

Comments on Energy Storage Enhancements Draft Final Proposal

Department of Market Monitoring

September 9, 2022

Summary

The Department of Market Monitoring (DMM) appreciates the opportunity to comment on the *Energy Storage Enhancements – Draft Final Proposal*.¹

DMM supports enhancements that improve the availability of ancillary services awarded to energy storage resources, and the proposed enhancements to allow state of charge exceptional dispatch of energy storage resources. The current proposal to compensate state of charge exceptional dispatches for the opportunity cost of missed market opportunities improves upon the earlier proposed approach. DMM supports the CAISO's consideration of submitted bids in the calculation of a counterfactual optimal dispatch for energy storage resources exceptionally dispatched to hold state of charge.

DMM suggests that the CAISO maintain the earlier proposed requirement for real-time energy bids to accompany the full quantity of awarded ancillary services. Consistent with the CAISO's proposal, any requirement for energy bids to accompany awarded ancillary services should be in the opposite direction of the awarded ancillary service to ensure that the real-time market can dispatch the battery as needed to manage state of charge.

DMM does not oppose the proposed enhancements for co-located resources. However, DMM believes it would be far more efficient to reflect tax implications of grid charging in energy bids rather than limit the ability to charge from the grid. Further, co-located storage resources that are restricted to charging from the output of co-located variable energy resources (VERs) are inherently less flexible and potentially less available in peak hours than storage resources that have limits on the amount of MWh they can charge from the grid. Therefore, it will be important that the CPUC's new slice-of-day resource adequacy framework and the CAISO's UCAP policy appropriately differentiate between the capacity contributions of these two different types of storage resources.

DMM supports the CAISO's proposal to include an opportunity cost component in the day-ahead default energy bid (DEB) for energy storage resources. The explicit inclusion of opportunity costs in the day-ahead DEBs may help preserve the consideration of opportunity

¹ *Energy Storage Enhancements – Draft Final Proposal*, California ISO, August 22, 2022:
<http://www.caiso.com/InitiativeDocuments/DraftFinalProposal-EnergyStorageEnhancements.pdf>

costs in storage resource market awards when storage resources are mitigated in select hours of the day-ahead market, but remain unmitigated in other hours.

Finally, DMM notes that the CAISO does not address the issue of bid cost recovery (BCR) that can result from differences in state of charge between the day-ahead and real-time markets. DMM continues to recommend that the CAISO consider mechanisms that could better align day-ahead and real-time state of charge levels, or consider other restrictions on bid cost recovery eligibility to prevent unnecessary BCR payments or potential BCR gaming opportunities.

Comments

I. Reliability Enhancements

DMM supports market enhancements that improve the availability of ancillary services awarded to energy storage resources

In earlier comments, DMM discussed some of the issues around the availability of ancillary services procured from energy storage resources.² The CAISO has also noted that a number of issues have been identified around the ability of storage resources to provide ancillary services to the market, and the feasibility of those awards between day-ahead and real-time. To address some of these issues, the CAISO proposes two enhancements in the draft final proposal:

- Model the estimated impact of regulation awards on state of charge, and
- Require all ancillary service awards for storage resources to be accompanied by energy bids in the opposite direction, up to 50 percent of the ancillary service award quantity.

DMM supports each of the proposed enhancements. Specifically, DMM appreciates the clarifications the CAISO has made from the second revised straw proposal and the enhancement to allow hourly multipliers in the estimated impact of regulation awards on state of charge.

DMM believes the proposal to require energy bids to accompany ancillary service awards could be strengthened by retaining the earlier proposed requirement which had real-time energy bids accompany 100 percent of ancillary service award quantities. Consistent with the CAISO's proposal, DMM notes that any requirement for energy bid range accompanying ancillary service awards should be in the opposite direction of the ancillary service to ensure accurate state of charge management by the market dispatch.

² *Comments on Energy Storage Enhancements Working Group*, Department of Market Monitoring, August 10, 2021: <http://www.caiso.com/Documents/DMM-Comments-on-Energy-Storage-Enhancements-Working-Group-Aug-10-2021.pdf>

DMM supports the CAISO’s proposed enhancement to allow hourly multipliers when modeling the impact of regulation awards on state of charge; DMM continues to request additional clarification of how the CAISO proposes to calculate multipliers

The CAISO’s proposed approach to account for regulation awards in the state of charge depends on a multiplier, as described in the draft final proposal.³ This multiplier appears intended to represent the typical impact of 1 MW of a regulation award at a given time on the state of charge. The CAISO states that this multiplier will be specified in a business practice manual, and may be updated as the CAISO updates analysis of the actual impacts of regulation awards on state of charge.

In the draft final proposal, the CAISO proposes to calculate multipliers that vary by hour. DMM supports this enhancement, and DMM recommended that the CAISO make this change from the static multipliers proposed in the second revised straw proposal. This approach is likely to produce more accurate results than the earlier proposed static multipliers. For instance, regulation down awards in the middle of the day during peak solar production may have a significantly different impact on state of charge than a regulation down award in peak demand hours.

The appendix of the draft final proposal provides analysis that establishes a potential range of multiplier values that may be used in the CAISO’s proposed modeling of regulation impacts on state of charge.⁴ However, the draft final proposal is still unclear on the details of how the CAISO proposes to calculate these multipliers initially or on an ongoing basis. DMM requests that the CAISO provide additional information to clarify how the multipliers will be calculated.

DMM supports the CAISO’s proposal to require energy bids to accompany ancillary service awards, but suggests that the CAISO maintain the earlier proposal of requiring real-time energy bids for the full quantity of regulation awarded day-ahead

DMM supports the CAISO’s proposal to require energy bids to accompany ancillary service awards. This requirement, when applied for energy bid range in the opposite direction of the awarded ancillary service, will ensure that resources with ancillary service awards can be charged or discharged by the market in real-time in order to ensure continued availability of awarded ancillary services capacity throughout the day. For example, a regulation up award with accompanying energy bids on the charging range of the resource will ensure that the real-time market can charge the battery as needed to maintain the regulation up capacity. Similarly, a regulation down award with accompanying energy bids on the discharging range of the resource will ensure that the market can discharge the battery as needed to maintain sufficient charging capability to support regulation down service.

³ Draft final proposal, pg. 9

⁴ This appendix appears unchanged from the second revised straw proposal.

DMM suggests that the CAISO's proposal would be strengthened by requiring energy bids to accompany 100 percent of ancillary service awards, rather than limiting them to 50 percent as currently proposed. The CAISO has not offered an explanation for the revised proposal. Requiring energy bids for 100 percent of ancillary service awards ensures that the market has maximum flexibility to move the resource to maintain ancillary service awards needed for reliability.

Some stakeholders have expressed that submitting energy bids to accompany ancillary service awards could lead to uneconomic dispatch of storage resources to maintain the ancillary service awards. DMM notes that, because the physical nature of storage resources is such that their ability to provide ancillary services is dependent on state of charge, the occasional need to charge at high prices or discharge at low prices is an expected outcome and a cost associated with storage resources providing ancillary services. When these storage resources face the full cost of their ancillary services provision, they may be expected to reflect these anticipated costs in day-ahead ancillary services offers. This could result in a different resource mix providing ancillary services, or in different ancillary services clearing prices. However, such an outcome may be appropriate and efficient to the extent that it more accurately reflects the true costs of storage resources providing ancillary services.

DMM suggests that the CAISO could further enhance ancillary services functionality for energy storage resources by better aligning day-ahead and real-time regulating limits used for these resources

DMM has observed that some storage resources frequently have more limited regulating ranges in real-time than the values registered in the CAISO Master File, which are used in the day-ahead market. When battery regulation limits change between the day-ahead and real-time markets, the real-time market may be forced – potentially uneconomically – to move a battery resource to an operating point at which day-ahead ancillary service awards remain feasible. If real-time regulation ranges cannot accommodate the full day-ahead regulation up and down awards, the real-time market may be forced to find regulation on other resources instead.

DMM suggests that if storage resource regulating ranges change frequently, and if updated values are known in the day-ahead timeframe, then the CAISO could allow storage resources to update regulating ranges on a timelier basis, and potentially at the hourly level. These updated values could be reflected in the day-ahead market, potentially aligning the day-ahead regulating ranges better with real-time values.

Forcing charge or discharge on a resource in real-time to maintain ancillary service awards when regulating limits are more restrictive in real-time presents bid cost recovery gaming concerns and potential operational issues when resources must be backed off of day-ahead ancillary services and the CAISO must procure these reserves from other resources in real-time on short notice.

DMM continues to support enhancements to exceptional dispatch procedures for energy storage resources

The CAISO proposes to expand exceptional dispatch (ED) functionality for energy storage resources. The proposed new functionality would allow CAISO operators to issue exceptional dispatches (EDs) for energy storage resources to maintain a level of state of charge, rather than only for minimum or maximum operating levels. DMM continues to support these proposed enhancements.

DMM believes that the proposal to allow ED instructions to batteries for state of charge values will be a significant improvement to existing processes. Issuing EDs to batteries as state of charge values could help prevent ED instructions from being infeasible and could mitigate instances of resources being forced to either discharge or charge uneconomically to meet ED instructions. Issuing EDs as state of charge values could also allow batteries more flexibility to maintain existing ancillary service awards and could provide resources more flexibility to capture additional revenue opportunities before the time at which the CAISO determines it needs the resource to be at a specific level of charge.

DMM supports the CAISO's proposal to use submitted energy bids to calculate counterfactuals for compensation of opportunity cost when storage resources are exceptionally dispatched to hold state of charge

The CAISO proposes to compensate energy storage resources for opportunity cost of missed market opportunities when exceptionally dispatched to hold state of charge. The concept of compensating this type of opportunity cost may be appropriate, and the CAISO's approach presented in the draft final proposal appears to be a further improvement over approaches presented in the earlier straw proposals.

As DMM understands, the CAISO is proposing to calculate an optimized charge and discharge schedule for a storage resource exceptionally dispatched to hold state of charge over the period of the exceptional dispatch, and for the remainder of the operating day. The proposed approach will use actual prices to produce two counterfactual dispatch scenarios (with and without the exceptional dispatch) as part of the settlement process. The CAISO proposes to compensate the exceptionally dispatched resource for any profit foregone as a result of the exceptional dispatch as indicated by the difference between the counterfactual profit calculations.

In the draft final proposal, the CAISO has further improved the proposed approach by clarifying that it will only consider counterfactual dispatches when economic based on submitted bids. DMM supports this improvement. However, DMM continues to request additional explanation of the counterfactual calculation presented in Table 1 on page 14 of the draft final proposal. This example appears to be the same example DMM commented on in the second revised

straw proposal, which does not appear to consider energy bids in the counterfactual calculation.⁵

II. Co-located Enhancements

Tax issues and enhanced co-located resource functionality

The CAISO proposes enhancements that would limit the dispatch charging instructions of co-located storage resources to the dispatch operating target of one or more co-located variable energy resources (VERs), and allow deviation of the storage resource when the VERs are unable to produce the forecasted amount. The proposed changes would not be available by default, but would be electable by any co-located storage resource. The CAISO proposes these changes to address stakeholder concerns that some co-located storage resources are limited in their ability to charge from the CAISO grid in order to maintain preferential tax treatment.

DMM continues to recommend that the CAISO and stakeholders develop a reasonable model for incorporating the investment tax credit (ITC) reductions into bids. This could be significantly more efficient than most co-located resources resorting to constraining themselves not to charge from the grid, and could represent a long-term solution available to all resources with such limitations, now or in the future. However, the investment tax credit and property tax issues seem significant enough to discourage participation, and could even discourage investment in new storage resources if the CAISO does not acknowledge them as costs or constraints in its dispatch instructions. Therefore, DMM does not oppose the provisions the CAISO is proposing which promote resource development and allow some co-located storage resources to avoid charging from the grid.

Given the CAISO's proposal to allow some co-located resources to elect to constrain themselves to never charge from the grid, it will be important that the CPUC's new slice-of-day resource adequacy framework and the CAISO's UCAP policy appropriately differentiate between the capacity contributions of the two types of storage resources.⁶ Storage resources that can never charge from the grid will be less flexible and less able to supply capacity at all critical hours than storage resources that can charge from the grid. Therefore, co-located resources that are constrained to not charge from the grid should receive a lower capacity payment than storage resources that can charge from the grid. If the CPUC slice-of-day framework and the CAISO's UCAP framework can appropriately discount the capacity values of co-located storage resources that will not charge from the grid, these resources will then be able to weigh the costs and benefits of choosing to limit their ability to charge from the grid.

⁵ *Comments on Energy Storage Enhancements – Second Revised Straw Proposal*, Department of Market Monitoring, August 4, 2022: <http://www.caiso.com/Documents/DMM-Comments-Energy-Storage-Enhancements-Second-Revised-Straw-Proposal-Aug-4-2022.pdf>

⁶ In the revised straw proposal, the CAISO estimates that the provisions to prevent grid charging would go into place in 2023. This timeframe could extend into new resource adequacy structures that are currently under development.

Pseudo-tie resources functionality

The CAISO proposes to relax the existing requirement that pseudo-tied co-located resources show firm transmission for the full generating capability of the resources from the generator interconnection to the CAISO delivery point. The CAISO then proposes to use the aggregate capability constraint (ACC) to ensure that the aggregate market dispatch of the pseudo-tied co-located resources do not exceed the interconnection limits and firm transmission associated with the project. DMM does not oppose this change, which appears to better align firm transmission requirements for co-located resources with generator interconnection limits.

III. Day-ahead default energy bid for energy storage resources

DMM supports the CAISO's proposal to introduce an opportunity cost component to the day-ahead default energy bid for storage resources

DMM supports the CAISO's proposal to introduce an opportunity cost component to the day-ahead default energy bid (DEB) for energy storage resources. The application of market power mitigation to only a portion of a day-ahead bid set appears to change the day-ahead bids for a mitigated storage resource such that the optimization may no longer consider intraday opportunity costs. DMM agreed with the CAISO's earlier conclusion that the timeframe of the day-ahead market may be sufficient to consider intraday opportunity costs. However, DMM also noted that explicit inclusion of opportunity costs may be needed where costs are otherwise not considered by the CAISO market optimization.⁷

The existing day-ahead DEB for storage resources does not include an opportunity cost component, based on the theory that explicit inclusion of intraday opportunity cost is not necessary when resources are optimized over a full 24-hour period. As the CAISO has noted observing in practice, and as further explained in DMM's comments on the second revised straw proposal, this theory does not hold when the underlying assumptions of the daily bid set for the storage resource are no longer valid.⁸ This can occur because individual bids in each hour are part of a complete daily bid set that can result in the profit-maximizing outcome over the day. Changing the bids in one hour can impact the market solution for a storage resource in subsequent hours. Therefore, while a given bid that does not explicitly include opportunity costs may lead to the optimal dispatch of a storage resource when used in the context of a broader optimal bidding strategy, this bid may not lead to the same market outcome if used individually outside of that context to replace a selected hour of a market bid. This is the case of

⁷ *Stakeholder Comments: Energy Storage and Distributed Energy Resources (ESDER) – Storage Default Energy Bid -- Draft Final Proposal*, Department of Market Monitoring, October 9, 2020: <http://www.aiso.com/Documents/DMMComments-ESDER4StorageDefaultEnergyBidDraftFinalProposal-Oct92020.pdf>

⁸ *Comments on Energy Storage Enhancements – Second Revised Straw Proposal*, Department of Market Monitoring, August 4, 2022: <http://www.aiso.com/Documents/DMM-Comments-Energy-Storage-Enhancements-Second-Revised-Straw-Proposal-Aug-4-2022.pdf>

local market power mitigation, where a DEB may replace a market bid for select hours, but unmitigated bids in other hours may be inconsistent with the optimal day-ahead bidding strategy from which the DEB is derived.

The CAISO's proposed approach to include opportunity cost in the day-ahead storage DEB is likely to improve the existing day-ahead storage DEB and improve the ability of the day-ahead market to accurately reflect intraday opportunity costs for storage resources when mitigated. However, DMM continues to recommend that for both the day-ahead and real-time energy storage DEBs, the CAISO consider a more precise estimate of hourly opportunity cost that can reflect changing opportunity costs throughout the operating day.

IV. Additional changes

DMM continues to recommend that the CAISO consider mechanisms to prevent unnecessary BCR and potential BCR gaming opportunities

In earlier comments, DMM expressed concern that significant deviations between day-ahead and real-time state of charge values can create opportunities for potential gaming of bid cost recovery payments.⁹ The CAISO does not address this issue in the draft final proposal. DMM continues to recommend that the CAISO consider mechanisms that could better align day-ahead and real-time state of charge levels, or add additional restrictions on bid cost recovery that could be related to differences between real-time state of charge and day-ahead market state of charge.

Early in the ESDER stakeholder processes, DMM recommended the CAISO consider the implications of a day-ahead submitted state of charge as a new and unique intertemporal constraint between the markets.¹⁰ DMM recommended that the CAISO revisit this topic in future initiatives to address potential settlement implications. DMM remains concerned about potential bid cost recovery (BCR) gaming opportunities related to batteries reaching state of charge limits at different intervals in the real-time markets than in the day-ahead market. These issues are exacerbated by a battery having a different initial state of charge in real-time than day-ahead, but they can arise even if the initial state of charge values are identical.

In light of the significant and growing volume of battery resources in the CAISO market (and payment of BCR for these resources), DMM recommends that the CAISO consider enhancements to avoid unnecessary BCR, and mitigate potential gaming opportunities related to state of charge limitations.

⁹ *Comments on Energy Storage Enhancements Working Group*, Department of Market Monitoring, August 10, 2021: <http://www.aiso.com/Documents/DMM-Comments-on-Energy-Storage-Enhancements-Working-Group-Aug-10-2021.pdf>

¹⁰ *Stakeholder Comments: Energy Storage and Distributed Energy Resources (ESDER) – Revised Draft Final Proposal*, Department of Market Monitoring, February 2, 2016: <http://www.aiso.com/InitiativeDocuments/DMMCommentsEnergyStorageDistributedEnergyResources-RevisedDraftFinalProposal.pdf>