Storage Design and Modeling

State of Charge (SOC) Management & Capacity Awards

Policy Review: Draft BPM Changes
Stakeholder Meeting

April 14, 2025

Housekeeping reminders

- This call is being recorded for informational and convenience purposes only. Any related transcriptions should not be reprinted without ISO's permission.
- The meeting is structured to stimulate dialogue and engage different perspectives.
- Please keep comments professional and respectful.
- Please try and be brief and refrain from repeating what has already been said so that we can manage the time efficiently.

Instructions for raising your hand to ask a question

- Open the Participant and Chat panels from the bottom right of the Webex screen.
- If you are connected to audio through your computer or used the “call me” option, select the raise hand icon  located at the bottom of the participant panel.

  -**Note**: if you dialed in outside of Webex, press *3 to get into the question queue.
- Please remember to state your name and affiliation before making your comment.
- If you need technical assistance during the meeting, please send a chat to Intellor Events.
- You may send your question via chat to all panelists.

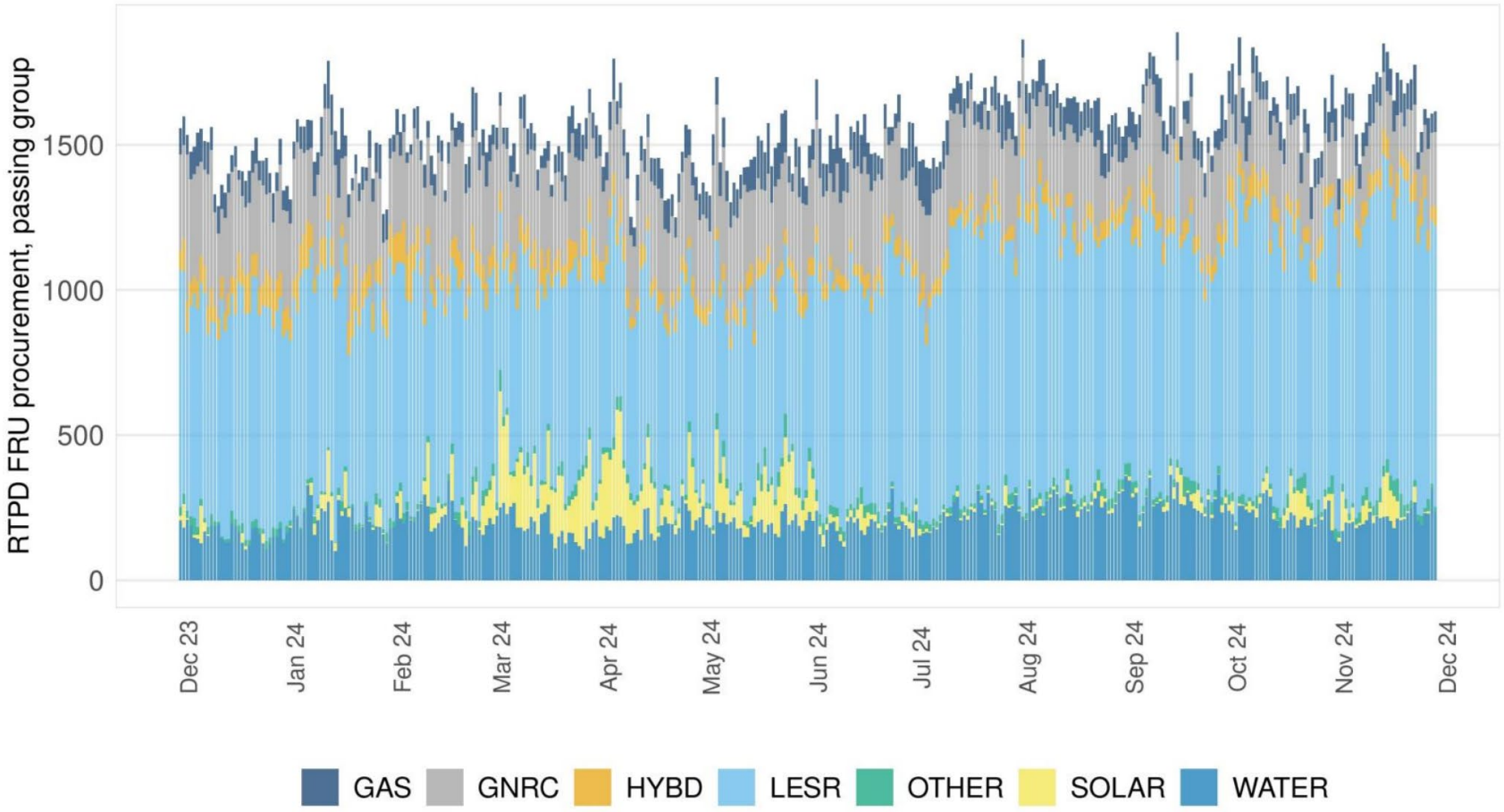
Today's Agenda

Time	Topic	Presenter
1:00 – 1:05	Welcome	Yelena Kopylov-Alford
1:05 – 2:50	Discussion of proposed modifications to the Market Operations Business Practice Manual	Sergio Duenas Melendez & Dinesh Das Gupta
2:50 – 2:55	Next steps	Yelena Kopylov-Alford

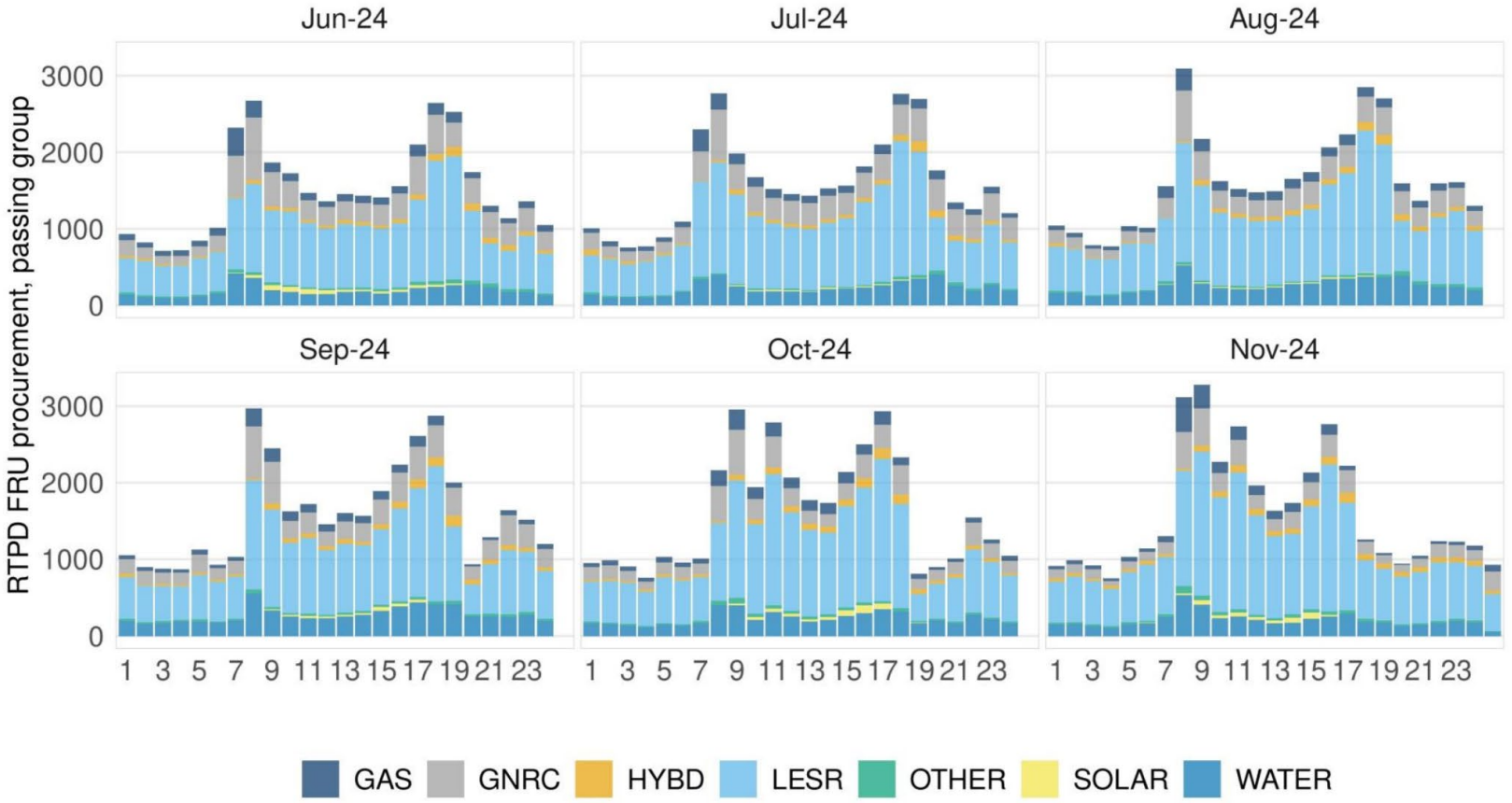
Background

- The SDM initiative is tackling a wide array of topics pursuant to energy storage in different configurations
- Topics have been categorized in a manner that allows for organized discussions, holistic consideration of issues, and the potential to resolve matters and implement solutions in a staggered manner
- Stakeholders feedback urged the ISO to focus on known issues that are amenable to expeditious resolution
- The ISO proposes to address the SOC Management and Capacity Awards issue, which covers the reflection of FRP impacts on SOC, ahead of summer 2025 through targeted modifications to the Market Operations Business Practice Manual (BPM)

Energy storage provides most upward FRP



Storage resources tend to support upward FRP procurement across all hours of the day



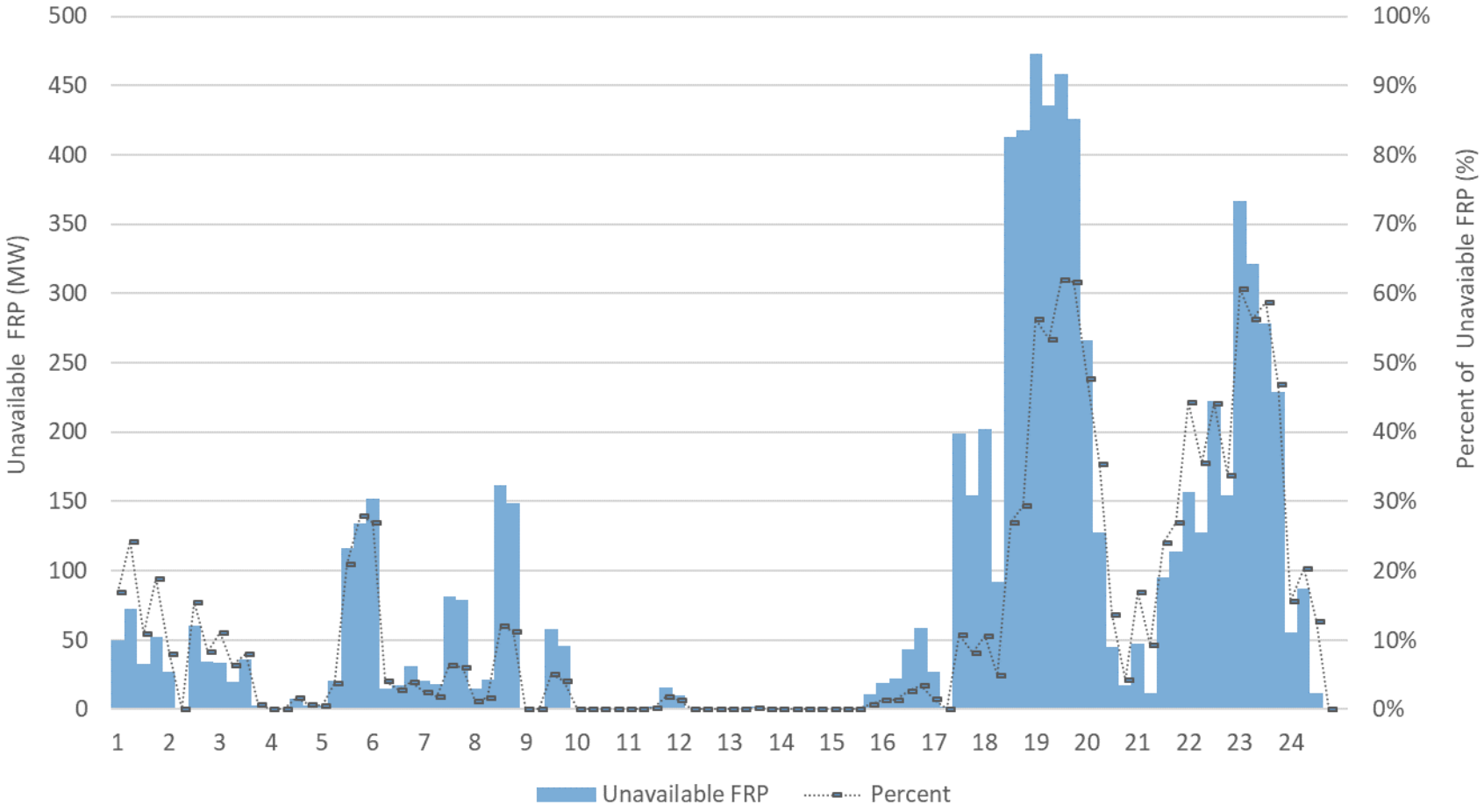
The current SOC formulation does not consider the impact of FRP on SOC

- Today, a large share of FRP is procured from storage resources
- Since the SOC calculation does not consider the impact of providing FRP, these awards could end up being unfeasible due to inadequate SOC
- This issue has price formation and market efficiency implications
  - Since FRP awards are not limited by their impact on SOC, FRP prices could be artificially suppressed
  - If inadequate SOC results in undeliverable FRP awards, the market will need to procure that additional energy from other resources, putting upward pressure on the bid stack and potentially increasing energy prices

The current SOC formulation does not consider the impact of FRP on SOC

- In FMM, the market accounts for the SOC impacts of Energy and AS to ensure feasible dispatch instructions (*i.e.,* that these awards can be supported by the SOC for every single interval of the horizon)
- Currently, this constraint does not include FRP awards
- When the market clears for Energy, AS or FRP it does it for all intervals of the horizon.
- Since FRP is not included in the SOC constraint, a storage resource may be dispatched for Energy and AS in a manner that it becomes infeasible to support FRP awards with the remaining SOC throughout the market horizon, resulting in a material change regarding the energy dispatched

In typical summer conditions, this gap can result in up to 60 percent (450 MW) of awarded FRP to be unavailable during peak hours



Anticipated issues

- Given the exponential growth of storage capacity, modeling SOC impacts of awarded FRP is increasingly important to ensure FRP deliverability
- The lack of modeling this interplay has a material impact on FRP pricing
- This also has implications for operations since it results in the need to use load conformance to secure ramping capability that is cannot be deployed from storage resources
- In this context, the ISO seeks to pursue a modification of the current SOC formulation and constraints to consider FRP impacts immediately, to ensure delivery by Summer 2025

Proposed modifications to the Market Operations BPM

7.8.2.5 Stored Energy Management for Non Generator Resources in Real-Time

For NGRs designated as Limited Energy Storage Resources (LESRs), state of charge (SOC) constraints are applied to both the binding and non-binding intervals in FMM and RTD based on their Master File parameters, Lower and Upper Charge Limit bids, End-of-Hour (EOH) SOC bids limits, and, if applicable, the reliability-induced Minimum SOC described in section 2.5.8 of this BPM.

Real-Time Interval State-of-Charge Management

To model state of charge for storage resources during each interval the real-time market uses telemetered values for state of charge from storage resources to calculate an initial value, similar to the way initial operating levels are calculated for traditional generation. From these initial conditions state of charge is updated from energy and regulation awards throughout the look-ahead periods considered by the real-time market. This is a similar process to how state of charge is modeled in the day-ahead market, outlined in section 6.6.2.3, with the exception that the real-time interval state of charge considers the impacts of Flex Ramp Up awards. ~~.~~ ~~T~~As a result, the state of charge is calculated for each interval in real-time markets as follows:

$$SOC_{i,t} = SOC_{i,t-1} - (EN_{i,t}^{(+)} + \eta EN_{i,t}^{(-)}) \frac{\Delta T}{T_{60}}$$

$$SOC_{i,t}^{AT} = SOC_{i,t-1}^{AT} - (FRU_{i,t} + EN_{i,t}^{(+)} + \eta EN_{i,t}^{(-)} + ATRU_t RU_{i,t} - ATRD_t \eta_i RD_{i,t}) \frac{\Delta T}{T_{60}}$$

$$\underline{SOC_{i,t}} \leq SOC_{i,t} \leq \overline{SOC_{i,t}}$$

$$\underline{SOC_{i,t}} \leq SOC_{i,t}^{AT} \leq \overline{SOC_{i,t}}$$

[…]

Proposed modifications to the Market Operations BPM

6.6.2.3 Stored Energy Management

[…]

The state of charge for a storage resource is governed by the state of charge equation as follows:

$$SOC_{i,t} = SOC_{i,t-1} - (EN_{i,t}^{(+)} + \eta EN_{i,t}^{(-)})\frac{\Delta T}{T_{60}}$$

$$\underline{SOC_{i,t}} \leq SOC_{i,t} \leq \overline{SOC_{i,t}}$$

$$SOC_{i,t}^{AT} = SOC_{i,t-1}^{AT} - (EN_{i,t}^{(+)} + \eta EN_{i,t}^{(-)} + ATRU_t RU_{i,t} - ATRD_t \eta_i RD_{i,t})\frac{\Delta T}{T_{60}}$$

$$\underline{SOC_{i,t}^{\cancel{AT}}} \leq SOC_{i,t}^{AT} \leq \overline{SOC_{i,t}^{\cancel{AT}}}$$

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Questions

NEXT STEPS

Next Steps

- No written comments requested for today's meeting.
- Written comments can be provided from April 29, 2025 to end of day May 13, 2025 through the BPM Change Management process.
- This presentation and other materials are available on the initiative page: https://stakeholdercenter.caiso.com/StakeholderInitiatives/Storage-design-modeling
- Additional questions please email: isostakeholderaffairs@caiso.com

This Week at the ISO – 04/14/25

Stakeholder Meetings

All public stakeholder meetings are also listed on the ISO calendar:

- Monday, April 14th - SOC Management for Capacity Awards
  - 1:00pm - 3:00pm PT (link)
- Tuesday, April 15th - 2024-2025 Transmission Planning Process
  - 9:00am - 2:00pm PT (link)
- Tuesday, April 15th - Release User Group Forum
  - 10:00am - 11:00am PT (link)
- Tuesday, April 15th - Interconnection Customer User Group
  - 2:00pm - 3:00pm PT (link- registration required)
- Wednesday, April 16th - WEIM - Assistance Energy Transfer (AET) Extension
  - 10:00am - 11:00am PT (link)
- Wednesday, April 16th - Gas Resource Management
  - 1:00pm - 3:00pm PT (link)
- Thursday, April 17th - Congestion Revenue Rights Customer Partnership Group
  - 10:00am - 11:00am PT (link)
- Thursday, April 17th - Market Update
  - 10:15am – 11:00am PT (link)

This Week at the ISO continued

Comment Submission Deadlines

- Tuesday, April 15th - Ancillary Services Focus Group 1
- Tuesday, April 15th - BPM Proposed Revision Requests 1614 - 1621
- Wednesday, April 16th - Congestion Revenue Rights Enhancements
- Wednesday, April 16th - Greenhouse Gas Coordination Working Group
- Thursday, April 17th - 2026 Local Capacity Requirements Technical Study Final Results

Trainings

- None scheduled for the week.
- The ISO encourages market participants to review the new training page on the Market Participant Portal. In addition to the Learning Center, this new training page provides Scheduling Coordinators with a centralized location for accessing computer-based training videos (to learn more, please view the High-Level Overview video).

Market Simulations

- Please refer to our Release Schedule for the most recent updates of initiatives scheduled for MAP- and Production- stage market sims.
- Thursday, April 17th - Market Simulation Forum
  - 2:00pm - 3:00pm PT (link)

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