Rules for bidding above the soft offer cap

Draft Final Proposal

May 2, 2024

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1. Executive Summary

Through the *Price Formation Enhancements (PFE) stakeholder working group, market participants* have requested the ISO consider and prioritize policy enhancements for summer 2024 that would allow resources with intra-day opportunity costs to reflect those costs in their energy bids. Market participants have posited that allowing these costs to be accurately reflected will ensure the market can effectively and efficiently manage the dispatch of these resources.

FERC Order 831 establishes that resource market bids are subject to a soft offer cap of $1000/MW, primarily to address concerns about the exercise of market power. Bids can be submitted above $1000/MWh but must be cost verified by the market operator or market monitor.

On stressed days with high prices that can exceed the soft offer cap, the soft offer bid cap can create challenges for energy-limited resources that do not have sufficient headroom to reflect their opportunity costs in their bids without hitting the cap, and cannot incorporate intra-day opportunity costs into their bids. Bids from these resources can appear lower cost and “economic” to dispatch early in the day resulting in the premature dispatch and exhaustion of these energy limited resources prior to the critical net load peak evening hours. For these reasons, market participants have stressed the importance of the ISO timely addressing intra-day opportunity costs in relation to the soft offer cap for energy limited resources such as battery storage, hydroelectric resources, and demand response resources.

Solutions to these issues depend on 1) the ISO’s ability to make timely technology enhancements for implementation for summer 2024, and 2) the policy and regulatory risks and associated tradeoffs discussed with stakeholders during the PFE working groups. Considering stakeholder recommendations and input — and the various regulatory, policy and technology feasibility risks — the ISO recommends the following:

1. Remove the $1000/MWh cap on Default Energy Bids (DEBs). Removing the cap on DEBs will allow hydro resources to reflect costs within their DEB and to be compensated up to that value, even if it is above $1000/MWh.
2. Modify the bid cap for energy storage resources to provide bidding flexibility using a proxy opportunity cost value. This will allow energy storage resources to submit bids that are higher than the current $1000/MWh soft offer cap. It will also allow the resources to indicate to the market their intra-day opportunity costs that support their availability for discharge during more stressed grid conditions, when prices might exceed the current soft offer cap.

The ISO believes that this proposal represents a balanced, reasonable and equitable approach for addressing the near-term market needs by allowing market participants to better reflect opportunity costs in their energy offers within the existing regulatory framework. The ISO is actively evaluating the feasibility of implementing these changes in summer 2024.

2. Background

FERC Order No. 831 requires market operators to verify the costs of incremental energy offers above $1,000/MWh (the "soft offer cap") before using these bids in the market. Its intent is to manage and mitigate concerns about market power. To comply with this order, the ISO uses its "reference level change request" (RLCR) process to verify costs above the soft offer cap. A reference level change request enables suppliers to update their "Default Energy Bids" (DEBs), which serve as a cost-based reference price used for mitigating market power. If approved, this request updates their DEB and enables them to bid up to their adjusted DEB if it exceeds the soft offer cap.

The RLCR process allows suppliers to adjust for energy cost changes not captured by their DEB in the ISO's market processes. When initially designed, the RLCR process was tailored toward gas resources that faced discrepancies between their actual fuel costs and the costs that CAISO's market systems used to calculate their DEB. The RLCR process was designed to validate requested DEB adjustments, using a reference based on fuel costs, in response to changing fuel costs. However, it lacks similar functionality for processing changes to the opportunity costs associated with storage, hydro, and demand response resources.

Through the *Price Formation Enhancements (PFE)* stakeholder working groups, stakeholders identified two primary issues that CAISO should promptly evaluate and address to manage resource availability during high price conditions, which generally correlate with stressed grid conditions across the market footprint:

1. Resources with intra-day opportunity costs may be unable to bid in a way to preserve their limited energy for the highest priced hours.
2. These resources may not be able to bid a way to maintain their day-ahead market schedules when real-time prices exceed the soft offer cap.

Intra-day opportunity costs refer to the potential revenues foregone when the market dispatches a resource with limited energy (i.e., battery storage, hydro generation) during a lower-priced period of the day instead of waiting for a higher-priced period, generally coinciding with periods when supply is most limited. If resources' DEBs do not accurately reflect these opportunity costs, these resources may be dispatched sub-optimally or otherwise not be available during higher-priced hours. This can cause inefficiencies and potential revenue losses. Additionally, if these energy limited resources have depleted their energy earlier in the day, they may be unable to meet their day-ahead market awarded schedules. Consequently, they would need to buy back their day-ahead schedules at high real-time prices to cover their positions. The inability to bid above the soft offer cap in the real-time market due to RLCR limitations exacerbates this issue. It prevents a resource from reflecting its opportunity costs and conserving its limited energy for the higher-priced hours that it had been scheduled for in the day-ahead market.

2.1. Default Energy Bids represent resource specific verified costs

FERC Order No. 831 requires that each resource's incremental energy offer is capped at the higher of $1,000/MWh or that resource's verified cost-based incremental energy offer.[1] FERC contemplated that cost verification requirements could work in conjunction with market power procedures; however, FERC does not prescribe the manner in which costs are verified.[2] Each ISO/RTO was empowered to propose how it would verify costs above $1,000/MWh in its compliance filing. FERC also requires verified cost-based incremental energy offers be capped at $2,000/MWh.

The default energy bid (DEB) mirrors a resource's competitive marginal costs in the market in conditions when market participants might have market power. These values are intended to be resource specific, and calculated pre-market based on information available at that time. Today, all DEBs are capped at $1,000/MWh when they are initially calculated. However, DEBs can be adjusted to above $1,000/MWh and up to $2,000/MWh through the reference level change request described below.

DEBs represent verified costs

Absent perfect information, the DEB serves as a reasonable benchmark for a resource's specific short run marginal costs using predefined resource-specific operating parameters, and considering specific intra-day opportunity costs like nodal specific LMPs used in storage DEBs and bilateral prices used in hydro DEBs.[3] Most DEB calculations include a scalar[4] to account for some margin of error between the value defined by the DEB, calculated based on information known to the ISO, and a resource's actual costs.

For cost variability beyond what can be accounted for pre-market, market participants can use reference level change request process. The ISO's reference level change request (RLCR) process allows market participants to update the costs reflected through their DEB.[5] Two options are available: the manual and automated RLCR process. These options can be leveraged whenever a generator wishes to request that the ISO use a different fuel or fuel-equivalent cost in its reference level calculations, whether bidding above the soft offer cap or not.

Today, resources use the RLCR process to request DEB adjustments beyond the value of their DEB by providing the ISO with the necessary information to inform that adjustment. However, a resource's DEB might otherwise be calculated to be above $1,000/MWh if not for the cap on the DEB. In this case, though the ISO already has sufficient information to verify the resource's costs, the current process requires the resource's scheduling coordinator to take action through the RLCR process to reflect those costs in the market.

[1] Order No. 831 at P 1.
[2] If the cost verification standard cannot be accommodated through the cost-verification process, resources are eligible for make-whole payments.
[3] More on DEB options can be found in Appendix A.
[4] More on Scalars can be found in Appendix B.
[5] The RLCR process also enables updates to commitment cost bids, i.e. minimum load cost and startup cost bids.

The RLCR process does not yet accommodate requested changes in response to intra-day opportunity costs.

Energy storage and hydro resources are effectively not able to use the RLCR process today to adjust their DEBs in response to intra-day opportunity costs, because the ISO does not have rules to determine a reasonable cost expectation upon which to base an intra-day opportunity cost adjustment request. Without the ability to use the automated RLCR process, hydro and storage resources cannot request DEB adjustments *or* bid above the soft offer cap when opportunity costs materialize in real-time.

Through the stakeholder working group discussions, stakeholders have expressed support for enhancements to the RLCR process, but enhancements will be technology and policy resource intensive and beyond scope of what is feasible for a summer 2024 implementation. The ISO is committed to evaluating enhancements as part of a longer term evaluation of the design and these potential enhancements are highlighted in Section 6 of this paper.

For implementation for summer 2024, the ISO recommends proposals described in Section 4 of this paper.

3. Proposal Development Process

3.1. Stakeholder Recommendations for Policy Design

Stakeholders in the PFE working groups made recommendations and held discussions about changes to ISO rules for bidding above the soft offer cap, which primarily drove the development of this proposal.[6]

Stakeholders support finding a solution that can be in place for Summer 2024 to support energy limited resources', particularly battery storage and hydro generation, ability to hold their positions in the supply stack and maintain their DA schedules in real-time during higher priced periods that generally coincide with more challenging operating conditions.

Stakeholders understand that a summer 2024 timeline is highly constrained and may not support a holistic, durable, policy solution or novel technology development. Most stakeholders acknowledge an interim solution may not be optimal, but agree it would improve the status quo during the summer period where stressed operating conditions are likely. Meanwhile, some stakeholders advocate caution when revising policy and implementing new technology solutions on an expedited basis. Ultimately, stakeholders agree that resources with opportunity costs should be able to reflect those costs accurately in the market.

In addition to the short-term changes, stakeholders support a more robust initiative to serve the broader problem statement of improving resources' ability to adjust their costs in response to changing

[6] PFE Rules for bidding above the soft offer cap Issue Paper P. 10 [IssuePaper-StakeholderRecommendations-PriceFormationEnhancements-Rules-BiddingAboveSoftOfferCap.pdf (caiso.com)]

market conditions. A future initiative would support developing a definition of, and calculation for, intra-day opportunity costs for use in DEBs and the real-time optimization.

Interim objective: improve resource's ability to hold their positions in the supply stack during high priced periods

Stakeholder recommendations intend to provide resources with sufficient energy bidding flexibility to ensure the market appropriately values these resources and efficiently utilizes a resource's limited energy. Stakeholders recommended a range of values to serve as proxies for intra-day opportunity costs, summarized in Table 1.

The Maximum Import Bid Price (MIBP) is currently used by the ISO in other processes to estimate prevailing bilateral prices, and some stakeholders support it as an appropriate proxy for both storage and hydro opportunity costs. Some stakeholders expressed concerns regarding the liquidity of bilateral indices on which this proxy price is based, as well as the accuracy of the resultant proxy price once a methodology to decompose the 16-hour block into an hourly value is applied. Stakeholders also have expressed mixed opinions on the appropriateness of using a single, peak, or hourly MIBP value to represent an opportunity cost for energy limited resources.

In response to stakeholder concerns around the MIBP, the ISO proposed using prices calculated in its day-ahead market as the forecast for real-time opportunity costs. Stakeholders also submitted for consideration the hard bid cap of $2,000 MWh as a reference price.

Table 1: Proxy values under consideration

Proxy Value	Purpose
Highest cost-verified bid, MIBP	This stakeholder proposal reflects the same logic used today to screen non-resource-specific RA import bids above $1000/MWh
Highest value of the MIBP	Stakeholders propose this solution as an improvement over the MIBP hourly curve, as the real-time market does not optimize over the full horizon.
4th highest Value of the MIBP	This solution considers that limited energy resources are able to derive an opportunity cost based on prevailing bilateral prices, but mimics the use of the 4th highest hour in the storage DEB to represent the flexibility needed for a typical 4-hour battery storage resource.
$2,000/MWh	This value represents the hard cap for resource bids to set LMPs under Order No. 831.
Highest DA Price	Opportunity cost estimate is based on a more liquid market result, but may not capture real time conditions or conditions outside of the CAISO BA.

Stakeholders put forth several interim measures that aim to enhance the bidding flexibility of energy-limited resources to represent their opportunity costs under tight system conditions. Below is a summary of these stakeholder recommendations for policy development. Stakeholders prefer a solution that would modify the DEB to ensure that market power mitigation would not reduce bids below a value that captures the agreed upon opportunity costs.

Summary of stakeholder recommendations for policy development

Approach 1 **Directly modify the cap applied to bids and default energy bids**. These proposals would allow certain resources to bid up to a specified cap whose value is a proxy for opportunity costs.

- Remove the $1,000/MWh cap on default energy bids
- Apply the same logic used today for non-resource specific RA imports
- Allow resources to bid up to a static value—4th highest MIBP, highest MIBP, $2,000/MWh
- Make these bid cap modifications conditional, or limited to only hours of the day in which issues have been observed

Approach 2 **Leverage existing tools to ensure resources can retain their day-ahead schedules in real-time.** These options provide a backstop for reliability. Importantly, these options would not require any immediate policy or implementation changes.

- End-of-Hour State of Charge constraint
- Self-Schedule the day-ahead schedule in real-time
- Base Schedule for WEIM entities
- Exceptional dispatch

Approach 3 **Enhance resources' ability to accurately identify and reflect costs through the reference level change request process.** These proposals are focused on modifications to DEB and/or the reference level change request process.

- Modify the reasonableness threshold to allow hydro and storage resources to request adjusted DEBs based on the highest (or 4th highest) MIBP value

3.2. Analysis: Proxies for intra-day opportunity costs on historical high priced days

None of the stakeholder recommended values, summarized in Table 1 above, are a perfect proxy for intra-day opportunity costs. Intra-day opportunity costs are the foregone profits of producing now rather than being able to produce later, so any proxy will necessarily be based on a forecast or assumption. The goal in identifying a sufficient energy offer cap is to find a proxy value that demonstrates a correlation with a resource's intra-day opportunity costs. For example, a proxy value for a four-hour duration battery storage resource would correlate with the four net peak load hours.

The options discussed in this paper intend to balance a reasonable representation of intra-day opportunity costs with the risk of overstating them. Over- or under-estimating costs can lead to undesirable outcomes.

The ISO performed analysis on historical high-priced days to investigate how the proposed offer cap proxies may have performed on a counterfactual basis when compared to real-time prices, specifically the hourly average system marginal energy cost (SMEC) from the fifteen minute (RTPD) market. The purpose of comparing to the RTPD SMEC is to show how closely each proxy might have correlated to realized, historical real-time prices, however this does not provide a perfect comparison.

Figure 1, Figure 2, and Figure 3 below plot the hourly average RTPD SMEC against three different proxies: the highest uncapped DEB value, the highest IFM SMEC value multiplied by a scaling factor of 1.1, and the hourly real-time maximum import bid price (MIBP). For the purposes of this analysis, the highest uncapped DEB value is assumed to be analogous to the highest cost-verified bid, however a high-priced DEB alone would not serve as a cost-verified bid. The plots are shown for three reference days that experienced tight system conditions: September 6, 2022, August 16, 2023, and January 14, 2024.

For the two summer days in 2022 and 2023, the real-time MIBP tracks the general shape of realized RTPD SMEC but does not provide a perfect correlation under all conditions. For example, the hourly real-time MIBP understates RTPD SMEC during the evening ramp of September 6, 2022 and subsequently overstates RTPD SMEC during evening peak hours of August 16, 2023. Further divergence is observed on January 14, 2024, when the MIBP was driven high due to high bilateral prices in the Pacific Northwest while system-wide SMEC stayed lower.

Static parameters like the highest cost-verified bid (as proxied by the highest counterfactual DEB) or highest IFM SMEC multiplied by 1.1 will inherently eliminate intra-day fluctuations and may also over- or under-state prices depending on the time of day. For example, the two static parameters undershoot the RTPD SMEC in peak hours on September 6, 2022 but overshoot the RTPD SMEC for other hours of the day. Static parameters may not sufficiently capture intra-day price variations; in particular, IFM SMEC may not capture regional price variations well enough to serve as a proxy for opportunity costs outside the CAISO area.

Figure 1. Price trend comparisons on September 6, 2022

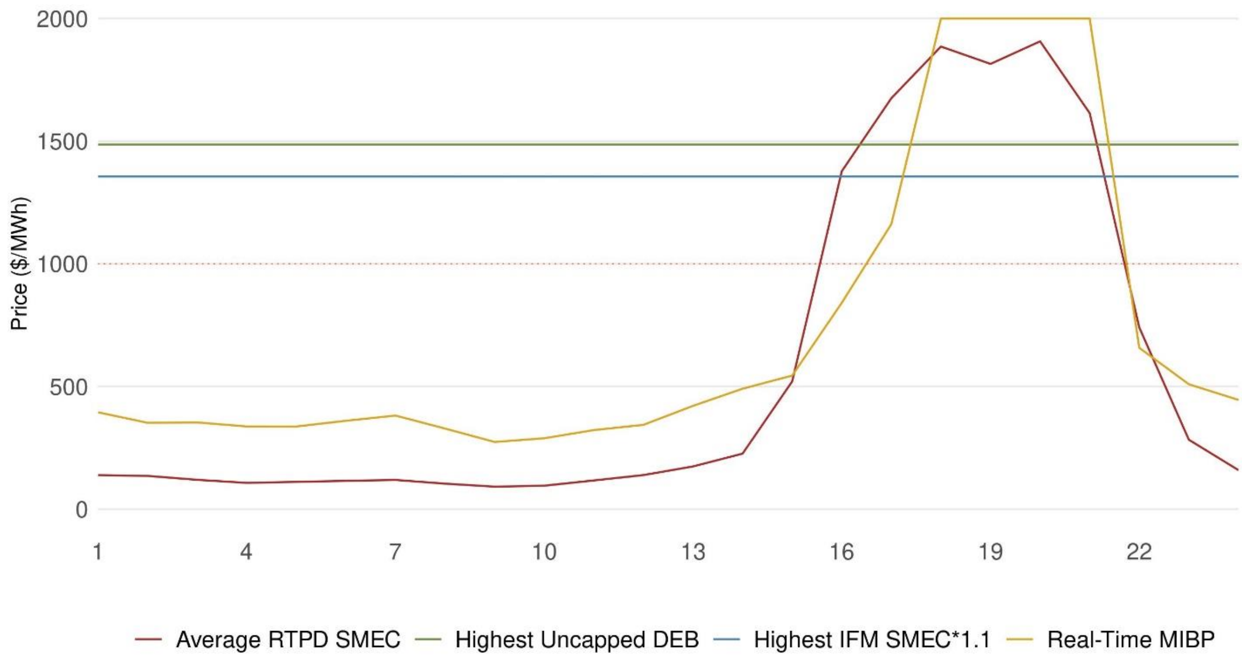


Figure 2. Price trend comparisons on August 16, 2023

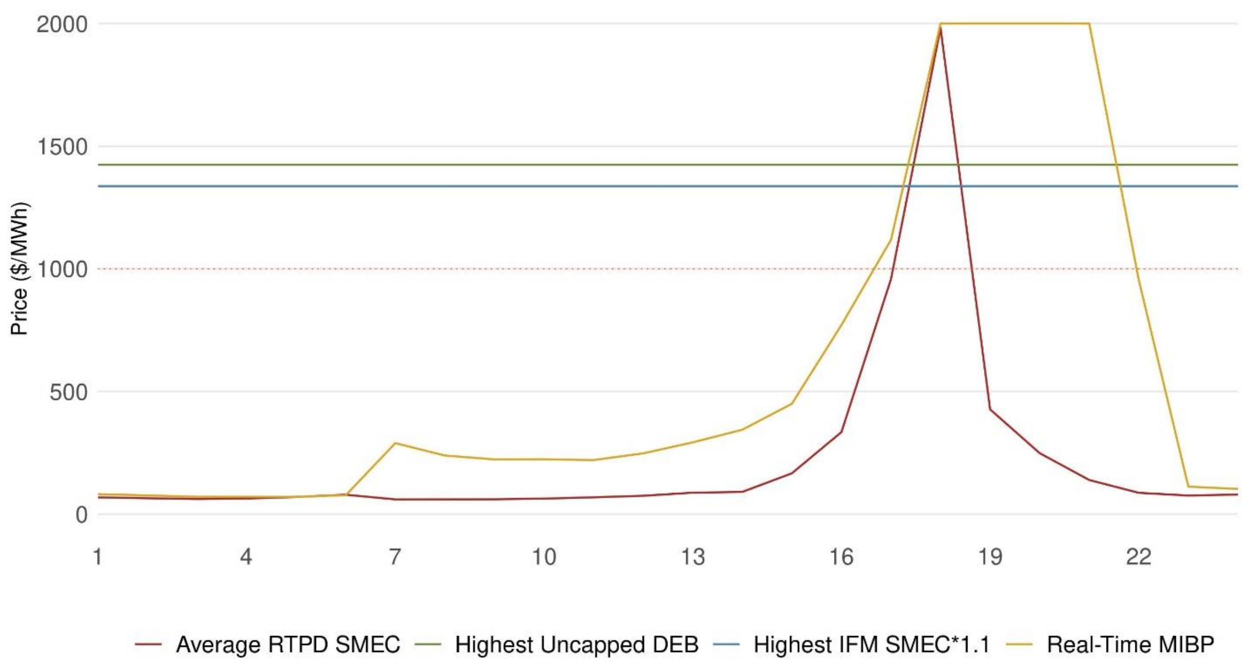
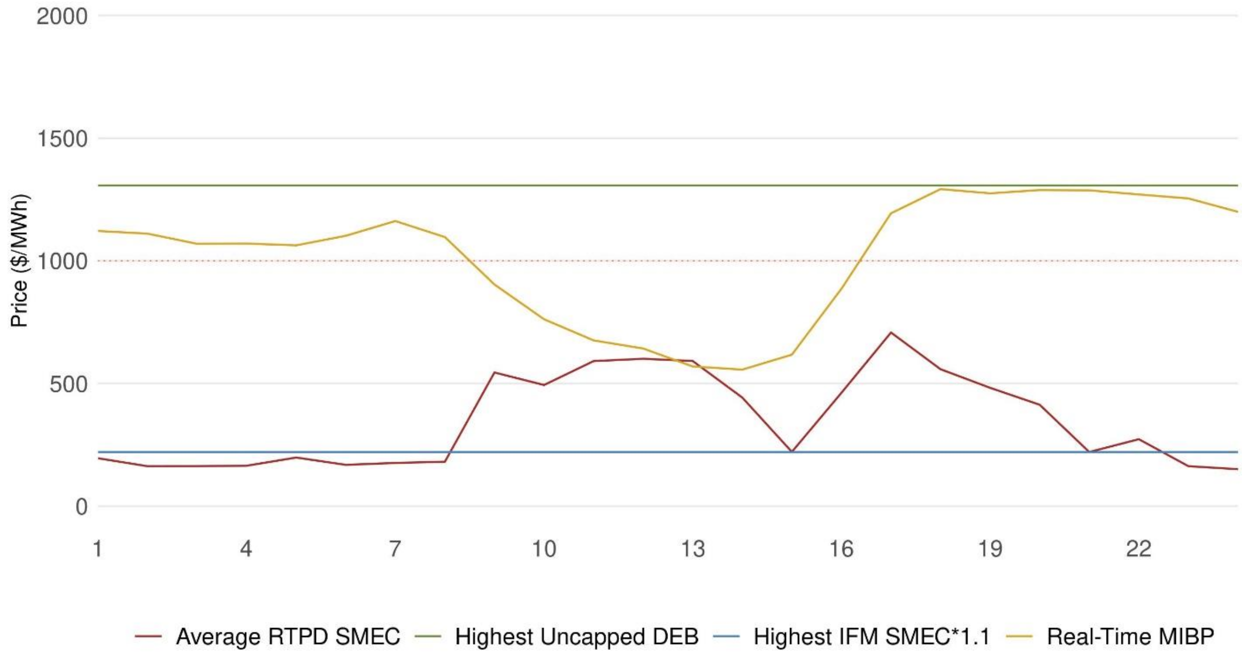


Figure 3. Price trend comparisons on January 14, 2024



4. Proposed Policy Changes for summer 2024

Considering the stakeholder recommendations and input, the ISO has identified proposals that may be feasible for summer implementation, pending further refinement and stakeholder input. These proposals (1) remove the cap on DEBs for all resources and (2) modify the bid cap for energy storage resources.

The proposals in this section address the identified issues for hydro and battery storage resources separately. The ISO considers this to be an appropriate outcome given the differences between how energy storage and hydro resources define opportunity costs today.

The ISO proposes the following:

- **(Section 4.2) Revise the cap on all Default Energy Bids from $1,000/MWh to $2,000/MWh.** This proposal would "uncap the DEB" for all resources. In particular, this would allow hydro resources to bid up to a value that reflects the opportunity costs already defined in their DEBs, even when those costs exceed $1,000/MWh.

- **(Section 4.3) Modify the bid cap for energy storage resources.** The additional modification of this proposal offers bidding flexibility to storage resources to maintain their relative position in the supply stack.

4.1. Proposal: **Revise the cap on all Default Energy Bids from $1,000/MWh to $2,000/MWh**

This proposal would revise the cap on DEBs from $1,000/MWh to $2,000/MWh. This change would apply to all DEBs[7] in both the day-ahead and real-time markets. As the DEB was designed to represent a resource's verifiable cost-based offer, this proposal is consistent with FERC Order No. 831 rules that require verified cost-based incremental energy offers to be capped at $2,000/MWh.

This proposal represents a process change, not a value change. Removing the $1,000/MWh cap from DEB calculations does not change the basis for calculating marginal reference costs accepted as default energy bid as described in the ISO's tariff. This proposal would not change the resource-specific parameters defined by any resource's DEB calculation, but offers value to resources for whom the automated RLCR process is cumbersome or unusable for validating costs above $1,000/MWh. The ISO has observed that DEB values today may, at times, rise above $1,000/MWh if not for the existing cap, based on the analysis in this section.

Today, gas resources can verify costs above $1,000/MWh through the RLCR process. This proposal does not give gas resources any additional headroom to make adjustments, but instead simplifies the adjustment process by removing the requirement to confirm existing cost information captured in the DEB. Gas resources would still rely on the RLCR process to make DEB adjustments in response to gas price volatility, in cases where the ISO-calculated DEB did not sufficiently capture that gas price volatility. Additional supporting information would still be required to support those types of DEB adjustment requests.

This proposal represents the foundational step for all further enhancements. A durable change, this proposal will simplify and support future enhancements to the RLCR process as well as additional interim rules.

In the near term, this change would have important impacts to bidding rules and market power mitigation.

Bidding Rules when the uncapped DEB is above $1,000/MWh: each resource's DEB becomes it's bid cap

The offer cap for each resource would be set by that resource's DEB, should the value of the DEB rise above $1,000/MWh. In effect, a resource's energy offer above $1,000/MWh would be considered cost-verified because it is assessed against the DEB value, the formula underlying which is used today as a reasonable measure of resource specific, verifiable costs.

[7] Through the PFE working group effort, stakeholders identified proxy demand response (PDR) for consideration within the scope of an interim approach. These resources do not currently have a DEB option, but are discussed in Section 6.2 of this paper. Other resources without DEBs, including hybrid resources, are out of scope for the interim.

This proposal to remove the cap from the DEB does not obviate the need for the RLCR process generally. In the event of resource specific fuel price spikes, gas-fired resources may still need to use the RLCR process to adjust their DEB if the ISO-calculated DEB does not capture the fuel price spike. Bids above $1,000/MWh would be capped by the higher of $1,000/MWh, the uncapped DEB, or the adjusted DEB. This logic ensures that future enhancements to the RLCR process recommended by stakeholders to allow storage and hydro resources to adjust their DEBs in response to intra-day opportunity costs will be consistent with existing rules.

When the uncapped DEB is above $1,000/MWh, the uncapped DEB becomes the resource's specific bid cap. A resource's ability to bid up to its uncapped DEB would not be conditional on any other factors. The conditions must be met for other unspecified resources (e.g. RA imports, virtual bids) to bid above $1,000/MWh—a cost-verified bid above $1,000/MWh or a MIBP value above $1,000/MWh—do not impact the bid cap for resources with an uncapped DEB.

- ➔ **In the near term, the bidding rules in this proposal cannot be applied to storage resources**. The technology implementation required to use a storage resource's DEB as its bid cap is not feasible for implementation by summer 2024. In light of this complication, the proposal in Section 4.2 provides an interim solution narrowly targeted for battery storage resources. Uncapping the DEB could still confer the benefits of improved outcomes post-mitigation to storage resources under certain conditions.[8] Storage resources (and all resources) also are still eligible for after-market cost recovery under the CAISO's tariff.

Market Power Mitigation when the DEB is above $1,000/MWh

Revising the DEB calculation cap to $2,000/MWh may also improve outcomes in the event that resources are mitigated under existing local market power mitigation procedures. Stakeholders emphasized the importance of DEB modifications to prevent resources from being mitigated to a DEB that is capped at $1,000/MWh. This proposal offers some relief to mitigated resources without substantially changing existing market power policy.

This proposal is an important first step and makes an incremental improvement, but may not solve in its entirety the problem presented by stakeholders. Implemented in isolation, this proposal may exacerbate the ability for battery storage resources to maintain state of charge should limited energy hydro resources be able to systemically position themselves higher in the offer stack. The opportunity cost defined by the storage DEB option is based on the 4th highest day-ahead LMP, which has not been observed to regularly be above $1,000/MWh during conditions when prices rise above $1,000/MWh in real-time. Figure 4 below shows a counterfactual calculation of hydro DEBs and storage DEBs, had the $1,000/MWh cap in the existing calculation not been applied. The values of these counterfactual DEBs are represented in a box-whisker plot[9] where hydro DEBs are plotted in blue, storage DEBs are plotted in

[8] See Appendix D for examples

[9] A box-whisker plot represents data where the box covers the interquartile range (25th to 75th percentile), the line in the middle of the box represents the median (50th percentile), and dots represent outliers.

red, and a horizontal dashed line is shown at $1,000/MWh for reference. The data is plotted for a broader set of high-priced days from 2022 to 2024.

High nodal LMPs on September 6, 2022 drove counterfactual storage DEBs to exceed the $1,000/MWh threshold but only for a few, resource-specific outliers, primarily due to congestion, while counterfactual hydro DEBs all remained below $1,000/MWh. However, on both August 16, 2023, and January 14, 2024, more counterfactual hydro DEBs were above the $1,000/MWh threshold due to high bilateral market prices while fewer counterfactual storage DEBs were above the threshold.

An uncapped DEB alone may not be sufficient for storage resources to submit energy offers at or above $1,000/MWh.

Figure 4. Counterfactual uncapped default energy bid values, high-priced days in 2022

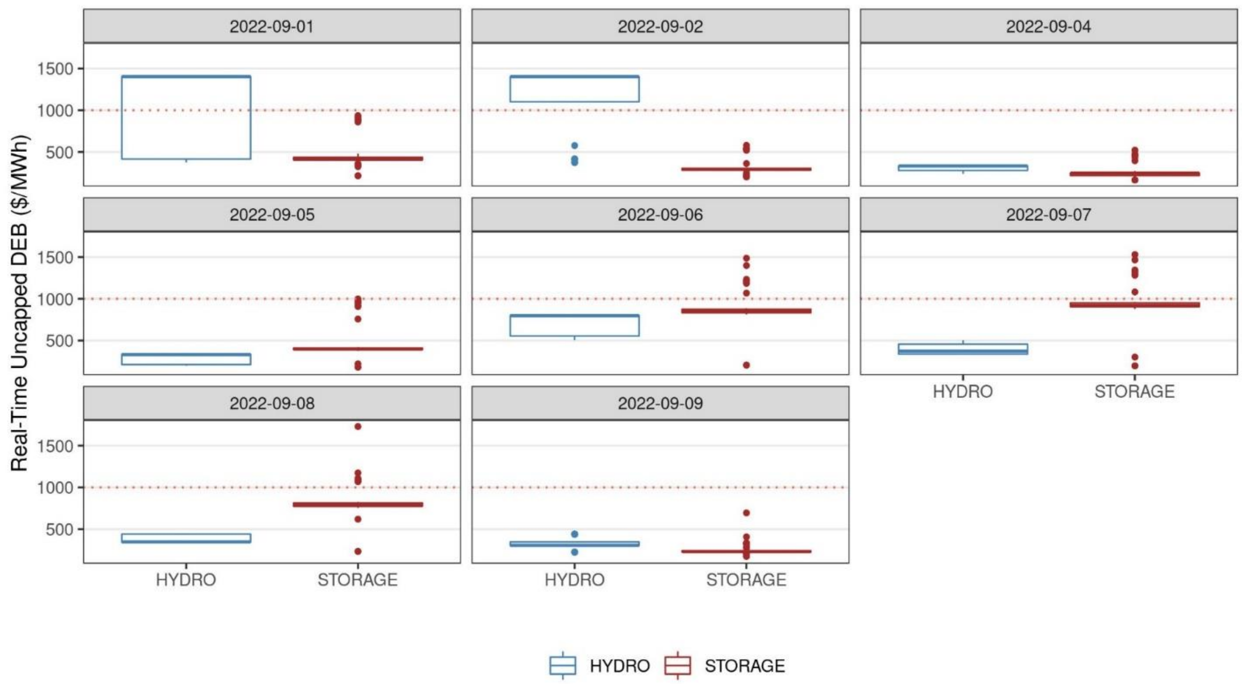
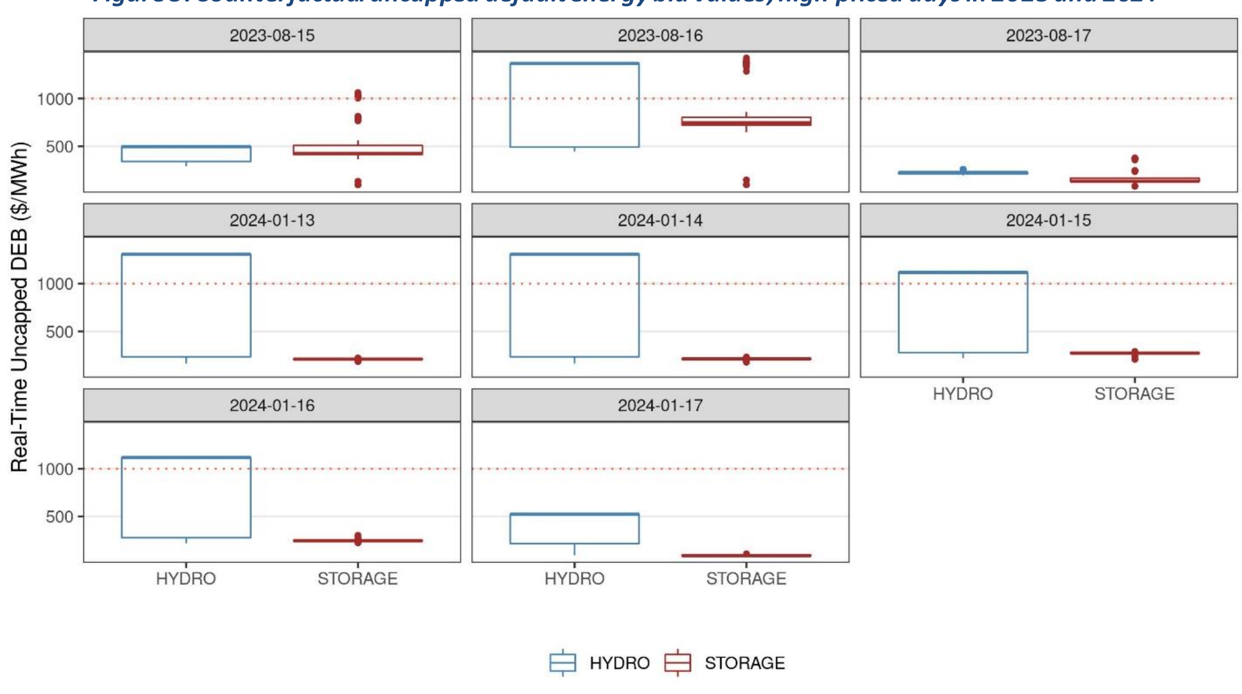


Figure 5. Counterfactual uncapped default energy bid values, high-priced days in 2023 and 2024



4.2. Proposal: **Modify the bid cap for energy storage resources using a proxy cost based on bilateral indices**

Today, storage resource bids are capped at $1000/MWh without consideration of the DEB going into the day-ahead market because the DEB is calculated using inputs from the day-ahead market run. In order to use a storage resource's specific DEB as its cost-verified cap in the day-ahead market, the data used to inform the DA storage DEB's cost calculations would need to be available pre-DAM. No stakeholder recommended proposals to modify the storage DEB in this manner.

Today, storage resources can only bid above $1,000/MWh in real-time if they receive a successfully adjusted DEB through the RLCR process, a function not available to storage resources today. Stakeholder proposals that would allow storage resources to successfully adjust their DEBs are not feasible for summer.

The technology implementation required to use a storage resource's DEB as its bid cap in real-time is not feasible for implementation by summer 2024.

This proposal offers storage resources an interim solution by including a modification to provide storage resources with additional bidding flexibility. The additional flexibility allows these resources to reflect intra-day opportunity costs not fully captured by the existing storage DEB, and allows storage resources to unlock the benefit of the uncapped DEB value as a cushion in the event of market power mitigation.

This proposal would apply to all battery storage resources, CAISO and WEIM, in both day-ahead and real-time.

Bidding Rules above $1,000/MWh for storage resources

In lieu of using the storage resource's uncapped DEB to inform a resource's specific bid cap, this proposal uses the maximum import bid price (MIBP) as a proxy for the storage resource's verifiable opportunity costs. The ISO proposes to allow storage resources to bid up to the higher of the MIBP's fourth-highest calculated hourly value and the highest cost-verified bid when either of those values rise above $1,000/MWh.

The ISO's proposal to utilize the fourth-highest hourly MIBP value would enable storage resources to manage their SOC through economic bids. Functionally, this proposal ensures four hours of SOC, which correlates to the typical sizing of the existing battery fleet, is available for use across net-peak hours, aligns with the day ahead schedules, and accurately values the storage resources' opportunity costs.

MIBP: Stakeholder feedback, and supporting analysis

Stakeholder approaches using the MIBP as a proxy for storage opportunity costs received the most stakeholder support as an interim solution. However, stakeholder proposals vary in terms of how to apply the hourly MIBP values. Some stakeholders urge the ISO to carefully consider the risks and benefits of each approach to provide sufficient time for stakeholder input and analysis.

The ISO performed analysis to compare historical real-time storage locational marginal prices (LMPs) from the fifteen minute market (RTPD) to both the hourly MIBP and fourth-highest MIBP on three days of interest, September 6, 2022, August 16, 2023, and January 14, 2024. A snapshot of peak hours, hours-ending 14 through 22, are shown. The purpose of this analysis is to compare the MIBP to realized real-time prices to evaluate how an MIBP-derived bid cap may have performed during tight system days. Note that while the effective storage bid cap was $1,000/MWh for the days below, the energy component or SMEC was still able to rise above $1,000/MWh, and nodal components like congestion also contributed to high LMPs during some hours. RTPD LMPs for all storage resources are shown using a box-whisker plot, while the hourly and fourth-highest MIBP values are plotted in green and blue respectively.

On September 6, 2022, the hourly MIBP values track the interquartile range of storage RTPD LMPs fairly closely, with the exception of some outliers that are driven higher or lower based on other non-energy LMP components. The fourth highest MIBP maxes out at the $2,000/MWh cap, so a bid cap based on the fourth-highest MIBP would have been set at a static $2,000/MWh value for the entire day. Conversely, on August 16, 2023, the hourly MIBP tracks higher than the interquartile range of storage LMPs during the evening hours whereas the fourth-highest MIBP also maxes out at $2,000/MWh. On January 14, 2024, the MIBP is far higher than RTPD storage LMPs, primarily driven by price separation between the high bilateral prices in the Pacific Northwest that set the MIBP and the relatively lower resource-specific LMPs.

Figure 6. Comparison of real-time storage LMPs and MIBP values, September 6, 2022

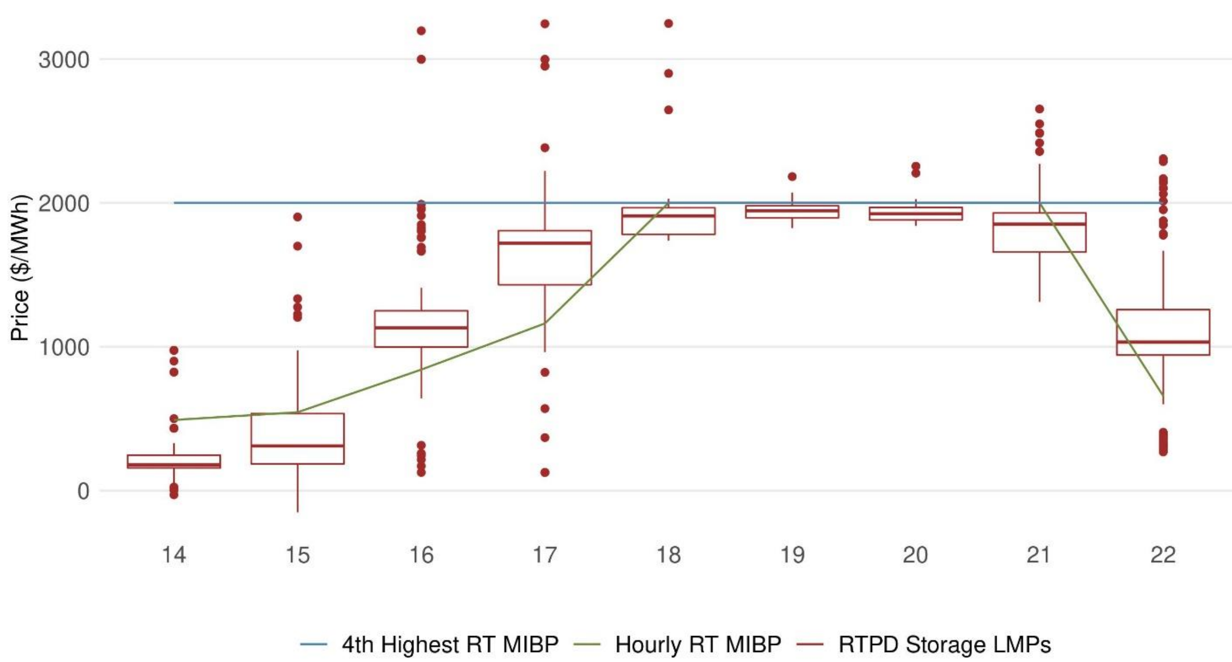


Figure 7. Comparison of real-time storage LMPs and MIBP values, August 16, 2023

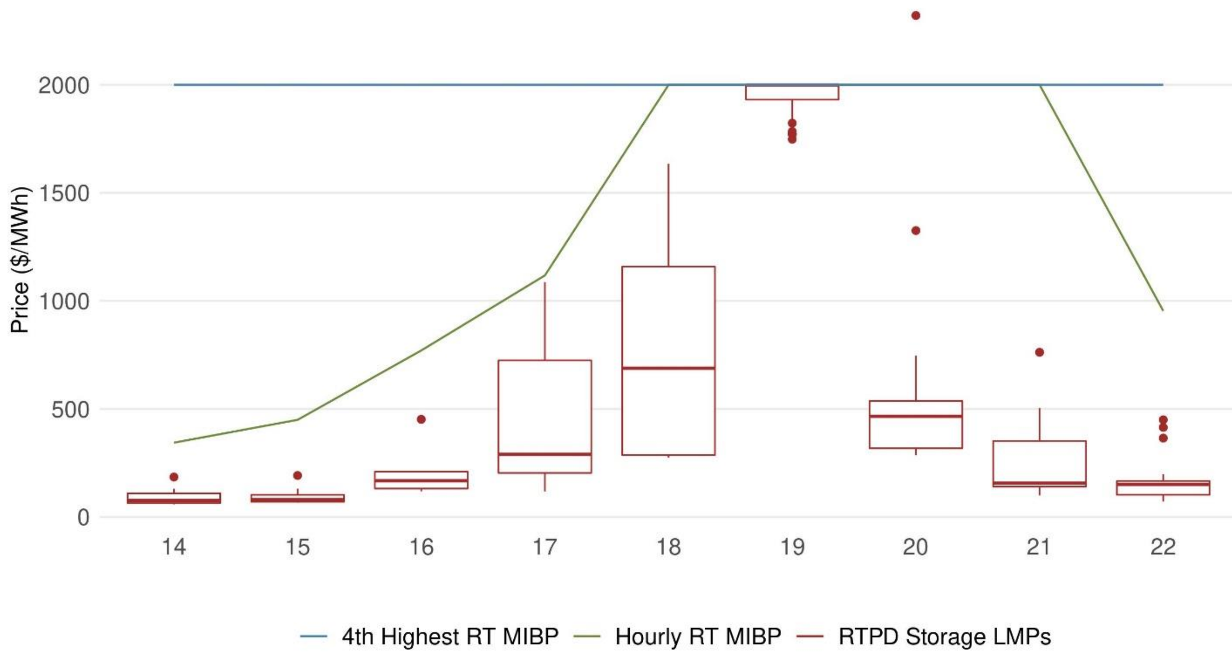
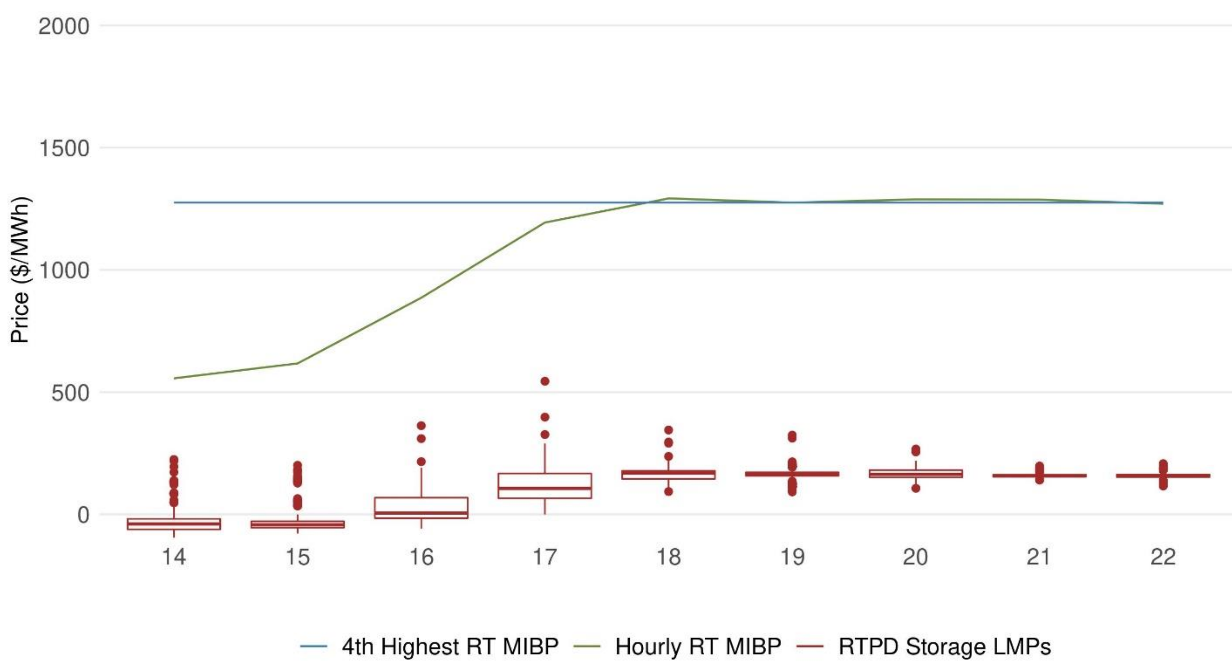


Figure 8. Comparison of real-time storage LMPs and MIBP values, January 14, 2024



Market Power Mitigation when the storage DEB is above $1,000/MWh

The full degree of intended benefits from providing this additional bidding flexibility to storage resources may be partially reduced if a storage resource's bid is mitigated due to market power.

However, this proposal is a necessary incremental step to unlock the benefit of uncapping the storage DEB for post-mitigation market outcomes. Even if a storage DEB uncapped is calculated to be above $1,000/MWh, that DEB value will not be used in MPM if the resource cannot submit a bid above $1,000/MWh. MPM takes the lower of the bid and the DEB. Storage resources would have to be able to bid above the DEB to use the uncapped DEB in MPM.

4.3. Monitoring and Evaluation

The automated RLCR process allows the ISO to audit any submitted requests and requires scheduling coordinators to retain documentation that justifies their request. The penalty for audit failure may include a temporary suspension from using the automated RLCR process. While the ISO would already have the relevant supporting information for bids above $1,000/MWh that are capped by the DEB, some stakeholders expressed concerns with divorcing the ability to bid above $1,000/MWh from similarly standardizing controls.

The ISO proposes to monitor the use of the new bidding flexibility enabled through this proposal and consider associated market results in any evaluation of future market reforms.

5. Long term enhancements for future consideration

5.1. RLCR process

Stakeholders support enhancements to the RLCR process that would enable non-gas resources to verify and reflect changes to their resource specific opportunity costs in the market. Some stakeholder recommendations include:

- facilitating DEB adjustments in response to intra-day opportunity costs that vary hourly, and beyond the value calculated by the DEB
- informing real-time opportunity costs using a forward looking real-time market time horizon

5.2. Proxy Demand Response (PDR)

The ISO understands PDR opportunity costs to be different then the temporal opportunity costs due to energy limitations. The opportunity costs for PDR might include, for example, the forgone usage of energy for residential or commercial activity. The ISO lacks visibility into the underlying assets, and therefore has a limited ability to verify PDR specific costs. Engagement with the PDR community, significant policy discussion and stakeholder consideration is warranted to properly define the costs associated with those resources.

6. Stakeholder Engagement

Stakeholder input is critical for developing market design policy. The schedule proposed below allows opportunity to for stakeholder involvement and feedback.

6.1. Schedule

Table 2 lists the proposed schedule for the stakeholder process.

Table 2: Schedule for Stakeholder Process

Item	Date
Draft Final Proposal	May 1, 2024
Stakeholder call	May 2, 2024
Stakeholder comments due	May 8, 2024
Market Surveillance Committee Opinion	May 13, 2024
MSC Opinion Call	May 15, 2024
Joint EIM Governing Body and CAISO Board of Governors	*May 21-23, 2024*
Target Implementation	*Summer 2024*

The CAISO proposes to present its proposal to the EIM Governing Body and CAISO Board of Governors on May 21-23, 2024. The CAISO is committed to providing ample opportunity for stakeholder input into its market design, policy development, and implementation activities. Stakeholders should submit written comments to InitiativeComments@caiso.com.

6.2. Governing Body Classification

This initiative proposes changes to allow certain resources to bid above the soft offer cap of $1,000 MWh. As explained below, CAISO staff believes that the WEIM Governing Body has joint authority with the Board of Governors over the proposed change.

The role of the WEIM Governing Body with respect to policy initiatives changed on March 20, 2024, when the Board of Governors adopted revisions to the corporate bylaws and the Charter for WEIM and EDAM Governance to implement the Governance Review Committee's EDAM governance proposal. Under the new rules, the Board and the WEIM Governing Body have joint authority over any

> proposal to change or establish a tariff rule applicable to the WEIM/EDAM Entity balancing authority areas, WEIM/EDAM Entities, or other market participants within the WEIM/EDAM Entity balancing authority areas, in their capacity as participants in WEIM/EDAM... The scope of this joint authority excludes, without limitation, any other proposals to change or establish tariff rule(s) applicable only to the CAISO balancing authority area or to the CAISO-controlled grid.

Charter for WEIM and EDAM Governance § 2.2.1. The proposed tariff changes to implement the initiative would apply to the entire market footprint, and thus be "applicable to WEIM/EDAM Entity balancing authority areas, WEIM/EDAM Entities, or other market participants within WEIM/EDAM Entity balancing authority areas, in their capacity as participants in WEIM/EDAM." They would not be applicable "only to the CAISO balancing authority area or to the CAISO-controlled grid." Accordingly, the proposed changes fall within the scope of joint authority.

This proposed classification reflects the current state of this initiative and could change as the stakeholder process moves ahead. Stakeholders are encouraged to submit a response in their written comments to the proposed classification of as described above, particularly if they have concerns or questions.

6.3. Next Steps

The CAISO will discuss the Draft Final Proposal during the stakeholder meeting on May 2, 2024. The CAISO requests stakeholders submit written comments on this proposal by May 8, 2024.

7. Appendices

7.1. Appendix A: The storage and hydro DEB calculations

Stakeholders and the ISO developed technology-specific DEB options for storage and hydro resources to better reflect their unique opportunity costs.

See BPM for Market Instruments Attachment D for more detail on DEB calculations.

The Storage DEB Calculation

This option reflects the costs of storage resources with a limited storage duration and variable operating costs. This option is available to applicable, participating storage resources. Because the costs defined in this DEB calculation use data from the day-ahead market, this option is not available to WEIM storage resources outside of the CAISO BAA.

This storage DEB option was developed through recent stakeholder policy initiatives: Energy Storage and Distributed Energy Resources Phase 4[10], and Energy Storage Enhancements[11].

[10] FinalProposal-EnergyStorage-DistributedEnergyResourcesPhase4-DefaultEnergyBid.pdf (caiso.com)

[11] FinalProposal-EnergyStorageEnhancements.pdf (caiso.com)

The Storage DEB has three main cost components:

1. Energy costs
2. Variable storage operations costs
3. Price-based opportunity costs

$$\text{Storage DEB} = \text{Max}\left\{\left[\text{Max}\left(\text{En}_{\delta/\eta}, 0\right) + \rho\right], \text{PB\_OC}_{\gamma}\right\} * \text{DEB Multiplier}$$

Where:

En	Energy Cost	Estimates the average cost of energy needed to charge the storage resource, using LMP prices from the relevant PNode
η	Round-Trip Efficiency	A resource-specific static value
δ	Energy Charging Duration	Based on a resource's registered max/min continuous energy limit and Pmin, adjusted for round trip efficiency
γ	Energy Discharge Duration	Based on a resource's registered max/min continuous energy limit and Pmin, adjusted for round trip efficiency
ρ	Variable Storage Operations Cost	A resource-specific registered value representing costs associated with variable operation of the resource, including cycling and cell degradation costs
PB_OC	Price-based Opportunity Cost	Estimates the market opportunity cost corresponding to the *n*th highest LMP, where *n* corresponds to the discharge duration of the resource (e.g. 4^{th} highest hour for a 4 hour discharge duration)
DEB Multiplier	110% Multiplier (1.1)	Multiplier to cover any potential variability between the storage DEB calculation and resource's actual marginal costs; consistent with other DEB calculations

The Hydro DEB Calculation

The Hydro DEB option reflects opportunity costs a hydroelectric generator faces due to their limited water supply. This option is available to hydroelectric resources in both CAISO and WEIM that have storage and can demonstrate limited water storage capability.

The hydro DEB option was developed through the Local Market Power Mitigation Enhancements stakeholder initiative to offer more flexibility for hydro resources. Stakeholders noted that the existing opportunity cost adders calculated monthly could account for the intertemporal energy sales at a unit's specific location, but did not capture the opportunity for intertemporal sales outside of the CAISO's real-time energy market, or reflect short-term (daily) limitations[12].

The cost components are linked to resource-specific parameters including the resource's maximum storage horizon, electric pricing hub based on the resource's location, other electric pricing hubs to which the resource has firm transmission rights.

Hydro DEB = MAX[Gas floor, Short-term component, Long-term component]

Where:

Gas floor	The gas floor represents the opportunity cost for the hydroelectric generator to sell electricity generated from a similarly-situated gas resource instead of the hydro resource. This is formulated similarly to the variable cost DEB calculation for gas generators and uses a standard peaker heat rate.	1.1 * [11,068 MMBtu/MWh * Fuel region gas price]
Short-term component	The short term component represents the opportunity cost of sales at the local wholesale electric pricing hub. The Day Ahead component is the DA power price index at the local default electric pricing hub. Balance of month and future monthly index prices are also included. This is the same bilateral price index used to calculate the MIBP.	1.4 * MAX[Day Ahead$_L$, Balance-of-Month$_L$, Month Ahead$_{L,+1}$]
Long-term component	The long-term component represents the opportunity cost of sales at the default and additional electric pricing hubs over future months of the storage horizon using future monthly index prices.	1.1 * MAX[Day Ahead$_L$, Balance-of-Month$_L$, Month Ahead$_{L,+1}$]

[12] Local Market Power Mitigation Enhancements, Draft Final Proposal P 31 DraftFinalProposal-LocalMarketPowerMitigationEnhancements2018.pdf (caiso.com)

7.2. Appendix B: Scalars

Scalars incorporated within DEB calculations can account for a margin of error between the information available to the ISO when the DEB is calculated and the actual incremental costs facing generators. The DEB is a single value calculated each day but updated information may become available that can inform the DEB. The reasonableness threshold, which can also have a scalar, can account for intra-day variation and facilitate hourly adjustments through the automated RLCR process.

Scalars incorporated into DEB calculations represent a margin of error between what is known by the ISO and what is reasonably expected to materialize. For a scalar to be an effective proxy, it should be resource specific, or based on observations or known variations between the actual and expected marginal costs to which it is being applied.

Hydro DEB option: Hydro uses a 140% scalar for the short-term component of the DEB. The analysis to inform the scalar calculated the default energy bid for each day without a scalar and compared it to real-time FMM prices in the resource's balancing area over a year[13]. It was observed that a resource would be dispatched any time EIM prices are greater than the DEB. The scalar equivocates the cost where the storage resource would be expected to be dispatched less than the potential daily energy availability 95% of the intervals assessed.

A larger scalar would account for a greater range of potential outcomes, but could also inflate costs unnecessarily if more precise information is available. Reasonableness thresholds based on a resource's specific parameters should allow resources to reflect costs no less than the value of their DEB, and request adjustments beyond that value hourly in real-time given supporting documentation.

7.3. Appendix C: Conditions to raise the energy bid cap

Today, one of two conditions must be met to raise the energy bid cap above the soft offer cap:

1. The market accepts a bid above $1,000/MWh from a resource-specific resource, or
2. The allowable MIBP goes above $1,000/MWh

Today, the tariff requires resource-specific resources to successfully cost-verify and receive an adjusted DEB through the reference level change request (RLCR) process in order for the market to accept a bid above $1,000/MWh. From a systems perspective, any bid above $1,000/MWh from a resource specific resource would fulfill the condition to change the energy bid cap. However, the market only clears resource-specific resource bids above $1,000/MWh that have been successfully verified through the RLCR process because that is the only way for resource-specific resources to reflect a bid above $1,000/MWh in the market today.

[13] Local Market Power Mitigation Enhancements December 2018

When the bid cap goes up, a set of penalty price parameters are doubled so that priorities are preserved.

If the bid cap is raised in any hour of the day-ahead market, the penalty prices will be scaled up for all trading hours of the day-ahead market and real-time market for the same trading day.

If the bid cap is not raised in any hour of the day-ahead market, but the conditions apply to raise the bid cap in hours of the real-time market, the real-time market will use the scaled up penalty price for all intervals of overlapping real-time market horizons.

7.4. Appendix D: Storage under the proposal to uncap the DEB