California ISO | WESTERN ENERGY MARKETS

Memorandum

To: ISO Board of Governors and Western Energy Markets Governing Body

From: Eric Hildebrandt, Executive Director, Market Monitoring

Date: October 31, 2024

Re: **Comments on Management's proposed changes to bid cost recovery rules for batteries**

This memorandum does not require ISO Board of Governors or WEM Governing Body action.

EXECUTIVE SUMMARY

This memo provides comments by the Department of Market Monitoring (DMM) on Management's Track 1 proposal on storage bid cost recovery and default energy bids enhancements. The Track 1 proposal should limit the potential for gaming of bid cost recovery rules for batteries. DMM does not oppose the Track 1 proposal as a temporary short-term measure that may limit inappropriate bid cost recovery payments. However, the Track 1 proposal does not fully eliminate gaming concerns and does not address the underlying bidding incentives created by current bid cost recovery rules, which create inefficient dispatch of batteries and reduce the reliability benefits of energy storage resources. DMM strongly encourages the ISO to continue working on a more complete and effective solution to the fundamental problems with current bid cost recovery rules for batteries so that the temporary Track 1 proposal can be replaced as quickly as possible.

COMMENTS

Background

The 24-hour optimization used in the ISO's day-ahead market provides a very effective mechanism for optimally scheduling battery resources to charge during mid-day hours when prices are lowest, and then discharge in the late afternoon and evening hours when prices are highest. To then also be optimally dispatched in real-time, batteries must submit real-time bids to charge during the low-priced mid-day hours that reflect their opportunity cost of not charging during these hours (e.g., the cost of charging in higher priced hours, or not having energy to discharge in the highest priced hours). Battery bids to discharge during these mid-day hours should represent their potential revenues from discharging in future high-priced hours.

A primary purpose of bid cost recovery is to incentivize resources to submit bids that accurately reflect actual hourly costs (including opportunity costs), so that the real-time

market optimization achieves efficient market outcomes. However, current bid cost recovery rules for batteries do the opposite, and instead create incentives to bid inconsistent with real-time opportunity costs in hours prior to the hours in which batteries have been scheduled to either charge or discharge through the day-ahead market. This can prevent batteries from being sufficiently charged to provide energy during the peak net load hours – when prices are highest and capacity is most critical for system reliability.

Changes to current bid cost recovery rules specifically need to account for battery state-of-charge constraints that can drive battery dispatch in real-time, regardless of bid prices. Battery operators can manage state-of-charge and modeled state-of-charge limits through market bids and submitted resource parameters. When these state-of-charge constraints bind, this can cause batteries to be dispatched when bids are uneconomic relative to market prices, thereby causing bid cost recovery payments.

The primary manner in which binding state-of-charge constraints lead to bid cost recovery observed by DMM is through the uneconomic reversal of day-ahead schedules, when the battery's real-time state-of-charge is insufficient to meet its day-ahead schedule. This is the largest driver of bid cost recovery paid to battery resources, and results from a combination of two sources:

- Revenue losses, which occur when incremental real-time revenue is insufficient to cover the real-time cost of reversing an infeasible day-ahead schedule.

- Bid-cost losses, which occur when the incremental bid cost associated with real-time dispatch is greater than the avoided bid cost from reversing an infeasible day-ahead schedule.[1]

A more detailed explanation of each of these sources of bid cost recovery is provided below.

Bid cost recovery associated with revenue losses removes the battery operator's exposure to real-time prices in the intervals that state-of-charge constraints lead to infeasible day-ahead schedules. This makes battery operators at least as well off from a revenue perspective between managing state-of-charge to deliver the day-ahead schedule, or dispatching earlier in the day, leading to state-of-charge insufficiency in the hours of the day-ahead schedule.

When dispatched early in real-time, a battery's net revenue for the day includes market revenue plus bid cost recovery. When this net revenue is likely to be at least as much as if the day-ahead schedule were delivered, batteries can have an incentive to bid below cost in the hours preceding a day-ahead schedule in an effort to receive early dispatch. Bidding in this way can lead to inefficient dispatch that is misaligned with

[1] The ISO's Market Surveillance Committee provides detailed numerical examples of how bid prices affect bid cost recovery payments in its *Opinion on Storage Bid Cost Recovery and Default Energy Bid Enhancements*.

actual real-time opportunity costs, and can leave resources unavailable when most needed by the real-time market.

Bid cost recovery associated with bid-cost losses is driven by bid prices submitted by battery operators, and creates incentives for batteries to actively try to be dispatched differently than day-ahead schedules earlier in the day. Under current bid cost recovery rules, it can be more profitable for batteries to set state-of-charge constraints and bid prices in ways that prevent batteries from having sufficient charge to meet their day-ahead schedules during the peak net load hours. This also creates opportunities for battery operators to game bid cost recovery rules in order to maximize bid cost recovery payments through strategic bidding.

The Market Surveillance Committee (MSC) highlights the role of bid cost recovery associated with bid-cost losses through a series of examples in their recent opinion.[2] As the MSC explains:[3]

> *Hence…premature dispatch is always profitable if the offer price in the interval in which the resource is dispatched above its day-ahead market schedule… exceeds its offer price in the interval in which it buys back its day-ahead market schedule…*

And similarly:

> *…as long as the bid to charge is higher in the hour in which energy is sold back… than in the hour in which energy is purchased… the premature filling of storage will be profitable without regard to real-time prices.*

As highlighted throughout the MSC's opinion, this difference in bid prices across hours can be exploited to maximize bid cost recovery payments. The ISO's final Track 1 proposal, and approaches discussed in the MSC opinion other than the ISO's initial Track 1 proposal, all target the bid cost portion of the bid cost recovery calculation to limit the ability of battery operators to bid in a manner that would increase bid cost recovery payments.[4] However, these approaches do not address the revenue portion of the bid cost recovery calculation. With all of these approaches, the incentives created by this portion of the bid cost recovery calculation ─ and the associated potential for efficiency and reliability issues ─ remain unaddressed.

Track 1 proposal

The ISO's initial Track 1 proposal was aimed directly at eliminating all adverse incentives and gaming opportunities by making batteries ineligible for bid cost recovery payments when dispatched out of merit order due to binding state-of-charge constraints. However, the ISO determined that it would require additional time to develop the details of this approach and address concerns raised by some stakeholders (including battery

[2] *Opinion on Storage Bid Cost Recovery and Default Energy Bid Enhancements*, Market Surveillance Committee of the California ISO. Example 3 illustrates this point most generally. The MSC refers to losses recovered through the bid cost component of the bid cost recovery calculation as "phantom losses".

[3] Ibid, pp. 8 and 11

[4] Ibid, pp.. 22 - 25

owners). As an interim step, the ISO proposes an alternative approach very similar to approaches suggested by battery storage stakeholders.

The final Track 1 proposal will limit the bids used in the real-time bid cost recovery calculation from falling below certain thresholds for decremental schedules, or above certain levels for incremental schedules. This proposal is aimed only at the bid cost portion of the bid cost recovery calculation, and reduces the ability of battery scheduling coordinators to strategically bid in a manner that maximizes bid cost recovery payments.

DMM is unable to estimate the potential impacts of the ISO's final proposal due to the complexity of such analysis, and uncertainty about future bids and market outcomes that serve as inputs to the proposed calculation. However, DMM's prior analyses indicate that extreme bid prices are not the primary driver of bid cost recovery for batteries. In addition, participants may modify their bidding behavior in response to these changes.

The Track 1 proposal should reduce the potential for significantly higher losses from gaming of bid cost recovery payments, and may reduce current levels of bid cost recovery being paid in some circumstances. However, DMM does not expect that the proposal will significantly reduce bid cost recovery payments. Further, the proposal does not entirely eliminate potential gaming.

More importantly, because the revenue portion of the bid cost recovery calculation is not impacted under the Track 1 proposal, storage operators will remain insulated from real-time prices when reversing an infeasible day-ahead schedule. In terms of expected net revenues, resources will still be at least as well off when dispatched early and having insufficient state-of-charge to meet a day-ahead schedule, as compared to managing state-of-charge so that they are able to meet their day-ahead schedules in high-priced hours.[5] Therefore, the proposal does not effectively address the core efficiency and reliability issues caused by current rules, and resources will maintain some incentive to bid below cost in an effort to achieve dispatch before the hour of a day-ahead schedule.

A complete and effective solution should address the core problem caused by the state-of-charge constraints. DMM encourages the ISO to continue exploring alternate methods of making batteries ineligible for bid cost recovery stemming from insufficient state-of-charge, so that storage resources will have an incentive to submit real-time bids reflecting expected real-time intraday opportunity costs. DMM's internal analysis of bid cost recovery paid to batteries suggests that there is an effective and implementable approach to identifying intervals of state-of-charge insufficiency based on market data, which was not adequately considered in the stakeholder process.

[5] While the goal is not necessarily to preserve day-ahead schedules, exposure to real-time prices during hours in which day-ahead schedules exist creates incentives to align real-time bids with expected real-opportunity costs and prices, which reflect real-time system needs.

Default energy bids

DMM continues to recommend that the ISO improve the default energy bids used for batteries in the ISO's local market power mitigation procedures. Two ways in which default energy bids can be made to better reflect the opportunity costs of batteries in real-time include the following:

- Currently, the opportunity cost of batteries discharging in real-time is based on the fourth highest hourly price from the day-ahead market. This approach could be improved by allowing these opportunity costs to be updated to better reflect expected real-time prices.

- In addition, rather than having one value for the entire day, default energy bids should be allowed to vary across different hours of the day to better reflect how opportunity costs can vary at different points in the day.

These enhancements would lead to a default energy bid for batteries that could be higher in some hours, but lower in other hours, as intraday opportunity costs change throughout the operating day.

Impact of local market power mitigation

In earlier stages of this initiative, the ISO proposed to eliminate eligibility for bid cost recovery during intervals where a battery's state-of-charge was insufficient to meet a day-ahead schedule. This change would directly address the core problem caused by state-of-charge constraints, by ensuring that batteries have an incentive to submit real-time bids reflecting expected real-time intraday opportunity costs. This would likely create an incentive for batteries to submit relatively high-priced bids to charge and discharge during the mid-day hours to avoid being dispatched prematurely, and to ensure charging occurs when needed to meet day-ahead schedules in later hours.

The Market Surveillance Committee and some stakeholders have raised the question of whether the ISO's current local market power mitigation might undermine the effectiveness of such rule changes by causing batteries to be dispatched for energy prior to the highest priced peak net load hours. To address this issue, DMM analyzed the actual and potential impacts of bid mitigation on the dispatch of batteries using market data from days in summer 2023 and 2024 when the ISO called for restricted maintenance operations. This analysis indicates that mitigation using the current default energy bids for storage resources would not significantly limit the efficiency and reliability benefits of the ISO's initial proposal.[6] Thus, implementation of an approach such as the ISO's initial proposal should not be deferred until enhancements to the default energy bids for batteries can be developed.

[6] https://www.caiso.com/documents/dmm-comments-on-storage-bid-cost-recovery-and-default-energy-bid-enhancements-revised-straw-proposal-sep-23-2024.pdf

Bid mitigation may in some cases result in financial losses to a battery in some intervals by preventing discharge in a future higher priced interval. While DMM's analysis suggests such losses would be relatively limited on these days, such losses might be more significant for certain resources on some days. Therefore, additional settlement provisions are needed to prevent revenue losses when a storage resource's bids are mitigated, causing them to have insufficient state-of-charge to discharge in a future higher priced hour.

As noted by the Market Surveillance Committee, such provisions could be based on current settlement provisions that were developed to compensate batteries for any lost revenues due to exceptional dispatches issued to maintain a resource's state-of-charge. This uplift should be further limited as default energy bids continue to be refined to better capture changing intraday opportunity costs.