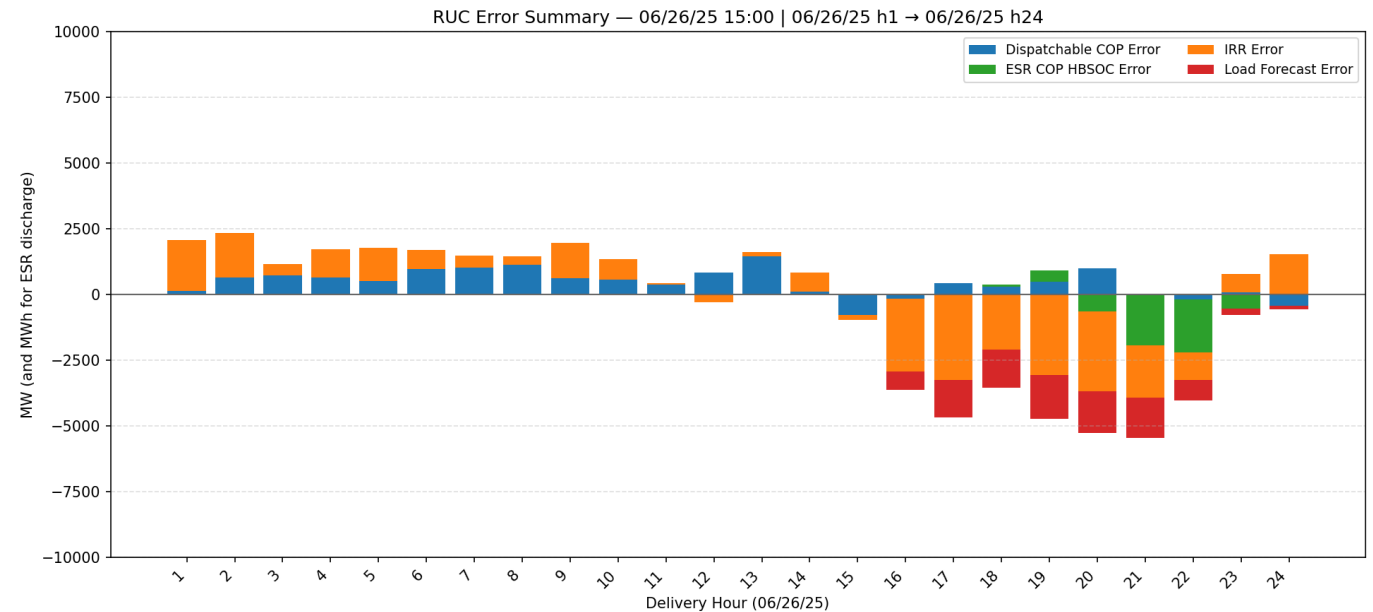
RUC Block: 06/26/25 HE20-23

Resource: HLSES_UNIT4

Listed Constraint: E_PASP

Commit Time: 6/26/2025 3:03:03 PM

Minimum HASL Margin: -3334 MW (HE21)

Dispatchable COP Error: ~(-)200 MW during HE22

ESR COP HBSOC Error: ~(-)2000 MW during HE22

RUC Error Summary — 06/26/25 15:00 | 06/26/25 h1 → 06/26/25 h24
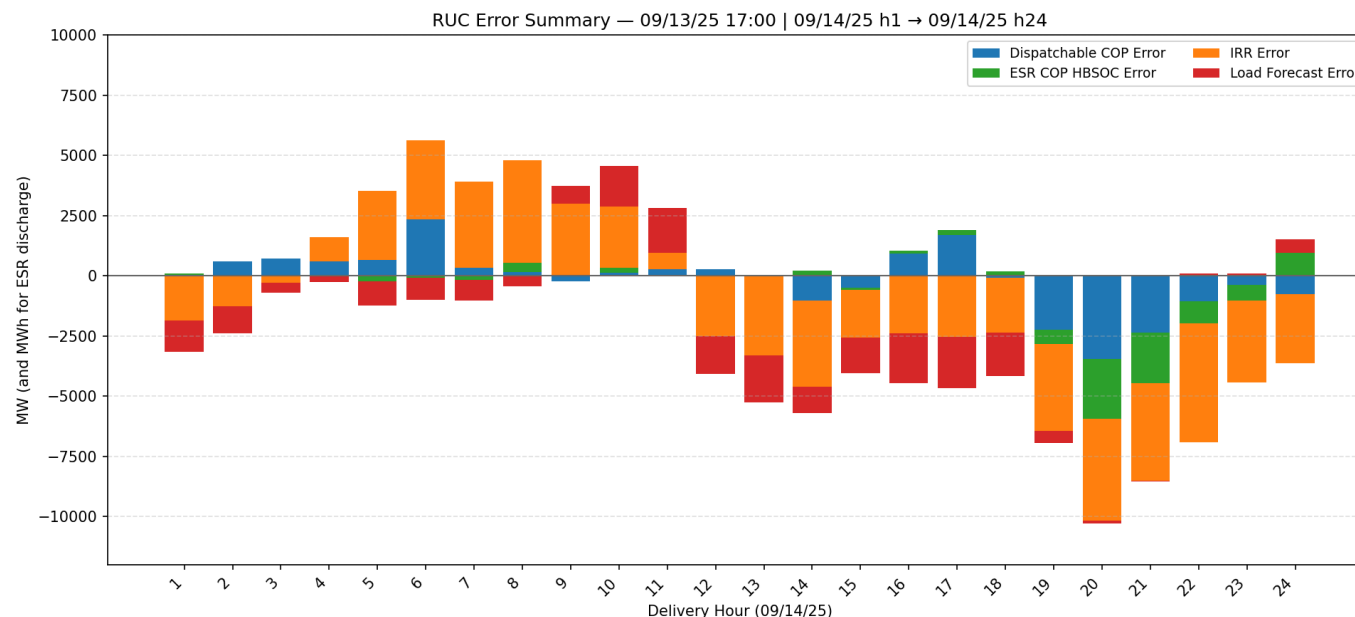
09/14/2025

RUC Block: 09/14/25 HE2-24

Resource:

Listed Constraint: E_PASP

Commit Time: 9/13/2025 5:03:03 PM

Minimum HASL Margin: -8530 MW (HE20)

Dispatchable COP Error: ~(-)3400 MW during HE20

ESR COP HBSOC Error: ~(-)2500 MW during HE20

RUC Error Summary — 09/13/25 17:00 | 09/14/25 h1 → 09/14/25 h24
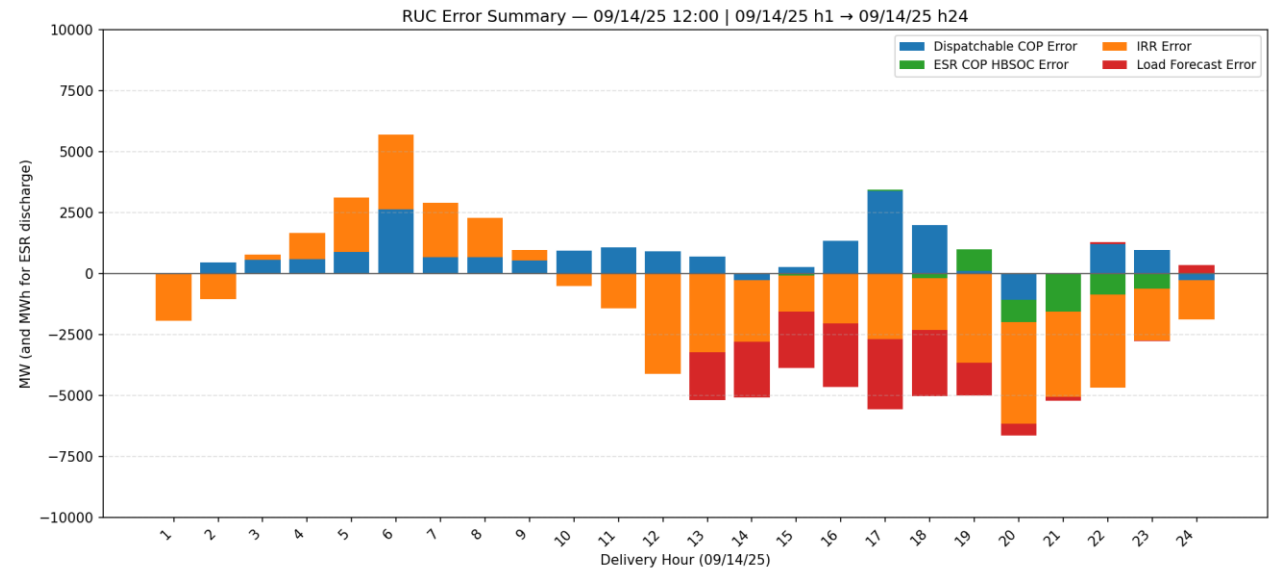
09/14/2025

RUC Block: 09/14/25 HE19-22

Resource:

Listed Constraint: E_PASP

Commit Time: 9/14/2025 12:03:03 PM

Minimum HASL Margin: -4654 MW
(HE20)

Dispatchable COP Error: ~(-)1000 MW
during HE20

ESR COP HBSOC Error: ~(-)900 MW
during HE20

RUC Error Summary — 09/14/25 12:00 | 09/14/25 h1 → 09/14/25 h24

05/24/2025

RUC Blocks: 05/24/25 HE16-22

Resource: 7 unique units

Listed Constraint: E_PASP

Commit Time: 5 HRUC studies

Minimum HASL Margin: One RUC had a negative HASL Margin during its RUC block. The other 8 RUCs had all positive HASL margins during the RUC blocks.

Dispatchable COP Error: ~(+)300 MW during HE21

ESR COP HBSOC Error: ~(-)1000 MW during HE21

RUC Error Summary — 05/24/25 08:00 | 05/24/25 h1 → 05/24/25 h24

Legend:
- Dispatchable COP Error
- ESR COP HBSOC Error
- IRR Error
- Load Forecast Error

Y-axis: MW (and MWh for ESR discharge)
X-axis: Delivery Hour (05/24/25)