

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

**California Independent System)
Operator Corporation)**

Docket No. ER23-1533-000

**MOTION TO INTERVENE AND COMMENTS
OF THE DEPARTMENT OF MARKET MONITORING
OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION**

Pursuant to Rules 212 and 214 of the Rules of Practice and Procedure of the Federal Energy Regulatory Commission (“FERC” or “Commission”), 18 C.F.R. §§385.212, 385.214, the Department of Market Monitoring (“DMM”), acting in its capacity as the Independent Market Monitor for the California Independent System Operator Corporation (“CAISO”), submits this motion to intervene and comment in the above-captioned proceeding.

I. MOTION TO INTERVENE

DMM respectfully requests that the Commission afford due consideration to these comments and motion to intervene, and afford DMM full rights as a party to this proceeding. Pursuant to the Commission’s Order 719, the CAISO tariff states “DMM shall review existing and proposed market rules, tariff provisions, and market design elements and recommend proposed rule and tariff changes to the CAISO, the CAISO Governing Board, FERC staff, the California Public Utilities Commission, Market Participants, and other interested entities.”¹ As this proceeding involves CAISO tariff provisions that would affect the efficiency of CAISO markets, it implicates matters within DMM’s purview.

¹ CAISO Tariff Appendix P, Section 5.1.

II. SUMMARY

In this filing, CAISO proposes four sets of tariff revisions originating from its recently approved Energy Storage Enhancements stakeholder initiative.² The proposed tariff revisions will: (1) clarify that the CAISO will consider the impact regulation awards have on energy storage resources' state of charge; (2) require storage resources to submit real-time energy bids to cover day-ahead ancillary service awards; (3) provide storage resources with opportunity cost compensation when they receive an exceptional dispatch to hold a state of charge; and (4) enhance storage resources' day-ahead default energy bids to include opportunity costs.³ DMM supports each of CAISO's proposed tariff revisions. DMM believes these tariff revisions will improve the reliability of ancillary services awarded to energy storage resources. The revisions should also improve the efficiency of energy storage exceptional dispatch settlement, and improve the ability of the day-ahead market to consider intraday opportunity costs of storage resources when subject to local market power mitigation.

² *Energy Storage Enhancements – Final Proposal*, California ISO, October 27, 2022: <http://www.caiso.com/InitiativeDocuments/FinalProposal-EnergyStorageEnhancements.pdf>

³ *California Independent System Operator Corporation Energy Storage Enhancements Tariff Amendment*, California Independent System Operator Corporation, Docket No. ER23-1533-000, ("Transmittal Letter").

III. COMMENTS

The proposed improvements to state of charge modeling will support availability of ancillary services provided by storage resources

CAISO has experienced repeated instances of storage resources receiving regulation awards in the day-ahead market that become unavailable in real-time. This is noted in the Transmittal Letter and has been observed by DMM.⁴ DMM believes CAISO's proposed tariff revisions will support reliability by improving the feasibility and real-time availability of regulation awarded to storage resources. These proposed tariff revisions will improve the feasibility and availability of regulation awarded to storage resources in several ways.

First, the proposed tariff revision to recognize the impact of regulation awards on storage resources' state of charge will prevent the market software from awarding many consecutive hours of regulation in one direction that becomes infeasible after several consecutive intervals of deployment. The CAISO real-time market includes an ancillary services state of charge constraint that will charge or discharge a storage resource as necessary to maintain deliverability of awarded ancillary services. This constraint ensures that ancillary services awarded to storage resources remain deliverable for at least 30 minutes, even when real-time state of charge may differ from that modeled when the ancillary services were awarded. When a storage resource receives regulation awards in large quantities for many consecutive intervals, or when the resource begins the operating day with a very high or low state of charge, this constraint can quickly bind in real-time as regulation is deployed. By modeling state of charge in a manner that estimates the impacts of regulation deployment, the CAISO market software will award

⁴ Transmittal Letter, p. 10

regulation to storage resources for a duration and quantity that is more likely deliverable without reliance on the real-time ancillary services state of charge constraint.

Proposed revisions to real-time energy bid requirements associated with day-ahead regulation awards will support availability of ancillary services provided by storage resources.

The proposed revisions to consider the impact of regulation awards in state of charge modeling will likely reduce dependence on the real-time ancillary services state of charge constraint. However, there will still be times when the real-time market needs to rely on the ancillary services state of charge constraint to maintain deliverability of regulation awarded to storage resources. CAISO's proposal to require real-time energy bids of at least 50 percent of day-ahead awarded ancillary services quantity (in the opposite direction of the awarded ancillary service) helps to ensure that the storage resource has sufficient real-time energy bid range to allow this constraint to function as intended.

When storage resources are awarded ancillary services, there is state of charge below or above which the resource becomes unable to provide the awarded service for 30 consecutive minutes. When state of charge falls outside of the level required to maintain 30 minute deliverability of the awarded ancillary services, the ancillary services state of charge constraint causes the real-time market to dispatch the storage resource to charge or discharge as needed to restore state of charge to the required level. For the real-time market to dispatch a storage resource, the resource must have submitted real-time energy bids for the range of the dispatch. Further, because the dispatches generated by the ancillary services state of charge constraint will necessarily be in the opposite

direction of the awarded ancillary service, the resource needs to have sufficient energy bid range in the direction opposite of the awarded ancillary service.

For example, if a storage resource has a regulation down award, there will be maximum state of charge above which the resource would no longer be able to provide regulation down for 30 minutes. When real-time state of charge rises above this maximum level – e.g., due to charging during the earlier deployment of regulation down service – the ancillary services state of charge constraint will bind, resulting in a discharge of the resource until the state of charge is sufficiently reduced. In order for this discharge to occur, the resource must have sufficient energy bid range in the discharge direction – the opposite direction of the awarded regulation down. In the absence of CAISO’s newly proposed real-time energy bidding requirements, the resource operator may fail to submit energy bids needed to allow operation of the real-time ancillary services state of charge constraint. This can render the awarded ancillary services undeliverable.

DMM notes that the CAISO’s proposed real-time energy bid requirements associated with day-ahead ancillary service awards will constrain the amount of ancillary service awards that a storage resource can receive in a given hour. This occurs since ancillary services awarded in one direction (e.g., charging) will require real-time energy discharge bid range at half of the awarded quantity, in the opposite direction (e.g., discharging). In order to satisfy this real-time energy bid requirement, the corresponding amount of capacity in the opposite direction cannot be encumbered with ancillary service awards, and must remain available for real-time energy dispatch. Therefore, the resource may be constrained in the amount of ancillary services that it can simultaneously receive on both the charging and discharging range of the resource. This constraint may be

appropriate to the extent that it ensures that storage resources only receive ancillary service awards in either direction up to the amount that can be effectively managed by the ancillary services state of charge constraint. Allowing the full charging and discharging capacity of the resource to be simultaneously awarded ancillary services would leave no energy bid range available to manage real-time state of charge, and could leave some portion of the awarded ancillary services undeliverable.

Compensation of opportunity costs associated with holding state of charge will provide incentives for storage resources to follow exceptional dispatch instructions while also supporting the development of more efficient storage exceptional dispatch tools

CAISO's existing tools and compensation rules for exceptional dispatch are designed for traditional generators to operate at specified output level, and to ensure cost recovery for producing at that level. Exceptional dispatch needs and appropriate compensation for storage resources are different, often driven by the need to manage state of charge rather than to operate at a specific megawatt output level.

DMM has long supported CAISO's development of improved tools for storage exceptional dispatch based on state of charge. DMM supports CAISO's proposed tariff revisions to compensate storage resources for opportunity cost associated with holding a given state of charge as one such improvement.

Storage resource operation is optimized over multiple periods. The actions of a storage resource in one period can impact the capabilities of the resource in a future period. Therefore, each market hour or interval has an expected profit maximizing action of charging, discharging, or no operation, associated with the expected profit maximizing

operation over the day. Deviation from the profit maximizing schedule in a given hour or interval may have opportunity cost in the form of foregone future profit opportunities.

When an exceptional dispatch requires the storage resource to charge or discharge at a specified MW power output level, standard exceptional dispatch settlement applies, and the corresponding energy bids should include any opportunity cost associated with charging or discharging at a given level at the specified time. However, as discussed in the Transmittal Letter, exceptional dispatch to hold a given state of charge is issued as an instruction to produce at 0 MWh.⁵ Under current rules, there is no compensation associated with this dispatch.⁶ Traditional resources do not face the same potential intraday opportunity cost as storage resources.

DMM supports CAISO's proposed tariff revisions that would compensate storage resources for opportunity cost associated with exceptional dispatches at 0 MWh to hold a specified state of charge, and DMM supports CAISO's proposed calculation of this opportunity cost that considers a counterfactual dispatch using submitted energy bids. Compensation of opportunity cost associated with holding state of charge creates incentives for storage resources to comply with exceptional dispatch instructions to forgo operation in order to be available to meet system needs in a future interval.

The proposed compensation structure also serves as a foundation for further enhancements to exceptional dispatch tools for storage resources. CAISO proposed such tool enhancements in the recent Energy Storage Enhancements stakeholder initiative.⁷ These improved exceptional dispatch tools for storage resources would allow CAISO

⁵ Transmittal Letter, p.2

⁶ Ibid.

⁷ *Energy Storage Enhancements – Final Proposal*, California ISO, October 27, 2022: <http://www.caiso.com/InitiativeDocuments/FinalProposal-EnergyStorageEnhancements.pdf>

operators to issue exceptional dispatch to a storage resource on the basis of a specified state of charge rather than a megawatt value. DMM also supports these enhancements to storage exceptional dispatch processes, which would significantly improve the process efficiency and feasibility of exceptional dispatches issued to energy storage resources.⁸

Including opportunity cost in the day-ahead storage default energy bid should improve the ability of the day-ahead market to accurately reflect intraday opportunity costs for storage resources when mitigated

DMM supports CAISO's proposed tariff revisions to introduce an opportunity cost component to the day-ahead default energy bid 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 CAISO's conclusion in 2021 that the timeframe of the day-ahead market may be sufficient to consider intraday opportunity costs. However, DMM also noted in earlier CAISO stakeholder comments that explicit inclusion of opportunity costs may be needed where costs are otherwise not considered by the market optimization.⁹

It is important to note that individual bids in each hour are part of a complete daily bid set that can result in the profit maximizing outcome for a storage resource over the day. Changing the bids in one hour can impact the market solution for a storage resource

⁸ *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>

⁹ *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.caiso.com/Documents/DMMComments-ESDER4StorageDefaultEnergyBidDraftFinalProposal-Oct92020.pdf>

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 local market power mitigation, where a default energy bid 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 default energy bid is derived.

When energy storage resources are subject to local market power mitigation and have market bids replaced with default energy bid in select hours, it cannot be assumed that the resulting bid set will lead to the optimal dispatch of the resource, or reflect intraday opportunity cost associated with the optimal dispatch in the mitigated hours. The bid set combining mitigated bids and the remaining unmitigated market bids may not be consistent with the daily profit maximizing bid strategy that produced the default energy bid. Only when the full days' day-ahead bids conform to the necessary assumptions can this outcome be assumed without explicit inclusion of opportunity costs in all hours.

In order to preserve the consideration of intraday opportunity cost associated with the optimal dispatch in the day-ahead mitigated bid set, this cost should likely be explicitly included in the day-ahead default energy bid. Intraday opportunity cost for the specific resource and market run will be determined by the daily bid set, comprised of both mitigated bids and unmitigated market bids. Therefore, explicit inclusion of this opportunity cost in a default energy bid will not consider opportunity costs in the context of the submitted bid set for the resource. However, a default energy bid constructed in

this way will reflect an estimate of intraday opportunity costs for that hour as would occur if the resource had bid in all hours of the day to achieve the profit maximizing dispatch solution over the day. This should be an appropriate basis for a cost-based default energy bid.

CAISO's proposed tariff revisions to include opportunity cost in the day-ahead storage default energy bid should improve the existing day-ahead storage default energy bid, and to improve the ability of the day-ahead market to accurately reflect intraday opportunity costs for storage resources when mitigated.

IV. CONCLUSION

DMM respectfully requests that the Commission afford due consideration to these comments as it evaluates the proposed tariff provisions before it.

Respectfully submitted,

By: /s/ Adam Swadley

Eric Hildebrandt, Ph.D.
Executive Director, Market Monitoring

Ryan Kurlinski
Senior Manager, Market Monitoring

Adam Swadley
Senior Advisor, Market Monitoring

California Independent System Operator
Corporation
250 Outcropping Way
Folsom, CA 95630
Tel: 916-608-7123
ehildebrandt@caiso.com

Independent Market Monitor for the
California Independent System Operator

Dated: April 21, 2023

CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon the parties listed on the official service lists in the above-referenced proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, California this 21st day of April, 2023.

/s/ Ariana Rebancos
Ariana Rebancos