

Energy Storage and Distributed Energy Resources Storage Default Energy Bid Draft Final Proposal

Comments by Department of Market Monitoring
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Summary

DMM appreciates the opportunity to comment on the ISO's *Energy Storage and Distributed Energy Resources – Storage Default Energy Bid Draft Final Proposal*.¹ DMM supports the ISO's overall direction to apply market power mitigation to battery resources, and DMM views the ISO's proposed energy storage default energy bid as a conservative initial step to mitigating energy storage resources.

While there is not currently a significant amount of battery capacity participating in the ISO markets, batteries continue to be sited in areas that are frequently downstream from non-competitive constraints (including transmission constrained load pockets). As battery capacity increases on the system and continues to replace traditional generation capacity in local areas, it will be increasingly important that these resources be subject to energy bid mitigation.

Based on recommendations from the Market Surveillance Committee (MSC), the ISO proposes two key changes in the Draft Final Proposal for the Storage Default Energy Bid:

- Elimination of opportunity cost from the day-ahead storage default energy bid
- A “safe harbor” that would exempt storage resources of less than 5 MW, and which are not affiliates of a net-seller in the CAISO market, from local market power mitigation

Regarding opportunity cost in the day-ahead storage default energy bid, the recent MSC opinion on the ISO's proposal states that if resource constraints and cycling costs are considered, the 24-hour time horizon of the day-ahead market is sufficient to capture opportunity costs and charging costs within the day.²

DMM agrees that the timeframe of the day-ahead market is sufficient to account for opportunity costs and charging within a day, and within the CAISO market. However, additional parameters or explicit inclusion of opportunity costs would be needed to account for

¹ *Energy Storage and Distributed Energy Resources – Storage Default Energy Bid Draft Final Proposal*, California ISO, September 15, 2020: <http://www.caiso.com/InitiativeDocuments/DraftFinalProposal-EnergyStorage-DistributedEnergyResources-StorageDefaultEnergyBid.pdf>

² *Opinion on Energy Storage and Distributed Energy Resources Phase 4*, Members of the Market Surveillance Committee of the California ISO, September 9, 2020: <http://www.caiso.com/Documents/DecisiononEnergyStorageandDistributedEnergyResourcesPhase4-MSCOpinion-Sep2020.pdf>

opportunity costs beyond the time horizon of the day-ahead market or where costs or resource constraints are otherwise not considered by the CAISO market optimization.

The ISO's Draft Final Proposal attempts to incorporate part of the MSC opinion by dropping the opportunity cost component of from the proposed day-ahead storage DEB. However, the charging cost component remains in the day-ahead DEB for energy storage resources. The ISO does not propose to add any additional costs or parameters to the day-ahead DEB formulation to account for the potential value of opportunity costs beyond the day-ahead market horizon, or any other cost that may be appropriate.

If the ISO is eliminating the opportunity cost component on the basis that the time horizon of the day-ahead market can sufficiently account for opportunity costs within the day, it is not clear to DMM why the DEB would still include a value to approximate charging costs within the day. The estimate of charging cost should itself reflect an estimate of opportunity cost in certain hours. If the actual intent of retaining this element is to capture a different, undefined cost, or to provide a "buffer" for uncertainty in the calculation, DMM recommends the ISO explicitly state the cost or adder that is being included, and provide appropriate supporting logic for including such a cost.

DMM supports the ISO's proposed retention of an opportunity cost component in the real-time DEB. This component may be especially valuable in the context of the ISO's proposed end-of-hour state of charge parameter, which can be expressed as either a fixed value or MWh range. While the proposed end-of-hour state of charge will on its own help account for opportunity costs beyond the time horizon of the real-time market, reflecting a value of opportunity cost in energy bids will optimize the use of the resource within the stated bounds of end-of-hour state of charge.

While the ISO's proposed energy storage DEB is an incremental improvement to the current market design that exempts these resources from mitigation, DMM believes there are several enhancements that could improve the ISO's proposed default energy bid (DEB) calculations.

- The costs of energy storage resources change over the day or other defined optimization horizon. The ISO should allow battery DEBs to reflect this fact by allowing DEBs to change hourly.
- If the ISO maintains the charging cost component of the day-ahead DEB, the ISO should reconsider using prices from the day-ahead LMPM run to estimate these costs. Prices from the LMPM run do not reflect the impact of any bid mitigation that may be applied in the subsequent market run.
- Finally, DMM notes that the small energy storage resources – which are exempted from local market power mitigation under the current proposal – can still have or exercise local market power. However, the limitation of this exemption only to resources which are affiliates of net buyers in the CAISO market alleviates many potential concerns.

I. Default Energy Bid for Energy Storage Resources

The ISO's logic for retaining an intraday charging cost component in the day-ahead DEB is not clear; DEB should be derived from clearly defined costs

The ISO proposes to remove the opportunity cost component from the day-ahead DEB. This change was proposed by the ISO in the Draft Final Proposal based on a recommendation of the MSC. The MSC's September opinion that that if cycling costs and other resources constraints are modeled, the 24-hour time horizon of the day-ahead market is sufficient to account for charging and opportunity costs within the day.

Given the ISO's reasoning for excluding the opportunity cost component from the day-ahead DEB, it seems to be logically inconsistent for the day-ahead DEB to retain an estimate of charging cost in the formulation. The same 24-hour time horizon that accounts for discharge opportunity cost within the day also accounts for the value of optimal charging opportunities within the day.

The approach presented in the Draft Final Proposal would estimate the charging cost by considering the block of the four lowest prices within the trading day. This approach implies that the ISO is estimating either charging cost expected to be incurred within the day, or costs that have already been incurred and would be considered for a discharge decision later in the day.

To the extent the proposed charging cost component of DEB reflects an expectation of charging opportunities within the day, this value is appropriately interpreted as another measure of opportunity cost associated with the future charging opportunity. As stated in the MSC's explanation on which the ISO relies, this cost should already be considered by the day-ahead market without explicit inclusion in energy bids. Although the logic for retaining only this component in the day-ahead DEB is not clear, there may be little lost efficiency from doing so for hours where the battery is positioned to charge and the lowest cost charging opportunities have not yet been reached. For these hours, loss of efficiency primarily results from the simplified strike-price approach to approximate the lowest daily prices, instead of a more dynamic value that can change hourly.

An alternative potential explanation for the inclusion of this type of charging cost in the day-ahead DEB is to consider the cost already incurred for charging energy when making discharge decisions. However, at the point charging has already occurred, this is a sunk cost and should no longer be considered in discharge decisions or the default energy bid. With the charging cost already incurred, the optimal future discharge decision is dependent only on future expected discharge and profit opportunities.

For these reasons, DMM views the ISO's continued inclusion of charging cost as described in the Draft Final Proposal as logically inconsistent with other modifications to the day-ahead DEB, and the logic of the MSC opinion used to make those changes.

DMM does not oppose the inclusion of additional costs in the energy storage DEB where appropriate, particularly those resulting from anticipated opportunity costs outside of the optimization time horizon.³ However, if approximations of these or other costs are to be included in the DEB, the ISO should modify the proposal to be explicit about which costs are being included, and the logic for including them.

A DEB that can change by hour could allow more accurate estimation of cycling costs

In earlier versions of the ESDER 4 proposal, the ISO sought to estimate the cost per MWh of cycling a storage resource, varying throughout the day based on resource operation over that day. While the approach was focused on cycling costs of lithium-ion batteries, the general approach appeared promising as an approach to accurately estimate costs of storage resources at a point in time. Key components of this general approach include tracking characteristics such as state-of-charge and number of cycles over the day, and allowing cycling costs reflected in DEBs to vary accordingly.

In the Second Revised Straw Proposal, the ISO proposed a static DEB value over the day. This approach is retained in the Draft Final Proposal. Because the DEB value will not be allowed to change throughout the day, the ISO proposes to use an estimate of cycling costs that will capture the highest-cost cycling scenario that a resource could face in the day. While such an approach may be necessary with a static DEB value for the day, this creates the potential to significantly overestimate costs in some hours and highlights the need for a DEB value that can change through the day.

The proposed approach also necessitates the use of a more blunt and conservative estimate of maintenance costs that may be varying with battery usage over the day. To more accurately capture the dynamic nature of energy storage resource costs, the approach could be refined to allow for different DEBs in different hours of the day and include better opportunity cost calculations.

Opportunity costs are dynamic and should reflect opportunities to recharge

DMM highlighted the role of opportunity costs for energy storage resources in earlier comments and appreciates that the ISO has considered this cost in the development of the proposed default energy bid methodology. Opportunity costs may be incurred if an energy storage resource charges or discharges at a time that is not profit maximizing over the day or other time period of resource optimization.

Explicit inclusion of these costs is especially important when expected outside the time horizon of market optimization, or when such costs might not otherwise be reflected in the CAISO

³ Inclusion of opportunity costs within the optimization period should result in similar efficiency of dispatch for the storage resource, when derived on an hourly basis, from a general profit maximization framework, and based on robust expectation of daily prices. This approach can result in additional efficiency over relying on the CAISO market optimization to implicitly determine costs when a resource faces costs or constraints that may not be modeled in the CAISO market optimization.

market optimization. Inclusion of these costs in energy bids may also improve efficiency when paired with a target state-of-charge MWh range at the end of an optimization period. Like the cycling costs considered by the ISO, these costs are dynamic and change over the day or other optimization timeframe. Opportunity costs will vary with respect to expected prices and upcoming charging and discharging opportunities.

In an effort to capture the type of opportunity costs described above in the real-time energy storage DEB, the ISO proposes to use realized day-ahead prices, construct a price duration curve of expected prices sorted in descending order, and then calculate the strike price on that curve corresponding to the discharge duration capability of the storage resource at maximum output. This approach may be appropriate for resources that have no ability to recharge within a day once discharged, as resources subject to these limitations would face static opportunity costs at the highest valued discharge opportunities expected in the day.

However, this approach does not reflect the actual physical characteristics of energy storage resources that may be capable of charging and discharging multiple times over the course of a day. The use of a simple strike price approach for these resources could overstate the opportunity cost for all but the intervals where recharging is not physically possible before reaching the highest valued discharging opportunities.

DMM discussed this issue at length in earlier comments, illustrating through example how the ISO's simplified DEB approach can significantly overstate opportunity costs when a resource can cycle multiple times per day.⁴ Additionally, DMM's comments on the ESDER 4 Straw Proposal outline a generalized approach that more fully accounts for opportunity and other costs at different points in the optimization period.⁵

This general approach accounts for the dynamic nature of energy storage opportunity costs at different points over a day or other designated optimization period, and accounts for the ability to charge and discharge multiple times over that time to maximize profit. The more general, dynamic approach also negates the need for the ISO to attempt to consider charging costs in the real-time DEB. At a given point in time, charging costs already incurred should not factor into discharge decisions. Future opportunities are already reflected in an approach that varies hourly and considers the value of charging and discharging in future hours.

DMM encourages the ISO to consider a future enhancement to estimated opportunity costs that accounts for the ability of energy storage resources to recharge throughout the day.

⁴ *Comments on ESDER 4 Second Revised Straw Proposal*, Department of Market Monitoring, March 27, 2020: <http://www.caiso.com/InitiativeDocuments/DMMComments-EnergyStorage-DistributedEnergyResourcesPhase4-SecondRevisedStrawProposal.pdf>

⁵ *Comments on ESDER 4 Straw Proposal*, Department of Market Monitoring, May 21, 2019: http://www.caiso.com/InitiativeDocuments/DMM_Comments-EnergyStorageandDistributedEnergyResourcesPhase4-StrawProposal.pdf

Estimated day-ahead charging costs may be influenced by market power when using LMPM run prices

If the ISO retains an estimate of intraday charging cost in the day-ahead DEB, or any other component deriving from expected day-ahead prices, the use of prices from the day-ahead LMPM run as an input may warrant further consideration.

The ISO has previously acknowledged that LMPM prices are not an appropriate choice to estimate opportunity costs for discharge opportunities because they may be influenced by market power. However, the ISO appears to make an assumption that because the charging costs are estimated using the lowest prices in the day, they would not be influenced by market power and would be acceptable for estimating charging costs.

DMM notes that binding transmission constraints can lead to local market power in any hour of the day, even if those hours are the lowest prices of the day—the lowest prices of the day can still be relatively elevated at a given node when congestion is present. The use of the LMPM run prices in any part of the DEB calculation can lead to a DEB that is influenced by the exercise of market power. DMM encourages the ISO to reconsider the use of LMPM run prices in the day-ahead charging cost portion of the DEB calculation to ensure that the DEB calculation is not influenced by market power.

Exempting small resources from mitigation is more appropriate for net-buyers

The ISO has proposed to exempt resources that have capacity of less than 5 MW and are operated by net-buyers from local market power mitigation. The ISO reasons, based on the advice of the MSC, that small resources may not have the ability to exercise market power and that an inaccurate DEB could be potentially harmful to these resources.

DMM does not agree that smaller resources cannot have or exercise local market power. In the context of local market power, a small resource, or collection of similarly positioned small resources could be among a limited number of resources able to provide significant counterflow to a non-competitive constraint. In that situation, these resources could set an uncompetitive price that affects all resources impacted by the constraint. Additionally, setting a MW threshold incentivizes development of multiple smaller projects just below that threshold.

While exempting resources below a certain size is not without potential issues, these issues may be more likely to arise when the entity operating the resources is a net-seller with greater incentive to exercise market power. As such, DMM believes that the additional provision to subject energy storage resources operated by net-sellers to mitigation, regardless of size, will alleviate many of the potential issues that could arise with the ISO's proposal.