



California Independent
System Operator Corporation

November 26, 2024

The Honorable Debbie-Anne A. Reese
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

**Re: California Independent System Operator Corporation
Docket No. ER25- ____-000**

**Tariff Amendment to Prevent Unwarranted Bid Cost Recovery
Payments to Storage Resources, and
Request for Effective Date on Shortened Notice**

Dear Secretary Reese:

The California Independent System Operator Corporation (CAISO) submits this tariff amendment to address a market design issue that affects real-time bid cost recovery rules for energy storage resources.¹ Over the past several years, energy storage resources have become a fast-growing and critical part of the CAISO's resource fleet. If accepted, the CAISO's proposed tariff amendment will mitigate the risk that energy storage resources receive unwarranted real-time market bid cost recovery payments. Specifically, the CAISO proposes to modify the real-time bid cost recovery calculations for storage resources to consider other cost proxies in addition to the real-time energy bid cost in all real-time intervals, thus mitigating the risk of energy bids unduly inflating bid cost recovery payments. These cost proxies will ensure storage resources remain eligible for bid cost recovery but will reduce the potential for unwarranted bid cost recovery payments.

The CAISO respectfully requests the Commission waive its notice requirement to allow the proposed tariff revisions to become effective on

¹ The CAISO submits this filing pursuant to section 205 of the Federal Power Act, 16 U.S.C. § 824d. Capitalized terms not otherwise defined herein have the meanings set forth in the CAISO tariff. References to numbered sections are references to sections of the CAISO tariff unless otherwise indicated.

December 1, 2024. Authorizing an effective date on shortened notice will permit the CAISO to apply these rules to mitigate the risk of unwarranted bid cost recovery payments sooner than otherwise permitted under standard notice procedures. The CAISO also requests the Commission issue an order accepting these tariff changes by February 20, 2025. The CAISO will implement these changes on recalculation settlement statements as part of its normal settlements process. For this reason, the CAISO does not request an expedited Commission order accepting this tariff amendment.

I. Executive Summary

Storage resources are an important and growing part of the resource mix in western electricity markets. As states continue to integrate renewable resources to meet their clean energy goals, battery storage resources play an increasingly crucial role in maintaining the flexibility and reliability of the power grid. Battery storage is the fastest growing resource type within the CAISO footprint. In the past four years, the quantity of storage resources participating in the CAISO markets has increased more than 20-fold, from about 500 megawatts (MW) in 2020 to over 10,000 MW in October 2024.² As of June 2024, the Western Energy Imbalance Market included about 3,500 MW of participating battery storage capacity.³

Bid cost recovery provides for “uplift payments” to a resource when revenues from the sale of energy and ancillary services do not cover the resource’s start-up, minimum load, and energy bid costs over the course of a day. Without the prospect of these uplift payments, resources would have an incentive to add a risk premium to their market offers to cover the possibility of not recovering these costs. This could lead to inefficient market outcomes, with higher overall costs for energy. To avoid that outcome, the CAISO provides bid cost recovery payments. However, storage resources lack the conventional drivers for bid cost recovery. Although storage resources may have other opportunity costs, they have neither start-up costs nor minimum load costs, and they generally have fast ramp rates.

The nature of storage resources further complicates the challenges associated with bid cost recovery. Energy storage resources’ bids do not result merely from their costs to produce energy in a given interval; instead, they also reflect storage resources’ desire to receive dispatches at a given time based on

² See CAISO Key Statistics dated September 2024, available at <https://www.caiso.com/documents/key-statistics-sep-2024.pdf>.

³ See CAISO Department of Market Monitoring Special Report on Battery Storage dated July 16, 2024 at 4, available at <https://www.caiso.com/documents/2023-special-report-on-battery-storage-jul-16-2024.pdf>.

their perceived opportunity costs in the future. As a result, the bids submitted by storage resources are not equivalent to those submitted by conventional thermal assets. Bids from storage resources do not solely represent the actual costs associated with injecting energy into the grid or consuming energy from the grid in a given interval. They also include an implied opportunity cost or a signal to hold state of charge for later dispatch that could fall outside the real-time market's forward optimization horizon. This means current bid cost recovery payments to energy storage resources may compensate such resources at a higher value than their actual costs and thus may be unwarranted. This creates an incentive for storage resources to bid in a manner to pursue excessive bid cost recovery payments. In these circumstances, the storage resources' bids do not represent the resources' actual costs, and uplift payments under these conditions cannot be justified by the principles underlying bid cost recovery.

Between January 2022 and September 2024, storage resources received bid cost recovery payments totaling approximately \$58 million. This represents a disproportionate share of total bid cost recovery paid to all resources in this timeframe. Storage resources received a much higher portion of the bid cost recovery payments (around 8 percent) compared to the portion of energy they provided to the grid (around 1.7 percent in 2024 and less than that in 2023 and 2022). In 2024, the CAISO's Department of Market Monitoring (DMM) published a special report on battery storage, which noted numerous situations where storage resources may receive inappropriate or unwarranted bid cost recovery payments.⁴ The CAISO now proposes to address these unintended consequences and unwarranted uplift payments by modifying application of the bid cost recovery rules to storage resources in all real-time intervals.

The issues underlying this tariff amendment involve real-time bid cost recovery payments. The day-ahead market schedules energy storage resources optimally over a 24-hour horizon whereas the real-time market optimizes over a more limited forward horizon. As a result, the day-ahead market generally leads to energy schedules that charge the storage asset during solar irradiation hours and discharge the storage assets during the afternoon ramp and into the net peak period. The real-time market makes decisions to charge and discharge a storage resource without knowing the full set of binding prices in future intervals for the operating day. As such, there are situations in which the real-time dispatch optimization process results in resources incurring greater costs to charge than earned through revenues for discharge.⁵ These situations can appropriately lead to real-time bid cost recovery payments. However, there are

⁴ *Id.*

⁵ There are benefits to having storage resources available to the real-time market because unanticipated conditions can and do occur in real-time. However, storage resources generally support reliability best by adhering to their day-ahead schedules.

other situations where real-time bid cost recovery is unwarranted because the purpose of bid cost recovery is not to provide foregone revenue based on a resource's bid when state of charge limitations mean the storage resource is not dispatched. Moreover, as explained herein, the current bid cost recovery rules provide an opportunity for strategic bidding to inflate real-time bid cost recovery payments.

This filing will help mitigate unwarranted real-time bid cost recovery payments by using proxies for a storage resource's real-time energy bid cost that more appropriately reflect a storage resource's real-time market energy costs. Table A identifies these cost proxies and describes the formula the CAISO would use to determine real-time energy bid costs for storage resources in all real-time market intervals for the purpose of bid cost recovery calculations. The formula ensures the real-time bid cost for incremental energy is the lower of two values: (1) the resource's real-time bid cost; or (2) the greater of the proxy values, which serve as a reasonable estimate of the resource's cost of providing incremental energy.⁶ The formula ensures the real-time bid cost for decremental energy or in cases where there is not change to a resource's real-time market schedule is the greater of two values: (1) the resource's real-time bid cost; or (2) the lower of the proxy values, which serve as a reasonable estimate of the resource's cost of providing decremental energy.⁷

These proposed rules will ensure that bid cost recovery calculations use reasonable values to estimate a resource's costs. The proposed rules also will mitigate storage resources' ability to engage in strategic bidding to inflate bid cost recovery uplift payments. Absent tariff changes, customers will continue to pay unwarranted uplift payments.

⁶ For storage resources operating as Non-Generator Resources, incremental energy may include a reduction in a charge schedule, increase in a discharge schedule, or both.

⁷ For storage resources operating as Non-Generator Resources, decremental energy may include a reduction in a discharge schedule, increase in a charge schedule, or both.

Table A – Summary of Proposed Bid Cost Recovery Rule Changes

For real-time incremental energy, the alternative would be the <u>minimum</u> of the bid and the <u>maximum</u> of three alternatives:	For real-time decremental energy or with no change, the alternative would be the <u>maximum</u> of the bid and the <u>minimum</u> of three alternatives:
<ol style="list-style-type: none">1. Real-time default energy bid2. Real-time market cleared price3. Day-ahead market cleared price <p>(only applicable to resources with a day-ahead award)</p>	

The CAISO respectfully requests the Commission accept these proposed rules and, for good cause, allow this tariff amendment to take effect on less than 60 days' notice. The CAISO will continue to work with all stakeholders to assess how the bid cost recovery framework applies to storage resources and explore more comprehensive market rule reforms.

II. Background

A. The Bid Cost Recovery Mechanism

Scheduling coordinators for resources submit three-part bids, which include start-up, minimum load, and energy bid costs. The market optimization considers the start-up and minimum load costs in optimizing for the least-cost commitment or dispatch of all resources. The optimization uses the energy bid cost to set the locational marginal price (LMP) for a given market interval.⁸ This creates a risk the rents from the difference between the LMP and the resource's energy bid costs will provide insufficient revenue to compensate the resource for its start-up and minimum load costs. Also, ramping rates, minimum run times, and minimum up times can lead to a resource's bid setting the price in one interval, but that resource may cease to be marginal (*i.e.*, its energy bid price may be above the market clearing price) in other intervals when it also must run

⁸ The LMP defines the price for electricity at specific points on the power grid.

to meet those inter-temporal constraints.⁹ Bid cost recovery uplift payments address these risks.

In addition, bid cost recovery payments create an incentive for resources to follow dispatch instructions because bid cost recovery helps ensure resources recover their operating costs even if they are dispatched out of merit order. The CAISO nets market revenues against bid costs over an operating day to determine whether to make bid cost recovery payments to a resource. If a resource's revenues from the day-ahead or real-time markets exceed its costs in the respective market, the resource does not receive a bid cost recovery payment. In 2014, the CAISO separated these calculations for the day-ahead market and the real-time market to increase the incentive for resources to submit real-time bids - both incremental and decremental - and to follow dispatch instructions so the CAISO can more efficiently dispatch resources to meet system needs.¹⁰ As a result, the CAISO calculates bid cost recovery surpluses and shortfalls across day-ahead market and real-time market separately. This calculation nets the surpluses in some intervals against the shortfalls in other intervals to determine any day ahead or real-time bid cost recovery payment for the resource.

Absent bid cost recovery, resources likely would seek to avoid unrecovered costs by internalizing these risks in their energy bids: They would add a risk premium to their energy bids. This reaction, while rational from the scheduling coordinator's perspective, would affect the efficiency of the CAISO market solution because the LMP no longer would reflect the marginal cost of providing energy on the CAISO system. Bid cost recovery helps avoid this outcome. The CAISO recovers the costs of bid cost recovery payments through uplift payments allocated to a combination of measured demand and virtual bidders.¹¹

B. Storage Resources in the CAISO Markets

Storage resources differ from other types of resources because they do not produce energy; rather, they store it and release it onto the grid at a later time. Storage resources participating in the CAISO markets generally use the CAISO's non-generator resource model, which tracks each resource's state of charge.¹² The CAISO introduced the non-generator resource model in 2012. At

⁹ *Cal. Indep. Sys. Op. Corp.*, 135 FERC ¶ 61,110 at PP 7 *et seq.* (2011).

¹⁰ *Cal. Indep. Sys. Op. Corp.*, 145 FERC ¶ 61,254 at P 33 (2013).

¹¹ See existing tariff section 11.8.6.

¹² See existing tariff section 30.5.6.1. The tariff defines state of charge to mean the energy available to CAISO markets from a non-generator resource or storage device. CAISO tariff

the time, storage resources typically provided regulation service, and only a small number of storage resources participated in the energy market. With the increased participation of storage resources in the energy markets, the CAISO and stakeholders are learning the current bid cost recovery rules do not adequately account for the unique characteristics of energy storage assets.

In 2022, the CAISO filed tariff revisions to prevent unintended market outcomes and unwarranted bid cost recovery payments during certain intervals. The revisions prevented storage resources from receiving real-time bid cost recovery for real-time market intervals in which the CAISO's market optimization requires a storage resource to charge or discharge to ensure the resource has sufficient state of charge to support an ancillary services award.¹³ The Commission accepted the tariff revisions, reasoning the revisions were "consistent with CAISO's existing principles underlying bid cost recovery" and "a targeted solution to resolve the issue of certain resources receiving excessive and undue uplift payments"¹⁴ The CAISO committed to monitor its bid cost recovery rules and their impacts on settlement in relation to storage resources. The storage fleet has continued to grow and now materially contributes to both the CAISO energy markets and ancillary services markets.

Storage resources can participate in the day-ahead and real-time markets by bidding or self-providing energy or ancillary services.¹⁵ The CAISO tariff requires resources participating in these markets to provide data identifying its operating characteristics. The CAISO maintains its master file as an electronic repository for such data.¹⁶ The information a storage resource can provide to the master file (through its scheduling coordinator) includes physical operating limitations such as the minimum state of charge and the maximum state of charge for a storage resource, expressed in MW for the storage resource's capacity limits and in megawatt-hours (MWh) for the storage resource's energy limits.¹⁷

appendix A, existing definition of "State of Charge."

¹³ See transmittal letter for CAISO Tariff Amendment Docket No. ER22-2881, at 1-2 (Sept. 19, 2022).

¹⁴ *Cal. Indep. Sys. Operator Corp.*, 181 FERC ¶ 61,146 at P 34 (2022).

¹⁵ A storage resource must have a rated capacity of 100 kilowatts or more to be eligible to participate in the CAISO markets. Existing CAISO tariff section 4.6.3.2; CAISO tariff appendix A, existing definition of "Participating Generator."

¹⁶ Existing tariff sections 4.6.4 and 4.6.11; tariff appendix A, existing definition of "Master File."

¹⁷ Existing tariff section 27.9.

Current bid cost recovery rules work well for conventional thermal assets. Unlike thermal resources, however, storage resources do not have start-up or minimum load costs, and they generally have fast ramp rates, thereby lacking the conventional drivers for bid cost recovery. Although storage resources may have other opportunity costs, they generally lack the intertemporal constraints that warrant bid cost recovery for conventional thermal resources. The Commission has concurred with this assessment stating, “storage resources do not generally experience these types of operating constraints or operating costs.”¹⁸

The nature of storage resource bids in the real-time market poses additional challenges for bid cost recovery. As opposed to conventional thermal resources that are incentivized to bid their marginal energy production costs, storage resource bids do not solely represent the costs to discharge or charge energy in a given interval. Instead, storage resource bids also reflect the resource’s desire for dispatch either to charge or discharge energy at a given time, based on perceived opportunity costs in future intervals, or a desire to hold state of charge for later dispatch. As a result, the bids submitted by storage resources are not equivalent to those submitted by conventional thermal assets because they do not necessarily reflect the cost of discharging or charging. As a result, bid cost recovery payments to storage resources may result in compensation exceeding the resource’s costs.

Additionally, current bid cost recovery rules treat storage resources differently from conventional generators when resources are unavailable to provide energy. Conventional resources are ineligible for bid cost recovery payments when unavailable due to a lack of fuel. If a conventional resource is unable to perform and fulfill its day-ahead schedule due to its unavailability (*i.e.*, an outage), the CAISO categorizes the expected energy from that resource as de-rate energy, which is ineligible for bid cost recovery.¹⁹ In contrast, when a storage resource is unable to meet its day-ahead schedule because its state of charge cannot support the schedule, the market can dispatch the storage asset in a manner that reflects its binding state of charge. This dispatch can result in the buy-back or sell-back of energy, which despite the state of charge limitation the CAISO categorizes as eligible for bid cost recovery.

¹⁸ *Cal. Indep. Sys. Operator Corp.*, 181 FERC ¶ 61,146 at P 33.

¹⁹ Existing CAISO tariff section 11.8.4. See also existing Appendix A to the CAISO tariff, definitions of FMM Derate Energy and RTD Derate Energy.

C. Potential for Unwarranted Real-Time Bid Cost Recovery Payments for Storage Resources

Real-time bid cost recovery payments made to storage resources over the past several years are disproportionate to the level of energy storage resources provide to the market.²⁰ High or frequent bid cost recovery payments can indicate inefficient market outcomes because storage resources would not be expected to receive significant real-time bid cost recovery payments. This is because they do not have start-up or minimum load costs and generally can ramp quickly. Although they may require bid cost recovery in some instances, storage resources generally are unlikely to face the inter-temporal constraints that cause a resource to be infra-marginal (*i.e.*, operating at a cost below the marginal resource) in one interval and supra-marginal (*i.e.*, operating at a cost above the marginal resource) in a closely related interval. In effect, neither the real-time market nor scheduling coordinators for storage resources knows the cost to discharge, charge, or hold state of charge at any given time. Instead, real-time energy bids may reflect only estimates of actual costs.

The current bid cost recovery calculation does not appropriately consider attributes common among storage resources, such as state-of-charge constraints, which determine whether an asset can support its awards and schedules. This results in materially different treatment for storage resources from conventional generators, which are not eligible for bid cost recovery payment when unavailable due to fuel insufficiency. The main limitations on dispatch of storage resources that lead to real-time bid cost recovery payments stem from state-of-charge constraints that limit charging and discharging. For example, when a battery does not have sufficient real-time state-of-charge to deliver a day-ahead market award, the real-time market software may force a battery to forgo charging or discharging out of merit order to buy-back or sell-back the day-ahead market award. Under the CAISO's settlement rules, this can lead to payment of real-time bid cost recovery, which the CAISO currently calculates as the difference between the storage resource's real-time bid costs and its revenues from the real-time market clearing price in each interval.²¹

In the day-ahead market, the market optimizes resources based on their bids over each of the 24 hours of a trading day. However, in the real-time market, the market software looks forward for only a limited time. For example, in the 5-minute real-time dispatch, the market software optimizes resources for a binding interval and a limited number of additional advisory intervals. As a result, the market may dispatch a resource in real-time in a way that impacts the state of charge needed in intervals beyond the real-time market's multi-interval

²⁰ See *infra*, Figure B – Bid Cost Recovery in \$ per MWh.

²¹ Existing CAISO tariff section 11.8.4.

optimization to support a day-ahead charging or discharging schedule in a future hour. In these cases, a storage resource may not have capability to charge or discharge according to its day-ahead market schedule or base schedule in the case of an Energy Imbalance Market (EIM) participating resource. The existing bid cost recovery framework treats these situations as if the resource has deviated from its day-ahead schedule at the direction of the market. Example 1 depicts this outcome.

Example 1:

A 400 MWh storage resource receives a 100 MW day ahead market discharge award in Hour Ending 1600 with an LMP of \$50 MWh. In real-time, the storage resource receives economic market dispatches in the hours preceding Hour Ending 1600 based on the resource's bids and real-time LMPs, which depletes the resource's state of charge to its minimum operating level. As a result, the resource must buy-back its day-ahead schedule in Hour Ending 1600 because it has insufficient state of charge. The real-time LMP is \$150 MWh. As a result, the storage resource faces a \$100 MWh bid cost recovery shortfall in Hour Ending 1600 (\$150 MWh less its \$50 MWh real-time bid), which essentially assumes the resource was economic and should be made whole to the infra-marginal rents it would have received as if it had been dispatched. The real-time bid cost recovery calculation does not make the resource's energy ineligible for bid cost recovery for its unavailability, despite the fact that the resource's state of charge limitation is driving the dispatch result rather than its bid.

The current market design also allows scheduling coordinators for storage resources to bid strategically to maximize their bid cost recovery payments.²² For example, an energy storage resource may directly impose state-of-charge limitations in their bids that can lead to bid cost recovery payments or simply adjust their bids to increase their real-time bid cost recovery shortfalls when they believe their state of charge will bind and force a buy back of a day-ahead schedule. Example 2 depicts this outcome.

²² DMM has identified concerns with the possibility that strategic bidding may result in the inflation of bid cost recovery payments to storage resources. See *DMM Special Report on Battery Storage*, dated July 16, 2024 at p. 24, available at <https://www.caoiso.com/documents/2023-special-report-on-battery-storage-jul-16-2024.pdf>.

Example 2:

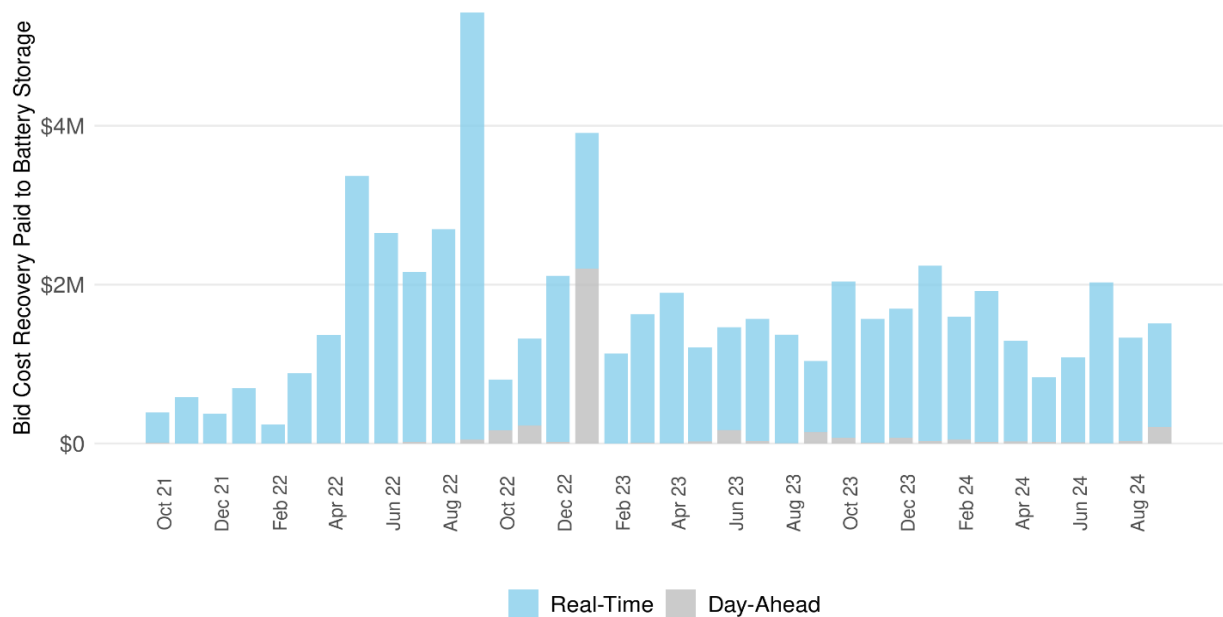
A 400 MWh storage resource receives a 100 MW day ahead market discharge award in Hour Ending 1600 with an LMP of \$50 MWh. In real-time, the storage resource receives market dispatches in hours preceding Hour Ending 1600 to address a grid condition, which depletes the resource's state of charge to its minimum operating level. As a result, the resource must buy-back its day ahead schedule in Hour Ending 1600 because it has insufficient state of charge. The scheduling coordinator for the storage resource anticipates its state of charge will bind and submits a real-time bid for Hour Ending 1600 of negative \$100 MWh to signal it will discharge the resource if LMP is negative \$100 MWh or even lower. The real-time LMP is \$150 MWh. As a result, the storage resource faces a \$250 MWh bid cost recovery shortfall in Hour Ending 1600 (\$150 MWh less its negative \$100 MWh real-time energy bid), which inflates the real-time bid cost recovery payment. The real-time bid cost recovery calculation reflects the resource's real-time energy bid (negative \$100 MWh) and calculates the resource's loss opportunity cost in Hour Ending 1600 as \$250 MWh. Again, current rules do not identify the resource's energy as ineligible for bid cost recovery for its unavailability, despite the fact that the resource's state of charge limitation is driving the dispatch result rather than its bid.

Storage resources may also bid or take other actions to prevent charging or discharging in earlier intervals to restrict state-of-charge in later intervals in a manner that leads to undeliverable day-ahead schedules. For example, a scheduling coordinator might decrease its offer in a prior interval so as to discharge in real-time prior to the interval in which it has a day-ahead schedule. This could lead to an insufficient state of charge to support a day-ahead or base schedule in a later interval, triggering a buy-back, and increasing the resource's real-time bid cost recovery. A scheduling coordinator might also submit real-time bids in a manner to affect real-time bid cost recovery surpluses in intervals in which the resource does not have a day-ahead market schedule but is dispatched in real-time. In these intervals, a buy-back or sell-back of a day-ahead schedule would not occur but the resource is nonetheless affecting the net bid cost recovery calculation for the day, which nets the surpluses in some intervals against the shortfalls in other intervals to determine with any bid cost recovery payment for the day is needed. Current settlement rules expose the market to the potential of storage resources bidding in such a manner to unduly

inflate bid cost recovery payments.²³ The multitude of scenarios that could inflate real-time bid cost recovery payments merits a solution to adopt real-time proxy costs used to calculate bid cost recovery that apply those proxies to all real-time market intervals.

Figure A depicts the trend of storage bid cost recovery payments as between the day-ahead and real-time market for the past three years:

Figure A – Bid Cost Recovery Paid to Battery Storage

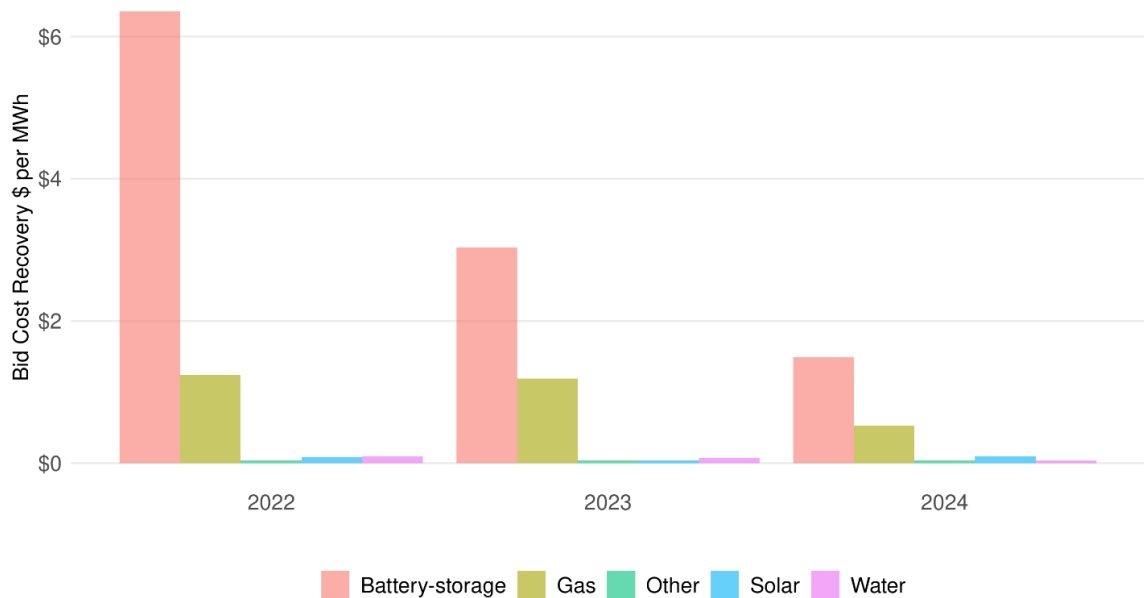


Between January 2022 and September 2024, storage resources received bid cost recovery payments totaling about \$58 million. Although this represents about 8 percent of the overall bid cost recovery paid in this period, it is disproportionate relative to the energy provided by storage resources. In 2024, storage resources have provided around 1.7 percent of energy to the CAISO system. This data indicates a potential market inefficiency and raises a concern that current bid cost recovery rules may be overcompensating storage resources in real-time.

²³ See *Opinion on Storage Bid Cost Recovery and Default Energy Bid Enhancements*, Susan L. Pope, WEM Governing Body Market Expert, dated November 6, 2024 at slides 10 and 11, available at <https://www.westerneim.com/Documents/WEMGoverningBodyMarketExpertOpiniononStorageBidCostRecoveryEnhancements-Presentation-Nov2024.pdf>.

Figure B shows disproportionate real-time bid cost recovery payments over the last three years to storage resources when compared to other resource types based on \$ per MWh. The amount paid to storage resources has decreased over time, but remains significantly and disproportionately larger than other resource types based on their MWh contribution to the CAISO system.

Figure B – Bid Cost Recovery in \$ per MWh



The data reflected in Figures A and B are anomalous in the context of bid cost recovery rules. Storage resources should not be receiving more bid cost recovery than conventional resources because they do not have underlying commitment costs or operating constraints that generally give rise to bid cost recovery payments. Based on the data above as well as observed drivers of real-time bid cost recovery payments to storage resources arising from sell-backs and buy-backs of day-ahead awards, the market may be overcompensating storage resources through bid cost recovery. Absent tariff changes, scheduling coordinators for storage resources could exploit market buy-backs and sell-backs through strategic bidding to inflate bid cost recovery payments even more, exposing market participants to adverse financial outcomes. The CAISO's Market Surveillance Committee (MSC), an independent body of industry experts that provides comments, critiques, and recommendations about a variety of market issues to the CAISO Board of Governors, agrees with this concern. The MSC issued an opinion finding that the current real-time bid cost recovery rules create incentive problems that could result in significant unearned transfers of money to storage resources and adversely affect market efficiency and

reliability.²⁴ The MSC determined that there are several potential bidding strategies that can significantly inflate bid cost recovery payments resulting from including real-time charging or discharging bids in bid cost recovery calculations. For example, the MSC opinion highlights that a bidding strategy can maximize bid cost recovery payments by using real-time bids to deplete state of charge to force a resource to buy-back its day-ahead schedule in a later interval when prices are high. The MSC refers to this problem as payment of bid cost recovery for *phantom losses*, *i.e.*, earning bid cost recovery payments that exceed actual economic losses in future intervals as result of state of charge limitations.

D. Stakeholder Process for this Tariff Amendment

For several years, the CAISO has continually reviewed and enhanced its market design for storage resources to keep pace with the growth of storage participation in the CAISO's markets. In July 2024, the CAISO launched the Storage Bid Cost Recovery and Default Energy Bids Enhancements initiative as the latest step in the ongoing review and enhancement process to address market design issues. This effort initially focused on a limited number of issues including unwarranted bid cost recovery for storage resources.

The stakeholder process for the initiative, although expedited, was extensive, and lasted from July 2024 until November 2024. The stakeholder process began with workshops to explore, establish, and prioritize the issues within scope of the initiative. Participants worked with the CAISO to propose and refine solutions throughout the course of the initiative. During the stakeholder process, the CAISO held several stakeholder meetings and posted multiple issue papers, proposals, and examples, each revised based on stakeholder feedback and the CAISO's own review. Stakeholders had numerous opportunities to provide both comments at the meetings and in writing. The proposed tariff revisions reflect several stakeholder recommendations. The CAISO Board of Governors and WEM Governing Body authorized the CAISO to submit this tariff amendment at a meeting held on November 7, 2024.²⁵

²⁴ MSC Opinion on Storage Bid Cost Recovery, at pp. 2, 4 (Oct. 2024) (MSC Opinion), available at <https://www.caiso.com/documents/market-surveillance-committee-draft-opinion-on-storage-bid-cost-recovery-nov-01-2024.pdf>.

²⁵ Attachment C to this tariff amendment contains a memorandum on the subject dated October 31, 2024 from Anna McKenna, Vice President of Market Design and Analysis, to the CAISO Board of Governors and WEIM Governing Body (Board Memorandum).

III. Proposed Tariff Revisions

The CAISO proposes to revise its tariff to mitigate the ability of energy storage resources to submit real-time energy bids that unduly inflate bid cost recovery payments.²⁶ The proposed tariff rules achieve this outcome by using proxy values for a storage resource's real-time energy bid cost based on the market's dispatch of that resource in the fifteen minute and five minute market in relation to the resource's market award in the day-ahead market or the fifteen minute market.²⁷ These proxy values will apply to storage resources in all real-time market intervals. Using these values will mitigate the risk that the real-time bid cost recovery calculation will yield unwarranted bid cost recovery payments to storage resources. In addition, scheduling coordinators will have less incentive to engage in strategic bidding to effect higher bid cost recovery payments. To be clear, storage resources will remain eligible for real-time bid cost recovery, but their real-time bid costs will reflect their real-time energy bids or an alternative proxy value that reasonably reflects their costs.

First, the CAISO proposes to revise the tariff to modify the real-time energy bid cost recovery rules for a storage resource participating as a non-generator resource when it receives a dispatch instruction in the fifteen-minute market that results in *incremental energy* to its day-ahead energy schedule, or a dispatch instruction in the five minute real-time dispatch that results in *incremental energy* to its schedule from the fifteen-minute market.²⁸ In these instances, the resource's real time energy bid cost will reflect the lower of the following two values for purposes of bid cost recovery calculations:

- (1) the resource's energy bid in the real-time market for that interval, or
- (2) the greater of the resource's day-ahead LMP, its real-time market default energy bid, or its real-time LMP for that interval, which are alternative proxy values to a resource's real-time incremental energy costs.

This revision will ensure a resource's real-time energy bid cost more closely reflects its costs to provide incremental energy and prevent strategic bidding opportunities that could lead to inflated bid cost recovery payments. Using the lower of the storage resource's energy bid in the real-time market or

²⁶ See proposed tariff sections 11.8.4.1.5.1 and 29.11(f)(3).

²⁷ The bid cost proxy values is essentially an alternative bid cost value that would apply in all intervals based on the applicable formula for purposes of bid cost recovery calculations.

²⁸ See first paragraph of proposed tariff section 11.8.4.1.5.1.

the greater of the alternative proxy values for incremental energy (*i.e.*, increasing expected energy²⁹) reflects the resource's likely costs to provide incremental energy and ensures the resource's bid does not result, even inadvertently, in unduly inflated bid cost recovery. Each of the alternative proxy values – the resource's day-ahead LMP, real-time market default energy bid, and the resource's real-time LMP – reflect a reasonable estimate of costs to provide incremental energy. The day-ahead LMP reflects the day-ahead market clearing price for the resource in the relevant trading hour. The storage resource's real-time default energy bid is a calculated value, which reflects opportunity costs to provide incremental energy.³⁰ The real-time LMP reflects the market clearing price of providing incremental energy as reflected in the real-time market for the relevant market interval. By taking the greater of these values, the CAISO's proposed rules treat the storage resource in a fair and equitable manner in representing the resource's costs. Each value is a reasonable representation of the cost of providing incremental energy given storage resources do not have commitment costs or operating constraints that typically give rise to bid cost recovery. The CAISO proposes to use the greater of these proxy values to calculate bid cost recovery payments unless a resource's real-time energy bid costs is actually lower than these values. Using the greater of the alternative proxy values will help ensure the proposed rules do not over-mitigate a resource's real-time market energy bid costs and still protects the market from real-time energy bid costs that may bear no relation to the resource's actual costs of providing incremental energy.

The following example explains how the CAISO's proposed formula will work for a resource providing incremental energy in real-time in relation to its day-ahead market energy schedule. Again, incremental energy for a storage resource may reflect a reduction in a charge schedule as well as an increase in a discharge schedule, or both. Assume a storage resource has a day-ahead energy schedule to charge 100 MWh in a certain hour to replenish its state of charge so it can dispatch energy later in the day. In the day-ahead market, the resource received a \$10 MWh LMP for its charge schedule. This schedule reflects an optimal charge schedule based on the resource's bids across each of the 24 hours of the operating day. The resource submits an \$800 MWh energy bid in the real-time market to charge, meaning it is willing to charge at any price up to \$800 MWh. Using an energy bid to signal a strong desire to charge is appropriate, but using it to calculate a resource's real-time bid cost recovery may

²⁹ The CAISO tariff defines expected energy in relevant part to mean:

The total Energy that is expected to be generated or consumed by a resource, based on the Dispatch of that resource, as calculated by the Real-Time Market (RTM), and as finally modified by any applicable Dispatch Operating Point corrections. Expected Energy includes the Energy scheduled in the IFM and is calculated for the applicable Trading Day.

³⁰ CAISO existing tariff section 39.7.1.8.

result in unwarranted bid cost recovery payments. In the real-time market, the resource's default energy bid is \$50 MWh; the real-time LMP is \$80 MWh. Notwithstanding its real-time market bid of \$800 MWh, the resource receives a dispatch instruction to reduce its charging schedule to 0 MWh based on state of charge limitations. Under current bid cost recovery rules, the resource's real-time energy shortfall is \$720 MWh (\$800 MWh bid less the \$80 MWh real-time LMP) even though the resource only paid \$10 MWh to charge in the day ahead market, and will be paid \$80 MWh in the real-time market to sell-back that position because it has a state of charge limitation and can no longer charge, *i.e.*, it receives incremental energy to reduce its charge.

In this case, the resource has no economic loss in this interval. The storage resource's bid reflects a signal to the market that it wants to charge rather than a representation of its actual costs. Calculating a real-time bid cost recovery payment based on the resource's real-time market energy bid likely will lead to what the MSC calls *phantom losses*. The storage resource may receive bid cost recovery payments that exceed actual economic losses. In the above example, the proposed rules in this filing would restate the storage resource's real-time energy bid cost for purposes of bid cost recovery calculations to be the lower of the two values:

- (1) \$800 MWh.
- (2) The greater of resource's day-ahead LMP (\$10 MWh), its real-time market default energy bid (\$50 MWh), or its real-time LMP (\$80 MWh) for that interval.

In this case, the market would use the real-time LMP (\$80 MWh) as the cost proxy for the resource's real-time energy cost for purposes of bid cost recovery calculations. Using this value for the storage resource's real-time energy bid cost is more consistent with the principle underlying bid cost recovery, *i.e.*, to ensure a resource does not operate when uneconomic without sufficient cost recovery. Indeed, in this example, the resource does not face any economic loss and using \$80 MWh in the bid cost recovery calculation will appropriately recognize that with in a \$0 shortfall for this interval. Accordingly, the real-time LMP more closely reflects the costs for the resource to provide incremental energy in the real-time market than the resource's actual real-time energy bid. This example helps illustrate why the real-time LMP can be an appropriate cost proxy because it correctly identifies that there is no actual economic loss in this interval.

The CAISO proposes to use a similar proxy value in cases where an energy storage resource does not have a day-ahead energy schedule or a base

schedule in the case of an EIM participating resource.³¹ However, the value cannot be the resource's day-ahead LMP because it is either not a relevant proxy or one does not exist.

Second, the CAISO proposes to revise the tariff to modify the real-time energy bid cost recovery rules for a storage resource participating as a non-generator resource when it receives a dispatch instruction in the fifteen-minute market that results in *decremental energy or no change* to its day-ahead energy schedule, or a dispatch instruction in the five minute real-time dispatch that results in *decremental energy or no change* to its schedule from the fifteen-minute market.³² In these instances, the resource's real time energy bid cost will reflect the greater of the following two values for purposes of bid cost recovery calculations:

- (1) the resource's energy bid in the real-time market for that interval, or
- (2) the lower of its day-ahead LMP, its real-time market default energy bid, or its real-time LMP for that interval, which are alternative proxy values for the resource's real-time energy bid cost to provide decremental energy.

This revision will ensure a resource's energy bid cost in the real-time market more closely reflects its costs and prevent strategic bidding opportunities that could lead to inflated bid cost recovery payments. Using the greater of the storage resource's energy bid in the real-time market or the lower of the alternative proxy values for incremental energy (i.e., decreasing expected energy) reflects the likely costs to provide decremental energy and ensures the resource's bid does not result, even inadvertently, in unduly inflated bid cost recovery. Each of the alternative proxy values – the resource's day-ahead LMP, real-time market default energy bid, and the resource's real-time LMP – reflect a reasonable estimate of costs to reduce its discharge, increase its charge, or both. The day-ahead LMP reflects the market clearing price in the day-ahead market for the resource for the relevant trading hour. The storage resource's real-time default energy bid is a calculated value, which reflects the resource's opportunity costs. The real-time LMP reflects the market clearing price of in the real-time market for the relevant market interval. By taking the lower of these values for bid cost recovery calculations, the CAISO's proposed rules treat the storage resource in a fair and equitable manner. Each value is reasonable; however, the CAISO proposes to use the lower of these proxy values to calculate bid cost recovery payments unless a resource's real-time energy bid costs is actually greater than these values. Using the lower of the alternative proxy values helps

³¹ See second paragraph of proposed tariff section 11.8.4.1.5.1.

³² See third paragraph of proposed tariff section 11.8.4.1.5.1.

ensure the proposed rules do not overstate a resource's real-time market energy bid costs when the resource provides decremental energy for purposes of real-time bid cost recovery calculations. This structure protects the market from outlier real-time energy bid costs that bear no relation to the resource's actual costs – that is, the formula will only use the bid rather than the chosen proxy value if doing so would result in a less generous bid cost recovery calculation.

The following example explains how the CAISO's proposed formula will work for a resource providing decremental energy in real-time in relation to its day-ahead market energy schedule. Again, decremental energy for a storage resource may reflect a reduction in a discharge schedule, an increase in a charge schedule, or both. Assume a storage resource has a day-ahead energy schedule to discharge 100 MWh in a certain hour. In the day-ahead market, the resource received a \$50 MWh LMP for its discharge schedule. This schedule reflects an optimal discharge schedule based on the resource's bids across each of the 24 hours of the operating day. The resource submits a negative \$100 MWh real-time energy bid. That bid signals the scheduling coordinator's desire to discharge at prices as low as negative \$100 MWh. Using an energy bid to signal this strong desire to discharge is appropriate, but using it to calculate a resource's real-time bid cost recovery may result in unwarranted bid cost recovery payments. In the real-time market, the resource's default energy bid is \$55 MWh; the real-time LMP is \$80 MWh. Notwithstanding its real-time market bid, the resource receives a dispatch instruction to reduce its discharge schedule to 0 MWh based on the resource's state of charge limitations. Under the current rules, the resource's real-time shortfall is negative \$100 MWh less \$80 MWh or \$180 MWh. The proposed rules in this filing would restate its real-time energy bid cost to be the greater of the two values:

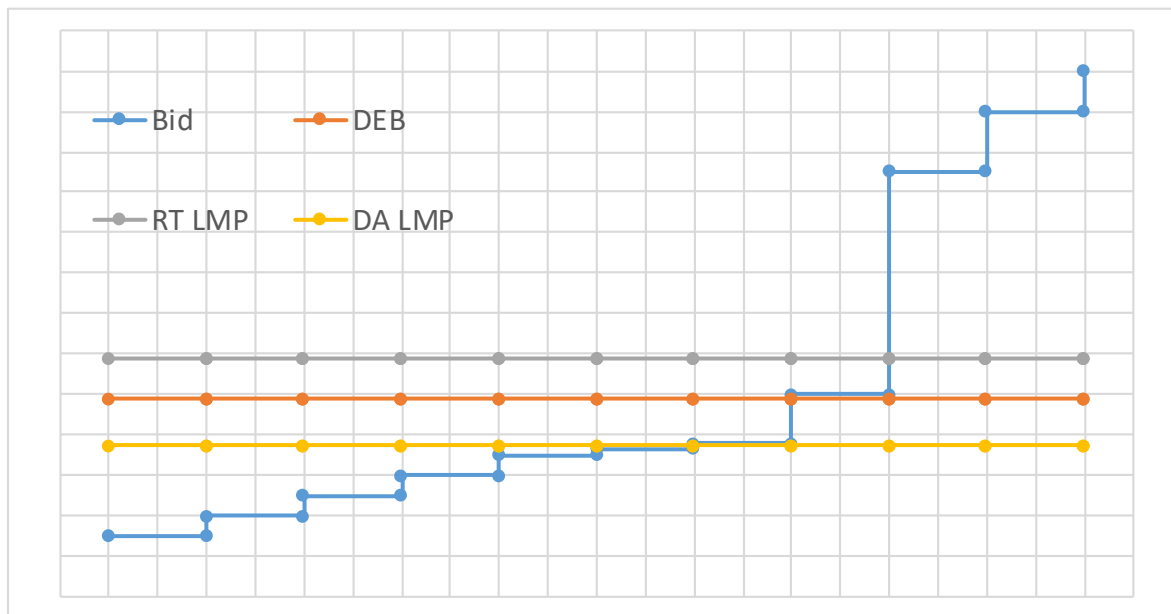
- (1) negative \$100 MWh.
- (2) The lower of resource's day-ahead LMP (\$50 MWh), its real-time market default energy bid (\$55 MWh), or its real-time LMP (\$80 MWh) for that interval.

In this case, the market would use a resource's day-ahead LMP (\$50 MWh) as the resource's real-time energy bid cost. Using this value for the storage resource's real-time energy bid cost instead of negative \$100 MWh is more consistent with existing principles underlying bid cost recovery. Indeed, in this example, the resource is paid \$50 MWh for its discharge award in the day-ahead market, and has to buy-back its position in the real-time market at \$80 MWh, losing \$30 MWh (not the \$180 shortfall as calculated under current rules). In this base, the resource receives decremental energy to reduce its discharge schedule. Using the day-ahead LMP as a proxy will more appropriately calculate a bid cost recovery shortfall of (day ahead LMP \$50MWh less its real-time market LMP \$80 MWh) = - \$30 MWh. Again, the storage resource's bid

signals to the market that it strongly desires to discharge rather than represent the actual costs to do so. Calculating a real-time bid cost recovery shortfall based on the resource's real-time market energy bid cost, however, likely will result in what the MSC calls *phantom losses*. The market would identify a bid cost recovery shortfall that exceeds the resource's actual economic losses. In this example, the day-ahead LMP more closely reflects the resource's costs to reduce its discharge in the real-time market.

Figure C illustrates an energy storage resource's bid curve (the blue line) across a charging and discharging range as well as bid cost proxy values for the resource's real-time market LMP, real-time default energy bid and day-ahead LMP. These values are illustrative only. When a resource receives a dispatch for incremental energy, the CAISO would use either the lower of the resource's energy bid in the real-time market for that interval, or the resource's real-time market LMP (the grey line), which is the greater of the proxy cost values. When a resource receives a dispatch for decremental energy, the CAISO would use either the greater of the resource's energy bid in the real-time market for that interval, or the resource's day-ahead market LMP (the yellow line), which is the lower of the proxy cost values.

Figure C – Illustrative Bid Curve and Bid Cost Proxies



The CAISO proposes to use a similar proxy value in cases in which an energy storage resource does not have a day-ahead energy schedule or a base schedule in the case of an EIM participating resource.³³ However, the proposed tariff revisions exclude the day-ahead LMP because it is either not relevant or one does not exist. The prior example helps to illustrate why day-ahead LMP can be a relevant proxy because it recognizes that a resource with a day-ahead schedule will be exposed to price differences between markets if it has to buy or sell back its position. However, that is not true for a resource with no day-ahead award in a given interval, so in that scenario the day-ahead LMP is irrelevant for purposes of calculating bid cost recovery.

The CAISO has proposed language in section 29 of its tariff to clarify that these rules will extend to EIM participating resources that are storage resources³⁴ except that the CAISO will treat references to day-ahead energy schedules as EIM base schedules. The CAISO will not consider day-ahead market LMPs in the calculation of real-time market energy bid costs for EIM participating resources that are storage resources and participate as non-generator resources because these resources only participate in real-time market clearing and so a day-ahead energy price does not exist at their location.

Several stakeholders expressed support for the CAISO's proposed rules. For instance, the California Community Choice Association encouraged the CAISO Board of Governors and WEM Governing Body to authorize the CAISO to file the proposed tariff revisions with the Commission.³⁵ The Western Energy Markets Body of State Regulators (BOSR) also supported the CAISO submitting these rule changes.³⁶ The Energy Division staff of the California Public Utilities Commission expressed its support for the proposed rules in order to prevent unwarranted payments through strategic bidding and protect ratepayers from artificially inflated and unwarranted costs.

The CAISO's DMM does not oppose this proposal but urges the CAISO to do even more to address the underlying bidding incentives created by current bid

³³ See fourth paragraph of proposed tariff section 11.8.4.1.5.1.

³⁴ Proposed tariff section 29.11(f)(3).

³⁵ See November 6, 2024 letter from California community Choice Association CCA to CAISO Board of Governors' and Western Energy Markets Governing Body Adoption of Storage Bid Cost Recovery Enhancements, available at <https://www.caiso.com/documents/calcca-public-comment-decision-on-storage-bid-cost-recovery-enhancements-nov-06-2024.pdf>.

³⁶ See Comments of the Western Energy Markets Body of State Regulators to the Western Energy Markets Governing Body on Track 1 of the Storage Bid Cost Recovery and Default Energy Bid Enhancements Initiative, available at <https://www.caiso.com/documents/bosr-public-comment-decision-on-storage-bid-cost-recovery-enhancements-nov-04-2024.pdf>.

cost recovery rules, which create inefficient dispatch of batteries and reduce the reliability benefits of energy storage resources.³⁷ Likewise, several stakeholders requested the CAISO continue working on a holistic redesign of the uplift mechanism for storage resources as well as other important market design changes to support energy storage resources.³⁸ The CAISO will continue to discuss with stakeholders what, if any, other longer-term enhancements it might make to the tariff to address bid cost recovery for energy storage resources, as well as other storage-related market design enhancements.³⁹ That effort need not interfere with the Commission accepting the CAISO's proposed tariff changes, which address a pressing market design issue that affects real-time bid cost recovery rules for energy storage resources and can result in unwarranted bid cost recovery payments to resources that do not reflect actual costs. The CAISO's proposed tariff revisions are a just and reasonable and not unduly discriminatory means to prevent future unwarranted bid cost recovery payments to storage resources under the circumstances described in this filing. Absent these tariff changes, market participants will face continued exposure to adverse and unjustifiable financial outcomes.

Some stakeholders noted concerns with application of the modified bid cost recovery calculation across all intervals of the day in the real-time market, as opposed to only a subset of intervals. These stakeholders suggest applying these proposed rules in all intervals could result in overly punitive outcomes. The CAISO disagrees. The cost proxies the CAISO will use for real-time market bid cost recovery calculations are reasonable estimates of the resource's costs based on objective inputs that reflect system conditions in the relevant operating interval. Applying the cost proxies in all intervals cannot punish a scheduling coordinator if they reasonably reflect a resource's costs. Using these cost proxies in all intervals will help ensure a resource recovers its costs and will follow dispatch instructions. In addition, this approach eliminates the need to develop more complex and potentially arbitrary rules that govern when to use the cost proxies as compared to a market participant's supply offer. More importantly, stakeholders arguing the CAISO should only use the cost proxies in intervals when buy-backs or sell-backs occur overlooks the real-time bidding

³⁷ Memorandum from Eric Hildebrandt, DMM Executive Director, to CAISO Board of Governors and Western Energy Markets Governing Body dated October 31, 2024, available at <https://www.caiso.com/documents/departments-of-market-monitoring-update-storage-bid-cost-recovery-nov-2024.pdf>.

³⁸ See e.g. Letter from California Energy Storage Association to the Chair of the CAISO Board of Governors and Chair of the Western Energy Markets Governing Body dated November 4, 2024, available at <https://www.caiso.com/documents/cesa-public-comment-decision-on-storage-bid-cost-recovery-enhancements-nov-04-2024.pdf>.

³⁹ The CAISO plans to hold a stakeholder meeting in December 2024 to continue these discussions.

behavior that could still inflate real-time bid cost recovery when a resource does not have a day-ahead market award. Indeed, the MSC observed that not just the offers in the hour with a day-ahead market award are important from the standpoint of bid cost recovery calculations. The offers in hours in which the resource has no day-ahead market schedule also matter because higher offers in those hours reduce the market surplus in bid cost recovery calculations when the resource is dispatched at those times. The MSC identified that it is precisely the difference between a resource's offers in intervals in which the resource receives a dispatch compared with those in intervals with day-ahead buy-backs or sell-backs that drives profit. Applying the modified bid cost recovery calculation only to a subset of intervals would affect only the bid cost recovery calculation of shortfalls associated with intervals with buy-backs and sell-backs, leaving the bid cost recovery calculation of surpluses entirely within the resource owner's control.⁴⁰ Applying the modified bid cost recovery calculation across all intervals will help mitigate these strategic bidding concerns compared to only applying them in certain intervals.

IV. Request for Order, Effective Date, and Waiver of Notice Requirement

The CAISO respectfully requests the Commission issue an order accepting these tariff revisions by February 20, 2025. The CAISO also requests the Commission grant waiver of its prior notice requirements and accept the tariff revisions effective December 1, 2024.⁴¹ Good cause exists to grant the requested waiver. Permitting the tariff revisions to go into effect on this date will address the issue of storage resources' unwarranted bid cost recovery payments and help prevent resources from taking advantage of the existing rules through strategic bidding. It also is consistent with the Commission's support for the CAISO monitoring the impacts of bid cost recovery provisions on energy storage resources.⁴² The Commission has previously accepted CAISO tariff revisions that went into effect on shortened notice in order to address financial settlement issues, including issues with bid cost recovery payments.⁴³ As in those cases, granting an effective date of December 1, 2024 for the tariff revisions is appropriate. The tariff revisions contained in this filing solely concern financial settlements, which means the CAISO can adjust bid cost recovery payments in

⁴⁰ MSC Opinion on Storage Bid Cost Recovery, at p 10.

⁴¹ Pursuant to section 35.11 of the Commission's regulations, 18 C.F.R. § 35.11, the CAISO respectfully requests waiver of the notice requirement contained in section 35.3(a)(1) of the Commission's regulations, 18 C.F.R. § 35.3(a)(1), to allow the tariff revision to go into effect on December 1, 2024.

⁴² *Cal. Indep. Sys. Operator Corp.*, 181 FERC ¶ 61,146 at P 36.

⁴³ See *Cal. Indep. Sys. Operator Corp.*, 181 FERC ¶ 61,146 at P 30 and n 43; *Cal. Indep. Sys. Operator Corp.*, 151 FERC ¶ 61,108 at PP 11, 20.

the future as part of its standard resettlements cycle as appropriate to reflect Commission acceptance of the tariff amendment.

V. Communications

Under Rule 203(b)(3),⁴⁴ the CAISO respectfully requests that all correspondence and other communications about this filing be served upon:

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VI. Service

The CAISO has served copies of this filing on the California Public Utilities Commission, the California Energy Commission, and all parties with scheduling coordinator agreements under the CAISO tariff. In addition, the CAISO has posted a copy of the filing on the CAISO website.

VII. Contents of Filing

In addition to this transmittal letter, this filing includes the following attachments:

Attachment A	Clean tariff sheets incorporating the tariff revisions proposed in this filing
Attachment B	Tariff sheets showing in redline format the proposed tariff revisions
Attachment C	CAISO Board of Governors and WEM Governing Body Briefing Materials and Records of Vote.

⁴⁴ 18 C.F.R. § 385.203(b)(3).

VIII. Conclusion

For the reasons set forth in this filing, the CAISO respectfully requests that the Commission accept the proposed tariff revisions contained in the filing effective December 1, 2024. These rules will minimize the risk of unwarranted bid cost recovery payments to storage resources as well as mitigate an opportunity for scheduling coordinators to engage in strategic bidding behavior to inflate their bid cost recovery payments.

Respectfully submitted,

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Attachment A – Clean Tariff

Tariff Amendment – Bid Cost Recovery Payments to Storage Resources

California Independent System Operator Corporation

November 26, 2024

11.8.4.1.5 RTM Energy Bid Cost

For any Settlement Interval, the RTM Energy Bid Cost for the Bid Cost Recovery Eligible Resource except Participating Loads shall be computed as the sum of the products of each RTD Instructed Imbalance Energy portion, except Standard Ramping Energy, Residual Imbalance Energy, FMM Exceptional Dispatch Energy or RTD Exceptional Dispatch Energy, FMM Derate Energy or RTD Derate Energy, MSS Load Following Energy, Ramping Energy Deviation and Regulating Energy, with the relevant Energy Bid prices, the Default Energy Bid price, or the Locational Marginal Price, if any, as further described in Section 11.17, for each Dispatch Interval in the Settlement Interval. For Settlement Intervals for which the Bid Cost Recovery Eligible Resource is ramping up to or down from a rerated Minimum Load that was increased pursuant to Section 9.3.3 for the Real-Time Market, the RTM Energy incurred by the ramping will be classified as FMM Derate Energy or RTD Derate Energy and will not be included in Bid Cost Recovery. For a Bid Cost Recovery Eligible Resource that is ramping up to or down from an Exceptional Dispatch, the relevant Energy Bid Cost related to the Energy caused by ramping will be settled on the same basis as the Energy Bid used in the Settlement of the Exceptional Dispatch that led to the ramping. The RTM Energy Bid Cost for a Bid Cost Recovery Eligible Resource, including Participating Loads and Proxy Demand Response Resources, for a Settlement Interval is subject to the Real-Time Performance Metric as described in Section 11.8.4.4 and the Persistent Deviation Metric as described in Section 11.17. Any Uninstructed Imbalance Energy in excess of FMM Instructed Imbalance Energy and RTD Instructed Imbalance Energy is also not eligible for Bid Cost Recovery. For a MultiStage Generating Resource the CAISO will determine the RTM Energy Bid Cost based on the Generating Unit level. For RMR Resources, the CAISO will determine the RTM Energy Bid Cost based on the relevant Energy Bid adjusted to remove Opportunity Costs.

11.8.4.1.5.1 RTM Energy Bid Cost for Storage Resources

When a storage resource participating as a Non-Generator Resource receives a Dispatch Instruction in the Fifteen-Minute Market that results in incremental Energy to its Day-Ahead Energy Schedule, or a Dispatch Instruction in the Real-Time Dispatch that results in incremental Energy to its Schedule from the Fifteen-Minute Market, the Energy Bid price used for purposes of calculating a Real-Time Market Energy Bid Cost in any Fifteen-Minute Market or Real-Time Dispatch interval will reflect the lower of the following

two values: (1) the storage resource's Energy Bid in the Real-Time Market for that interval, or (2) the greater of its Day-Ahead Locational Marginal Price, its Real-Time Market Default Energy Bid, or its Real-Time Locational Marginal Price for that interval.

In intervals when a storage resource participating as a Non-Generator Resource does not have a Day-Ahead Energy Schedule or only participates in Energy Imbalance Market and receives a Dispatch Instruction in the Fifteen-Minute Market for incremental Energy or a Real-Time Dispatch that results in incremental Energy to its Schedule from the Fifteen-Minute Market, the Energy Bid price used for purposes of calculating a Real-Time Market Energy Bid Cost in any Fifteen-Minute Market or Real-Time Dispatch interval will reflect the lower of the following two values: (1) the storage resource's Energy Bid in the Real-Time Market for that interval, or (2) the greater of its Real-Time Market Default Energy Bid, or its Real-Time Locational Marginal Price for that interval.

When a storage resource participating as a Non-Generator Resource receives a Dispatch Instruction in the Fifteen-Minute Market that results in decremental Energy or no change to its Day-Ahead Energy Schedule, or a Dispatch Instruction in the Real-Time Dispatch that results in decremental Energy or no change to its Schedule from the Fifteen-Minute Market, the Energy Bid price used for purposes of calculating a Real-Time Market Energy Bid Cost in any Fifteen-Minute Market or Real-Time Dispatch interval will reflect the greater of the following two values: (1) the storage resource's Energy Bid in the Real-Time Market for that interval, or (2) the lower of its Day-Ahead Locational Marginal Price, its Real-Time Market Default Energy Bid, or its Real-Time Locational Marginal Price for that interval.

In intervals when a storage resource participating as a Non-Generator Resource does not have a Day-Ahead Energy Schedule or only participates in the Energy Imbalance Market and receives a Dispatch Instruction in the Fifteen-Minute Market that results in decremental Energy or a Dispatch Instruction in the Real-Time Dispatch that results in decremental Energy or no change to its Schedule from the Fifteen-Minute Market, the Energy Bid price used for purposes of calculating a Real-Time Market Energy Bid Cost in any Fifteen-Minute Market or Real-Time Dispatch interval will reflect the greater of the following

two values: (1) the storage resource's Energy Bid in the Real-Time Market for that interval, or (2) the lower of its Real-Time Market Default Energy Bid or its Real-Time Locational Marginal Price for that interval.

29.11 Settlements and Billing for EIM Market Participant

* * * * *

(f) Real-Time Bid Cost Recovery.

- (1) **In General.** The CAISO will provide EIM Participating Resources RTM Bid Cost Recovery.
- (2) **Calculation of Real-Time Bid Cost Recovery.** The CAISO will calculate Real-Time Bid Cost Recovery in accordance with Section 11.8.4, except that the CAISO will treat a non-zero EIM Base Schedule of an EIM Participating Resource as an IFM Self-Schedule and the corresponding intervals as IFM self-commitment intervals.
- (3) **RTM Energy Bid Cost for Storage Resources**
The CAISO will calculate Real-Time Market Energy Bid Cost for EIM Participating Resources that are storage resources and participate as Non-Generator Resources in accordance with 11.8.4.1.5.1, except that the CAISO will treat references to Day-Ahead Energy Schedules as EIM Base Schedules. The CAISO will not consider Day-Ahead Market Locational Marginal Prices in the calculation of Real-Time Market Energy Bid Costs for EIM Participating Resources that are storage resources and participate as Non-Generator Resources.
- (4) **Application of Real-Time Performance Metric.**
The CAISO will adjust the RTM Energy Bid Cost, the RTM Market Revenues, and RTM Minimum Load Costs determined pursuant to Section 29.11(f)(2) by

multiplying the Real-Time Performance Metric with those amounts for the applicable Settlement Interval pursuant to the rules specified in Section 11.8.4.4 and its subsections, except that the CAISO will treat an EIM Base Schedule as a Day-Ahead Schedule.

(5) **Allocation of EIM Entity RTM Bid Cost Uplift.**

- (A) **Calculation of Charge.** The Net RTM Bid Cost Uplift will be determined for each EIM Entity Balancing Authority Area in accordance with the methodology set forth in Section 11.8.6.
- (B) **Settlement.** The CAISO will assess the Net RTM Bid Cost Uplift calculated for each EIM Entity Balancing Authority Area to the applicable EIM Entity Scheduling Coordinator in accordance with Section 11.8.6.6.(ii).

Attachment B – Marked Tariff

Tariff Amendment – Bid Cost Recovery Payments to Storage Resources

California Independent System Operator Corporation

November 26, 2024

11.8.4.1.5 RTM Energy Bid Cost

For any Settlement Interval, the RTM Energy Bid Cost for the Bid Cost Recovery Eligible Resource except Participating Loads shall be computed as the sum of the products of each RTD Instructed Imbalance Energy portion, except Standard Ramping Energy, Residual Imbalance Energy, FMM Exceptional Dispatch Energy or RTD Exceptional Dispatch Energy, FMM Derate Energy or RTD Derate Energy, MSS Load Following Energy, Ramping Energy Deviation and Regulating Energy, with the relevant Energy Bid prices, the Default Energy Bid price, or the Locational Marginal Price, if any, as further described in Section 11.17, for each Dispatch Interval in the Settlement Interval. For Settlement Intervals for which the Bid Cost Recovery Eligible Resource is ramping up to or down from a rerated Minimum Load that was increased pursuant to Section 9.3.3 for the Real-Time Market, the RTM Energy incurred by the ramping will be classified as FMM Derate Energy or RTD Derate Energy and will not be included in Bid Cost Recovery. For a Bid Cost Recovery Eligible Resource that is ramping up to or down from an Exceptional Dispatch, the relevant Energy Bid Cost related to the Energy caused by ramping will be settled on the same basis as the Energy Bid used in the Settlement of the Exceptional Dispatch that led to the ramping. The RTM Energy Bid Cost for a Bid Cost Recovery Eligible Resource, including Participating Loads and Proxy Demand Response Resources, for a Settlement Interval is subject to the Real-Time Performance Metric as described in Section 11.8.4.4 and the Persistent Deviation Metric as described in Section 11.17. Any Uninstructed Imbalance Energy in excess of FMM Instructed Imbalance Energy and RTD Instructed Imbalance Energy is also not eligible for Bid Cost Recovery. For a MultiStage Generating Resource the CAISO will determine the RTM Energy Bid Cost based on the Generating Unit level. For RMR Resources, the CAISO will determine the RTM Energy Bid Cost based on the relevant Energy Bid adjusted to remove Opportunity Costs.

11.8.4.1.5.1 RTM Energy Bid Cost for Storage Resources

When a storage resource participating as a Non-Generator Resource receives a Dispatch Instruction in the Fifteen-Minute Market that results in incremental Energy to its Day-Ahead Energy Schedule, or a Dispatch Instruction in the Real-Time Dispatch that results in incremental Energy to its Schedule from the Fifteen-Minute Market, the Energy Bid price used for purposes of calculating a Real-Time Market Energy Bid Cost in any Fifteen-Minute Market or Real-Time Dispatch interval will reflect the lower of the following

two values: (1) the storage resource's Energy Bid in the Real-Time Market for that interval, or (2) the greater of its Day-Ahead Locational Marginal Price, its Real-Time Market Default Energy Bid, or its Real-Time Locational Marginal Price for that interval.

In intervals when a storage resource participating as a Non-Generator Resource does not have a Day-Ahead Energy Schedule or only participates in Energy Imbalance Market and receives a Dispatch Instruction in the Fifteen-Minute Market for incremental Energy or a Real-Time Dispatch that results in incremental Energy to its Schedule from the Fifteen-Minute Market, the Energy Bid price used for purposes of calculating a Real-Time Market Energy Bid Cost in any Fifteen-Minute Market or Real-Time Dispatch interval will reflect the lower of the following two values: (1) the storage resource's Energy Bid in the Real-Time Market for that interval, or (2) the greater of its Real-Time Market Default Energy Bid, or its Real-Time Locational Marginal Price for that interval.

When a storage resource participating as a Non-Generator Resource receives a Dispatch Instruction in the Fifteen-Minute Market that results in decremental Energy or no change to its Day-Ahead Energy Schedule, or a Dispatch Instruction in the Real-Time Dispatch that results in decremental Energy or no change to its Schedule from the Fifteen-Minute Market, the Energy Bid price used for purposes of calculating a Real-Time Market Energy Bid Cost in any Fifteen-Minute Market or Real-Time Dispatch interval will reflect the greater of the following two values: (1) the storage resource's Energy Bid in the Real-Time Market for that interval, or (2) the lower of its Day-Ahead Locational Marginal Price, its Real-Time Market Default Energy Bid, or its Real-Time Locational Marginal Price for that interval.

In intervals when a storage resource participating as a Non-Generator Resource does not have a Day-Ahead Energy Schedule or only participates in the Energy Imbalance Market and receives a Dispatch Instruction in the Fifteen-Minute Market that results in decremental Energy or a Dispatch Instruction in the Real-Time Dispatch that results in decremental Energy or no change to its Schedule from the Fifteen-Minute Market, the Energy Bid price used for purposes of calculating a Real-Time Market Energy Bid Cost in any Fifteen-Minute Market or Real-Time Dispatch interval will reflect the greater of the following

two values: (1) the storage resource's Energy Bid in the Real-Time Market for that interval, or (2) the lower of its Real-Time Market Default Energy Bid or its Real-Time Locational Marginal Price for that interval.

29.11 Settlements and Billing for EIM Market Participant

* * * * *

(f) Real-Time Bid Cost Recovery.

(1) **In General.** The CAISO will provide EIM Participating Resources RTM Bid Cost Recovery.

(2) **Calculation of Real-Time Bid Cost Recovery.** The CAISO will calculate Real-Time Bid Cost Recovery in accordance with Section 11.8.4, except that the CAISO will treat a non-zero EIM Base Schedule of an EIM Participating Resource as an IFM Self-Schedule and the corresponding intervals as IFM self-commitment intervals.

(3) **RTM Energy Bid Cost for Storage Resources**

The CAISO will calculate Real-Time Market Energy Bid Cost for EIM Participating Resources that are storage resources and participate as Non-Generator Resources in accordance with 11.8.4.1.5.1, except that the CAISO will treat references to Day-Ahead Energy Schedules as EIM Base Schedules. The CAISO will not consider Day-Ahead Market Locational Marginal Prices in the calculation of Real-Time Market Energy Bid Costs for EIM Participating Resources that are storage resources and participate as Non-Generator Resources.

(~~4~~3) **Application of Real-Time Performance Metric.**

The CAISO will adjust the RTM Energy Bid Cost, the RTM Market Revenues, and RTM Minimum Load Costs determined pursuant to Section 29.11(f)(2) by

multiplying the Real-Time Performance Metric with those amounts for the applicable Settlement Interval pursuant to the rules specified in Section 11.8.4.4 and its subsections, except that the CAISO will treat an EIM Base Schedule as a Day-Ahead Schedule.

(54) **Allocation of EIM Entity RTM Bid Cost Uplift.**

- (A) **Calculation of Charge.** The Net RTM Bid Cost Uplift will be determined for each EIM Entity Balancing Authority Area in accordance with the methodology set forth in Section 11.8.6.
- (B) **Settlement.** The CAISO will assess the Net RTM Bid Cost Uplift calculated for each EIM Entity Balancing Authority Area to the applicable EIM Entity Scheduling Coordinator in accordance with Section 11.8.6.6.(ii).

Attachment C – Board of Governors Materials
Tariff Amendment – Bid Cost Recovery Payments to Storage Resources
California Independent System Operator Corporation
November 26, 2024



California ISO

WESTERN ENERGY MARKETS

Decision on Storage Bid Cost Recovery Enhancements

Becky Robinson, Director, Market Policy Development

Joint ISO Board of Governors and WEM Governing Body meeting
General Session
November 7, 2024

Management has identified the need to modify the bid cost recovery rules for storage resources

- Today's bid cost recovery calculations create two concerns. Those calculations:
 - 1. Limit storage resources' exposure to real-time prices for deviating from day-ahead schedules**
 - 2. May incentivize strategic bidding by storage resources to inflate bid cost recovery payments**
- Unique attributes of storage resources mean that applying the same bid cost recovery rules results in unequal treatment relative to conventional resources

Background on bid cost recovery

- Resources receive bid cost recovery payments when market revenues do not cover the resource's bid costs, such as start-up, minimum load, and transition costs
- Bid cost recovery incentivizes resources to follow dispatch and bid efficiently by removing the resource's risk if the market operator's dispatch does not cover resource operating costs
- Bid cost recovery is calculated separately for the day-ahead and real-time markets

Management proposes updating the calculation of real-time bid cost recovery for storage resources

- Bid cost would be based on an alternative to the bid to eliminate the opportunity for strategic bidding to inflate bid cost recovery

For resources dispatched up, the alternative would be the minimum of the bid and the maximum of three alternatives:

For resources dispatched down, the alternative would be the maximum of the bid and the minimum of three alternatives:

1. Real-time default energy bid
2. Real-time market cleared price
3. Day-ahead market cleared price
(only applicable to resources with a day-ahead award)

- To remove the ability of storage resources' bids to inflate bid cost recovery payments, this calculation will apply to all intervals

Management's proposal was developed based on stakeholder recommendations

- Incorporated feedback from seven stakeholder meetings and five opportunities for written comment
- Broad stakeholder agreement that the status quo creates poor incentives
- Management's proposal pursues a modified version of a solution put forth by stakeholders
 - Stakeholders' proposal modifies the bid cost recovery calculation for storage resources only in some intervals, while Management's proposal applies in all intervals

Management recommends approval of the proposed changes to storage bid cost recovery

- Provides proportionate bid cost recovery payments to storage resources
- Feasible to develop policy in the near-term and resettle market for unwarranted bid cost recovery payments once effective
- Some stakeholders supported Management's proposal as a viable near-term compromise but noted other storage uplift issues remain unsolved
- Some stakeholders opposed Management's proposal noting its application across all intervals could be overly conservative
- Management has committed to further consider bid cost recovery for storage resources in the context of other storage market design elements



Memorandum

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

From: Anna McKenna, Vice President Market Design and Analysis

Date: October 31, 2024

Re: Decision on Storage Bid Cost Recovery Enhancements

This memorandum requires ISO Board of Governors and WEM Governing Body action.

EXECUTIVE SUMMARY

Management has identified the need to modify the application of the bid cost recovery rules to storage to address two concerns: 1) incentive issues unique to short-duration storage, and 2) potential exploitation of bid cost recovery payments through strategic bidding. The ISO proposes a near-term change in the calculation of real-time bid cost recovery payments for storage resources that would address the second concern and close a market design gap, while it continues to develop more fundamental changes to how storage resources are optimized and costs are recovered to more holistically address the first concern.

Management recommends that the ISO Board of Governors and Western Energy Markets Governing Body approve the proposed changes to storage bid cost recovery as described in this memorandum.

Moved, that the ISO Board of Governors and WEM Governing Body approve the changes to bid cost recovery for storage as described in the memorandum dated October 31, 2024; and

Moved, that the ISO Board of Governors and WEM Governing Body authorize Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the changes proposed in this memorandum, including any filings that implement the overarching initiative policy but contain discrete revisions to incorporate Commission guidance in any initial ruling on the proposed tariff amendment.

BACKGROUND

Grid-scale energy four-hour storage assets within the California Independent System Operator (CAISO) footprint have grown from about 500 MW in 2020 to approximately 10,000 MW by July 2024. Storage resources are defined by their unique operational characteristics: flexibility, responsiveness, and their energy-limited nature, as fuel availability is endogenous to the electric market.

The markets the CAISO operates ensure resources recover their costs for providing energy and ancillary services through the bid cost recovery mechanism, like all energy markets that are based on locational marginal pricing (LMP). Under these rules, the CAISO calculates a shortage or surplus of revenues earned in each interval as the difference between market revenue based on the market clearing price and bid costs, which include start-up, minimum load, transition, and energy costs. These market revenues shortage and surpluses are netted over the day, separately for the day-ahead and real-time markets, to determine whether a payment is necessary when market revenues for the day fall short of the resource's bid costs. The rationale for offering these payments is to incentivize efficient bidding by allowing for the recovery of commitment costs. Without these payments, resources would have an incentive to add a risk premium to their offers, leading to inefficient market outcomes, with higher overall costs for energy.

The current bid cost recovery rules were designed for conventional thermal assets. When storage resources started to enter the resource mix, these rules were extended to storage resources without modifications. At the time, storage resources were typically used for regulation, and, with only a small number of resources participating in the energy market, it was not immediately necessary to modify the bid cost recovery rules. Experience with increased participation of storage resources across the energy markets shows that the current bid cost recovery rules do not reflect the unique characteristics of grid-scale energy storage assets. Unlike thermal resources, storage resources do not have start-up or minimum load costs and generally have fast ramp rates, thereby lacking the conventional drivers for bid cost recovery. Although they may have other opportunity costs, they generally lack the intertemporal constraints that warrant bid cost recovery for conventional thermal resources.

The challenges associated with bid cost recovery for storage assets are further complicated by the nature of their bids in the real-time market. Energy storage resources' bids do not result merely from their costs to produce energy in a given interval; instead, they also reflect storage resources' desire to be dispatched at a given time based on their opportunity costs in future intervals. As a result, the bids submitted by storage resources are not equivalent to those submitted by conventional thermal assets as they are not solely a representation of the actual costs associated with injecting energy into the grid at a given interval, but also include an implied opportunity cost or simply indicate to the market a strong signal to hold state of charge for later dispatch that could fall outside the immediate optimization window. This means that current bid cost recovery payments to energy storage resources may make resources

whole to a higher value than their costs and may be unwarranted. This creates an incentive for storage resources to bid in an inefficient manner that jeopardizes their ability to meet their schedules in order to pursue outsized bid cost recovery payments, potentially hindering the reliability of the grid.

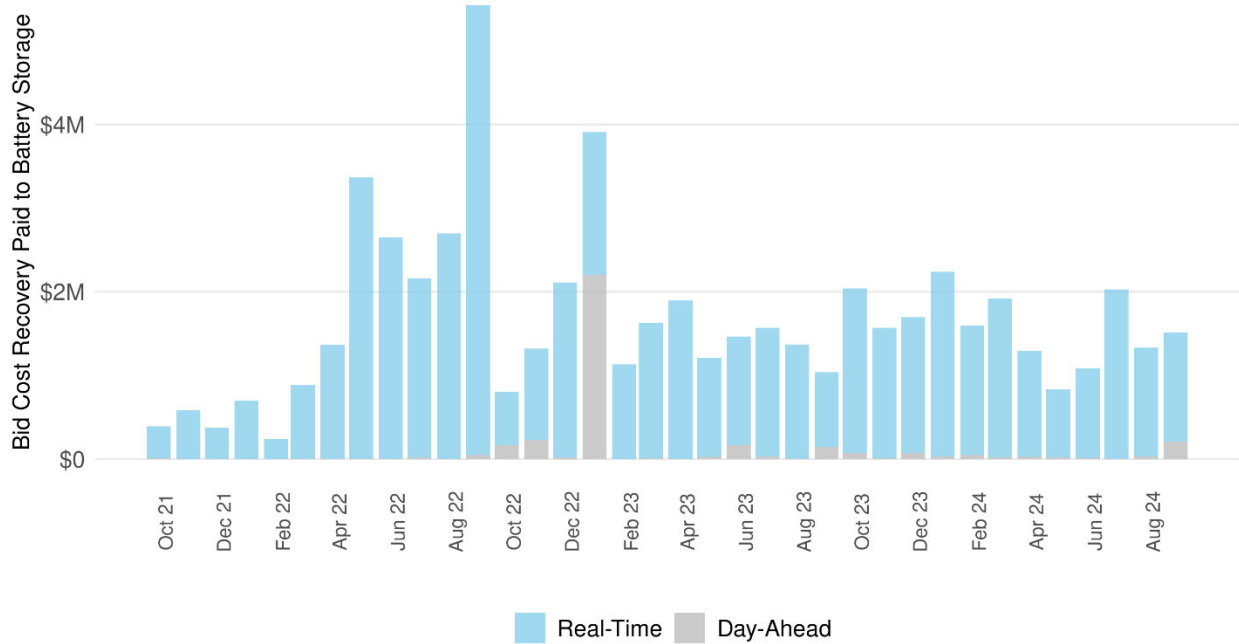
In addition, current bid cost recovery rules treat storage resources differently from conventional generators when they are unavailable to provide energy. Conventional resources are not eligible for bid cost recovery payments when unavailable due to a lack of fuel, but storage resources can experience fuel insufficiency in the form of state of charge limitations and still receive bid cost recovery payments under the current paradigm. This is particularly problematic since, given how shortfalls and surpluses are calculated today, storage resources can bid in a manner that inflates bid cost recovery payments.

In 2022, Management proposed and the ISO Board of Governors and WEIM Governing Body approved changes to the bid cost recovery rules for storage because the ISO observed that the then-applicable provisions related to bid cost recovery for energy storage did not align with the overall objectives and intent of bid cost recovery. Specifically, storage resources were receiving high bid costs recovery payments due to a combination of ancillary service awards or self-provision of regulation-down in the real-time market, coupled with relatively high energy bids.

FERC approved the tariff change noting that storage resources' high bids did not represent the resources' actual bid costs but rather reflected economic unwillingness to discharge, essentially avoiding energy dispatch in certain intervals. At that time, the ISO also committed to monitor the impacts of the bid cost recovery provisions to energy storage resource settlements and to continue to engage with stakeholders to examine whether any other longer-term enhancements might be made to the tariff to address this issue.

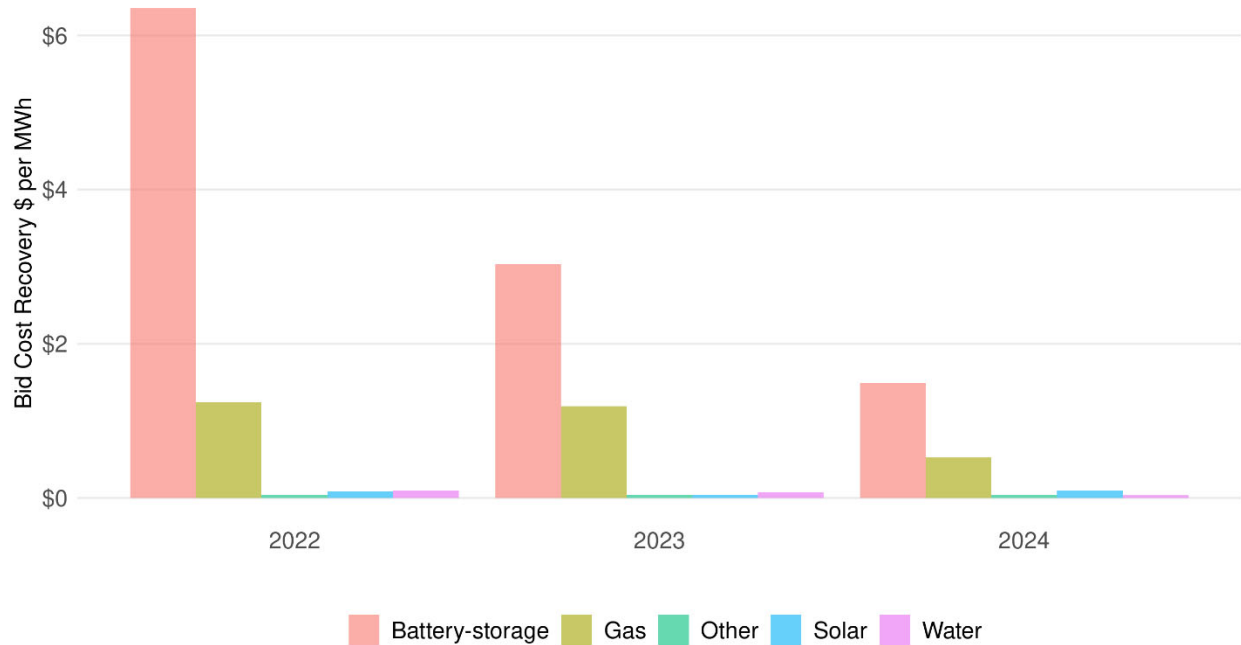
Figure 1 below shows the trend of bid cost recovery applicable to storage resources for the last three years organized by the market in which the cost was accrued. The majority of bid cost recovery for storage resources accrued in the real-time market.

Figure 1: Bid cost recovery for storage resources



Bid cost recovery paid to storage resources from January 2022 through September 2024 is about \$58 million. While this represents a relative small share of the overall bid cost recovery paid in this period – about 8 percent – this is a disproportionate cost relative to the energy provided by storage resources. In 2024, storage resources have provided around 1.7 percent of energy, up from 0.5 percent in 2022, as more storage resources have integrated into the system. The disproportionate payment can be shown by the average cost estimated with the bid cost recovery paid divided by the energy they provided. These average costs are shown for the main technology categories in Figure 2.

Figure 2: Average cost per energy associated with bid cost recovery



While bid cost recovery for storage resources has been decreasing in aggregate on a per MWh basis, detailed analysis on the dynamics leading to specific instances of bid cost recovery paid to storage resources indicates that some of these payments may not be aligned with the purpose and intent of bid cost recovery. The current bid cost recovery calculation does not adequately consider attributes common among storage resources, such as state-of-charge constraints, which determine whether an asset can support its awards and schedules. This results in materially different treatment for storage from conventional generators, which are not eligible for bid cost recovery payment when unavailable due to fuel insufficiency. Significant bid cost recovery payments related to the buy- and sell-back of day-ahead schedules are driven by limited or insufficient state of charge.

This differentiated treatment of unavailable energy between conventional and storage assets creates two concerns:

- **Concern 1:** Storage assets are not exposed to real-time prices for deviating from day-ahead schedules, thereby lacking sufficient incentives to bid in such a way as to be available in times of greatest system needs.
- **Concern 2:** Storage assets are incentivized to bid strategically to maximize the combined bid cost recovery and market payment.

The concerns described above often materialize in the context of buy- and sell-backs of day-ahead schedules. The day-ahead market optimizes the storage asset over the full 24 hour horizon, whereas the 5-minute real-time market only optimizes over the next couple of hours. As a practical matter, the day-ahead schedules will position the resource to charge and discharge in the optimal hours considering the information available at the time. Because of that, day-ahead bid cost recovery payments are rarely if ever needed for storage resources. In contrast, the real-time market optimizes over a moving window of multi-interval optimization, and makes decisions to charge and discharge a storage resource without knowing the full set of binding prices in future intervals. Thus, there are scenarios where the real-time market optimization results in resources incurring greater costs to charge than earned through revenues for discharge. While there are benefits to having storage resources available to the real-time market throughout the day, as unanticipated conditions can and do occur in real-time, storage resources generally support reliability best by being available to deliver their day-ahead schedules, which have been optimized taking anticipated conditions the full day into account.

A buy-back of a discharge day-ahead schedule can occur when a storage asset's real-time state of charge is too low to support the day-ahead award. This can be due to the state of charge of the resource in the binding interval, but also in any of the advisory intervals considered in the multi-interval optimization. Conversely, a sell-back of a charge day-ahead schedule can occur when a storage asset's real-time state of charge is too high to support the day-ahead award. Similarly, this can be due to the state of charge of the resource in the binding interval, but also in any of the advisory intervals. When buy- and sell-backs materialize, a storage resource would receive a dispatch instruction in the fifteen-minute market that creates a differential relative to the day-ahead schedule. Likewise, in the real-time dispatch, a storage resource may receive a dispatch instruction in the five-minute market that creates a differential relative to the fifteen-minute schedule.

Since today's energy bid cost formulation for the purposes of bid cost recovery only uses the real-time bid as its sole proxy of costs, storage resources can bid in a manner that would unduly inflate bid cost recovery payments through buy-back or sell-back of the day-ahead schedule. This behavior can materially hinder reliability because grid operators rely largely on market dispatches and energy storage resources would be unavailable when needed in real-time. This construct also creates economic inefficiency, as it removes exposure to real-time prices, thus eliminating incentives to provide real-time offers that would drive the market to dispatch the resource in the highest value intervals. Finally, the current bid cost recovery paradigm can lead to undeliverable day-ahead market awards for storage, because scheduling coordinators may bid in a manner that would artificially inflate bid cost recovery payments precisely by not being available during times of anticipated highest value.

PROPOSAL

Replace the bid cost component of the calculation with an alternative value to eliminate incentives to bid strategically to expand bid cost recovery payments

The market design gap allowing strategic bidding behavior to unduly inflate bid cost recovery payments for storage assets must be closed in the near-term as it exposes market participants and ratepayers to adverse financial outcomes. Management proposes a near-term solution developed with stakeholders focused on modifying the real-time energy bid cost calculation in the real-time bid cost recovery settlement for storage resources for bid cost recovery payments accrued for energy dispatched between the fifteen-minute market and the day-ahead schedule as well as between the five-minute real-time dispatch and the fifteen-minute schedule.

To address strategic bidding concerns (Concern 2 noted above), Management proposes to replace the bid cost component of the bid cost recovery calculation with an alternative price dependent on the how the resource is dispatched in the fifteen-minute market and the five-minute real-time dispatch relative to their prior schedule.

The ISO's proposal would replace the real-time bid cost for storage resources in this calculation as follows:

For resources dispatched up, the alternative would be the <u>minimum</u> of the bid and the <u>maximum</u> of three alternatives:	For resources dispatched down, the alternative would be the <u>maximum</u> of the bid and the <u>minimum</u> of three alternatives:
<ol style="list-style-type: none">1. Real-time default energy bid2. Real-time market cleared price3. Day-ahead market cleared price <p>(only applicable to resources with a day-ahead award)</p>	

- The phrase “dispatched up” or “dispatched down” is relative to the prior market.
 - A resource is dispatched up if the fifteen minute market dispatches a storage resource to increase its discharge or decrease its charge relative to its day-ahead schedule, or if the five-minute market dispatches a storage resource to increase its discharge or decrease its charge relative to its fifteen-minute market schedule.
 - A resource is dispatched down if the fifteen minute market dispatches the resource to decrease its discharge or increase its

charge relative to the day-ahead schedule, or if the five-minute market dispatches a storage resource to decrease its discharge or increase its charge relative to its fifteen-minute market schedule.

- In intervals without a day-ahead schedule, the day-ahead price is not applicable. Accordingly, Management proposes to exclude the day-ahead price term from the calculation applicable to storage resources that are in the Western Imbalance Energy Market but not in the CAISO/EDAM footprint, as it would for any resource without a day-ahead schedule.
- The alternative calculation will include the segment of the bid and default energy bid curves corresponding to the market dispatch. Prices included are the locational marginal prices at the resource's location.

This modified bid cost recovery calculation should be applied across all intervals of the day in real-time, as opposed to solely in a subset of intervals as proposed by some stakeholders. Management observes that implementation in all intervals is necessary to effectively eliminate the ability of resources to bid strategically in a manner that unduly inflates bid cost recovery. Moreover, this implementation is feasible to develop in the near-term and resettle as needed, thus curing the current design gap as soon as possible and it is a measured approach to solve some of the concerns described herein while allowing for the continued development of a new uplift mechanism for storage assets.

Stakeholder Feedback

Management's proposal is responsive to five rounds of verbal and written stakeholder feedback, which included seven public meetings and over 60 sets of written comments. The solution proposed by Management herein represents a modified version of the alternative bid cost recovery calculations put forth by stakeholders. Specifically, Management's proposal, as discussed since the September 11 meeting and further detailed in the October 9 meeting, is to apply the modified energy bid cost calculation for energy storage resources in all real-time intervals as opposed to in a subset of intervals as put forth by stakeholders.

Some stakeholders supported Management's proposal as a viable near-term compromise but urged the ISO to continue working on the remaining storage uplift issues so as to promptly address them. In contrast, other stakeholders opposed Management's proposal noting its application across all intervals could be overly conservative and may result in overly punitive outcomes. Regardless of their position on Management's proposal, all stakeholders have asked Management to continue working on a holistic redesign of optimization approach and uplift for storage resources as soon as possible.

The issues related to bid cost recovery are complex and merit a holistic revision of the uplift mechanism applicable to storage resources. This being said, it is also evident from the material discussed in this Memorandum that the current design gap that could allow for strategic bidding behavior to unduly inflate bid cost recovery payments for storage assets must be closed in the near-term as it exposes market participants and

ratepayers to adverse financial outcomes. Management reiterates its commitment to continue working on an uplift redesign for storage assets. If the present near-term solution is approved by the joint Board of Governors and WEM Governing Body, Management will commence a storage initiative to holistically redesign uplift for storage assets. Said initiative shall consider the interplay of storage bid cost recovery with other enhancements recommended by stakeholders to the ISO, such as modifications to the storage default energy bid formulation, consideration of the non-linearity of storage performance, optimization methodologies, and evaluation of the impacts of outages, bid parameters, and mitigation with relation to bid cost recovery.

CONCLUSION

Management proposes to modify the calculation of bid cost recovery for storage resources to limit the opportunity for strategic bidding to inflate bid cost recovery payments. Management proposes this near term solution as it appropriately eliminates the ability to bid strategically to inflate bid cost recovery payments and will continue to work with stakeholders to determine more appropriate optimization approaches and bids cost recovery rules for storage resources. The proposed changes can be implemented in a manner that would allow for resettlement to the effective date following the submittal of tariff changes to FERC, once approved by FERC.

Management recommends that the ISO Board of Governors and Western Energy Markets Governing Body approve the proposed changes to storage bid cost recovery as described in this memorandum.

Decision on storage bid cost recovery enhancements

Motion

Moved, that the ISO Board of Governors and WEM Governing Body approve the changes to bid cost recovery for storage as described in the memorandum dated October 31, 2024; and

Moved, that the ISO Board of Governors and WEM Governing Body authorize Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the changes proposed in this memorandum, including any filings that implement the overarching initiative policy but contain discrete revisions to incorporate Commission guidance in any initial ruling on the proposed tariff amendment.

WEM Govering Body vote: ISO Board of Governors vote:		Action: Passed 10-0						
Name	Position	Body	Move/ Second	Yes BoG	No BoG	Yes GB	No GB	Other
Borenstein	Vice Chair	Board	Moved	Y				
Campbell	Member	GB				Y		
Decker	Member	GB				Y		
Eto	Governor	Board	Second	Y				
Galiteva	Governor	Board		Y				
Kondziolka	Chair	GB				Y		
Leslie	Governor	Board		Y				
Prescott	Member	GB				Y		
Schori	Chair	Board		Y				
Wagner	Vice Chair	GB				Y		
Vote Count				5		5		