Discussion on Recent RUC Instructions

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Purpose

- In recent months, the frequency of RUC commitments has increased, particularly those nominally attributed to congestion
- Stakeholders have requested additional discussion on the primary drivers of the increase to help to understand this trend
- Today's discussion is an opportunity to review the RUC commitment process, discuss recent trends, and to educate stakeholders on the system condition interdependencies associated with RUC recommendations and commitments

Understanding the RUC Process

There is often not a single reason why the RUC engine is recommending certain units based on the optimization outputs

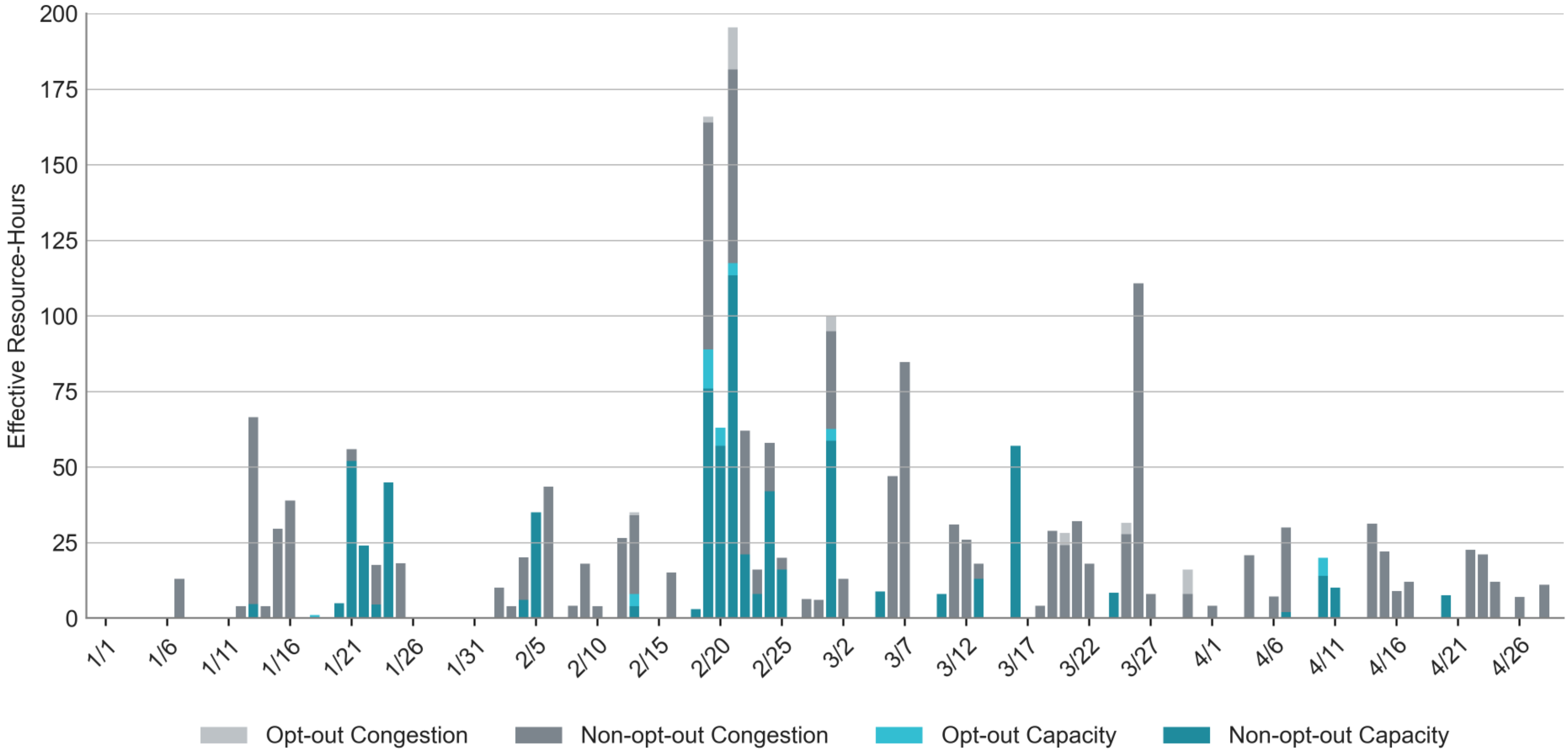
- For example: a RUC dispatch will curtail generation in the South to manage congestion while simultaneously committing units in the North to achieve power balance.
- The interdependency between these two decisions makes it difficult to always show cause and effect a given RUC instruction (i.e., tie RUC to one reason only).
- RUC activity can be more pronounced during outage season while there is also a high amount of congestion being observed on the system.

Understanding the RUC Process

Operators must react quickly to review and select/deselect units recommended for commitment and to attribute a reason to the commitment (or decision not to commit)

- Operator decisions on unit commitments and attribution of the RUC reason are based on deep operational experience and heuristic analysis of shift factors
- On a best efforts basis, ERCOT reports on the reasons given for RUC instructions using operational logs but this determination is more of a heuristic rule.
- The Operations log may show a single reason e.g. ‘capacity’, ‘constraint name’, however in reality there could be multiple simultaneous factors leading to the RUC commitment

Daily Effective RUC Hours in 2025



* Note: Includes data only up to Apr 28th

RUC by Reason in January to April 2025

- From January 1 to April 23 there were 220 HRUC Commitments for congestion
  - 72% were labeled as actions taken to relieve congestion on the South Texas GTCs, specifically E_PATA and E_PASP
  - Another 9% were labeled as actions to relieve congestion on the Valley Export
- ~71% of HRUC Commitments attributed to congestion occurred when High Ancillary Service Limit (HASL) Margin* was negative (i.e. HASL was less than Load Forecast)
- South Texas GTCs limit the units which can be committed by Operators
  - Only ~11% of HRUC Commitments for congestion were units in the South Load Zone

Congestion RUCs	**Jan-25**	**Feb-25**	**Mar-25**	**Apr-25****	**Total**
Positive HASL Margin	9%	35%	29%	33%	29%
Negative HASL Margin	91%	65%	71%	67%	71%

*HASL refers to the difference between the High Sustained Limit (HSL), which is the maximum generation a unit can provide, and the capacity reserved for Ancillary Services
** Note: Apr-2025 data only up to Apr 23rd

RUCs for Capacity and Congestion

When HASL Margin is positive	When HASL Margin is negative
• The power balance constraint is satisfied • RUC can manage *some* congestion by curtailing capacity ‘stuck’ behind binding constraints and replacing it with excess HASL from other online units	• The power balance constraint is violated • There is likely some capacity ‘stuck’ behind congestion. RUC will need to curtail that capacity and replace it with RUC-instructed capacity

- The RUC optimization will recommend the lowest cost combination of units that resolves both the:
  1. power balance constraint violation, and
  2. network constraint violation

Example - RUC for Capacity and Congestion

- Hypothetical hour where HASL Margin before RUCs = (-) 500 MW

Solution 1	Solution 2
RUC commits Resource A (700 MW) at a cost of $50k dollars	RUC commits Resource C (800 MW) at a cost of $70k dollars
RUC commits Resource B (300 MW) at a cost of $30k	Brings HASL Margin to (+) 300 MW
RUC of Resource A brings HASL Margin to (+) 200 MW, but network constraints still violated	RUC of Resource C also resolves all network constraint violations
Combined RUCs of Resource A and Resource B brings HASL Margin to (+) 500 MW and resolve all network constraint violations	
Total RUC Cost = $50k + $30k = $80k	**Total Cost of RUC = $70k**

- Solution 2 is lowest cost solution and Resource C is recommended for both capacity *and* congestion

Shift Factor (SF) Overview

- Single Reference SFs (used in DAM and RUC)
  - Single Reference SF for a Resource A – Constraint B pair represents the change in power flow through Constraint B if 1 MW is injected at Resource Node A and entirely consumed at the reference bus (Comanche Peak)
  - What matters is **the relative difference** between the single reference SF for Resource A and the SFs for other resources or electrical buses on the system. The optimization considers the cumulative flow impacts to the constraint.
  - The selection of a particular reference bus doesn't impact the optimization solution, but it can impact how people interpret the data being published, both the magnitude and sign (+ or -).
    - Think of the example of a radial constraint where there is no load behind the radial constraint and the resource behind the constraint is the reference bus. The SF will be zero, but should that be interpreted as the "Resource does not impact the constraint?"

Shift Factor (SF) Overview cont’d

- Load Distributed SFs (used in SCED)
  - Same methodology as Single Reference SFs, except that 1 MW injection is consumed at all network nodes weighted by the actual load at the nodes at the time of interest, rather than being entirely consumed at Comanche Peak
  - Magnitude and sign of Load Distributed SFs can be more intuitive than Single Reference SFs when interpreting the data
- While shift factors are informative, and Load Distributed SFs can be more helpful than Single Reference SFs in this context, considered in isolation they will not give us the whole picture

Using SFs to Analyze RUC Commitments

- When the RUC optimization recommends a resource to help resolve a violation of a network constraint, it is curtailing the generators that were overloading the constraint and replacing that curtailed generation with the RUC-instructed resource

- Neither the Single Reference SF or the Load Distributed SF for the RUC-instructed resource are particularly relevant on their own. **What matters is that the SF for the RUC-instructed resource is *less* hurting than the SFs for the generators it is replacing**

- ***Example:*** To reduce power flow South to North on E_PASP and E_PATA, RUC would curtail generators south of E_PASP and E_PATA and replace that generation with RUC instructions to units north of E_PASP and E_PATA

Discussion Summary and Next Steps

- Higher frequency of RUCs observed in recent months
- The RUC engine is working as expected. However, there is often not a single reason why the engine is recommending certain units:
  - RUC instructions nominally attributed to congestion were also recommended to help solve power balance
  - GTCs may limit the units in South Zone which can be committed
- The *relative* shift factor difference between a RUC-instructed unit and a unit that was backed down is important in understanding why a unit was recommended
- The optimization will recommend the lowest cost combination of units that resolves both the power balance constraint violation and network constraint violation
- Review of monthly RUC activity reporting will continue as a standing item at WMWG and ERCOT SMEs can support future discussion and questions from stakeholders