Comments on Storage Design and Modeling Issue Paper and Straw Proposal on Outage Management, Nonlinearity, and SOC Clarification

Department of Market Monitoring

May 23, 2025

Overview

The Department of Market Monitoring (DMM) appreciates the opportunity to comment on the *Storage Design and Modeling Issue Paper and Straw Proposal on Outage Management, Nonlinearity, and SOC Clarification* and the corresponding stakeholder meeting held May 9, 2025.[1,2] In these comments, DMM adds to our previous comments from the ISO's Storage Design and Modeling (SDM) Working Group 1 through 3.[3,4]

While DMM supports many items in the proposed scope of this initiative, DMM continues to encourage the ISO to address the storage bid cost recovery (BCR) concerns as a top priority, before undertaking additional storage design enhancements that may considerably slow the pace of development for needed storage bid cost recovery enhancements.

In these comments, DMM addresses the following three issues raised in the Issue Paper and Straw Proposal:

- **Modeling nonlinearity of storage operations.** DMM supports development of market model improvements that incorporate nonlinearities of storage resource operations. If the ISO is unable to directly model nonlinearities in the near term, DMM conditionally supports extending dynamic limit functionality to storage resources as an interim solution. If the ISO extends dynamic limit functionality to all storage resources, the ISO should also:
    - Clearly specify the acceptable use of dynamic limits for storage resources in the CAISO Tariff,
    - Require new Master File data sufficient to allow monitoring of the use of the dynamic limits, and

[1] *Storage Design and Modeling Issue Paper and Straw Proposal on Outage Management, Nonlinearity, and SOC Clarification*, California ISO, March 27, 2025: https://stakeholdercenter.caiso.com/InitiativeDocuments/2025-03-27-SDM-Outage-Management-Nonlinearity-SOC-Definition-Issue-Paper-Straw-Proposal-FINAL.pdf

[2] *Storage Design and Modeling Working Group: Outage Management, Nonlinearity, and SOC Clarification*, California ISO, May 9, 2025: https://stakeholdercenter.caiso.com/InitiativeDocuments/Presentation-StorageDesignandModeling-May9-2025.pdf

[3] *Comments on Storage Design and Modeling Working Group Session 1*, Department of Market Monitoring, January 8, 2025: https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-working-group-session-dec-11-2024-jan-8-2025.pdf

[4] *Comments on Storage Design and Modeling Working Group Session 2 and 3*, Department of Market Monitoring, March 7, 2025: https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-working-group-sessions-2-and-3-mar-07-2025.pdf

- Establish that resources using the dynamic limit would be ineligible for real-time bid cost recovery (BCR) for intervals in which the dynamic limit impacts the resource's dispatch – up to the entire operating day if it is infeasible to accurately identify such intervals.

- **Outage reporting.** DMM supports improvements to outage reporting that better reflect limitations unique to storage resources. DMM continues to recommend ISO staff work together to coordinate the development of new storage outage types into resource adequacy policy developments.
- **SOC definition and calculation.** DMM supports improvements to the definition of SOC to clearly reflect resources' stored energy that is available to the market.

Comments

DMM conditionally supports extending the use of dynamic limits to storage resources

Stakeholders have suggested implementing dynamic limits for all storage resources to allow scheduling coordinators to manage issues such as foldback. DMM has previously recommended against this use of dynamic limits.[5] However, the ISO has indicated it cannot model the foldback limitations in the near-term. As a result, DMM conditionally supports the use of dynamic limits as an interim solution.[6]

DMM's conditional support for the use of dynamic limits by storage resources depends upon the ability of the ISO and DMM to monitor for appropriate use, clearly enforceable tariff provisions in the event of inappropriate use, and ineligibility of real-time bid cost recovery when dynamic limits impact the resource's dispatch.

If this interim solution is pursued, DMM requests improvements to Master File to facilitate monitoring of dynamic limit usage for all storage resources. DMM also requests the ISO detail the appropriate use of dynamic limits for storage resources to manage foldback and nonlinearities in the CAISO Tariff. Finally, DMM requests that resources using the dynamic limit would be ineligible for real-time BCR for intervals in which the dynamic limit impacts the resource's dispatch. This would include the interval in which the dynamic limit was used directly, as well as any surrounding intervals at other points in the day where the use of a dynamic limit in a previous or future interval may have impacted the resource's availability. If it is deemed infeasible to identify such intervals, the ISO should establish that resources would be ineligible for real-time BCR for the entire operating day in which a dynamic limit is used.

The ISO developed dynamic limits for hybrid resources because the market model does not incorporate all the information of the individual component generating units of a hybrid resource. The dynamic limit is intended to allow resources to capture constraints and operational limitations that may not be modeled, to aid in a feasible dispatch.

Foldback is similar, in that it creates an operational limitation in the upper and lower ends of the storage resource's state-of-charge (SOC). To overcome the nonlinearities of battery storage charging and foldback, in the interim, the ISO could extend the dynamic limit functionality to storage resources.

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[5] *Ibid.*

[6] *Storage Design and Modeling Working Group: Outage Management, Nonlinearity, and SOC Clarification*, California ISO, May 9, 2025: https://youtu.be/4DPKVa7skik

DMM believes that with appropriate transparency, monitoring, and bid cost recovery rules, this could be an improvement over the status quo, but DMM does not see this as a long-term solution. More robust modeling of nonlinearities and other storage limitations through, e.g., SOC based bidding, may be preferred instead as a long-term approach.[7,8]

To facilitate monitoring, DMM requests the ISO collect in Master File the operational characteristics for each storage resource related to foldback. The Master File detail could include the expected upper and lower regions of the SOC where foldback would become an operational limitation to the resource, and the expected modified ramp rate the resource would experience during foldback.

A consideration discussed below is the use of outage cards and their interaction with the Resource Adequacy Availability Incentive Mechanism (RAAIM), and forthcoming unforced capacity (UCAP) methodology for resource adequacy capacity accreditation. These policies are used to create incentives for resources' operational and planning availability to the market. Because dynamic limits were developed for hybrid resources, which are exempt from RAAIM, there has been no discussion of the RAAIM implications of dynamic limit use.

However, DMM believes the dynamic limit may impact RAAIM calculations for storage resources in a manner similar to outages, because dynamic limits adjust real-time bids to the availability of the resource reflected by the dynamic limit. This potential interaction could help incentivize resources to be available during stressed grid conditions. The dynamic limit would not impact UCAP calculations because the dynamic limit does not reflect a physical outage (or derate) on the resource reported through the outage management system (OMS).

DMM conditionally supports extending the dynamic limit functionality to storage resources to reflect foldback and nonlinearities. To the extent dynamic limit use can have RAAIM implications, storage resources will still be incentivized through RAAIM to demonstrate their maximum available capacity. In the long term, DMM recommends the ISO sunset this feature, develop market functionality to allow storage resources to bid SOC to manage issues of foldback, and develop other market enhancements as necessary to manage other operational nonlinearities.[9]

DMM supports improved outage reporting for storage resources

DMM continues to support enhancements to storage outage reporting for storage resources.[10] Storage resources face limitations and outage types not currently covered in outage management system (OMS) that are unique to storage resources, such as negative Pmin and energy (SOC) limitations.

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[7] *Comments on Storage Design and Modeling Working Group Session 1*, Department of Market Monitoring, January 8, 2025: https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-working-group-session-dec-11-2024-jan-8-2025.pdf

[8] *Comments on Storage Design and Modeling Working Group Session 2 and 3*, Department of Market Monitoring, March 7, 2025: https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-working-group-sessions-2-and-3-mar-07-2025.pdf

[9] *Comments on Storage Design and Modeling Working Group Session 2 and 3*, Department of Market Monitoring, March 7, 2025: https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-working-group-sessions-2-and-3-mar-07-2025.pdf

[10] *Ibid.*

DMM understands that outages may be one approach currently used to manage foldback issues discussed above. Should outages continue to play a role in managing foldback, DMM recommends introduction of a new outage card type to signal effects of foldback on ramp rates. However, DMM agrees with California Public Utilities Commission Energy Division staff that outages used to communicate foldback should not be RAAIM exempt. RAAIM exemption would not send the appropriate incentives to contracted capacity to perform to their RA obligations. [11]

DMM further supports the development of additional outage types that are unique to storage resources, and incorporating the cause descriptions in the Business Practice Manual nature of work table for storage resources. Outages are physical limitations of a resource, and these physical limitations should be detailed for storage scheduling coordinators to reflect resource availability to the market. Improved outage reporting will assist market operators and monitors in ensuring the system is operating reliably and efficiently. DMM continues to recommend ISO staff work together to coordinate the development of new storage outage types into resource adequacy policy developments. [12]

Instances of observed lack of availability highlight the need to improve SOC definition

DMM has raised concerns to the ISO about the definition and calculation of SOC. The concerns arise from instances of observed lack of availability of storage resources, and a vague tariff definition of what SOC should represent. The definition specifies that SOC should reflect stored energy available to the CAISO markets, but does not provide a definition of availability, e.g., within what timeframe the stored energy must be available. [13]

Clarifications to the definition and calculation of telemetered SOC need to more accurately reflect the true SOC availability of storage resources to the market, at the time of market dispatch. DMM has identified cases in which the SOC is greater than zero, but the stored energy is unavailable to the market. This situation is most apparent in cases where the resource is available and receiving a dispatch operating target, however the resource cannot respond to the dispatch because the telemetered SOC is unavailable, which is later revealed through an outage. This leads to the market solving under inaccurate conditions for these resources. DMM recommends the ISO clarify a definition of SOC availability in the tariff, and consider including a standardized approach to calculating SOC.

[11] *Storage Design and Modeling Issue Paper and Straw Proposal on Outage Management, Nonlinearity, and SOC Clarification*, California ISO, March 27, 2025: https://stakeholdercenter.caiso.com/InitiativeDocuments/2025-03-27-SDM-Outage-Management-Nonlinearity-SOC-Definition-Issue-Paper-Straw-Proposal-FINAL.pdf

[12] *Ibid.*

[13] *CAISO Tariff – Appendix A*, California ISO, February 5, 2025: https://www.caiso.com/documents/appendix-a-master-definition-supplement-as-of-feb-5-2025.pdf