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RUC SOC Analysis – OD January 28, 2026

Matt Skiles and Brendan Long
Market Intelligence and Strategy

Wholesale Market Working Group (WMWG)

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Outline

- Low ESR SOC Drove RUC Commitments During OD 01/28/26 HE8-10
- SOC Constraints for ESRs with Discharge Energy Dispatch Differ Between SCED and RUC
- QSE-submitted COP HBSOC Used by HRUC Differed From RT SOC
- ESRs Were Awarded Less Energy and AS During HE8 in RUC Than in SCED
- AS Shortages for HRUC Studies Were Greater Than in RT
- Next Steps

01/28/26 RUC Analysis

Background

The purpose of this analysis is to explore how the state-of-charge (SOC) data available to the HRUC engine may have played a role in shaping its projections and commitment recommendations for operating day (OD) January 28, 2026.

Key Takeaways

- Tight morning system conditions and ESR discharging on January 28, 2026, left fleet SOC depleted.
- Limited ESR availability and accuracy issues with some ESR COP data contributed to large Ancillary Service shortfalls during HE8–10 in early morning HRUC studies, likely influencing RUC commitment decisions.
- Early morning HRUC studies allocated most available ESR SOC to energy and select Ancillary Services (primarily REGDN and RRS), while restricting participation in NSPIN, REGUP, and ECRS.

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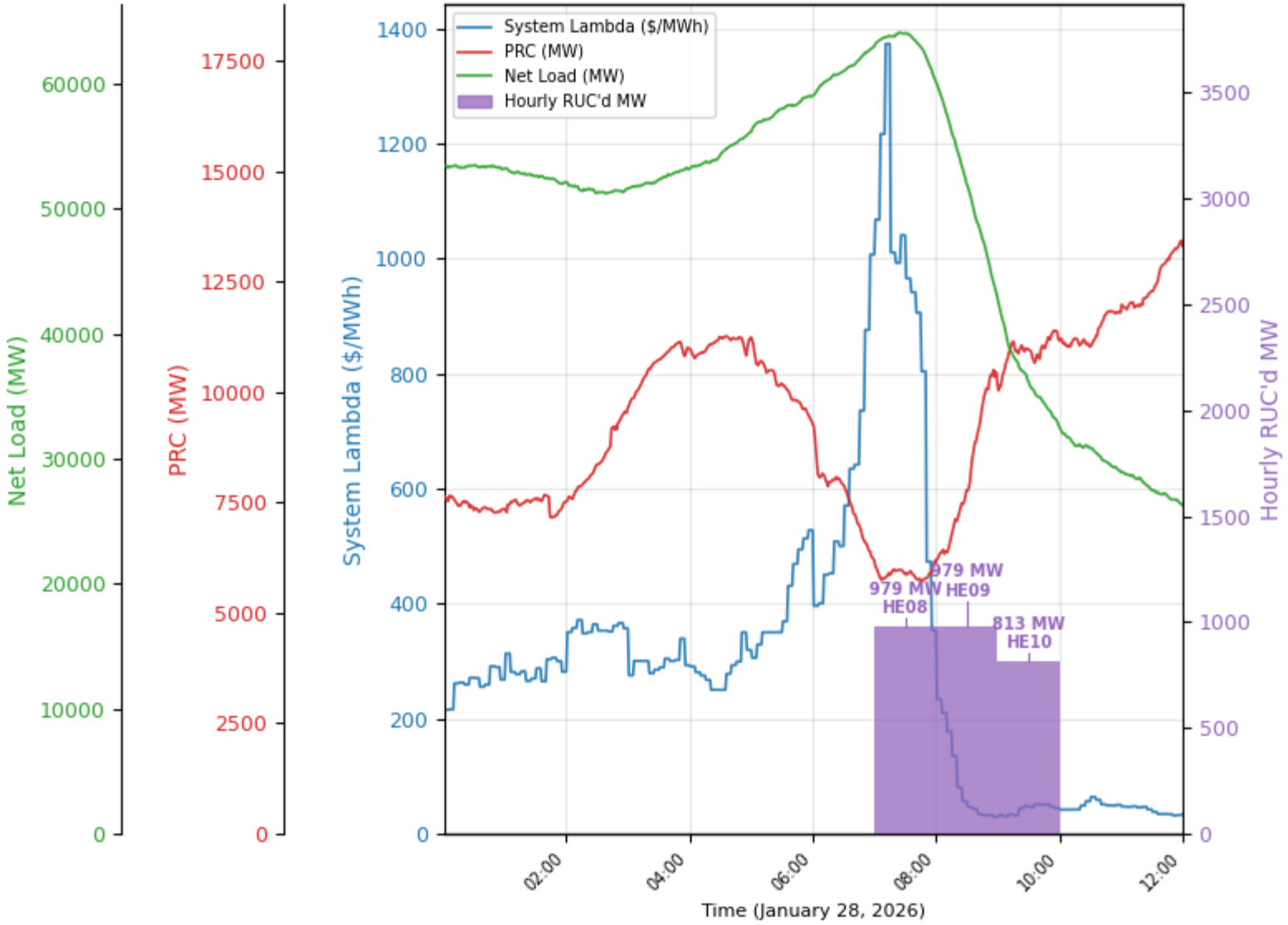
Tight System Conditions Drove RUC Commitments During OD 01/28/26 HE8-10

System Lambda, PRC and Net Load with RUC Committed on 01/28/26



KEY TAKEAWAY

- Tight system conditions on the morning of January 28, 2026 prompted multiple operator actions to maintain reliability.
- Between 5:00 AM and 8:00 AM, operators issued RUC commitments to six resources totaling 1,481 MW of capacity for various RUC blocks during HE8-10.

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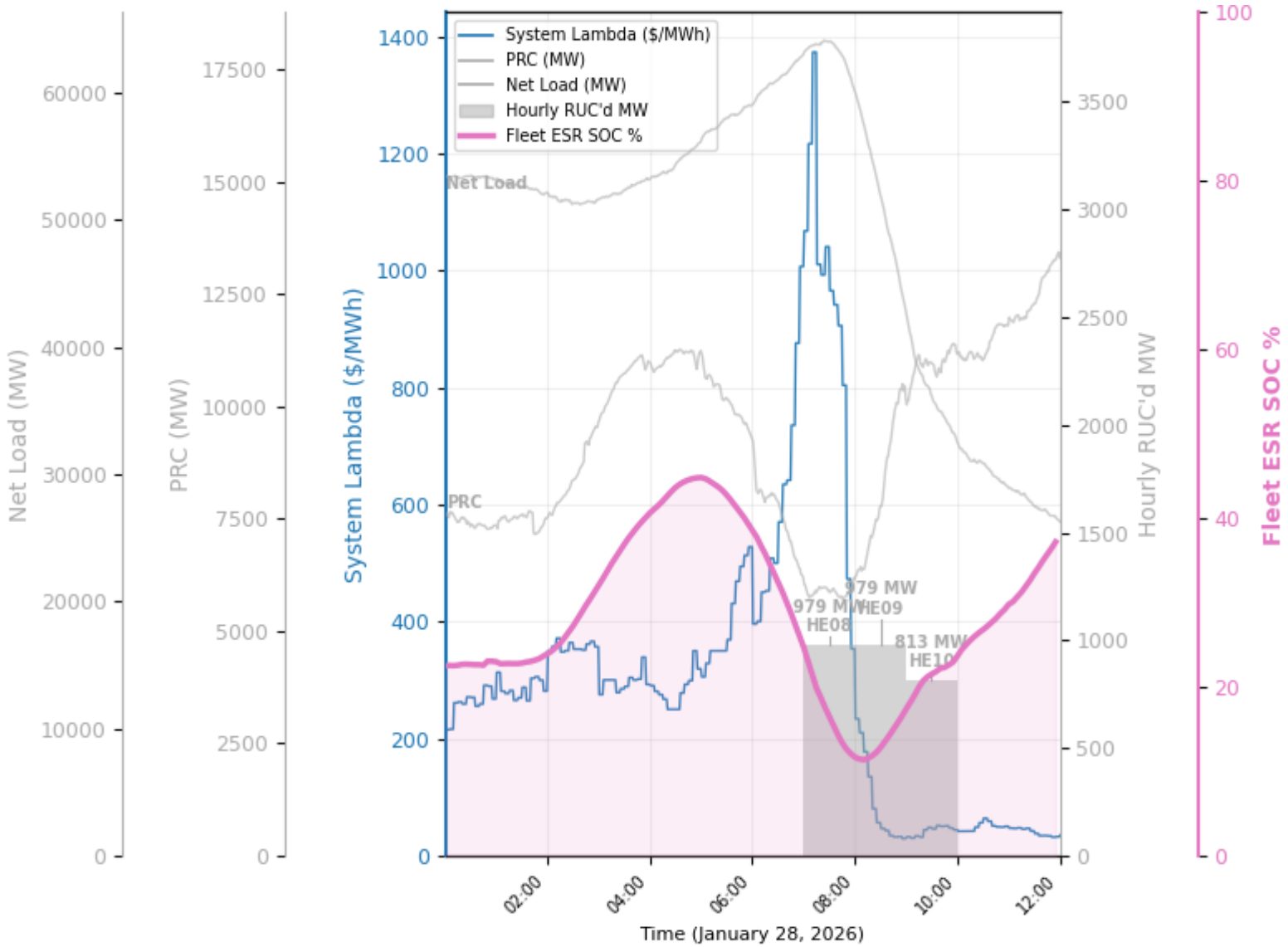
Low ESR SOC in Real-Time Contributed to Tight Conditions

System Lambda and Fleet ESR SOC % on 01/28/26



KEY TAKEAWAY

- As morning prices rose, ESRs discharged, reducing fleet SOC from 44% to 10% and resulting in low availability by HE8–10.

* Fleet ESR SOC % only counts ESRs with ON status

SOC Constraints for ESRs with Discharge Energy Dispatch Differ Between SCED and RUC

SCED	RUC	
MinSOC Constraint	**MinSOC Constraint**	**Hour Beginning SOC (HBSOC) Constraint**
$TelemSOC_i$ $-MW_i^{EnergyBidOfferAward} \times \Delta t_{ene}^{sced}$ $-MW_i^{RegUpAward} \times \Delta t_{Reg}^{sced}$ $-MW_i^{RRSPFAward} \times \Delta t_{RPF}^{sced}$ $-MW_i^{RRSFFAward} \times \Delta t_{RFF}^{sced}$ $-MW_i^{ECRSSAward} \times \Delta t_{ecr}^{sced}$ $-MW_i^{NSPINAward} \times \Delta t_{nsp}^{sced}$ $\geq TelemMinSOC_i$	$RUCHourBeginningPlannedSOC_{i,h}$ $-MW_{i,h}^{EnergyBidOfferAward} \times \Delta t_{ene}^{ruc}$ $-MW_{i,h}^{RegUpAward} \times \Delta t_{Reg}^{ruc}$ $-MW_{i,h}^{RRSPFAward} \times \Delta t_{RPF}^{ruc}$ $-MW_{i,h}^{RRSFFAward} \times \Delta t_{RFF}^{ruc}$ $-MW_{i,h}^{ECRSSAward} \times \Delta t_{ecr}^{ruc}$ $-MW_{i,h}^{NSPINAward} \times \Delta t_{nsp}^{ruc}$ $\geq RUCMinSOC_{i,h}$ $+ MinSOCViolationAmount$	$RUCHourBeginningPlannedSOC_{i,h+1} - RUCHourBeginningPlannedSOC_{i,h} =$ $-MW_{i,h}^{EnergyBidOfferAward} \times \Delta t_{ene-DF}^{ruc}$ $-\kappa_h^{RegUp} MW_{i,h}^{RegUpAward} \times \Delta t_{Reg-DF}^{ruc}$ $+\eta_{rt}\kappa_h^{RegDn} MW_{i,h}^{RegDnAward} \times \Delta t_{Reg-DF}^{ruc}$ $-\kappa_h^{RPF} MW_{i,h}^{RRSPFAward} \times \Delta t_{RPF-DF}^{ruc}$ $-\kappa_h^{RFF} MW_{i,h}^{RRSFFAward} \times \Delta t_{RFF-DF}^{ruc}$ $-\kappa_h^{ecr} MW_{i,h}^{ECRSSAward} \times \Delta t_{ecr-DF}^{ruc}$ $-\kappa_h^{nsp} MW_{i,h}^{NSPINAward} \times \Delta t_{nsp-DF}^{ruc}$ $+UnderSOCViolationAmount_{i,h} - OverSOCViolationAmount_{i,h}$
Where: $\Delta t_{Award\ Type}^{SCED}$: *Time duration required to sustain MW Award*	Where: $\Delta t_{Award\ Type}^{RUC}$: *Time duration required to sustain MW Award dispatch* $\Delta t_{Award\ Type-DF}^{RUC}$: *Deployment Factor Time duration for Award dispatch* κ_h^{AS}: *RUC Deployment Factor for AS in hour h (value between 0 and 1)* η_{rt}: *ESR roundtrip efficiency*	
• SCED dispatches ESRs economically based on their energy bid/offer curves while satisfying the hard MinSOC Constraint	• HBSOC Values are submitted via ESR COPs • ESRs do not have energy bid/offer curves and are dispatched to satisfy the soft MinSOC and HBSOC Constraints • The RUC MinSOC Constraint limits ESR capability based on the magnitude of COP HBSOC (i.e., stored energy) • The RUC HBSOC Constraint limits ESR capability based on the hour-to-hour change in COP HBSOC (i.e., charge/discharge)	

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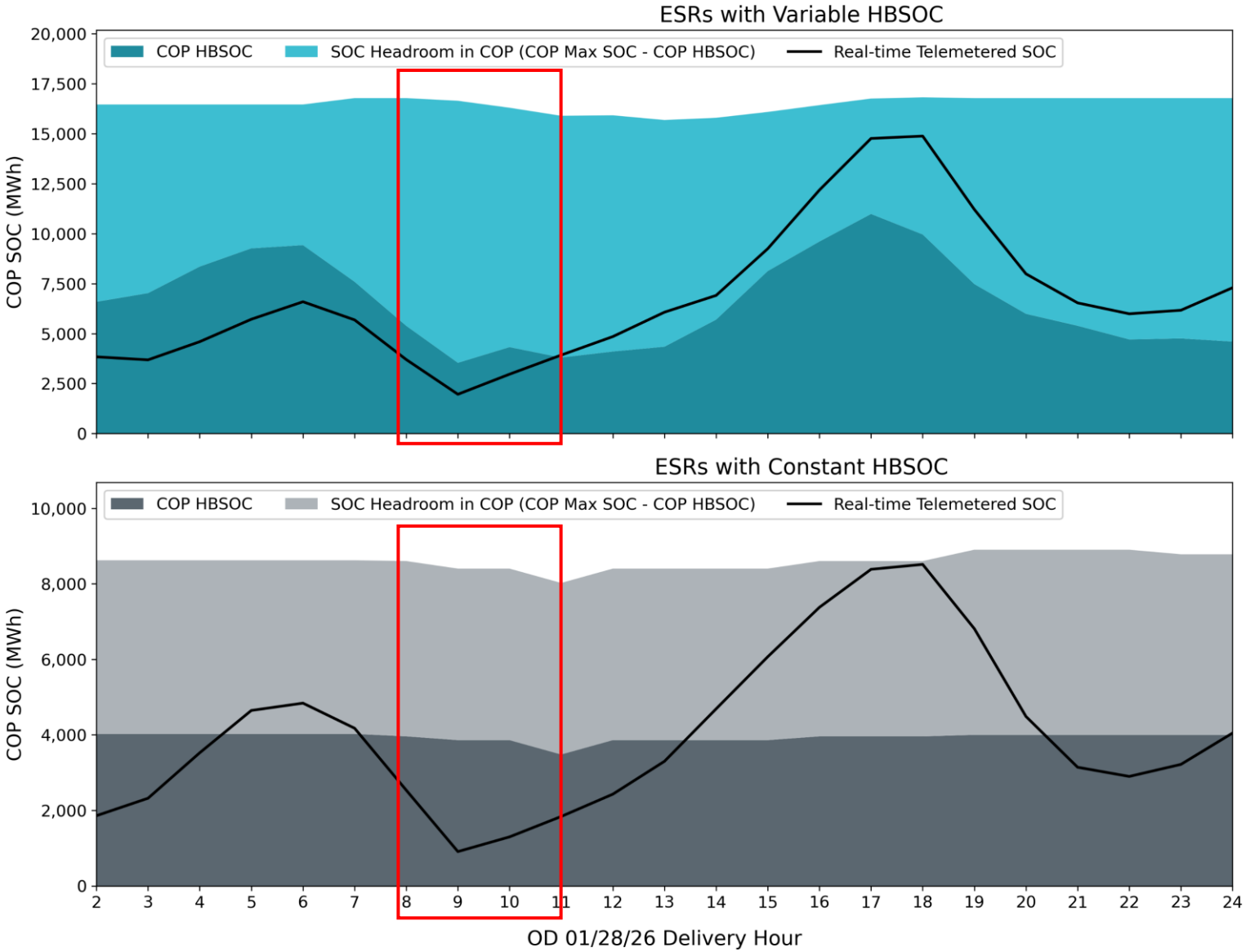
QSE-submitted COP HBSOC Used by 01/28/26 00:03:45 HRUC Differed From RT SOC



- ESRs that had different (Variable) COP HBSOC values across delivery hours on OD 01/28/26 had ~16,000 MWh of COP Max SOC.
- ESRs that had the same (Constant) COP HBSOC values for every delivery hour of OD 01/28/26 had ~8,000 MWh of COP Max SOC.
- The Constant COP HBSOC profile implies those ESRs would not be net charging or discharging during any hours of the day, which was not representative of the telemetered real-time SOC behavior for those ESRs.
- **The RUC HBSOC Constraint would prevent RUC from awarding any energy or AS to ESRs with Constant HBSOC profiles (unless an AS type has a Deployment Factor (DF) = 0).**

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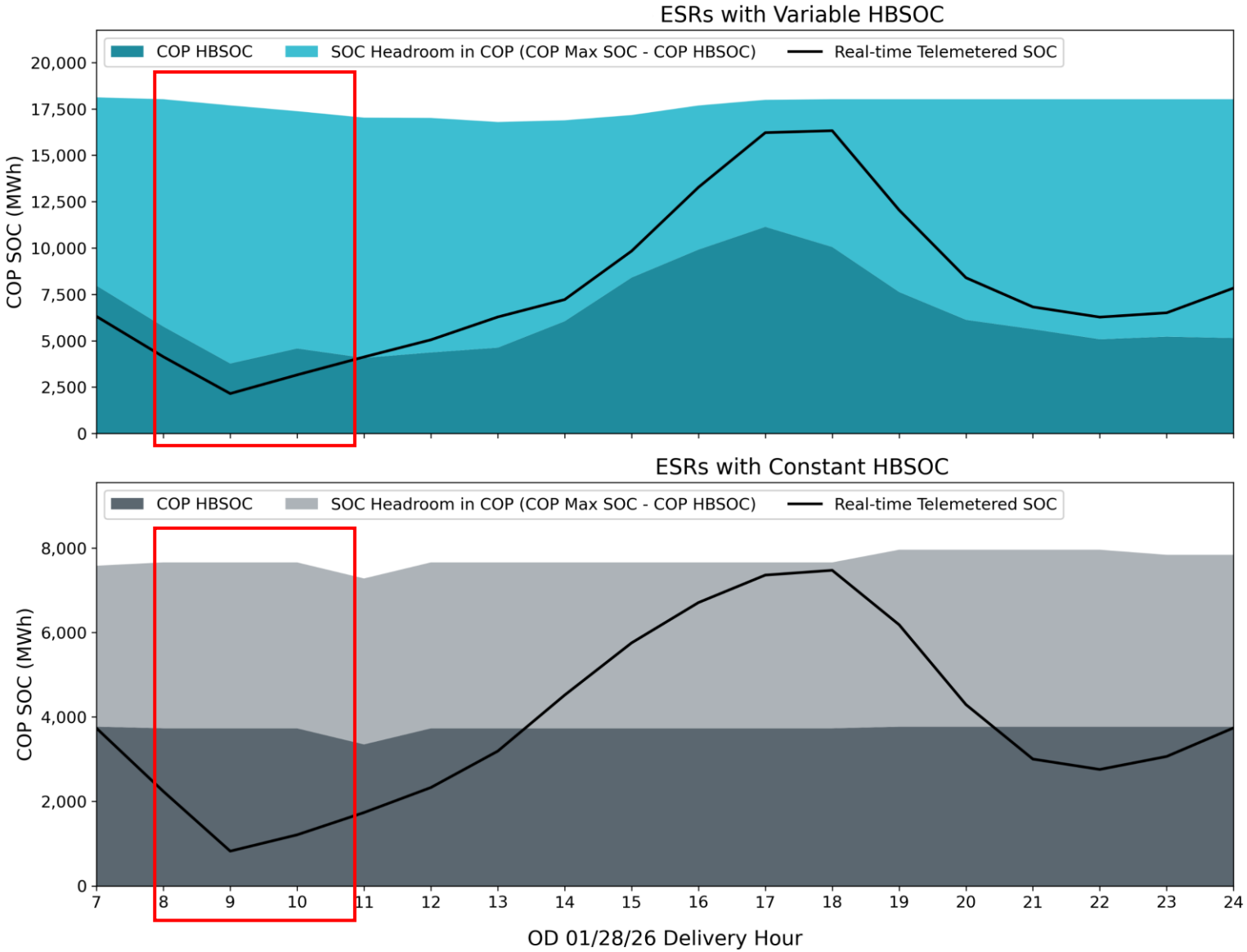
QSE-submitted COP HBSOC Used by 01/28/26 05:03:03 HRUC Differed From RT SOC



- During HE8-10 of the HRUC study with the most RUC activity (05:03 study), the COP HBSOC profiles for Variable COP HBSOC ESRs was a relatively accurate forecast of their real-time discharge behavior but over-forecasted the amount of stored energy they would have.
- The HE8-10 COP HBSOC profiles for Constant COP HBSOC ESRs under-forecasted their energy discharge and over-forecasted how much stored energy they would have.
- During the HE8-10, the RUC HBSOC constraint prevented ESRs with Constant COP HBSOC from getting any energy and AS awards except RRS (During HE8-10, RRS DF was zero).

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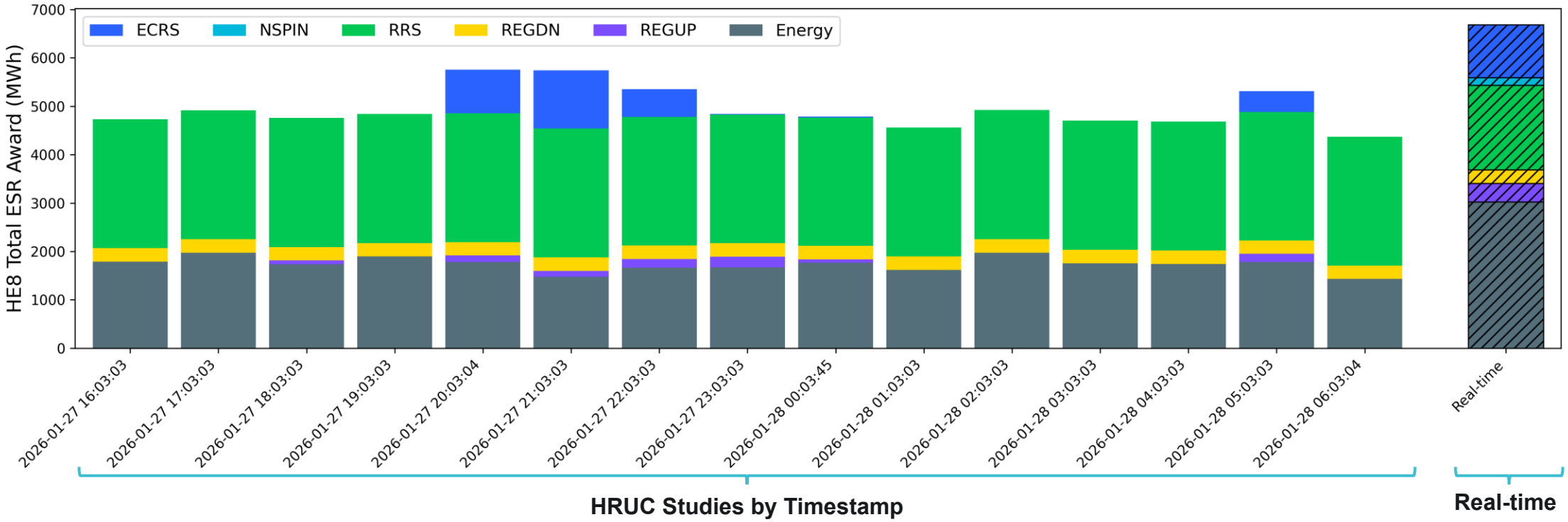
ESRs Were Awarded Less Energy and AS During HE8 in RUC Than in SCED



When conditions are tight, RUC maximizes the amount of energy and AS it can award by:

- Awarding NSPIN to offline resources that are qualified to provide offline NSPIN
- Awarding AS types with DF = 0 to ESRs with Constant COP HBSOC

Consequently, during HE8 of most HRUC studies leading up to the morning peak on OD 01/28/26:

- ESRs were awarded zero NSPIN, REGUP, and ECRS
- ESRs were awarded nearly all the REGDN (278 MW) and RRS (2,702 MW) plans
- All available COP SOC was allocated to fulfill energy awards

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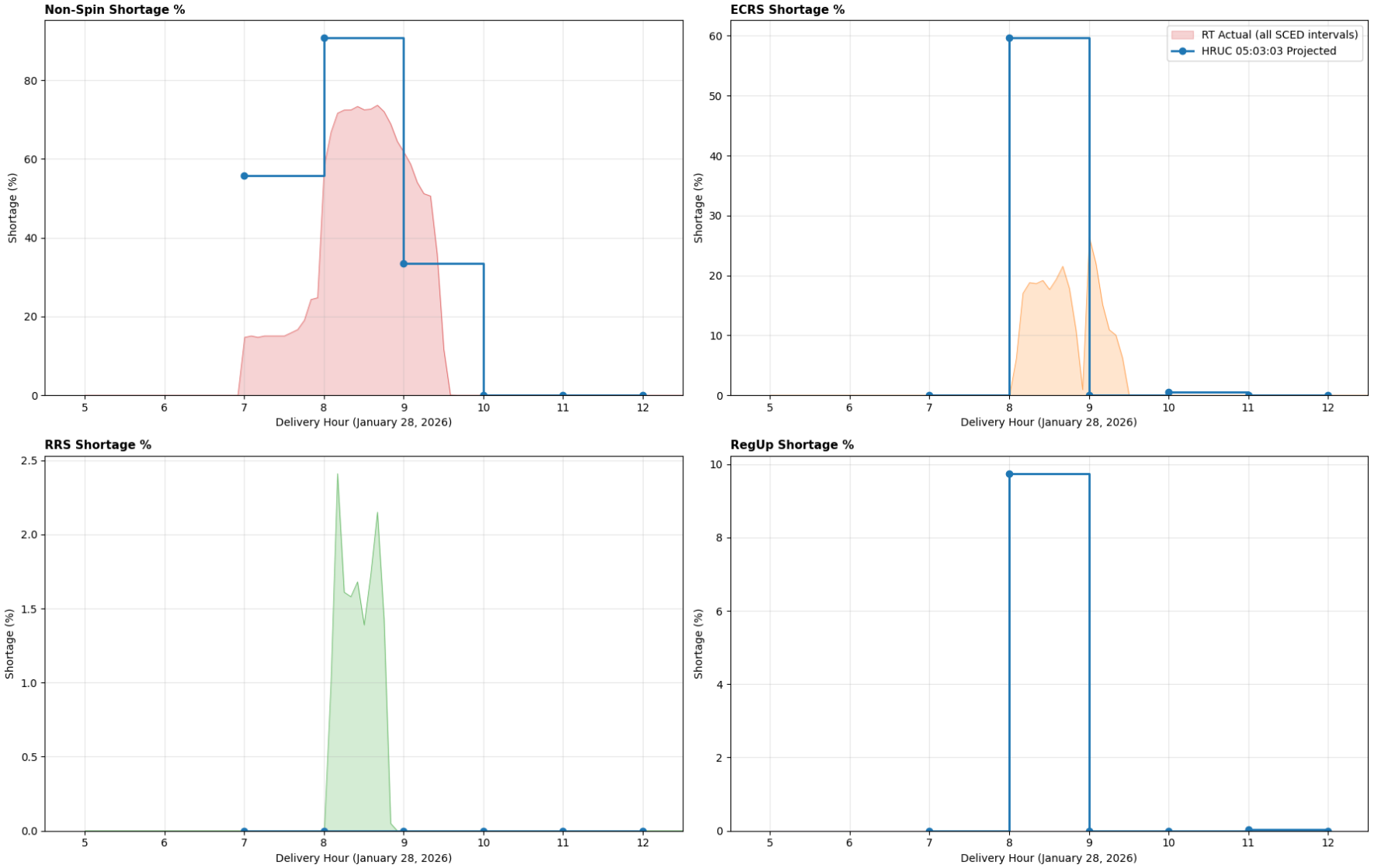
AS Shortages for the 05:03 HRUC Study Were Greater Than in RT

RT vs 5:00 AM HRUC Projected AS Shortages (HE7-HE12) – 01/28/26



KEY TAKEAWAY

- The depleted ESR SOC during HE8–10 drove RT ancillary service shortfalls in HE8–10.
- The 5:00 AM HRUC study had projected more severe ancillary service shortages.
- No RRS shortage was projected for HE8-10 in any HRUC due to its Deployment Factor being 0.
- REGUP shortage was non-zero in HRUC studies where there was zero RRS shortage.

Key Findings and Path Forward

Lessons Learned from this Analysis

- Inaccurate COP SOC data can result in underrepresentation of ESR capability in RUC.
- When conditions are tight, the RUC engine allocates most available ESR SOC to energy and Ancillary Services with small SOC cost (REGDN and RRS), while limiting SOC allocation to NSPIN, REGUP, and ECRS.

Next Steps

ERCOT will continue to analyze the impacts of AS deployment factors and ESR SOC constraints on RUC recommendations.

Appendix

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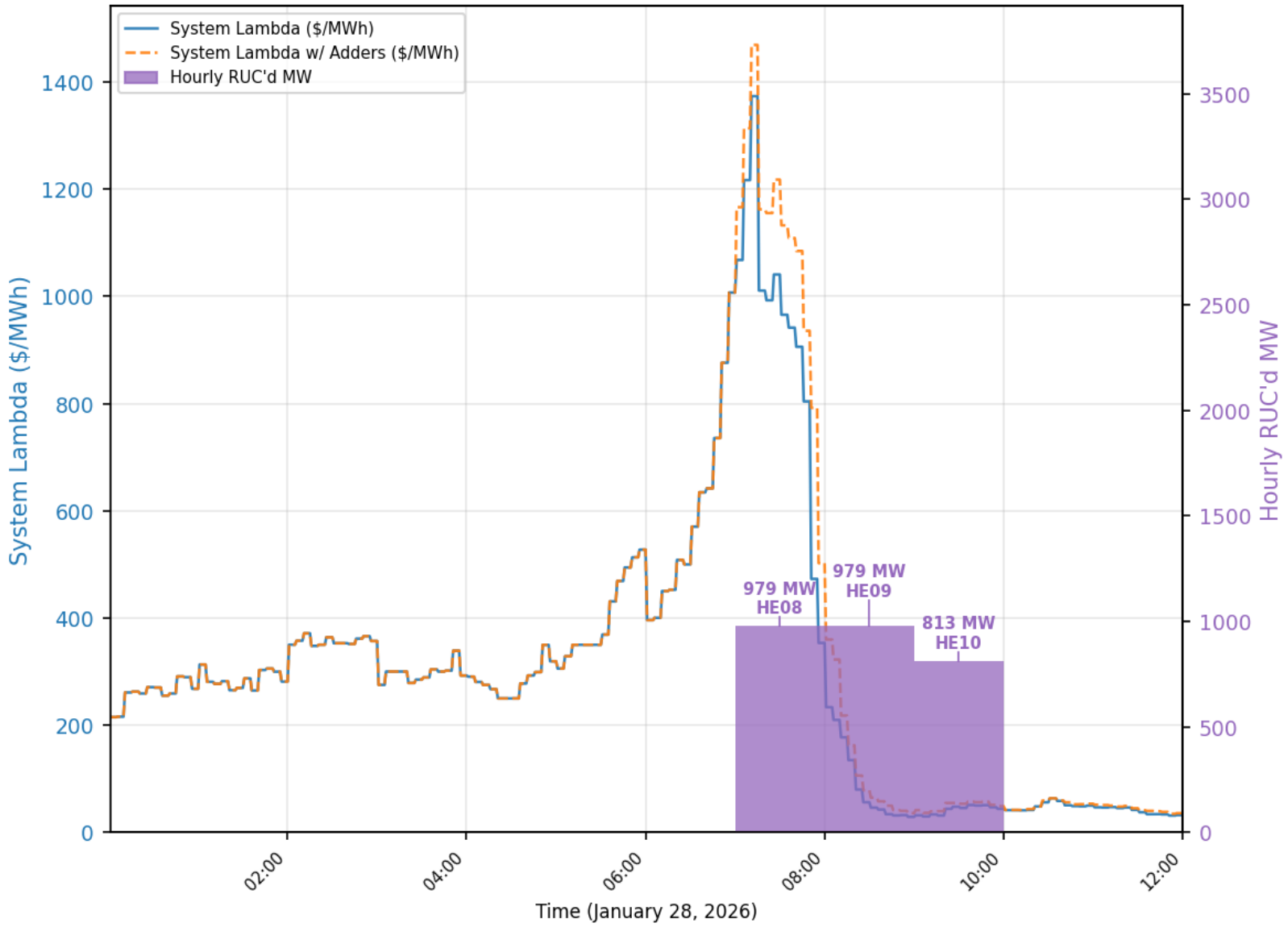
Pricing during RUC Commitments

System Lambda with and without RDPA Adders and RUC Committed on 1/28/26



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AS Shortages in RUC

HRUC Projected AS Shortages (HE7-HE10) – 1/28/26

HRUC Timestamp	Delivery Hour	NSPIN %	ECRS %	RRS %	RegUp %
01/28 00:03	HE07	43.6	0	0	1.2
	HE08	94.5	76.7	0	49
	HE09	52.1	11.8	0	0
	HE10	0	0	0	0
01/28 01:03	HE07	47.8	0	0	0.1
	HE08	94.5	88.4	0	100
	HE09	53.2	13	0	0
	HE10	0	0	0	0
01/28 02:03	HE07	76.1	9.8	0	5.7
	HE08	94.5	88.4	0	100
	HE09	42.5	0	0	0
	HE10	0	0	0	0
01/28 03:03	HE07	42.3	0	0	0.1
	HE08	94.5	84.4	0	100
	HE09	39.4	0	0	0
	HE10	0	0	0	0
01/28 04:03	HE07	45.6	0	0	0
	HE08	95	77.8	0	67.4
	HE09	36.5	0	0	0
	HE10	0	0	0	0
01/28 05:03	HE07	55.8	0	0	0
	HE08	90.7	59.6	0	9.7
	HE09	33.5	0	0	0
	HE10	0	0.5	0	0
01/28 06:03	HE08	93.1	87.2	0	100
	HE09	23.7	0	0	0
	HE10	0	0	0	0
01/28 07:03	HE09	2.8	0	0	0
	HE10	0	0	0	0
01/28 08:03	HE10	0	0	0	0