

# Comments on Storage Design and Modeling Working Group Presentation on November 12, 2025

## Department of Market Monitoring

November 26, 2025

### Summary

The Department of Market Monitoring (DMM) appreciates the opportunity to comment on the *Storage Design and Modeling* working group presentation held on November 12, 2025.<sup>1</sup>

DMM appreciates the ISO's attention to storage bid cost recovery (BCR) issues. DMM continues to support eliminating day-ahead (DA) BCR for storage resources unless specific instances are identified where DA BCR is clearly appropriate to support efficient market outcomes for storage resources.<sup>2</sup> DMM continues to recommend a similar approach to establishing real-time (RT) BCR eligibility for storage resources, with a default of no BCR, and eligibility for RT BCR only established under specific situations when it is deemed appropriate. Specifically, DMM recommends the ISO eliminate RT BCR for storage resources buying back day-ahead schedules due to insufficient state-of-charge (SOC) by default, only allowing this source of RT BCR in specifically identified situations deemed appropriate.

If the ISO instead chooses to maintain default eligibility of batteries for RT BCR, and attempts to address each individual scenario that could lead to unwarranted RT BCR, DMM supports the proposal to reduce day-ahead buybacks due to insufficient SOC by better incentivizing accurate submissions of the DA initial state-of-charge (DA ISOC) parameter. Even if the DA ISOC is accurate, there is still a bidding incentive issue if storage resources receive BCR for day-ahead buybacks due to insufficient SOC. DMM supports the ISO requiring DA ISOC submission independent of the BCR issues. DMM recommends strengthening the tariff language to better define expected use of the DA ISOC in order to promote reliability and discourage misuse of this parameter.

The system state-of-charge mechanism introduced by the ISO appears to be another potential proposal aimed at reducing day-ahead buybacks due to insufficient state-of-charge. However, this approach also does not address the underlying BCR design issue, and DMM requests more information about this mechanism and how it is different than the minimum SOC constraint that was retired in 2023.

DMM supports enhancements to the storage default energy bid (DEB) and continues to recommend an hourly DEB for storage resources that reflects estimated intraday opportunity cost associated with future intervals and changing real-time conditions.<sup>3</sup>

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<sup>1</sup> *Storage Design and Modeling Working Group on Outage Management, Uplift & DEB, and Mixed-Fuel & Distribution-Level Resources* presentation, California ISO, November 12, 2025:

<https://stakeholdercenter.caiso.com/InitiativeDocuments/Presentation-Storage-Design-and-Modeling-Nov12-2025.pdf>

<sup>2</sup> *Comments on Storage Design and Modeling Working Group Presentation on September 29, 2025*, Department of Market Monitoring, October 14, 2025: <https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-sep-29-2025-working-group-presentation-oct-14-2025.pdf>

<sup>3</sup> *Comments on Storage Design and Modeling May 28, 2025 Presentation*, Department of Market Monitoring, June 11, 2025: <https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-may-28-2025-presentation-jun-11-2025.pdf>

DMM supports the ISO's proposal to require storage resources to provide Master File parameters that reflect a qualifying capacity (QC) where the resource can discharge for four hours or more without expected power limitations (e.g., foldback). Further, DMM recommends the ISO introduce additional Master File parameters that allow for the additional energy within the resource to be available to the market during extenuating circumstances if the market or market operators were to need to access the stored energy.

## **Comments**

DMM supports the ISO addressing storage bid cost recovery issues as a top priority. DMM continues to recommend redesigning storage BCR rules to assume no eligibility, and only add eligibility under specific situations where it is deemed appropriate and necessary to support market efficiency.<sup>4</sup>

### ***DMM supports elimination of day-ahead BCR for storage resources***

DMM supports the ISO's proposal to eliminate DA BCR for storage resources. The ISO and stakeholders have not demonstrated that DA BCR for storage resources is necessary to support market efficiency. Further, the current DA BCR design can lead to unwarranted BCR payments and is susceptible to gaming. DMM recommends the same bottom-up approach be taken to establish rules for real-time bid cost recovery.

### ***DMM continues to recommend that storage resources only be eligible for RT BCR under specific situations where deemed appropriate***

Allowing storage resources to receive BCR for day-ahead buybacks due to insufficient state-of-charge removes their exposure to real-time prices and fails to incentivize efficient bidding for storage resources in the real-time. Many of the potential policy changes discussed by the ISO aim to minimize day-ahead buybacks due to insufficient SOC, but do not address the underlying issue that storage resources would still receive unwarranted BCR whenever these types of day-ahead buybacks do materialize.

As DMM has previously noted, allowing real-time bid cost recovery for day-ahead buybacks due to insufficient state-of-charge (SOC) can lead to inefficient bidding incentives and market outcomes.<sup>5</sup> DMM continues to recommend that storage resources only be eligible for RT BCR under specific situations where deemed appropriate.

If the ISO instead chooses to try to identify and address each different scenario that could lead to unwarranted RT BCR, DMM supports the consideration of proposals for limiting day-ahead buybacks due to insufficient SOC. DMM has found this to be the major driver of unwarranted BCR in the real-time market. Based on DMM's monitoring over the last few years, DMM cautions that it will be challenging to identify and develop settlement rules to effectively prevent all the different causes of unwarranted BCR *ex ante*. In many cases, DMM has only been able to identify causes of unwarranted BCR *ex post* after detailed investigation of the interaction of market software features, market and operational conditions, and how settlement rules are applied.

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<sup>4</sup> *Ibid.*

<sup>5</sup> *Comments on Storage Design and Modeling Working Group Presentation on June 30, 2025*, Department of Market Monitoring, July 16, 2025: <https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-jun-30-2025-working-group-presentation-jul-16-2025.pdf>

***DMM supports the ISO's proposal to better incentivize accurate submission of day-ahead initial state-of-charge parameters. And DMM recommends strengthened tariff language to better define how the day-ahead initial state-of-charge should be used.***

DMM supports the ISO's proposal to address the current lack of incentive for storage resources to submit accurate DA ISOC parameters. While DMM supports the ISO's specific proposals of requiring the submission of the DA ISOC in order to submit DA bids and making battery resources ineligible for RT BCR if their DA ISOC is sufficiently incorrect, DMM continues to recommend the ISO achieve this by removing RT BCR eligibility for day-ahead buybacks due to insufficient SOC. Even if resources submit accurate DA ISOC estimates, continuing to provide RT BCR for day-ahead buybacks due to insufficient SOC still results in inefficient bidding incentives and inefficient dispatch of storage resources in real-time.

Outside of the BCR context, DMM supports the ISO requiring the submission of DA ISOC for reliability purposes. DMM also supports strengthening the tariff language to better define expected use of DA ISOC, highlighting that it should be used to reflect a physical expectation of how the resource will be positioned in real-time at the beginning of the operating day, and explicitly state that it is not to be used solely for the purpose of effectuating a desired day-ahead schedule for economic purposes.

***DMM requests more detail regarding the system state-of-charge mechanism mentioned in the presentation***

The ISO's presentation briefly introduced the concept of a system state-of-charge mechanism that would improve alignment between the SOC modeled in the day-ahead market and the telemetered SOC.<sup>6</sup> DMM's understanding is the ISO is considering this mechanism as another potential avenue to minimize day-ahead buybacks for storage resources due to insufficient state-of-charge.

It is unclear whether this is the most efficient approach as it does not address real-time bidding incentives to manage SOC. DMM continues to recommend re-designing the BCR paradigm for storage resources so that they are properly incentivized to bid in a way that positions storage resources efficiently in the real-time. A system SOC mechanism does not address the underlying BCR design issues. DMM requests that the ISO provide additional information about this potential mechanism, and how it is different than the minimum state-of-charge constraint that was retired in 2023.

***DMM supports enhancing the storage DEB to an hourly value that incorporates intraday opportunity costs***

DMM has long recommended the storage DEB be refined to better incorporate real-time intraday opportunity costs. DMM has previously noted issues with the current storage DEB.<sup>7</sup> In particular, the DEB is static and therefore does not account for how intraday opportunity costs change across the day. In addition, the utilization of day-ahead prices does not account for differences that can materialize between the day-ahead and real-time and therefore may not be the most appropriate basis to estimate real-time intraday opportunity cost.

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<sup>6</sup> *Storage Design and Modeling Working Group*, California ISO, November 14, 2025, p 56: <https://stakeholdercenter.caiso.com/InitiativeDocuments/Presentation-Storage-Design-and-Modeling-Nov12-2025.pdf>

<sup>7</sup> *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>

DMM continues to recommend the ISO implement a storage DEB that varies hourly so that it can incorporate the changing intraday opportunity cost associated with potential charge and discharge opportunities in future intervals.<sup>8</sup> An accurate hourly DEB would account for market conditions in future intervals when estimating the opportunity cost component of a particular hour. DMM recommends the ISO develop hourly DEBs that would allow the DEBs to be higher in the intervals leading up to the peak pricing hours, and lower in later intervals as intraday opportunity costs fall.<sup>9</sup>

In addition, a storage DEB that varies hourly would be necessary for the type of framework proposed by the California Energy Storage Alliance (CESA). DMM has discussed how storage resources may incorrectly be eligible or ineligible for BCR depending on DEBs that are incorrectly high or low.<sup>10</sup>

DMM recognizes that developing an approach that allows dynamic adjustments to battery DEBs in real-time could involve significant design and implementation complexities. Therefore, DMM recommends that the ISO and stakeholders pursue an incremental approach. A key software change that could be implemented expeditiously includes simply allowing real-time DEBs to vary for different time periods of the day, so that greater “headroom” is provided during the hours *prior* to the peak net load hours (12-17), compared to the level of “headroom” that is provided *during* the peak net load hours (18-22). A second key software change would be to allow real-time battery DEBs that are set based on day-ahead prices to be scaled upwards during the operating day based on actual market and system conditions.

***Mitigation of storage resources should not be eliminated, as suggested by some stakeholders***

While some stakeholders have suggested eliminating mitigation of storage resources, DMM does not believe this would be an appropriate market rule change. Storage resources should continue to be subject to market power mitigation where the potential for uncompetitive conditions exists. The establishment of more dynamic DEBs considering real-time conditions reduces the risk of mitigation to values that do not reflect real-time opportunity costs.

While the ISO’s presentation mentions that charging bids are subject to mitigation due to the need for monotonically non-decreasing bid curves, there are other reasons these bids are subject to mitigation including the flow effects of charging schedules on potentially uncompetitive constraints. Counterflow is provided when a resource forgoes charging. Uneconomically high bids to charge can worsen congestion by withholding this counterflow of foregone charging; therefore, mitigating those charging bids can relieve congestion by reducing uneconomic charging schedules.

***DMM supports updating Master File characteristics for storage resources to reflect the stored energy available to the market to maintain full capacity of the resources across its operational range***

The ISO is proposing that storage resources be “right sized”, whereby the parameters of storage resources provided to Master File reflect a qualifying capacity (QC) so that the resource can discharge for four hours

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<sup>8</sup> *Comments on Storage Design and Modeling May 28, 2025 Presentation*, Department of Market Monitoring, June 11, 2025: <https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-may-28-2025-presentation-jun-11-2025.pdf>

<sup>9</sup> *Comments on Storage BCR and DEBs July 8, 2024 Workshop*, Department of Market Monitoring, July 18, 2024: <https://www.caiso.com/documents/dmm-comments-on-storage-bcr-and-default-energy-bids-july-8-2024-workshop-jul-18-2024.pdf>

<sup>10</sup> *Comments on Storage Design and Modeling Working Group Presentation on August 14, 2025*, Department of Market Monitoring, September 5, 2025: <https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-aug-14-2025-working-group-presentation-sep-05-2025.pdf>

or more without expected power limitations (e.g., foldback).<sup>11</sup> For resources in the CAISO balancing area, QC is determined by the California local regulatory authorities (LRAs). The proposal directs the LRAs to ensure that the QC of the resource is based on the SOC range that will not result in power limitations from physical (chemical) SOC constraints. The “right sizing” changes mean that in Master File the resource will only reflect the minimum and maximum continuous energy limit that will *best* ensure resources do not experience power limitations because of the resource’s SOC.<sup>12</sup>

The ISO states the change in resource QC will ensure consistency across all assets, minimize reliability and operational concerns, eliminate the need to use outage cards and be assessed resource adequacy availability incentive mechanism (RAAIM), and incorporate the power limitations into any future capacity constructs such as the unforced capacity (UCAP) adjustment to QC.<sup>13</sup> This change will effectively reduce the capacity and energy of storage resources that are available to the market, as well as reduce the QC that the asset owners will be able to sell to load serving entities as resource adequacy.

DMM has previously recommended the ISO create clear rules for storage resources experiencing power limitations in the extremes of their SOC.<sup>14</sup> DMM recommendations have emphasized that the rules must require that resources be assessed RAAIM and consider any future policies that would reflect capacity limitations to the market (e.g., UCAP). As a result, DMM supports the ISO requiring resources to only provide the operational characteristics of the resource in Master File that meet the capability of the resource. However, as discussed below, there are solutions to allowing access to the stored energy in the extremes of the SOC ranges to continue to provide grid services and reliability.

Reducing the operational range and adjusting the QC of some of the storage resources on the CAISO system will ensure the purchased resource adequacy (RA) of the storage resources can be expected to perform at their full power output when dispatched. As argued by REV Renewables, the reduction in the available SOC range may lead to adverse impacts on reliability, ratepayer costs, and storage owners.<sup>15</sup> DMM does not

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<sup>11</sup> *Storage Design and Modeling Working Group on Outage Management, Uplift & DEB, and Mixed-Fuel & Distribution-Level Resources* presentation, California ISO, November 12, 2025:

<https://stakeholdercenter.caiso.com/InitiativeDocuments/Presentation-Storage-Design-and-Modeling-Nov12-2025.pdf>

<sup>12</sup> DMM notes that the minimum and maximum continuous energy limit ought to be “best” represented to the market to not impact power limitations due to the SOC of the resource. The use of *best* acknowledges there are many temporary factors that can lead to power limitations of the storage resource, such as cell imbalance. The scheduling coordinator should work with their operator to have the long-term limitations accurately reflected to the market. Whereas short-term limitations, such as maintenance and cell imbalances, should not be reflected within the limitations. These limitations will then be incentivized through interrelated policies such as RAAIM or UCAP.

<sup>13</sup> *Storage Design and Modeling Working Group on Outage Management, Uplift & DEB, and Mixed-Fuel & Distribution-Level Resources* presentation, California ISO, November 12, 2025:

<https://stakeholdercenter.caiso.com/InitiativeDocuments/Presentation-Storage-Design-and-Modeling-Nov12-2025.pdf>

<sup>14</sup> *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: <https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-issue-paper-and-straw-proposal-on-outage-management-nonlinearity-and-soc-clarification-may-23-2025.pdf>

<sup>15</sup> *CAISO Storage Design and Modeling – Foldback/Non-Linearity Proposal*, REV Renewables, November 12, 2025: <https://stakeholdercenter.caiso.com/InitiativeDocuments/REV-Renewables-Presentation-Storage-Design-and-Modeling-Nov12-2025.pdf>

agree with this position, and would like to refer stakeholders to the resource adequacy modeling and program design (RAMPD) stakeholder initiative, and the importance of ensuring resources have a like-to-like resource adequacy (capacity) valuation to ensure fungibility within the RA market.<sup>16</sup>

REV Renewables argued the reduction in QC will result in reduced reliability without access to the additional energy, as well as increased RA price pressures as further RA would need to be procured.<sup>17</sup> A standard supply and demand analysis would suggest the reduction in RA supply will increase costs, however simultaneously the improved market modeling of the resources will lead to improved RA quality, and thus increased reliability of the QC on the system. Assuming no other changes in underlying conditions, this may ultimately lead to less demand for RA capacity in the long run, making the net effect on RA prices less clear.

DMM recommends access to energy in the extremes of the SOC should be available to the market in extenuating conditions. As proposed by REV Renewables, allowing access to the stored energy beyond the updated minimum and maximum continuous energy limits would require two modifications to Master File: (1) including a new maximum and minimum energy limit that extends beyond the range that is not power limited, but is still within the operating limits of the resource, and (2) a factor to adjust the Pmax of the resource to ensure power limits are not exceeded in the extended range.<sup>18</sup>

DMM has previously recommended the ISO develop additional Master File parameters to address power limitations at the SOC extremes.<sup>19</sup> To ensure there is consistent representation of the resource to the market, DMM recommends the ISO direct the LRAs to limit QC to the operational range that is not impacted by SOC limitations, and then allow resources to register their additional SOC and reduced power for extenuating circumstances if the market or system operators were to need the additional energy.

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<sup>16</sup> *Comments on Resource Adequacy Modeling and Program Design Working Group*, Department of Market Monitoring, March 13, 2025: <https://www.caiso.com/documents/dmm-comments-on-resource-adequacy-modeling-and-program-design-working-group-mar-13-2025.pdf>

<sup>17</sup> *CAISO Storage Design and Modeling – Foldback/Non-Linearity Proposal*, REV Renewables, November 12, 2025: <https://stakeholdercenter.caiso.com/InitiativeDocuments/REV-Renewables-Presentation-Storage-Design-and-Modeling-Nov12-2025.pdf>

<sup>18</sup> *Ibid.*

<sup>19</sup> *Comments on Storage Design and Modeling Working Group Presentation on August 14, 2025*, Department of Market Monitoring, September 5, 2025: <https://www.caiso.com/documents/dmm-comments-on-storage-design-and-modeling-aug-14-2025-working-group-presentation-sep-05-2025.pdf>