



California ISO

Local Market Power Mitigation Enhancements

Draft Final Proposal

January 16, 2019

Prepared by
Brittany Dean
Elliott Nethercutt
Danielle Tavel
Donald Tretheway
Gabe Murtaugh

California Independent System Operator

Table of Contents

1. Changes from the Revised Straw Proposal	3
2. Introduction	3
3. EIM Decisional Classification	5
4. Stakeholder Comments	6
4.1 Mitigation Process Enhancements	7
4.2 Hydro Resource Default Energy Bid	11
4.3 Reference Level Adjustments – Reasonableness Threshold	17
4.4 EIM Decisional Classification	18
5. Principles	19
6. Proposal	19
6.1 Mitigation Process Enhancements	20
6.1.1 Prevention of Flow Reversal.....	20
6.1.2 Prevention of Economic Displacement between Mitigated Balancing Authority Areas (BAAs).....	24
6.2 Hydro Resource Default Energy Bid	32
6.3 Reference Level Adjustment - Reasonableness Thresholds	41
6.3.1 Gas Resources	42
6.3.2 Hydro Resource Default Energy Bid	45
6.4 Gas Prices Indices	46
7. Stakeholder Engagement	47
7.1 Stakeholder Comments	47
Appendix	48
Commitment Cost and Default Energy Bids Enhancements –.....	48
Before Market Reference Level Adjustment Requests	48
CAISO’s Local Market Power Mitigation Design.....	50
Day-Ahead Market.....	52
Real-Time Market.....	52

1. Changes from the Revised Straw Proposal

The CAISO appreciates the written stakeholder comments received in response to the revised straw proposal and the November 28, 2018 stakeholder call. In response to this input, this draft final proposal includes the following modifications from the revised straw proposal:

- **Prevention of Economic Displacement between Mitigated Balancing Authority Areas (BAAs):** The CAISO modified the proposed rule to limit transfers between balancing authority area's (BAA) during mitigated intervals. The proposed rule in this draft final proposal will limit BAA net exports to the greater of the quantity of base transfers or pre-mitigation transfers, plus the total of the flexible ramping-up awards in excess of the BAAs flexible ramping up requirement (reflecting the EIM design principle that ramping capability is shared between EIM balancing areas). This proposed rule will be optional, based on the preference of the EIM BAA.
- **Hydro Resource Default Energy Bid:** The CAISO has updated the hydro default energy bid. The revised calculation includes a gas floor price (based on the average heat rate of a gas peaking unit), a locational floor (with an updated multiplier of 1.40), and a geographical floor (representing opportunities to sell energy in other geographic areas). Additional analysis to support these changes has also been included within this draft final proposal.
- **Reference Level Adjustment – Reasonableness Thresholds and Hydro Resource Default Energy Bid:** The CAISO updated its proposed process for updating same-day gas prices used for real-time market reasonableness thresholds to include provisions for manual reference level consultations and/or basing them on same-day gas trading observed on the Intercontinental Continental Exchange (ICE). Additionally, the CAISO is proposing a process to update the gas floor default energy bid component for resources that opt to use the hydro default energy bid.

2. Introduction

The CAISO's local market power mitigation rules include measures to mitigate a supplier's energy bid when local market power exists. EIM participants have identified cases when mitigation results in the market dispatching their hydro resources at prices below their marginal costs and often in quantities greater than needed to resolve market power. In addition, market participants, including those with resources in the CAISO BAA, have raised concerns related to recent real-time gas price volatility.

This paper presents the CAISO's draft final proposal for several enhancements to address these concerns, including refinements to the reference level adjustment process recently developed as part of the *Commitment Cost and Default Energy Bid*

Enhancements (CCDEBE) initiative.¹ The CAISO proposes five enhancements in this initiative, as detailed below.

Mitigation Process Enhancements

Market participants have expressed concerns about two situations that can arise because of the market power mitigation process in the CAISO's real time-market: (1) "flow reversal," and (2) "economic displacement."²

Flow reversal occurs in cases when an EIM BAA or group of BAAs are import-constrained in a market interval, triggering mitigation, which results in the BAA shifting to export at mitigated prices in the subsequent market run. This situation can result in mitigating bids for resources' exported power that does not have market power. The CAISO proposes to address this issue by changing the market rules so that the market updates the price used in mitigation in each interval based on that interval's competitive locational marginal price and no longer extending mitigation beyond the interval being tested. These modifications will largely eliminate cases of flow reversal and improve the market power mitigation process.

Economic displacement is similar to flow reversal in that it occurs when a group of BAAs are import-constrained in the real-time market's market power mitigation run. Economic displacement can occur when the real-time market increases transfers from one BAA to another, relative to its market power mitigation run, because they become more economic when resources' bids are mitigated. Although market power mitigation should protect against market power within the combined BAA "bubble" with import constraints, it is not appropriate to export greater quantities at the mitigated price than what was originally scheduled in the market power mitigation run.

The CAISO proposes to address this issue by limiting transfers between EIM BAAs in a manner that recognizes the EIM design principle that EIM BAAs share a portion of their ramping capability, thus reducing each EIM BAA's flexible ramping requirement. Accordingly, the CAISO proposes to limit transfers from mitigated BAA when exporting to the greater of: (1) the pre-mitigation transfer quantity, or (2) the base transfer quantity, plus the sum of the flexible ramping up awards determined in the market power mitigation run in excess of the BAA's flexible ramping up requirement, as adjusted for EIM diversity. This proposed rule would be available for all BAAs in the EIM that elect to use it.

Hydro Default Energy Bid

CAISO's existing methodologies for calculating default energy bids can inaccurately reflect the actual costs for hydro resources with storage. The mitigation process

¹ http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCosts_DefaultEnergyBidEnhancements.aspx.

² These situations are not applicable to resources within the CAISO BAA because mitigation for a congested EIM transfer constraint is only triggered when there is congestion between an EIM BAA or group of BAAs and the CAISO BAA.

enhancements described above will address situations when the market dispatches resources in quantities greater than what is needed to resolve market power. However, there will still be cases when a resource's default energy bid is applied. To address stakeholder concerns, the CAISO proposes an additional default energy bid option for hydro resources with storage. This option will be available to qualifying hydro resources located in EIM and the CAISO BAAs.

Reference Level Adjustment

The CAISO proposes changes to its reference level adjustment process recently developed in its *Commitment Cost and Default Energy Bid Enhancements* (CCDEDE) initiative.³ The CAISO proposes to update reasonableness thresholds based on same-day gas trading information it observes on ICE and/or on manual requests received from suppliers. The CAISO also proposes to update the gas price floor component of hydro default energy bids within an applicable fuel region if these requests indicate the gas price changes are applicable to an entire fuel region.

The CAISO also proposes when calculating day-ahead market reference levels to include gas prices based on a Monday-only index when available and reported by ICE.

Finally, the CAISO proposes to update the gas floor component of hydro default energy bids based on same-day gas trading and manual requests for reference level adjustments.

Gas Price Indices

The CAISO proposes consolidating the published gas-price indices that the real-time market uses to calculate gas-fired resources' reference levels.

3. EIM Decisional Classification

This initiative includes five elements. The first and second elements involve enhancements to two of CAISO's existing bid mitigation processes. The third introduces a new default energy bid option for hydro resources. The fourth element modifies the reference level adjustment process for gas resources. The fifth updates the CAISO tariff to reflect current gas publications for the real-time market.

The second element, the limitation of transfers in the bid mitigation process falls within the EIM Governing Body's primary authority, because it proposes changes to market rules that are EIM-specific. It would introduce a mitigation process rule that would impose transfer limitations between mitigated regions of EIM BAAs. This rule will be optional for each EIM BAA, as determined by the appropriate authority.

³ "Reference levels" are default energy bids and commitment cost bid caps that are based on the CAISO's calculations of a resource's costs.

The remaining elements fall within the EIM Governing Body's advisory role, because they propose to change market rules that apply uniformly throughout both the CAISO and EIM BAAs. Specifically, the first element would modify the calculation of the competitive locational marginal price used in market power mitigation. The third element establishes a new default energy bid designed to approximate the opportunity costs for hydro resources with storage capability. This enhancement would apply uniformly to hydro resources in both the CAISO and EIM. The fourth element includes enhancements to the reference level adjustment process used by the real-time market for gas-fired resources and changes to the gas price index used to calculate reference levels in both the day-ahead and real-time markets. These changes would apply uniformly in both the CAISO and EIM BAAs. The fifth and final element introduces updates to the CAISO tariff to reflect current gas publications for the entire real-time market.

The second element, which is within the EIM Governing Body's primary authority, ultimately must be approved or rejected together with the first element, as both the flow reversal and transfer limitation rules must be implemented at the same time. These two elements together are therefore classified as a hybrid. The CAISO believes they are properly classified as hybrid, non-EIM specific, because the primary driver for these two elements (and the entire initiative) is an issue that applies throughout the real-time market, as opposed to EIM BAAs only. For additional information on this point, see the discussion of related stakeholder comments in Section 4.4.

When a proposal is hybrid, non-EIM specific, the CAISO presents the EIM-specific part of the hybrid proposal to the EIM Governing Body for its approval, and then the entire hybrid proposal goes to the Board for its approval on a non-consent agenda basis. Applying this rule, the CAISO would present element two to the EIM Governing Body for its approval, with the remaining elements being presented to the EIM Governing Body for its advisory input. Assuming element two is approved, then the entire proposal would be presented to the Board of Governors for its approval on a non-consent agenda basis.

Stakeholders are encouraged to submit remaining input regarding the responses to the updated proposed EIM classification of this initiative in their written comments—particularly if there are any questions or concerns.

4. Stakeholder Comments

Following the posting of the revised straw proposal on November 16, 2018, the CAISO held a call on November 28, 2018 to review and further discuss the latest updates to various elements of the initiative. Stakeholders submitted comments on the revised straw proposal on December 7, 2018. These comments are summarized below.

4.1 Mitigation Process Enhancements

Prevention of Flow Reversal

Bonneville Power Administration (Bonneville), PacifiCorp, Public Generating Pool (PGP), Powerex, Southern California Edison, and Six Cities support the proposed mitigation framework enhancements to address flow reversal, as introduced by the CAISO in the straw proposal for this initiative.⁴ The Western Power Trading Forum (WPTF), Seattle City Light (SLC) also support the approach, but request additional analysis after implementation to evaluate how effective the nominal adder is for preventing cases of flow reversal. The CAISO anticipates it can fulfil this request through the Market Performance and Planning Forum at the appropriate time following implementation.⁵

NV Energy supports the updated design principle with a recommendation that the CAISO should monitor and identify potential adverse outcomes occur following implementation. NV Energy does not agree that there is a necessity for a competitive LMP adder in conjunction with the other market mitigation proposals in this initiative. If an adder is ultimately implemented, NV Energy recommends the inclusion of a price cap for the nominal price. This cap should be specified in the tariff so that stakeholders can identify and consider any potential issues from the magnitude of the adder.

The CAISO emphasizes that the proposed nominal adder will be as minimal as possible and tailored specifically to only create price separation between the competitive local marginal price and the default energy bid price, without impacts to market schedules or prices. With regard to a price cap on this proposed nominal adder, the CAISO proposes an approach similar to the EIM transfer cost.⁶ The CAISO will specify a maximum adder of \$0.10 in the tariff, and include the actual adder necessary to meet the objectives of the rule in the business practice manual which is planned to be \$0.001 for the price adder.

The Department of Market Monitoring (DMM) supports eliminating the extension of mitigation in one 15-minute interval to the remaining 15-minute intervals in the hour. DMM also supports eliminating the extension of mitigation in one 5-minute interval to the remaining 5-minute intervals. However, DMM raises concerns about eliminating the extension of mitigation in the 15-minute market to the corresponding three 5-minute market intervals. DMM is concerned that a potential consequence of this change could result in a resource running at its day-ahead schedule, but forfeiting revenue to the CAISO in real time. DMM maintains the relative advantages of the current policy versus the proposed policy may differ by market participant and by resource. DMM

⁴ <http://www.caiso.com/Documents/IssuePaperandStrawProposal-LocalMarketPowerMitigationEnhancements.pdf>.

⁵ <http://www.caiso.com/informed/Pages/MeetingsEvents/UserGroupsRecurringMeetings/Default.aspx>.

⁶ <http://www.caiso.com/Documents/ConformedTariff-asof-Nov15-2018.pdf>. See Section 29.17 EIM Transmission System (p. 729).

recommends that the CAISO solicit and consider additional stakeholder feedback on this issue.

The CAISO acknowledges that there could be cases when an offer price is mitigated to a lower level in the 15-minute market than in the three 5-minute market. If this occurs, the seller could have to buy back its 15-minute market schedule at the real time dispatch (RTD) market price. As the MSC observed at the August, 2018 meeting, the removal of extension of mitigation in the 5-minute real-time dispatch when in the 15-minute market mitigation is triggered is the economically efficient outcome. This does results in an buying back at the RTD price, but “this outcome would be preferable to the outcome in which the resource is dispatched based on a mitigated price that is lower than the competitive LMP price...”⁷ This is because the resource loses less revenue by buying back than selling at the mitigated price.

Economic Displacement between Mitigated Balancing Authority Areas (BAAs)

Bonneville Power Administration (Bonneville), Idaho Power Company, PacifiCorp, Powerex, and WPTF agree with the updated approach provided by the CAISO in the revised straw proposal.

PGP also supports the updated approach, but requests that the CAISO consider third parties with participating resources within an EIM BAA. These entities may not want additional transfers to a neighboring BAA based on mitigated bids even if the BAA in which their resources are located decides not to use the proposed functionality to limit transfers to that scheduled in a market power mitigation run. Therefore, PGP requests the CAISO consider an approach that will allow these resource owners to determine whether or not to allow mitigated bids to result in additional transfers. However, that would not be feasible because the functionality must apply at the BAA level and not to individual resources. This is because all resources within a BAA must be mitigated when the BAA becomes import constraint because each resource has the same effect on the net transfers of the BAA.

PG&E and PGE share concerns that this proposed rule may be unnecessary, since other elements of this initiative will adequately address mitigation framework issues. PGE requests that the CAISO clarify how often an entity could update a BAA’s application of this rule. The CAISO has proposed that the transfer limitation rule will be designated in the CAISO’s Master File by the appropriate EIM entity for a given BAA.

SCL asks that the CAISO explore introducing a tool that can identify economic displacement in real-time, enabling entities to respond with changing market conditions. In order to accomplish this, the CAISO would need to develop a tool to compare market power mitigation schedules for each BAA with final market results for each interval, with results published to OASIS. The CAISO believes this is not feasible, since the election

⁷ See slide 23: http://www.caiso.com/Documents/Presentation-EIMMarketPowerMitigationDiscussion-FTI-Consulting-Aug7_2018.pdf

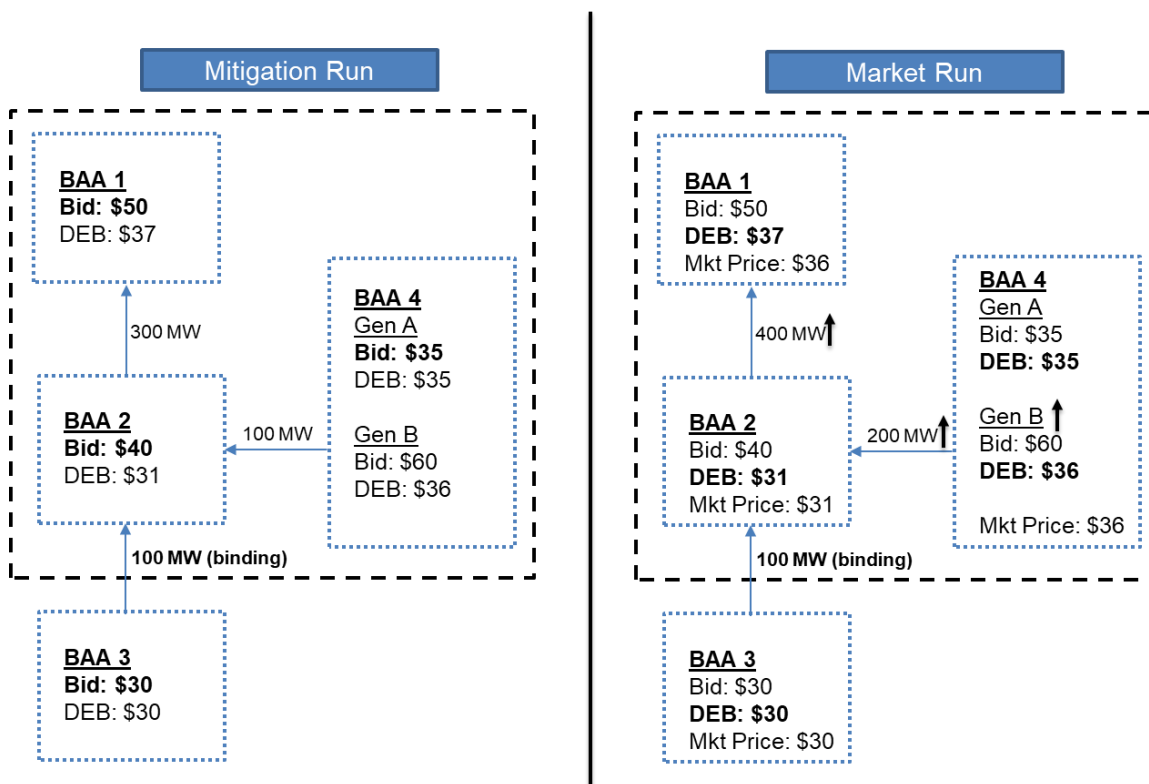
to enforce the transfer limitation rule must be implemented in the Master File, outside of the real-time market.

PG&E requests additional analysis on the implications of the congestion rents being returned to the source EIM BAA when economic displacement is being resolved. The allocation of congestion revenues is consistent with existing EIM principle that congestion revenues are returned to the BAA in which the constraint is located. The net transfer out constraint is located within the source BAA.

The Department of Market Monitoring (DMM) raised concerns related to the establishment of schedules in two different runs with different sets of inputs and prices. DMM is concerned this could lead to potentially unintended and undesirable outcomes, including prices that are inconsistent with the CAISO's dispatch instructions and incentives for resources to deviate from dispatch or to not bid their true marginal costs. DMM presented an example to illustrate these concerns. The CAISO has included a modified version of this example below.

In this example, there are four BAAs, each with a bid and a default energy bid for a marginal resource. Given the bids, the mitigation run will schedule 100 MW flowing from BAA 3 (CAISO) to BAA 2, and 100 MW flowing BAA 4 to BAA 2, and 300 MW flowing from BAA 2 into BAA 1. We assume load and base schedules in each area are such that with this dispatch, prices in each BAA will be at the marginal bid in that BAA. BAA 2 enforces the proposed rule to limit net exports in the market run to the pre-mitigation run quantities. In this example, those net exports are 100MW (300 MW transfer out, less 200 MW transfer in). The figure below illustrates this example:

Enforcing Transfer Limitations with Four Balancing Authority Areas (BAAs)



With the proposed rule enforced by BAA 2, resources will be protected from additional economic displacement, beyond the 100 MW offered in the mitigation run. As a result, transfers increase from BAA 2 to BAA 1 from 300 MW to 400 MW, while imports from BAA 4 increase from 100 MW to 200 MW. Thus, the net exports remain at 100 MW. In the absence of the proposed transfer limitation rule, BAA 2 could manually withhold transfer capability to prevent additional wheels to occur (because there would be no ETSRs to support the energy flow). Limiting the ETSRs to minimize exposure to selling at mitigated prices (*i.e.*, reducing economic displacement) would negatively impact other BAAs in two ways. First, the result would reduce available transfer capability, which increases the probability of binding transfers (triggering additional mitigation). It would also prevent the ability to wheel energy in accordance with prices between BAAs within the bubble. The proposed rule will enable BAA 4 to sell to BAA 1, while preventing economic displacement by using resources in BAA 2.

The CAISO acknowledges that there is an appearance that energy would flow from an area with higher price to an area with lower prices. In actuality, lower price energy is supporting a higher priced BAA because the energy wheels through BAA 2. This allows BAA 4 to sell to BAA 1 at \$36, which sets the market price below the \$37 default energy bid that load in BAA 1 would otherwise be charged. BAA 4 can avoid this outcome if it enables the proposed rule, which would then limit the export from BAA 4 to the pre-mitigated export of 100MW.

DMM's concern that the rule will still result in a resource selling below their bid is also an acceptable outcome when mitigation occurs. This rule benefits resources by limiting the quantity of sales at mitigated prices, thus limiting the impacts of economic displacement. DMM's concern regarding congestion rents have been explained within this proposal. All congestion rents will be allocated to the BAA where the constraint is located. Accordingly, in the above example, \$5 of congestion rents will be paid to BAA 2 (since the price in BAA 2 is \$31 and the price in BAA 1 is \$36, resulting in a \$5 price difference).

Finally, DMM requests clarification on the allocation of congestion rents between limited transfers from the mitigation run of a 15-minute interval and the transfer capability that the CAISO proposes to use in the corresponding 5-minute interval. If transfers are not limited in the 5-minute market, DMM is concerned this inconsistency could potentially incentivize strategic bidding behavior to leverage differences between the two markets.

The CAISO believes that since all real-time bids are submitted at T-75, the same bids are used in the 15-minute market and in the RTD. Therefore, there isn't an opportunity to implement a bidding strategy knowing that in one market (15-minute market) the rule has been triggered, and may not be triggered in a subsequent market (RTD).

NV Energy does not support the CAISO's updated design principle to address economic displacement due to concerns that the rule inappropriately allows a participating EIM entity to elect to "pull capacity out of the market that it had previously offered voluntarily, during periods of mitigation." NV Energy suggests that by allowing participants to withdraw capacity during intervals of mitigation, the CAISO will be allowing occurrences of noncompetitive outcomes.

As discussed above, the amount of transmission that is made available to support EIM transfers out of the EIM BAA is voluntary. As discussed above, the amount of transmission that is made available to support EIM transfers out of the EIM BAA is voluntary. Without the economic displacement rule, an EIM entity may seek to minimize the amount of energy that is sold to other EIM BAA's at mitigated prices by reducing transmission to support transfers. If this occurs, the EIM would be harmed more since wheel through transactions will also be limited because transmission is not available.

4.2 Hydro Resource Default Energy Bid

The CAISO received comments on the proposed default energy bid in the revised straw proposal. The CAISO modified the proposed default energy bid for hydro resources with storage in this draft final proposal. The proposal addresses much of the feedback received from stakeholders through the last iteration of the policy initiative process. Changes include consideration for opportunity costs for replacement energy from peaking gas resources, futures pricing over determined storage horizons, and sales

opportunities at multiple price hubs. Below is a summary of responses to all stakeholder feedback:

Geographic Consideration

Several stakeholders – including Bonneville, Seattle City Light, Public Generating Pool, Idaho Power Company, Chelan, and the National Hydropower Association (NHA) – endorse expanding the allowance to elect multiple trading hubs to all hydropower resources – including those with short-term storage capability (less than four months). The CAISO has included multiple trading hubs for all resources in this draft final proposal. The default energy bid crafted in this draft final proposal maintains a limited group of potential locations that may be included in the calculations for the geographic component of the default energy bid. If a resource owner has firm transmission availability to sell energy at multiple locations, these would be missed opportunities for energy sales at any of these hubs. Therefore the maximum price at any of those hubs should be included in the resource’s default energy bid. This proposal outlines that the maximum value of these futures prices is used in the default energy bid calculation, and this is consistent with a calculations for a resource’s opportunity costs.

In addition to including multiple geographic hubs for all resources, the Idaho Power Company also suggests that the CAISO should not require firm transmission to be directly tied to the applicable geographic hub. The CAISO does not envision that firm transmission necessarily be demonstrated to directly sink at a geographic hub. The entity may also sink at an electrically similar geographic hub for consideration.

The NHA indicates resources with very short-term storage may face even greater operational challenges and energy availability limitations than resources with larger reservoirs and greater storage capability. Accordingly, the NHA recommends the CAISO use a separate formula for short-term storage resources that recognizes and incorporates the highest value hours over a 24-hour period. The CAISO responds by emphasizing that if this hydro default energy bid is insufficient, these resources have the option to proceed with a negotiated default energy bid to capture the specific nuances of their resource. Additionally, these resource may opt to receive a *Commitment Cost Enhancements – Phase 3* opportunity cost adder.⁸

PG&E specifically requests that the highest price hub should be used in the geographic floor. The CAISO’s revised proposed hydro default energy bid in this draft final proposal includes the highest prices hub that a resource has firm transmission to for calculation of the geographic floor component.

The Department of Market Monitoring highlights that the value of firm transmission is not appropriately accounted for. The CAISO maintains that hydro resources with the ability to deliver energy to a specific hub, using firm transmission rights, also have the

⁸ <http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCostEnhancements.aspx>.

ability to earn revenues on that energy equal to those hub prices. This includes energy sold at futures prices as well as near-term agreements. Energy produced and delivered from hydro facilities may not be equivalent to other energy produced by different fuel types that a resource owner may purchase locally and deliver to a different energy hub. In practice, hydro power with its zero greenhouse gas emissions is not fungible with generic power purchased at hubs. Thus, the power is associated with the output of a specific generator.

DMM further identifies concerns with the criteria used to determine if a resource owner has the ability to sell energy at a different hub. The CAISO emphasizes that the availability of transmission is necessary for a resource to sell energy at any location, either electrically close or distant. Through his proposal CAISO is requiring demonstration of long-term firm transmission rights before considering distant hubs as a component of opportunity cost for any resource. There could be instances when the demonstrated firm transmission rights are no longer available, *i.e.*, rights are sold or allocated, and thus may not be appropriate to include as an opportunity cost, even though the ability to sell at these locations may have previously existed and would appropriate to include in previous opportunity costs. CAISO will require that firm transmission rights previously demonstrated to the CAISO for means of a hydro default energy bid and subsequently sold be reported so that these components of the related default energy bids calculations can be updated appropriately.

PGP further argues that entities should not be required to demonstrate the prior year of purchased monthly transmission rights. The CAISO responds by emphasizing that the demonstration of firm transmission rights should not be overly burdensome for resource owners, but still allow resource owners to demonstrate other opportunities that will be included in the default energy bid calculation. Generally, the CASIO expects that demonstrating firm transmission on an annual basis accompanied with information on firm transmission sold during the year, will be sufficient for this process. The CAISO also proposes to have the authority to audit and request confirmation of changes as necessary, which may include the request for a sworn statements and documentation, to ensure that scheduling coordinators comply with this requirement. The CAISO would recognize that some resource owners may purchase firm transmission in monthly markets, and would allow for such resource owners to also have access to these opportunity costs.

Gas Price Floor

Idaho Power Company, Bonneville, PGP, and Chelan also request that the CAISO use a peaking gas heat rate to establish the price floor. The default energy bid proposed in this draft final proposal includes a heat rate for a peaking gas resource, with a 110% multiplier. This default energy bid includes a proxy peaking natural gas resource that represents the opportunity cost for generating energy at the same location of the hydro resource. The heat rate specified for this natural gas resource is 11,176 Btu/KW-hr for

an average gas turbine resource in 2017, as reported by the Energy Information Agency. The CAISO will specify the applicable heat rate in the business practices manuals and will update it through the business practice manuals change management process.

Southern California Edison suggests that the gas price index should capture the highest gas price in the BAA. The CAISO believes that the gas price index for a hydro resource should reflect the gas index for a similarly located gas resource in the geographic area. Reference levels for gas resources are based on the weighted average gas price, not the highest gas price in an area.

Methodology for Establishing a Multiplier

Several stakeholders provided input on the proposed price floor multiplier. PGP, Southern California Edison, and Bonneville support the application of a consistent methodology for establishing a multiplier, which would be updated annually. PGP emphasized that this methodology should be updated by the CAISO on regular cadence with criterion applied consistently for short- and long-term storage resources. The default energy bid proposed in this draft final proposal consists of one set of criteria that will be used to determine the local floor and the multiplier for all hydro resources, with the inclusion of multiple hubs. The CAISO recognizes the importance of this default energy bid and the need for it to generate acceptable values for hydro resource owners. At this time, the CAISO does not feel that it is necessary to re-evaluate the multiplier on an annual basis. However, if this default energy bid no longer meets the objectives outlined in this paper, the CAISO may reevaluate and assess if the multiplier is appropriate. This may be necessary as market conditions change in the EIM, as markets offered by the CAISO expands (such as the EDAM), and if there are significant changes in transmission availability for CAISO run markets. The CAISO will take necessary action if critical feedback from market participant submissions through the normal the customer service representative process is received in the future on this component of the initiative.

Bonneville specifically suggests using a target availability of 4 hours per day at 99% efficiency. SCL and Chelan further recommend a multiplier that would result in a dispatch efficiency of 99% of all hours (instead of 95%), claiming that the inefficient water depletion during the remaining 5% is problematic. SCL also suggests the CAISO consider using Powerdex bilateral prices, instead of PacifiCorp West EIM prices.

The Idaho Power Company recommends the application of a 1.65 multiplier for the proposed hydro default energy bid. Although the CAISO is trying to identify a multiplier that will result in a sufficiently high default energy bids, some hydro resources bidding at those levels will not be dispatched beyond their potential available hydro output in the short-term. For the analysis, which is very similar to prior analysis, the CAISO targets specific daily availability limits and percent of intervals that a resource that actually had

this availability would be dispatched less than this level, based on historic energy imbalance market price data.

WPTF requested that the CAISO consider making the proposed default energy bid available to any resource with opportunity costs – including run-of-river resources. Currently, the CAISO is only considering this default energy bid for hydro resources with storage. Hydro resources that have the ability to store water, run or not run at different times of the day, and respond to dispatch instructions from the CAISO, will have the ability to elect this proposed default energy bid. There are other default energy bid options available for resources that use other fuel types. WPTF also requested additional detail on how this proposed hydro default energy will function with opportunity cost adders. Resources that elect to use this default energy bid will not be eligible to apply for an opportunity cost adder in addition to the formulation used for this default energy bid. The resources would still be eligible for an opportunity cost adder if they elected a variable cost default energy bid. CAISO understands that certain hydro resources may have costs that are not covered by this default energy bid on some occasions. If this frequency occurs, such resources may elect to use an opportunity cost adder or negotiated default energy bid.

There was considerable deliberation by the CAISO for the availability and efficiency values. The CAISO feedback with specific recommendations for values to use for analysis. In this draft final proposal the CAISO presents analysis that was conservative in nature and is recommending that a multiplier of 1.40 be applied to the local floor. Although a 95% efficiency still may leave some days when a resource is dispatched inefficiently, a resource with these constraints and actual opportunity costs will not necessarily be dispatched inefficiently this frequently for two reasons: First, resources with market based rate authority may bid above default energy bids. This may cause resources to be dispatched less frequently and resources will only be dispatched inefficiently when market power mitigation is frequently triggered and competitive LMPs are calculated at values less than the default energy bid. Second, this analysis considers a resource that has no firm transmission to another location. If a resource owner can demonstrate firm transmission to another location, this will increase the default energy bid and reduce the frequency that the resource is dispatched. Finally, the analysis presented shows that there are conceivable opportunity costs that a resource could have which would dispatch a hydro resource inefficiently (*i.e.*, too frequently). This default energy bid is not necessarily meant to be sufficient for all resources, particularly those with very limited water availability, but rather a solution that may work for most hydro resources. In cases where this default energy bid is insufficient, the CAISO will continue to offer *Commitment Cost Enhancements – Phase 3* opportunity cost adders and negotiated default energy bids.

Chelan requests that the CAISO complete analysis to determine the multiplier using hourly Powerex data. The analysis proposed by Chelan may be useful in determining the effectiveness of this default energy bid as the EIM continues to develop. CAISO

included additional analysis, analogous to that performed for EIM areas, with Powerdex data. This analysis showed that a resource with 4 hours of availability to generate energy would be dispatched less than this amount more than 95% of days during the data reviewed.

Powerex requests that Alberta be included as a geographic hub. The CAISO has included Alberta in the list of available geographic hubs for the proposed default energy bid included in this draft final proposal. The Alberta hub will be available for entities that can demonstrate that the hub is robust enough to be used in these calculations. The CAISO is currently performing analysis to make this determination.

Additional Analysis and Information

Pacific Gas & Electric asks the CAISO to include a table in this proposal to illustrate the different default energy bid options available to hydro resources. The CAISO has included this table in the background section of this proposal. PG&E also requests the CAISO conduct analysis using mitigation frequencies for a specific resource. The CAISO does not believe the analysis to establish a default energy bid based on opportunity costs should consider the frequency of mitigation. Rather, a default energy bid based on a resource's opportunity cost should reflect the resource's actual opportunity costs.

NV Energy does not oppose changes to the default energy bid to reflect actual lost opportunity costs, but questions whether it is appropriate to compare lost opportunity costs to the bilateral market. NV Energy points out that the proposed default energy bid may not include opportunity costs in the default energy bid and requests a comparison to the proposed hydro default energy bid to the lost opportunity costs calculated in Phase 3 of the *Commitment Cost Enhancements* initiative. The CAISO believes that the objective of the adders in the *Commitment Cost Enhancements – Phase 3* initiative are to determine an adder to an existing bid that would allow a specific resource to be dispatched at exactly the amount of available energy that resource had, given projected future local energy prices. In cases of such a calculation the opportunity cost of selling to external bilateral markets is already implicitly considered and less than the value that the energy would be sold into the EIM. Practically, a resource owner may sell some hydro capacity into the residual markets and the EIM market. Capacity considered in analysis for a *Commitment Cost Enhancements – Phase 3* opportunity cost bid adder would only consider the energy sold in the EIM market, and not that being sold into the bilateral market. A resource owner may find selling in the bilateral market advantageous as prices may be higher at geographically distant bilateral hubs, but want to participate in the EIM market to capture potential price spikes during periods of market tightness and the ability to meet sufficiency requirements. Further, if a resource owner does consider the opportunity to sell energy in the bilateral market as an opportunity cost for a hydro resource, that price should be considered and respected when a resource is dispatched.

DMM requests additional examples and data to support the proposed default energy bid. The CAISO has included additional analysis in this draft final proposal that was not included in the earlier versions of this paper, including three BAAs: PacifiCorp West, PacifiCorp East, and Puget Sound Energy.⁹ These areas are representative of where hydro resources are located in the EIM markets and show that generally resources with daily limitations of 4 or more hours per day will not be dispatched more than their energy limits.

Finally, DMM requests that the CAISO provide additional guidelines on how the CAISO will review requests for customizable inputs. The CAISO explains in this draft final proposal that customizable inputs for the hydro default energy bid will include the maximum storage horizon and the long-term bilateral hubs applicable for the resource. The maximum storage horizon will be determined by the historical water cycling data for the resource. This will include requirements for the resource owner to submit documentation of historical cycling patterns for a resource. Section 6.2 provides several examples of such a determination. Resources will need to demonstrate the availability of firm transmission on an annual basis in order to be eligible for different geographic hubs in their default energy bids. They will also be required to announce to the CAISO if those transmission rights are sold or otherwise released during the year. As noted above, the CAISO proposes to have the authority to audit the SC and request for confirmation of changes, including attestations.

4.3 Reference Level Adjustments – Reasonableness Threshold

NRG is notes several possible shortcomings with the CAISO's proposed approach for reference level adjustments: First, NRG notes the reasonable thresholds are updated from a single morning-of same-day inspection of prices of the Intercontinental Exchange (ICE). This single static update may be insufficient to account for volatility in the same-day market. Second, whether the update adequately provides opportunity for market participants to reflect their expectations of same-day gas prices in their bids will depend on what morning-of, same-day price is used, and what kind of scalar is applied to the morning-of, same-day price used. The CAISO understands NRG concerns, but believes updating reasonableness thresholds using same-day gas trades observed on ICE would allow gas price increases to be captured and potentially used in the market through a reference level adjustment. The CAISO is limited to current market processes that only allow for reasonableness thresholds to be updated in the mornings. The CAISO cannot account for every single gas price volatility that may occur throughout same-day.

Six Cities and Puget Sound Energy support the latest proposal related to reference level adjustments. DMM cautions that many EIM areas have less liquid trading hubs, and published prices may not reflect their actual trading conditions. The CAISO observed

⁹ Generally prices in these areas are similar to others in the northwest, which may have limited EIM pricing data available because of the newness of these markets.

that some gas hub areas are not sufficiently traded on ICE and has revised its proposal in Section 6.3.1 Gas Resources to account for these exceptions.

Puget Sound Energy requests the CAISO to revise its proposed elimination of the reference level adjustment for hydro resources proposal to update a resource's reasonableness threshold based on the resource's corresponding fuel region to account for day of/intra-day pricing and multiple appropriate index points. Bonneville also believes the proposed elimination proposal may be significantly harmful to hydro resources and suggest the CAISO include an intra-day gas price adjustment in the gas price floor. The CAISO agrees that hydro resources with the default energy bid should be able to account for changes in gas prices and has revised its proposal in Section 6.3.2 Hydro Resource Default Energy Bid.

Puget Sound Energy is further concerned that the proposal does not account for resources capable of dual fuel usage and requests a modification to ensure these resources can apply the correct reference level, as conditions warrant. The *Commitment Cost and Default Energy Bid Enhancements* CDEBE policy accounts for resources described by Puget Sound Energy.¹⁰

4.4 EIM Decisional Classification

The CAISO received several comments on the CAISO's proposed EIM classification in the revised straw proposal. PacifiCorp, Powerex, and Seattle City Light support the proposed classification of the various elements, while SLC notes it is unlikely this initiative would have been undertaken without EIM entities that identified the concerns being addressed. Powerex also highlights how current governance can result in the EIM Governing Body having only a secondary role on an issue of primary importance to—and initiated by—entities outside of the CAISO. The Public Generating Pool does not agree with the proposed classification and recommends the entire initiative should fall under the primary decision making authority of the EIM Governing Body.

The CAISO responds to these concerns with the proposed EIM classification by emphasizing that most elements of this initiative – including the need for mitigation process enhancements – were identified by the CAISO. While EIM entities were the first to raise concerns that the default energy bids did not adequately reflect opportunity costs for hydro resources, the CAISO's exploration of the "EIM Offer Rules" led it to discover that mitigation rules were an issue throughout the market as whole. Moreover, the CAISO identified additional elements, beyond local market power mitigation, that are directed toward improving the market as a whole. These included reference level adjustment processes, gas price indices, and the introduction of the hydro default energy bid. All these elements are equally impactful to CAISO and EIM entities. Additionally, the Governing Body's authority guidance document for handling policy

¹⁰ See Revised Draft Final Proposal at page 37: <http://www.aiso.com/Documents/SecondRevisedDraftFinalProposal-CommitmentCosts-DefaultEnergyBidEnhancements.pdf>.

initiatives does not hinge on who identifies issues. Rather, their authority hinges on whether an EIM specific design feature is a cure to the issue being addressed. For all of these reasons, the CAISO believes the primary driver for this initiative is to improve the performance of the entire market.

5. Principles

The CAISO believes the following market design principles are appropriate when considering design enhancements to the market power mitigation process, default energy bids, and the reference level adjustment process:

- Supply should not be forced to sell power below its bid price if it cannot exert market power. Supply bids should be mitigated to marginal costs to the extent supply has market power.
- EIM is a voluntary market but the design assumes sharing of ramping capability. In cases of mitigation involving EIM transfers to another BAA, entities should not be forced to sell energy at mitigated prices beyond: 1) the pre-mitigation transfer quantity or 2) the base transfer quantity. This quantity should be further adjusted to include the flexible ramping up awards in the market power mitigation run, less the BAAs flexible ramping up requirement.¹¹ Ultimately, the use of mitigated bids should not result in additional economic displacement of other supply.
- Mitigated bid prices should be based on a competitive locational marginal price in each interval that accurately reflects market conditions.
- The marginal costs used to calculate default energy bids for hydro resources should include opportunity costs for future market sales and for sales at other geographic locations.
- Gas prices used to calculate reference levels should account for real-time gas prices volatility so that the CAISO efficiently dispatches supply, resulting in accurate market prices that minimize the need for after-the-fact cost recovery.

6. Proposal

The CAISO proposes five enhancements in this initiative:

- Local market power mitigation process enhancements to prevent cases of flow reversal
- Local market power mitigation process enhancements to limit cases of economic displacement
- The introduction of a default energy bid for hydro resources

¹¹ This adjustment recognizes that energy and flexible ramping up capacity should be fungible in the pricing run.

- Modifications to the reference level adjustment process
- Changes to the gas price indices used in the real-time market

Additional details on each element is provided in more detail below.

6.1 Mitigation Process Enhancements

The CAISO proposes to modify limited parts of the market power mitigation process to address stakeholders concerns associated with inappropriately mitigating energy bids in the EIM. The flow reversal proposal, described below, will also be applicable to resources within the CAISO BAA. These changes will reduce instances when a resource's energy bid is mitigated to its default energy bid.

6.1.1 Prevention of Flow Reversal

Flow reversal occurs in cases when an EIM BAA or group of BAAs are import-constrained during a prior market interval, which triggers mitigation for the balance of the hour in the 15-minute market run (or balance of the 15-minute interval in the real-time dispatch). As system conditions change, this can result in a BAA exporting at mitigated bid prices for the remainder of the hour.¹² As a result, a resource within the mitigated BAA can be forced to sell at mitigated prices that could be lower than the resource's estimated marginal costs—particularly if the default energy bid fails to appropriately reflect these marginal costs.

Balance of the Hour Mitigation

The current market process can lead to flow reversal when the competitive locational marginal price used for mitigation in one market run is restricted from increasing in subsequent market runs. If a resource is mitigated in a prior 15-minute market run, the mitigated bid price will be applied for the remainder of the hour in both 15-minute market and real time dispatch. If a resource is mitigated in a prior real-time (5-minute) dispatch run, the mitigated bid will be applied for the remaining three intervals of the 15-minutes.

The resource's offers will be subject to mitigation at the higher of the resource's default energy bid or the competitive locational marginal price. While the actual competitive locational marginal price (*i.e.*, reflecting actual locational marginal prices in the current interval) can change in subsequent market runs, current rules do not allow the mitigated bid price to reflect increases in the actual competitive locational marginal price. If a resource is mitigated for the balance of an hour in the 15-minute market (or balance of

¹² Based on analysis performed by the Department of Market Monitoring, flow reversal has the potential to occur "up to 2% of all 15-minute intervals" and ".4% of all 5-minute intervals. The analysis performed by DMM underestimates the magnitude of the problem because Powerex is setting export limits to zero in hours where they believe flow reversal is most likely to occur. For more details on this analysis see pp.6 and 7 of the DMM's July, 2018 EIM Governing Body General Session Presentation <https://www.westerneim.com/Documents/DepartmentofMarketMonitoringUpdate-Presentation-Jul2018.pdf>

the 15-minute interval in the real-time dispatch) the current rules fix a mitigated bid price unless the competitive locational marginal price decreases.

As a result, if a resource's offer is mitigated to a lower competitive locational marginal price than the actual competitive locational marginal price in the current interval, the resource can become more economic relative to other competitive supply. This can result in a BAA exporting power at mitigated prices that are lower than an appropriate level of mitigation.

The CAISO initially designed these market mitigation rules due to software limitations and with the intent of limiting the frequency of resources responding to rapid ramping instructions. The Department of Market Monitoring later confirmed the CAISO's understanding of the issue within comments submitted on October 4, 2018.¹³ Since the implementation of the original policy, the CAISO market software has been enhanced and the mitigation performance has been improved, making these measures no longer needed.

The CAISO proposes addressing the issue of flow reversal by eliminating current rules for balance of the hour mitigation in the 15-minute market (or balance of the 15-minute interval in the real-time dispatch) and modifying how the competitive locational marginal price is used in each interval. In addition, the CAISO proposes to update the mitigated bid price in each interval based on the current competitive locational marginal price. Further, the CAISO proposes that a resource mitigated in the 15-minute market will no longer automatically be mitigated in the 5-minute real-time dispatch in the corresponding intervals.

Mitigated Price Adder

As discussed at the August 3, 2018 Market Surveillance Committee meeting,¹⁴ even if the competitive locational marginal price is calculated for each interval and market run, mitigated prices can result in a resource's default energy bid that is equal to the competitive locational marginal price. To address this concern the CAISO is proposing to add a small parameter to that the mitigated price established inside the constrained BAA or region to create price separation from the external competitive locational marginal price. The CAISO proposes to include a maximum price adder of \$0.10 in the tariff, with the actual adder necessary to meet the objectives of the rule in the business practice manual. The CAISO currently plans to use \$0.001 for the price adder.

The following mitigated bid calculation will be applied to resources assuming the market bid is higher than the default energy bid:

¹³ <http://www.caiso.com/Documents/DMMComments-LocalMarketPowerMitigationEnhancements-IssuePaper-StrawProposal.pdf>

¹⁴ The presentation is available at: http://www.caiso.com/Documents/Presentation-EIMMarketPowerMitigationDiscussion-FTI-Consulting-Aug7_2018.pdf

$$\text{Mitigated Bid} = \text{MAX} (\text{Default Energy Bid}, \text{Competitive Locational Marginal Price} + \$0.001)$$

The parameter added to the competitive locational marginal price is nominal, used to establish price separation between competitive and non-competitive areas. This price separation will further prevent flow reversal from occurring in cases when a resource is mitigated to either the resource’s default energy bid, or the competitive locational marginal price. For all of the following examples, a \$1 adder will be used as the nominal price adder for illustration purposes only.

The examples below illustrate the current mitigation process of the market run for the 15-minute market, as well as the proposed changes to address the potential for flow reversal.

Example A: Mitigation Occurs in the First 15-Minute Market Interval

Current Mitigation Process

Interval	Unmitigated Bid	Actual Competitive LMP	Default Energy Bid	Market Power Detected	Mitigated Bid	Carry Through Rule	Flow Reversal
1	\$60	\$30	\$25	Yes	\$30	No	No
2	\$60	\$60	\$25	No	\$30	Yes	Yes
3	\$60	\$62	\$25	No	\$30	Yes	Yes
4	\$60	\$59	\$25	No	\$30	Yes	Yes

- Market power is detected in the first 15-minute market interval. The mitigated bid price for this resource is \$30 because the actual competitive locational marginal price is greater than the submitted default energy bid of \$25.
- The mitigated bid of \$30, from the first interval, is carried through as the mitigated bid price for the remaining intervals in the hour based on the current balance of the hour rule.
- Flow reversal occurs in intervals two, three and four because the resource is forced to sell at its mitigated bid price of \$30 in these intervals. This mitigated bid price is less than the actual competitive locational marginal price.

Proposed Mitigation Process

Interval	Unmitigated Bid	Actual Competitive LMP	Default Energy Bid	Market Power Detected	Mitigated Bid	Carry Through Rule	Flow Reversal
1	\$60	\$30	\$25	Yes	\$31	No	No
2	\$60	\$60	\$25	No	\$60	No	No
3	\$60	\$62	\$25	No	\$60	No	No
4	\$60	\$59	\$25	Yes	\$60	No	No

- Since market power is detected in interval one, the mitigated bid price is \$31 because the actual competitive locational marginal price + \$1 is greater than the default energy bid of \$25.
- Market power is not detected in interval two; therefore, the mitigated bid price is based on the unmitigated bid of \$60.
- Market power is not detected in interval three; therefore, the mitigated bid price is based on the unmitigated bid of \$60.
- Market power is detected in interval four; therefore, the mitigated bid price is \$60 because the actual competitive locational marginal price + \$1 and the unmitigated bid price are equal.
- As a result of eliminating the balance of the hour mitigation rule, the mitigated bid price has flexibility to change and flow reversal does not occur even when market power is detected.

Example B: Mitigation Occurs in the Third 15-Minute Market Interval

Current Mitigation Process

Interval	Unmitigated Bid	Actual Competitive LMP	Default Energy Bid	Market Power Detected	Mitigated Bid	Carry Through Rule	Flow Reversal
1	\$60	\$30	\$25	No	\$60	No	No
2	\$60	\$45	\$25	No	\$60	No	No
3	\$60	\$26	\$25	Yes	\$26	No	No
4	\$60	\$50	\$25	No	\$26	Yes	Yes

- Market power is detected in the third 15-minute market interval. The mitigated bid price for this resource is \$26 because the actual competitive locational marginal price is greater than the submitted default energy bid of \$25.
- The mitigated bid of \$26, from the third interval, is carried through as the mitigated bid price for the remaining interval in the hour based on the current balance of the hour rule.

- Flow reversal occurs in interval four because the resource is forced to sell at its mitigated bid price of \$26 in this interval. This mitigated bid price is less than the actual competitive locational marginal price.

Proposed Mitigation Process

Interval	Unmitigated Bid	Actual Competitive LMP	Default Energy Bid	Market Power Detected	Mitigated Bid	Carry Through Rule	Flow Reversal
1	\$60	\$30	\$25	No	\$60	No	No
2	\$60	\$45	\$25	No	\$60	No	No
3	\$60	\$26	\$25	Yes	\$27	No	No
4	\$60	\$50	\$25	No	\$60	No	No

- Market power is not detected in intervals one and two; therefore, the mitigated bid price is based on the unmitigated bid of \$60.
- Market power is detected in interval three; therefore, the mitigated price is \$27 because the actual competitive locational marginal price +\$1 is greater than the submitted default energy bid of \$25.
- Market power is not detected in interval four; therefore, the mitigated bid price is based on the unmitigated bid of \$60.
- As a result of eliminating the balance of the hour mitigation rule, the mitigated bid price has flexibility to change and flow reversal does not occur even when market power is detected.

Although the above example shows that with the implementation of the proposed rules, flow reversal will not occur when market power is detected, there is still a possibility that bids in another BAA are mitigated to below \$27, thus causing flow reversal to occur. For this reason, the CAISO will enforce a net EIM transfer constraint in the third 15-minute market interval (after the market power mitigation run) to prevent a potential flow reversal.

6.1.2 Prevention of Economic Displacement between Mitigated Balancing Authority Areas (BAAs)

As described above, the changes to the balance of the hour (or 15-minute interval) mitigation rules will address flow reversal when a single BAA is import-constrained. However, additional rules are needed to address instances of “economic displacement” due to mitigated bid prices that can occur when a group of EIM BAAs become import-constrained, which triggers mitigation.

As observed in previous examples, market power mitigation can result in a different dispatch within BAAs in the constrained regions when mitigated bids are used. However, given the voluntary nature of the EIM, allowing for economic displacement of

resources between EIM BAAs that occurs solely due to using mitigated bids should be addressed. Economic displacement due to mitigated bids occurs when energy from one resource is replaced with energy from another, beyond what is necessary to resolve market power. Mitigated bids that result in additional transfers in a voluntary market can be problematic – particularly in cases when the default energy bid is lower than a resource owner’s estimate of current marginal costs. Economic displacement has the potential to reduce transfer capability within the EIM as BAAs may limit the amount they make available to limit economic displacement. It could potential also discourage additional EIM participation.

The CAISO proposes a market rule that would prevent economic displacement by not allowing transfers between two EIM BAAs to increase beyond a specified amount between then market power mitigation run and the market run for a specific interval. This rule would limit transfers from the mitigated BAA when exporting to the greater of: (1) the pre-mitigation transfer quantity or (2) the base transfer quantity, plus the sum of the flexible ramping up awards in the market power mitigation run in excess of the BAA’s flexible ramping up requirement. The additional allowance recognizes that energy and flexible ramping up capacity are fungible in the next market run, and that flexible ramping up awards in excess of the requirement are procured for uncertainty that may materialize in other BAAs.

The proposed rule is presented formulaically below:

$$T_{BAA} \leq \max(T_{BAA}^{(Base)}, T_{BAA}^{(MPM)}) + \max\left(0, \sum_{i \in BAA} FRU_i^{(MPM)} - FRUR'\right)$$

T_{BAA}	Net EIM Transfer of the mitigated BAA
$T_{BAA}^{(Base)}$	Base net EIM Transfer of the mitigated BAA
$T_{BAA}^{(MPM)}$	Pre-mitigation (market power mitigation run) net EIM Transfer of the mitigated BAA (for RTD, the previous RTD run serves as the market power mitigation run)
$FRU_i^{(MPM)}$	Flexible ramping up award for resource i (in the MPM run)
$FRUR'$	Flexible ramping up requirement for the mitigated BAA, adjusted for EIM diversity and demand elasticity

This proposed rule will use the maximum of the transfer scheduled in the market power mitigation run or the base transfer. After the maximum value is identified, the rule will add the mitigated BAA’s flexible ramping-up awards in excess of the adjusted flexible ramping-up requirement for the following reasons. It is appropriate to use the transfer scheduled in the market power mitigation run if it is a quantity greater than the base transfer amount because using a lower amount would undo the market results and

potentially result in a solution in which the transfer is limited such that the receiving BAA was unable to meet its imbalance energy requirement. It is also appropriate to incorporate the sending BAA's flexible ramping up awards in excess of the flexible ramping up requirement because the EIM design assumes sharing of flexible ramping capacity between BAAs. Accordingly, each BAA's flexible ramping requirement used in the resource sufficiency test is reduced by a diversity benefit.

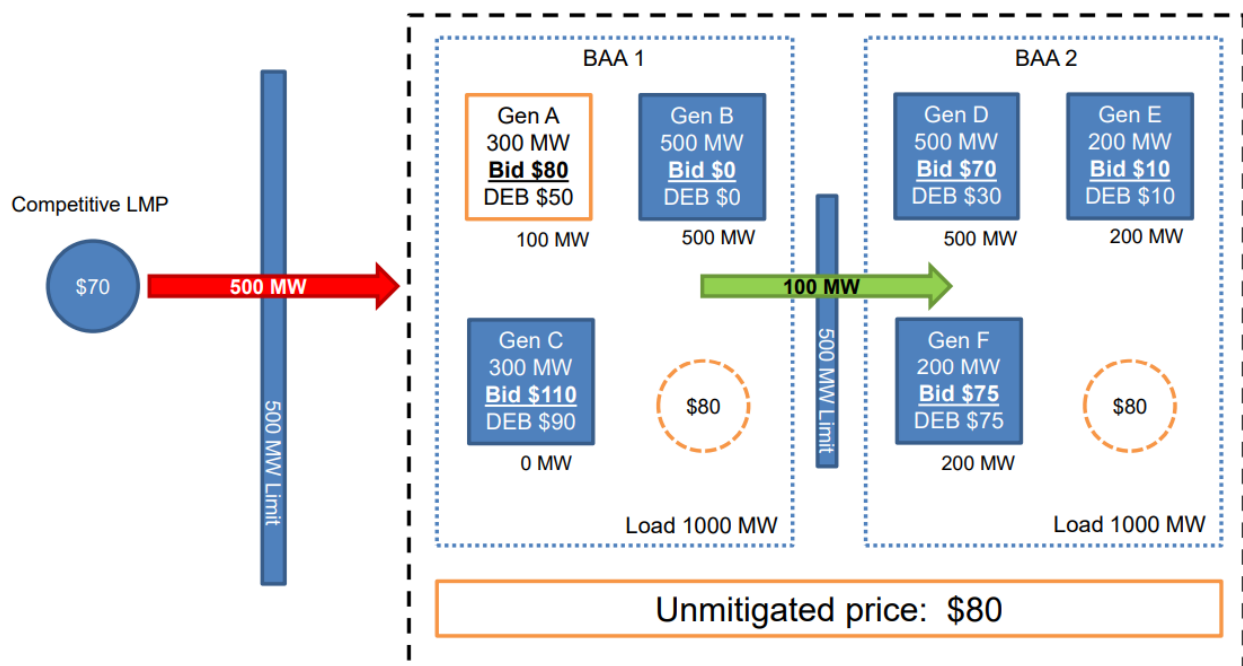
This rule will be applied apply in both the 15-minute market and real-time dispatch, so that every interval is tested separately. In the event the transfer constraint is binding in the pricing run, the congestion rents will accrue to the source EIM BAA. This is consistent with the current EIM treatment for congestion rents, in which congestion rents accrue to the BAA where the constraint is located (the transfer constraint is specific to the source BAA).

The CAISO proposes that application of this rule be optional to address EIM participant concerns that this rule could reduce transfers between EIM BAAs and consequently limit EIM benefits. Each EIM entity would have the option to activate this rule to enforce EIM transfer limitations after mitigation. Upon implementation, the default setting for the rule would be inactive for all EIM BAAs. Accordingly, BAAs that choose to enforce the rule would need to make the appropriate designation in the CAISO's Master File. EIM entities would therefore have the capability to enforce or disable this rule through the normal Master File registration process. Those EIM entities that elect to enforce it may need to ensure their respective OATT processes are aligned to appropriately respond to the corresponding transfer limitations.

Example C below presents a simplified case of economic displacement with this proposed rule applied to the mitigation process.

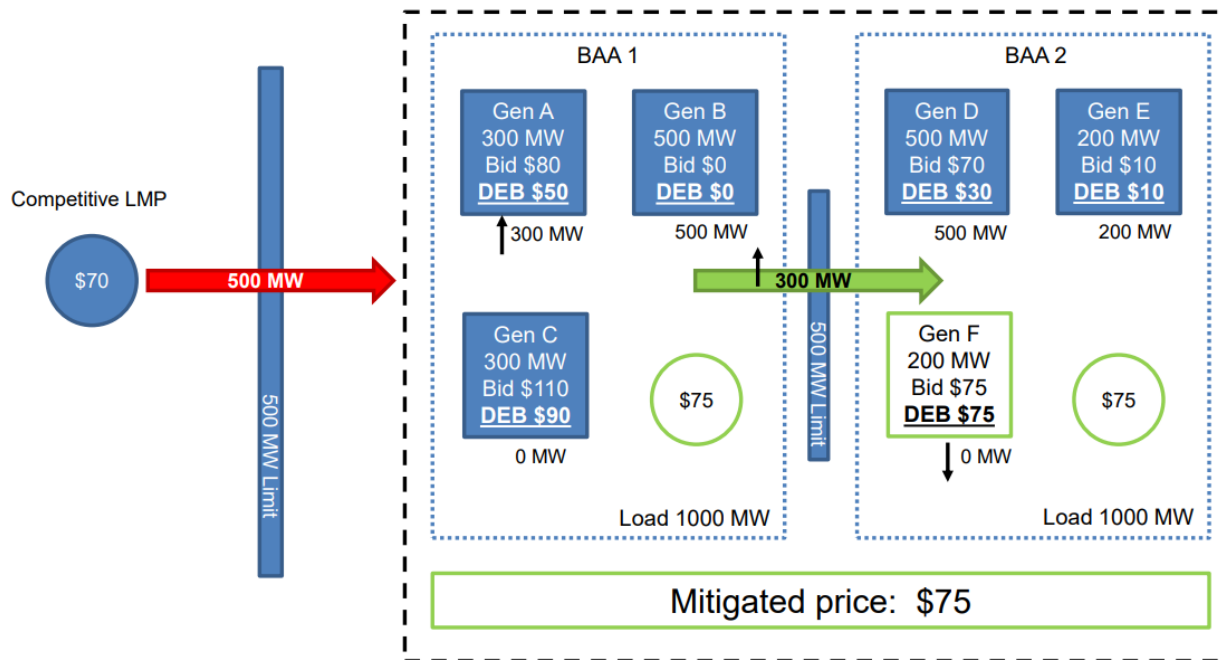
Example C

1. Market Power Mitigation Run



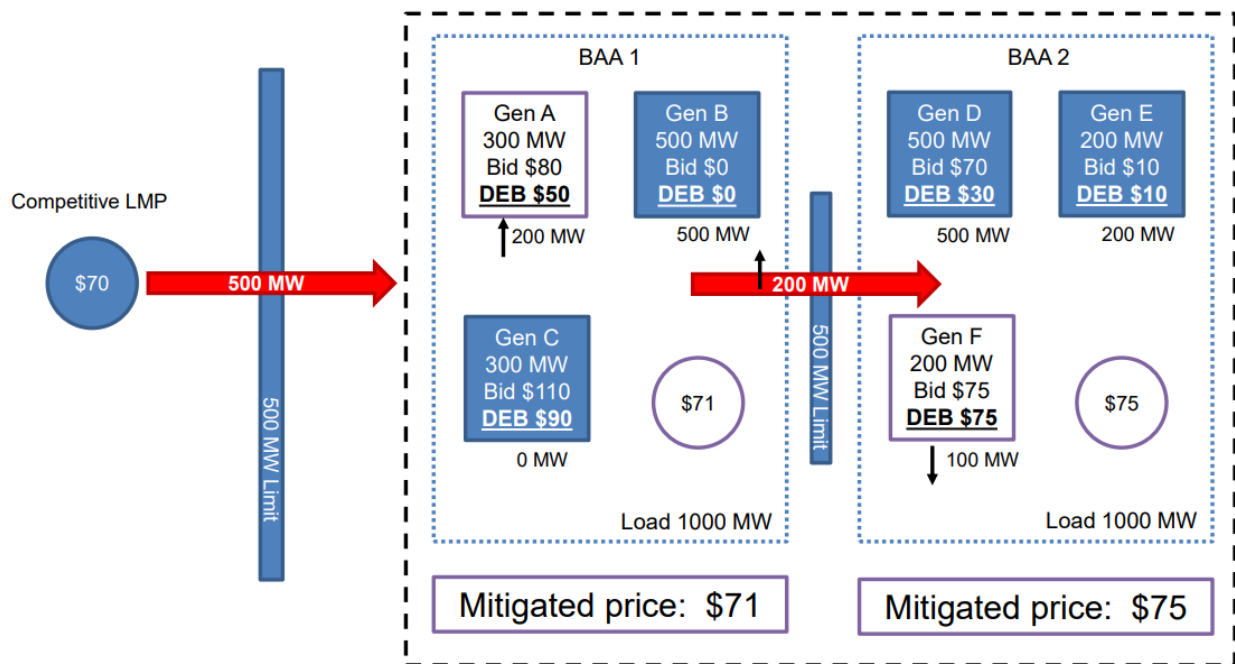
- BAA 1 and BAA 2 are in a constrained region, with a competitive locational marginal price of \$70. Imports into the region are binding at 500 MW.
- BAA 1 is exporting 100 MW to BAA 2. The bids result in a price of \$80 for both BAAs.

Market Run



- The default energy bids are examined in this market run, resulting in an increase in Generator A from 100 MW to 300 MW, and a decrease in Generator F, from 200 MW to 0 MW.
- This results in a price of \$75 for both BAA 1 and BAA 2, as Generator F is the marginal generator for both BAAs (assuming BAA 2 could reduce imports to BAA 1).

Market Run with Proposed Rule

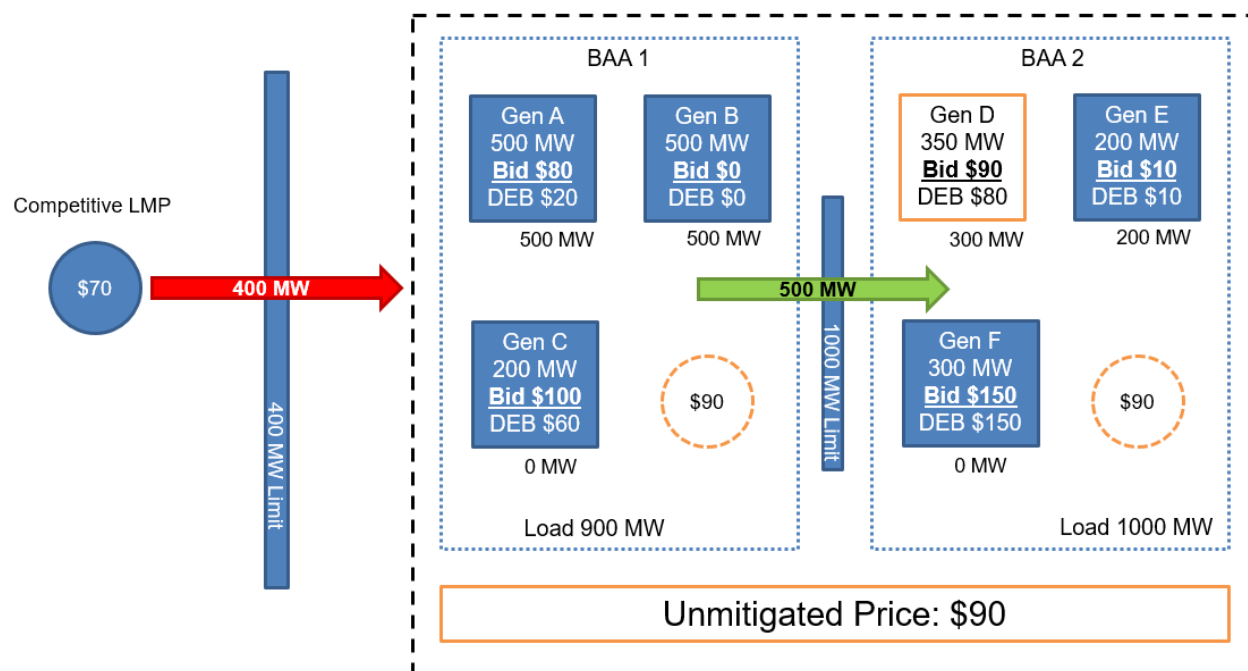


- By introducing a rule that would limit exports from any EIM BAA to the greater of: (1) base EIM transfer (assumed zero); or (2) pre-mitigation (MPM) export (100MW), plus the flexible ramping up awards in excess of the adjusted flexible ramping up requirement for the mitigated BAA.
- In this example, it is assumed that the flexible ramping upwards in BAA 1 amount to 200 MW with an adjusted flexible ramping up requirement of 100MW. Accordingly, exports can increase from 100 MW in the market power mitigation run to 200 MW.

The rule does have shortcomings in the real-time dispatch, since the market power mitigation and pricing runs do not occur in the same interval. The transfer constraint quantity would be determined using the advisory interval from the previous market run. Consequently, changes in system conditions can result in a transfer that would have been different had the market inputs from the binding interval been used. The CAISO highlights this scenario below:

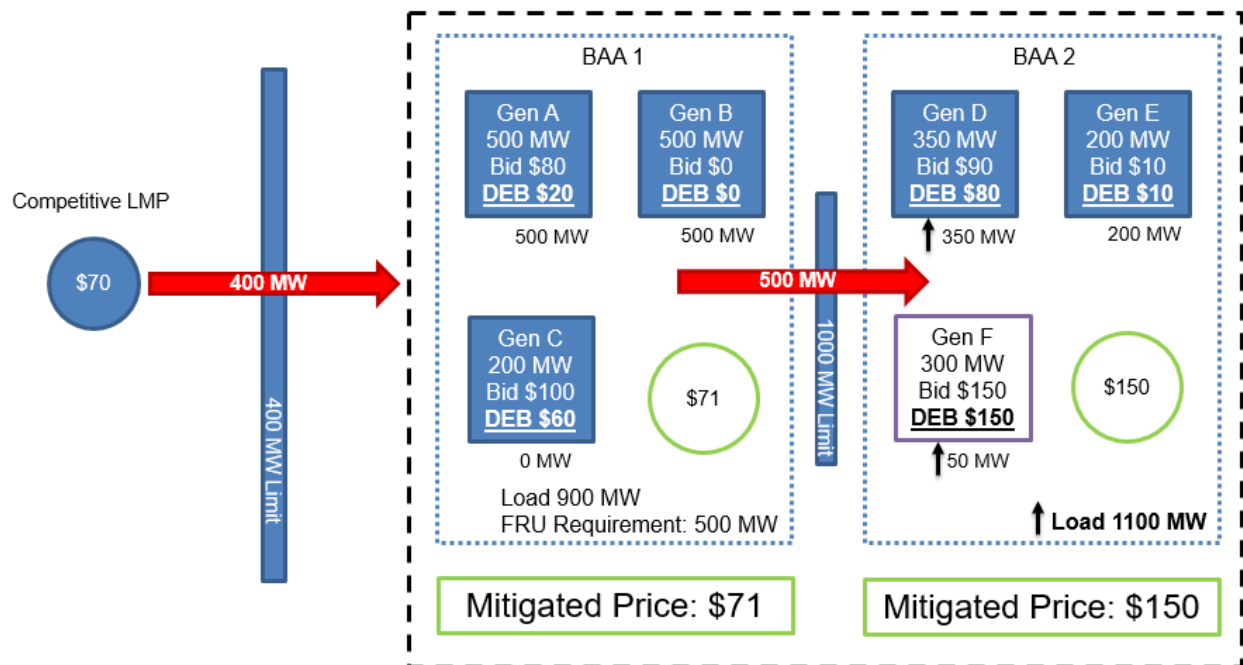
In this example, the advisory interval load forecast is lower than the actual load forecast in the binding interval. Since the transfer limit for BAA 1 is established based upon the lower load forecast this results in lower transfers than would have been scheduled had a the actual load forecast been used. This results in BAA 2 relying on internal resources alone to cover for the load change in the combined bubble.

RTD Market Power Mitigation Triggered in Advisory Interval of Prior RTD Run



- Assume imports into BAA 1 are binding at 400 MW, the base EIM transfer for BAA 1 is 0 MW, and the BAA 1 Flexible Ramping Up awards are 0 MW.
- Assume then Generator D has a capacity of 350 MW and that Gen F has an offer price and default energy bid of \$150. Suppose that the unmitigated dispatch in the advisory interval was based on 1000 MW net load in BAA 2 and 900 MW in BAA 1 so there would be 500 MW of exports to BAA 2.
- The price would then be \$90 in both BAA 1 and BAA 2 in the unmitigated dispatch.
- With the proposed mitigation process changes, prices and transfers would be used in the binding RTD.

Load Increases by 100 MW in BAA 2 Compared the Prior Market Run



- With the transfer from BAA 1 capped at pre-mitigation EIM transfer of 500 MW, the price in BAA 2 would rise to \$150 set by Generator F, while the lower cost generation available in BAA 1 goes undispached because of the binding limit (500 MW) on exports, even though the dispatch of resource C in BAA1 would be economic even at the unmitigated offer price (\$100).
- The application of mitigation will raise the price paid by imbalance purchasers in BAA 2. Congestion rents in this example would be paid entirely to BAA 1.

The CAISO acknowledges these concerns and recognizes that limiting exports will create the potential caused by different loads and resource availability between the advisory runs and real-time dispatch runs. However, there is an inherent shortcoming of using the advisory interval for mitigation purposes in the real-time dispatch. Ultimately, while limiting transfers of energy that could potentially be needed by an importing BAA to meet load in real-time dispatch, this is inconsistent with requiring a neighboring BAA to sell its power in a voluntary market. Furthermore, the importing BAA can rely on internal resources, including those set aside as available balancing capacity to meet their load.

6.2 Hydro Resource Default Energy Bid

In response to stakeholders advocating for an alternate default energy bid for hydroelectric resources with limited generation capability, the CAISO proposes an additional default energy bid option. This new default energy bid option would capture opportunity costs for hydro resources to sell energy in markets outside of the CAISO and to generate replacement energy from a peaking resource. It also includes a floor that serves to ensure that the default energy bid is sufficiently large such that hydro resources with limited capability to run may not be dispatched more than energy available, dictated by short-term limitations, too frequently. This default energy bid will be available to hydro resources with storage in any of the BAAs – CAISO or energy imbalance market – that participate in the real-time market.

Accuracy of default energy bids reflecting opportunity costs are important anytime a resource's energy bid is mitigated to its default energy bid. If a default energy bid is lower than opportunity costs, it can cause a resource with limited availability to run inefficiently, or earlier than at optimal times. This in turn could result in reducing energy available to markets, or worse not offering any energy into the market and reducing overall market capability and efficiency.

The CAISO currently offers a default energy bid opportunity cost adder, which considers the limited availability of fuel for a resource over a specified time horizon. This default energy bid option allows hydro resources bidding at forecast future local prices to be optimally dispatched over that time horizon. Although these opportunity cost adders can account for intertemporal energy sales at a unit's specific location, they do not capture the potential opportunity for intertemporal energy sales outside of the CAISO's real-time energy market. They also do not reflect the short-term – potential daily – limitations that hydro resources, including those with long-term storage, encounter.¹⁵

Background

Hydro resources are unlike many other resources that currently participate in the CAISO and energy imbalance markets. Gas resources typically have default energy bids that are computed using heat rates, fuel costs, and other variable inputs which roughly approximates their marginal cost to operate at any given time during a day. Wind resources and solar resources generally can respond to dispatch instructions to reduce output when prices are sufficiently low, but produce as much energy as possible when prices are higher, unless otherwise instructed by the CAISO. Hydro resource owners may make decisions to generate based on opportunity costs for water, but may also be primarily concerned with other water flow considerations. Additionally, hydro opportunity costs tend to be very complicated to calculate and may change even within a specific day.

¹⁵ In addition to the opportunity cost adders, hydro resources are also eligible for variable cost, LMP, and negotiated rate default energy bids, like other resources participating in CAISO markets and the EIM.

Models that hydro resource owners use to calculate daily generation quantities may be very complex and may take into account various probabilities for different water inflow considerations – which may depend on variable intraday weather, upstream conditions, and corresponding spill probabilities – as well as downstream conditions, and legal restrictions and obligations for water that may be moved past the facility. These models may consume hundreds of inputs and may imply opportunity costs that change drastically even within a single operating day. It is unreasonable to believe that the CAISO would be able to replicate these calculations during all intervals, particularly since default energy bids are fixed over the course of the day.

Because of these considerations a hydro resource may be particularly sensitive to a default energy bid that dispatches the resource more frequently than the predicted generation quantities that result from the resource owner’s model. This may occur when local market power mitigation is triggered and a higher bid coming from a hydro resource is mitigated to the default energy bid in multiple intervals, and the water allocation for the day is depleted. If this happens early in an operating day, the resource may be unable to run during the evening ramping hours, when energy prices are highest, because reservoir water was depleted earlier in the day. This discourages participation of such resources in the market, and may force the CAISO to forgo their participation in hours when their flexibility is most needed.

Additionally, hydro resource operators may not dispatch their resource based strictly on the opportunity cost of water, but may instead prioritize managing local water conditions, and may only operate the resource to earn energy market revenues as a secondary objective. Hydro resources that are often dispatched too frequently may find it challenging to meet legal water flow requirements imposed by regulators, and this could result in self-scheduled resources and reduced participation in real-time energy markets.

Most hydro resources are fast ramping and can be highly effective at managing the increasing ramping needs necessary for reliable energy grid operations. More participation of fast ramping resources allows the CAISO to respond to sudden energy needs from changing system conditions, which reduces the total number of power balance constraint violations. This in turn reduces price volatility and overall market prices, and effectively, energy prices faced by ratepayers.

Default Energy Bid Calculation

The CAISO proposes a new default energy bid option for hydro resources that reflects the following factors:

- Maximum storage horizon
- Ability to sell energy at different locations inside and outside their balancing area
- Opportunity cost of generation by substituting local gas resources

- Potential short-term limitations

This default energy bid would be available for any hydro resource in a CAISO or energy imbalance market area that has storage available and can be bid in and dispatched through the real-time market. This is in contrast today in which hydro bids largely use negotiated default energy bids negotiated separately and non-publicly. The CAISO believes a standard hydro default energy bid option is important to treat hydro resources comparable with gas-fired resources, which already have a standard cost-based option. A standard hydro default energy bid will also add transparency to default energy bids for hydro resources.

When this default energy bid option is selected, the resource owner will be required to demonstrate the resource's maximum storage horizon, and will have the option of demonstrating the ability to make bilateral sales at additional locations.

The proposed default energy bid for a hydro resource with storage will have the following three components:

$$DEB = MAX(Gas\ Floor, Local\ Floor, Geo\ Floor)$$

And:

$$Gas\ Floor = (Peaker\ Heat\ Rate * GPI) * 1.1$$

$$Local\ Floor = MAX(DA\ Index, BOM\ Index, M\ Index_{+1}) * Mult$$

$$Geo\ Floor = MAX(DA\ Index, BOM\ Index, M\ Index_{+1}, \dots, M\ Index_{+12}) * 1.1$$

Where, the *M Index* values in the geographic (Geo) floor term of the calculations would be limited to the number of months within the resources storage horizon,¹⁶ and

- *DA Index* – Day-ahead (DA) peak price at the trading hub
- *BOM Index* – Balance-of-month (BOM) futures price for the current month at the trading hub
- *M Index_{+N}* – Monthly index futures price at the trading hub for the successive months *N* after the current month
- *Mult* – A multiplier, specified as 1.4, is applied to the local floor to establish a default energy bid value sufficiently high to not deplete a resource too frequently
- *Gas Heat Rate* – Average heat rate for a typical gas resource¹⁷
- *GPI* – The specific gas price index for the resource¹⁸

¹⁶ Any resource with one month of storage or less will receive a default energy bid that includes the *M Index₊₁*, but not additional *M Index* terms. Resources with longer than 12 months of storage will receive a default energy bids with *M Ahead* terms from *M Index₊₁* and additional months through *M Index₊₁₂*.

¹⁷ The heat rate used throughout examples in this paper is 11,176 Btu/kWh. This heat rate is cited by the Energy Information Agency as an average heat rate for a gas turbine resources in 2017: https://www.eia.gov/electricity/annual/html/epa_08_02.html.

¹⁸ The process for any resource to set up a gas price index is already specified by the CAISO, and hydro resources applying for this default energy bid will be subject to the same process already in place.

The CAISO will calculate this default energy bid for each resource once per day. Most of the inputs for this formula are also updated each day to reflect current market conditions.

This proposed default energy bid calculation includes three components, the *Gas Floor*, *Local Floor*, and the *Geographic Floor*. The *Gas Floor* and the *Geographic Floor* components of the default energy bid represent the opportunity costs for the hydroelectric generator to substitute peak energy from a gas resource and opportunities to sell energy in geographic areas outside of the resource's local area, respectively.

The local floor is computed using local hub prices, which may be used as a rough proxy for average levels of energy imbalance market energy prices. A multiplier, of 1.40, will be applied to this calculated value so that it can be used to ensure the default energy bid is not higher than local energy imbalance market prices too frequently. This may prevent hydro resources using this default energy bid from being dispatched inefficiently or depleting water reserves too early in an operating day. The local floor component of the default energy bid is used as a cap for acceptable bids for hydro resources. This 1.40 multiplier is based on the analysis described below with an intent of having the resource not dispatched more than 4 hours per day in a range of 95-99% of the time based on modeling EIM prices in various EIM BAAs compared to the representative bilateral hub prices.

The gas floor is calculated similar to a variable cost default energy bid for a gas resource. The heat rate for an average peaking resource is multiplied by the gas price index for a representative gas resource if it were at the same location. This calculation is completed by applying a 110% multiplier, similar to calculations for other default energy bids.

The geographic floor is calculated as the maximum of the day-ahead, balance of month, and month ahead indices for the resource. Resources are eligible for future month-ahead prices, up to the amount of maximum storage horizon. For example, if a resource has three months of storage, the month ahead index for the successive month, two months in advance, and three months in advance are used. The geographic hub may be different than the local hub, and is specified through a consultative process with the ISO where demonstration of firm transmission rights is required. Further, if firm transmission rights are shown for multiple hubs, a resource will receive the greater geographic floor, as determined each day.

Customizable Inputs

This default energy bid formula has two inputs that may be customized for each resource receiving this default energy bid. These include:

- Maximum storage horizon
- Long term bilateral hub

The maximum storage horizon represents the maximum length of storage a hydro resource has when cycling reservoirs during typical hydro year conditions. This component of the default energy bid is included to represent the total amount of time a resource could store energy, and the derivation of this value should be computed comparing historic pond elevations for multiple years for the hydro project and observing typical cycling times for the resource. The specific calculation may be the average length of time between each period when the water is at peak levels. This value represents the amount of time in the future that a resource may have an opportunity when selling energy at the current time.

For example, a hydro facility that has some available reservoir storage capacity but generally drains and fills (cycles) on a weekly basis throughout the year, would be a storage facility with less than one month worth of storage. For these resources, generally generating today means the loss of future energy sales at a later time during the same month, but generally does not mean the loss of sales perhaps more than 45 days in the future. In another example, a hydro facility with an annual pattern where reservoirs are emptied prior to spring months, run at maximum capacity or spill during the spring months, and run selectively during summer months when available prices are highest, may have multiple months of storage, but less than 12 months. A similar resource that does not need to run at full output during expected peak inflow may have 12 months or more of storage.

The CAISO will require resource owners to submit a proposed value for the maximum storage length, include an attestation that this value corresponds to the definition of the maximum storage horizon, and provide corroborating information for validation by the CAISO. Corroborating data may include several years of historic water levels at the specific hydro facility and regulatory filings related to the operations of the resource.

The CAISO proposes to offer five different bilateral energy-trading hubs for hydro resources with this default energy bid, which will be included in the geographic floor component of the default energy bid. These include Mid-Columbia, Palo Verde, Alberta, north-of-path 15, and south-of-path 15.¹⁹ Hydro resources with storage within particular energy imbalance market areas or areas within CAISO will be eligible for a default bilateral energy hub, indicated in the table below. CAISO will identify some default hubs that will be included in the geographic component of the default energy bid calculation and will be the default value.

Table 1 below shows the mapping that will be used for default bilateral trading hubs.

¹⁹ Additional bilateral hubs were considered, but to maintain ease of calculation CAISO has elected to offer these five hubs. CAISO included Alberta in the list of geographic hubs, and will offer this hub if it can be demonstrated that the hub is robust enough to be used in these calculations. CAISO is currently performing analysis to make this determination. This determination will be made if the trade volume at Alberta is within 10% of the lowest trade volume for the other hubs that will be offered.

Table 1: Default bilateral energy trading hubs

Resource Area	Default Bilateral Hub
PacifiCorp West, Portland, Powerex, Puget Sound	Mid-Columbia
Arizona, Idaho, PacifiCorp East, NV Energy	Palo Verde
Northern California	North-of-path 15
Southern California	South-of-path 15

In addition to the default bilateral hub, which will be used in the geographic floor portion of the default energy bid, a resource owner will also have the opportunity to select additional bilateral hubs, for use in the geographic hub component of the default energy bid. To do this, the market participant will be required to show the CAISO firm transmission from the resource to one of these hubs or an electrically similar location.²⁰

Resource owners opting for this default energy bid will be required to request this default energy bid, specific maximum storage horizons, and applicable bilateral hubs from the CAISO. Generally, the CAISO believes that maximum storage horizons are attributes for a resource that will not change over time. This parameter may be justified to the CAISO initially when requesting this default energy bid, but would not need to be reexamined later.²¹ However, because transmission contracts can change over time, resources electing this default energy bid would be required to resubmit documentation to demonstrate firm transmission rights on an annual basis. If a resource fails to submit documentation for a different bilateral hub, the default energy bid will automatically revert to one using the default bilateral hub. Additionally, each resource with this default energy bid will be required to submit documentation to the CAISO if shown firm transmission is no longer available during the year. Failure to report these changes may result in sanctions under existing applicable market rules. The CAISO will retain the right to audit this data, request additional information, and require a resource owner to attest to additional values and information submitted to the CAISO. If inaccurate

²⁰ Resources may demonstrate transmission to multiple locations, and the CAISO will make evaluations for each geographic hub and use the maximum value in calculating the default energy bid for those resources. Resources with less firm transmission rights than resource capacity will only be eligible for a weighted blend of bilateral prices between the hub with transmission rights and the default bilateral hub. Annual firm transmission rights need to be demonstrated by the resource owner, or demonstration of monthly purchases of the rights during the prior year. Values for each hub will be evaluated and compared on a daily basis by the ISO when computing default energy bids for all resources.

²¹ Acceptable documentation to verify maximum storage horizons may include analysis for historic reservoir conditions and/or a letter of attestation of available storage from the resource owner.

information is disclosed to the CAISO and discovered, eligibility for the use of this default energy bid may be revoked and resource owners may be referred to FERC.

Analysis

This CAISO performed detailed analysis to inform potential bounds on the multiplier applied to the local floor within the default energy bid for hydro resources with storage capability. The default energy bid is calculated for four different cases using actual EIM prices for the PacifiCorp East (PACE), PacifiCorp West (PACW), Puget Sound Energy (PSEI) BAAs, and the Powerdex hourly prices for Mid-Columbia. In each set of analysis additional information – including bilateral hub prices at the Mid-Columbia and Palo Verde trading hubs and gas price indices from October 2017 through September 2018 – was used to determine a potential appropriate multiplier for the local floor component of the default energy bid. The steps of this analysis are outlined below:

1. Calculate a default energy bid for each day during the time period.
 - a. The default energy bid was calculated for each day in the date range, using available historic data. The default energy bids for PacifiCorp West (PACW) and Puget Sound Energy (PSEI) BAAs, and the Powerdex hourly prices were calculated first with Mid-Columbia bilateral hub prices for both a 1 month storage horizon and a 3 month storage horizon. The default energy bids for PacifiCorp East (PACE) were calculated with Palo Verde bilateral hub prices for both a 1 month storage horizon and a 3 month storage horizon.
 - b. The Sumas fuel region was used to calculate the gas floor for the default energy bids associated with the PacifiCorp West (PACW) and Puget Sound Energy (PSEI) BAAs, and the Powerdex hourly prices. The Kern fuel region was used to calculate the gas floor for the default energy bids associated with the PacifiCorp East (PACE).
2. Compare the daily default energy bid to real-time prices in the EIM market.²²
3. Determine percentage of intervals that a resource would be dispatched if bidding into the market at default energy bids.

This analysis was carried out with a variety of multipliers applied to the local floor component of the default energy bid to determine how frequently resources with different storage horizons would be dispatched in the market. This analysis focuses on a resource with 3 months of storage being dispatched less than a particular amount of hours during each day, or that a resource with a particular amount of storage is dispatched at its available daily energy limitation or less.

²² This analysis considers the EIM prices as exogenous and does not consider changes in resource bidding or new market outcomes because of different default energy bids applying to some subset of resources.

If a hypothetical resource has 3 months of available storage and has generation capability of 4 hours per day, then **Table 2**, **Table 3**, and **Table 4** show that such a resource, bidding at this default energy bid with a 1.4 multiplier applied to the local floor, would be efficiently dispatched more than 95% of days in PacifiCorp East, PacifiCorp West and in Puget Sound Energy. In fact, resources in PacifiCorp West and Puget Sound Energy would be dispatched efficiently during 99% of days. This analysis shows that a resource was capable of producing 4 hours per day that with a 1.4 multiplier the resource may be completely depleted through dispatch less than 1-in-20 days regardless of if the resource was in the PacifiCorp East, PacifiCorp West, or Puget Sound Energy balancing areas.

In practice, any specific resource may have 4 hours of available storage on one specific day, but may have more or less on a different day and therefore this analysis will not reflect how often any specific resource is or is not dispatched too frequently. Instead, the objective of this analysis is to suppose a hypothetical resource and determine how often that resource is or is not dispatched inefficiently. The intent of this is to reflect the uncertainty of calculating the availability of any specific hydro resource because of their varying and subjective limitations, and to develop a default energy bid that is a reasonable reflection of a wide variety of hydro resource's opportunity costs.

Resources with more storage duration or the ability to generate during more hours would have a sufficiently high default energy bid during a greater percentage of intervals. Similarly, this multiplier would not be sufficient this frequency of intervals if the same resources had less storage availability or less energy that could be produced during a given time frame. CAISO attempted to identify a multiplier that could be applied that would be sufficiently high, to not distort dispatches for some resources that may be frequently mitigated. This default energy bid is not meant to be a prescriptive exact calculation that covers the opportunity costs for any potential resource at all times, and acknowledge that this default energy bids may be insufficient for some subset resources. These resources may find that a default energy bid or an opportunity cost adder may be more appropriate to capture certain resource limitations.

When reviewing this analysis it is important to note that resources with market based rate authority are not required to bid in at default energy bids, and may bid lower or higher than these values. Resources are dispatched based on bids, and if mitigated default energy bids, which implies that a resource may be dispatched below their available energy more or less frequently than indicated in these tables depending on their market bids. Further, it is important to note that CAISO will only insert default energy bids for a resource when local market power mitigation is triggered for that resource. Mitigation is triggered more frequently in some areas than in others, but also may not drive the results shown in the tables below. CAISO policy changes outlined in Section 6.1 detail how the local market power mitigation framework will be changed in this initiative, and may decrease the frequency that the mechanism is triggered.

Finally, **Table 5** below shows a similar resource subject to Powerdex hourly prices. The CAISO received feedback that indicated that Powerdex hourly prices may be more representative of future prices in the Northwest that hydro resource may face when more market participants join EIM, more transmission is available in EIM, and the day-ahead enhancement initiative is complete. Results for these prices, over the same time period show the same results, that the same resource, with a 1.4 multiplier applied to the local floor, may only be inefficiently dispatched during 3% of intervals.

Table 2: Percent a resource is dispatched less than potential daily availability (PACE prices)

Multiplier	Resource Storage Duration (Hours/Day)			
	2 Hrs.	4 Hrs.	6 Hrs.	8 Hrs.
120%	68%	89%	95%	98%
130%	73%	92%	97%	99%
140%	77%	95%	98%	99%
150%	82%	97%	99%	99%
160%	88%	98%	99%	100%

Table 3: Percent a resource is dispatched less than potential daily availability (PACW prices)

Multiplier	Resource Storage Duration (Hours/Day)			
	2 Hrs.	4 Hrs.	6 Hrs.	8 Hrs.
120%	80%	94%	100%	100%
130%	84%	97%	100%	100%
140%	88%	99%	100%	100%
150%	91%	99%	100%	100%
160%	94%	99%	100%	100%

Table 4: Percent a resource is dispatched less than potential daily availability (PSEI prices)

Multiplier	Resource Storage Duration (Hours/Day)			
	2 Hrs.	4 Hrs.	6 Hrs.	8 Hrs.
120%	80%	95%	99%	100%
130%	85%	97%	100%	100%
140%	88%	99%	100%	100%
150%	91%	99%	100%	100%
160%	93%	99%	100%	100%

Table 5: Percent a resource is dispatched less than potential daily availability (Powerdex)

Multiplier	Resource Storage Duration (Hours/Day)			
	2 Hrs.	4 Hrs.	6 Hrs.	8 Hrs.
120%	88%	94%	97%	99%
130%	91%	96%	98%	99%
140%	93%	97%	99%	99%
150%	95%	98%	99%	99%
160%	96%	99%	99%	100%

This proposal allows for the default energy bid to incorporate the features outlined above, including allowing for the length of fuel storage, ability to sell energy at different locations outside of a CAISO or EIM area, opportunity cost of generation using substitute local resources, and the ability to dispatch a resource less than the amount of available energy.

6.3 Reference Level Adjustment - Reasonableness Thresholds

The CAISO’s recent *Commitment Costs and Default Energy Bid Enhancements* (CCDEBE) policy initiative established a process in which resource owner will be able to request a before-the-market adjustment to a resource’s start-up cost bid cap, minimum load cost bid cap, or to its default energy bid (*i.e.*, its cost reference levels as calculated

by the CAISO).²³ This process was established in recognition that the CAISO's calculated reference levels based on published price information may not always reflect individual supplier's cost expectations.

For a resource owner to request an adjustment to a resource's reference level under this process, the supplier's cost expectations must be based on actual price quotes and its expected cost must be greater than the CAISO-calculated reference level. Suppliers must retain sufficient documentation supporting the need for a reference level adjustment request.²⁴

The CAISO would screen these reference level adjustment requests using an automated process based on "reasonableness thresholds." The CAISO would automatically approve any request to adjust a reference level up to a resource's reasonableness threshold.

In CCDEBE, the CAISO proposed to calculate these reasonableness thresholds each day by increasing the gas prices used in calculating each resource's reference levels by 10%, except for Mondays and days after holidays, in which case the CAISO would increase the gas price by 25%. The CAISO obtains these gas prices from published price indices. This process recognized that individual suppliers' actual costs can vary from the published price indices, and that, due to the nature of gas trading, this variation is greater on Mondays and days after holidays.

The CAISO has not yet filed the tariff changes resulting from the CCDEBE initiative with FERC. It plans to do so in 2019 so it can implement them in Fall 2019. Based on recent gas market trends, the CAISO proposes a modification to the reference level adjustment process for gas resources developed in CCDEBE described above, and proposes a modification to the gas index used for the day-ahead market. Finally, the CAISO is proposing a reference level adjustment process for resources using the hydro default energy bid. These changes are described in the following subsections.

6.3.1 Gas Resources

As stated above, the CAISO proposes to amend the reasonableness threshold rules for gas resources developed in CCDEBE to better account for gas price volatility.²⁵ The CAISO believes this is appropriate given recent large differences in the price for same-day gas purchases relative to the gas price indices the CAISO uses. Currently, the CAISO uses separate gas prices in the day-ahead and real-time markets.

²³ California ISO will not support adjustment requests to the transition component. Instead, a supplier should submit the request to adjust the start-up costs of the multi-stage generators configurations. The verified amounts will be used in the estimated proxy cost option for transition costs

²⁴ For conditions that would warrant a supplier's cost expectations to differ from their administratively calculated cost estimates, see: Second Revised Draft Final Proposal Commitment Cost and Default Energy Bid Enhancements, 36

²⁵ Commitment Cost and Default Energy Bid Enhancements Second Revised Draft Final Proposal, Section 5.4
<http://www.caiso.com/Documents/SecondRevisedDraftFinalProposal-CommitmentCosts-DefaultEnergyBidEnhancements.pdf>

For the real-time market, the CAISO calculates a gas price by averaging at least two published gas prices.²⁶ The CAISO calculates the gas price each day for the next day's real-time market between 7:00 and 10:00 pm using natural gas prices published earlier on the same day based for next-day gas trading. The CAISO uses these gas prices in a daily "fuel region" calculation, which it then includes to calculate each resources' bid cost reference levels. The CAISO then uses these reference levels in the next day's real-time market.²⁷ As these gas prices reflect next-day gas trading from the previous day rather than same-day gas trading on the operating day, there may be different suppliers actual costs to procure gas for real-time market dispatches.

For the day ahead market, the CAISO uses the volume weighted average hub prices that ICE publishes between 8:00 and 9:00 am. The CAISO uses this gas price to calculate bid cost reference levels for the day-ahead market run that day for the following day.

The CAISO would use separate processes to establish reasonableness thresholds for the day-ahead and real-time markets as described below.

Real-Time Market

If the CAISO determines that the same-day gas prices differ significantly from the indices published the preceding evening, rather than basing reasonableness thresholds used by the real-time market only on gas indices published the previous evening, the CAISO proposes to update the reasonableness thresholds used by the CAISO's real-time market in the morning.²⁸ Reasonableness thresholds will be updated based a combination of same-day gas price information on ICE or through individual reasonableness threshold adjustment requests received from resource owners.

The CAISO proposes to review same-day gas prices on ICE each morning and individual reasonableness threshold adjustment requests each morning. If there is sufficient information on ICE, and/or based on individual reasonableness threshold adjustment requests, to indicate that same-day gas prices are greater than 10% compared to the next-day gas price index from the previous evening, the CAISO will automatically recalculate all resources' reasonableness thresholds in the applicable fuel regions.²⁹ Otherwise, the CAISO would update the reasonableness threshold for an individual resource making an adjustment request.

An updated reasonableness threshold will apply throughout the remainder of the day for the real-time market. The CAISO will update gas price indices and recalculate reasonableness thresholds beginning with the next upcoming real-time market bid submission window.

²⁶ Natural Gas Intelligence, SNL Energy/BTU's Daily Gas Wire, Platt's Gas Daily, and the Intercontinental Exchange.

²⁷ California ISO Business Practice Manual, Market Instruments, Appendix C, Fuel Region Gas Price Calculations Rules

²⁸ For days in which there is trading on ICE, i.e. non-holiday weekdays.

²⁹ Both energy and commitment cost reasonableness thresholds would be recalculated.

To the extent the CAISO's review of same-day gas prices does not account for some individual resource's reasonableness thresholds, these resources may request a manual consultation with the CAISO. The CAISO proposes resource owners may request a manual consultations when same-day gas prices are more than 10% or \$0.50, whichever is highest, more than the next-day gas price index based on the indices used that are published the previous evening.³⁰

At the time of the manual consultation request, resource owners will be required to provide cost justification supporting an adjustment greater than a resource's reference level. Resource owners must retain the same documentation for bids above a resource's reference levels that are approved because of an automatic reasonableness threshold adjustment request. Bidding up to a supplier's reasonableness threshold is not a safe harbor and adjustment requests must be based on expected costs. Acceptable documentation to justify a supplier's increased real-time natural gas costs include the following:

- Invoices for gas purchased in real-time that demonstrate an incremental gas costs above the gas price that was used to develop a supplier's reference levels.
- Quotes from gas suppliers for real-time gas that demonstrate an incremental gas cost above gas price that was used to develop a supplier's reference levels.
- Evidence of other deals transacted in real-time at a price above the gas price that was used to develop reference levels.
- An offer to buy gas in real-time on a trading platform at or above the gas cost that was used to develop reference levels, where the offer was posted for a reasonable period of time but was not accepted. The documentation required would include the name of the trading platform, the price offered to buy the gas, the time the offer was placed and the time the offer was removed or rescinded.
- Other evidence of real-time gas costs temporarily above the gas reference index will also be considered.
- Suppliers may propose other methods of demonstrating temporarily increased gas costs to the CAISO.

If the requested amount appears to reflect current costs, the CAISO will approve the manual reasonableness threshold adjustment request. As outlined in the CCDEBE initiative, for the CAISO to consider these to reflect current costs, they should generally reflect multiple price quotes and the CAISO would calculate the cost as the weighted average of the quotes. If approved, the resource's revised reasonableness threshold would be reflected in the soonest bid submission window after processing the updated gas prices.³¹

³⁰ The CAISO anticipates it would establish windows for manual consultations such as up to 8 am on business days

³¹ Both energy and commitment cost reasonableness thresholds would be recalculated.

If the CAISO has sufficient information either through same-day gas trades ICE and/or manual consultations (e.g. three different gas price information from three different sources), the CAISO proposes to adjust reasonableness thresholds for other resources in the same fuel region. The CAISO would use a weighted average of the gas prices for updating reasonableness thresholds for a fuel region.

Day-Ahead Market

The CAISO also proposes to change the way it accounts for differences between Monday gas prices and the published price index the CAISO currently uses for the day-ahead market. As part of the CAISO's request to FERC to extend the temporary Aliso Canyon Phase 3 measures through 2019, NRG has raised concerns with the gas price index the CAISO uses for the day-ahead market run on Sunday for Monday. In response to NRG's comments, the CAISO proposes to adjust its use of the gas price index in its day-ahead market for Mondays by including ICE's Monday-only index.³²

With this change, the CAISO believes, similar to the change proposed above for calculating real-time market reasonableness thresholds, it will no longer need to increase gas prices used to calculate reasonableness thresholds for the day-ahead market by 25% for Mondays. Instead, the CAISO will calculate reasonableness thresholds for the day-ahead market by increasing the gas price used in the calculation by 10%. The CAISO will retain the reasonableness threshold of 25% for other days without an index published in the day-ahead time frame, *i.e.*, days after holidays.

6.3.2 Hydro Resource Default Energy Bid

The CAISO proposes a reference level adjustment for the hydro default energy bid based on changed gas prices that reflect its gas floor component. In order for the calculation to account for changes in gas prices and be an accurate gas floor price used in the default energy bid calculation, it is appropriate to update the gas component if gas prices increase significantly relative to the index price otherwise used by the market.

The CAISO proposes to adjust hydro default energy bids if the CAISO has sufficient information to update a gas fuel region, as described above. The CAISO will adjust hydro default energy bids for all hydro resources in that same fuel region based on updated gas prices when the CAISO updates the gas resource reasonableness threshold for a fuel region. For example, assume hydro resource A's default energy bid uses the gas hub Sumas. Gas resource B, C, and D's default energy bid also uses the gas hub Sumas. The only way hydro resource A's gas floor component could be adjusted would be if gas resources B, C, and D were to request and have their reference level adjustment approved. The CAISO understands that most hydro resources do not purchase gas. Further, if a hydro resource were to request a reference

³² The CAISO is separately proposing to enhance the temporary Aliso Canyon measures to include the ability to use the Monday-only index. <http://www.caiso.com/Documents/WhitePaper-TemporaryUse-GasPriceIndex-Day-AheadMarket.pdf>

level adjustment, they would likely be unable to provide the necessary documentation to have their request validated and approved by the CAISO. Therefore, the only way for CAISO to determine if sufficient information is available to update a hydro resource's default energy bid is through manual consultations with gas resources in the same fuel region and/or through same-day gas trading observed on ICE.

The CAISO understands that some resource owners may control a hydro resource and a gas resource. To address these instances, the CAISO would allow the supplier to request a manual reference level adjustment for their hydro default energy bid based on the supplier's gas resource's increased real-time natural gas costs.³³

6.4 Gas Prices Indices

The CAISO proposes to remove references to ICE in the CAISO tariff regarding gas price indices for the real-time market because an index published by ICE is no longer available. S&P Global Platts, another gas index, now contains information about Intercontinental Exchange trades through their daily and monthly North America natural gas indices. The CAISO will continue to reference S&P Global Platts as a source of gas indices that now contains information about ICE trades.

The CAISO also proposes to modify the requirement for the CAISO to use a minimum of two gas indices to determine the blended gas price use in the CAISO markets. The CAISO is proposing to allow the gas price index to be determined with as few as one index available from the various index providers. The publications the CAISO uses today include the following: Natural Gas Intelligence, SNL Energy/BTU's Daily Gas Wire, and Platt's Gas Daily.

The CAISO does not propose to modify the current practice of updating every weekday morning the gas price index for day-ahead market calculations using the information available from ICE trades.

³³ The adjustment would be subject to the supporting documentation requirements as described above.

7. Stakeholder Engagement

Table 6 outlines the proposed schedule to complete policy for the EIM Identified Market Power Mitigation Enhancements.

Table 6

Date	Milestone
January 16, 2019	Draft Final Proposal posted
January 23, 2019	Stakeholder call
January 30, 2019	Stakeholder written comments due
March 12, 2019	EIM Governing Body meeting
March 28, 2019	Board of Governors meeting

7.1 Stakeholder Comments

The CAISO will discuss this draft final proposal with stakeholders during a teleconference on January 23, 2019. Stakeholders should submit their written comments to initiativecomments@caiso.com by close of business on January 30, 2019.

Appendix

Background

The purpose of this section is to provide context needed to understand the CAISO's issue/straw proposal presented in Section 6, Proposal. The CAISO will present this context by discussing the following:

- *Commitment Cost and Default Energy Bids Enhancements*– Before Market Reference Level Adjustment Requests
- California ISO's Local Market Power Mitigation Design
- Stakeholder Comments following the *EIM Offer Rules* stakeholder workshops³⁴

Commitment Cost and Default Energy Bids Enhancements – *Before Market Reference Level Adjustment Requests*

The CAISO recently completed a policy initiative titled, *Commitment Costs and Default Energy Bid Enhancements*, which evaluated the CAISO's market rules relating to supplier's bidding flexibility. The CAISO plans to file the tariff revisions needed to implement the changes resulting from this initiative in 2019 prior to implementing them in fall of 2019.

Through the *Commitment Costs and Default Energy Bid Enhancements* initiative, the CAISO determined the existing reference level (*i.e.*, default energy bids and commitment cost caps) design did not always accurately reflect suppliers' costs. To address stakeholder's concerns, the initiative developed provisions for suppliers to have the ability to request adjustments to reference levels used by the market. These reference level adjustments may be used to adjust a resource's startup cost, minimum load cost, or energy cost (default energy bid). Suppliers can only request an adjustment when conditions arise that drive the supplier's actual cost away from the CAISO's administratively calculated cost estimates. The supplier must be able to provide documentation supporting justification of their new cost using actual and current information.³⁵ Suppliers are prohibited from utilizing reference level adjustments for strategically placing bids to inflate market revenues or create uplift.

After a supplier submits a reference level adjustment request, the CAISO will verify the requested amount before a market run.³⁶ To verify an adjustment request, the CAISO

³⁴ For details regarding the *EIM Offer Rules* stakeholder workshop, see:

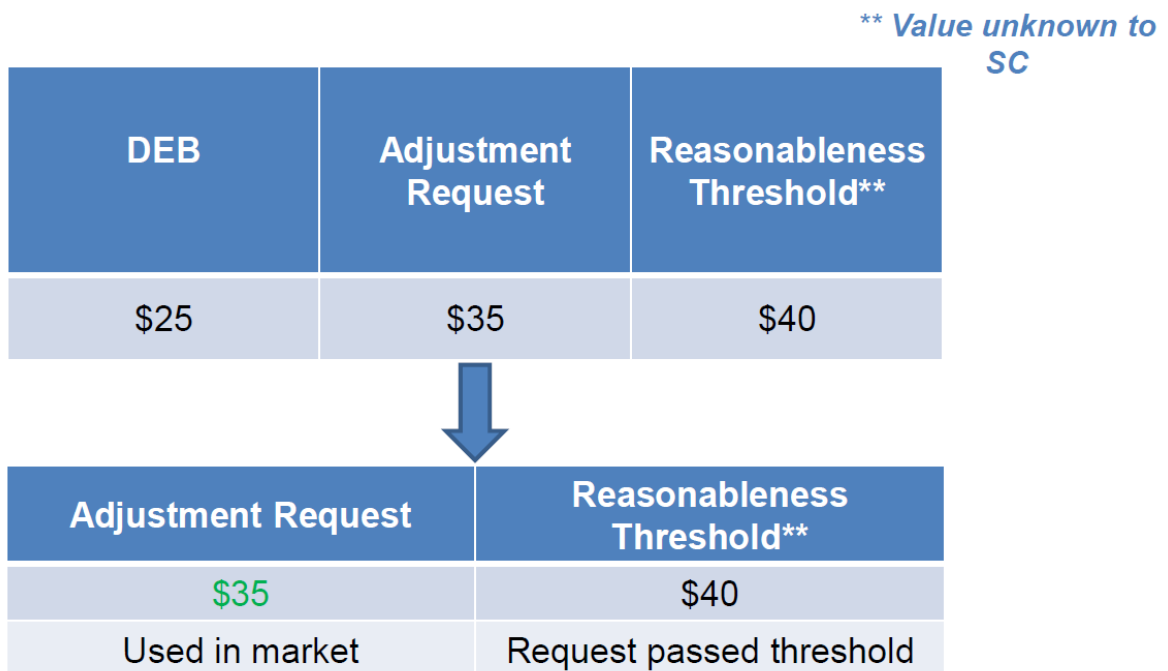
<http://www.caiso.com/informed/Pages/MeetingsEvents/MiscellaneousStakeholderMeetings/Default.aspx>

³⁵ Suppliers will not be required to submit this documentation to the CAISO for every adjustment request; however, it must be available upon request.

³⁶ If the CAISO is unable to verify an adjustment before the market run, the CAISO will determine whether costs were actual costs incurred above the adjusted reference level through the after-market verification process.

will use an automatic screen comparing the requested amount against a “reasonableness threshold.” This reasonableness threshold establishes an amount the CAISO will automatically verify for a resource’s reference level adjustment. The reasonableness threshold is different based on if a resource is gas-fired or non-gas-fired. For gas resources, the reasonableness threshold includes a gas price volatility scalar of either 125% or 110%.³⁷ For non-gas resources, the reasonableness threshold is 110%.³⁸

Assume a supplier would like to request an adjustment to their default energy bid. Their default energy bid is \$25 and they believe their costs are now \$35. The supplier would submit the adjustment request; the CAISO would then verify the request through the automatic screen using the reasonableness threshold. The reasonableness threshold for this resource is \$40. The supplier’s adjustment amount of \$35 would pass the reasonableness threshold and the \$35 would be used in the market.



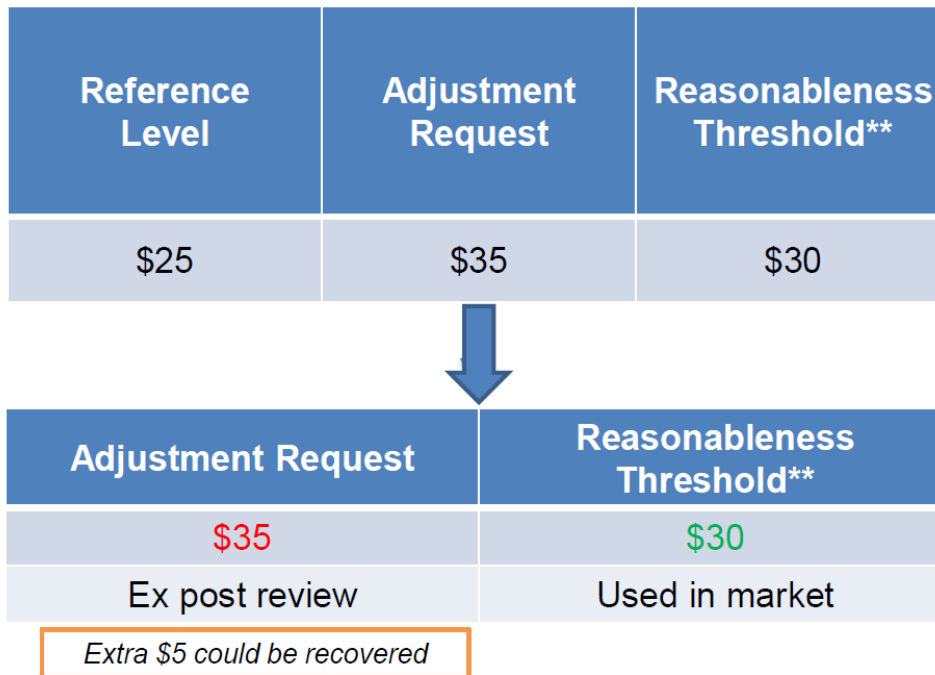
Assume the same supplier would like would like to request an adjustment to their default energy bid. Their default energy bid is \$25 and they believe their costs are now \$35. The supplier would submit an adjustment request; the CAISO would then verify the request through the automatic screen using the reasonableness threshold. The reasonableness threshold for this resource is \$30. The supplier’s adjustment amount of \$35 would fail the reasonableness threshold. The CAISO would limit their adjustment to

³⁷ The volatility scalars will vary depending on the day. For Monday and days without a published index when the market would fall back on the prior day’s published index (e.g. weekdays after holidays), the volatility scalar will be 125%. For all other days the volatility scalar will be 110%.

³⁸ The scaled fuel equivalent costs are calculated by applying a volatility scalar to Master File registered fuel equivalent cost values.

the reasonableness threshold amount of \$30. The remaining \$5 would be eligible for after the market review (ex-post) and could be potentially be recovered through the bid cost recovery process.

** Value unknown to SC



The CAISO provided after the market review and after-the-fact cost recovery mechanism for any reference level adjustment that was limited because a supplier’s adjustment request exceeded the reasonableness threshold. However, a supplier’s cost recovery is limited to actually incurred costs that exceed either: a cap or mitigated price level.³⁹

CAISO’s Local Market Power Mitigation Design

Each organized electric market has a methodology used to detect market power and trigger bid mitigation when it is detected. This section will describe the CAISO’s current market power mitigation methodology and bid mitigation.

The CAISO evaluates market power through a market structure assessing two quantitative measures for energy.⁴⁰ The CAISO’s market power mitigation test is most commonly referred as a three pivotal supplier test.⁴¹ To assess transmission competitiveness, the CAISO must first determine if there is sufficient supply to meet

³⁹ May not include any adders above cost such as a risk related adder or unrecovered costs through market revenues.

⁴⁰ Pending FERC approval of tariff changes resulting from the *Commitment Cost and Default Energy Bid Enhancements (CCDEBE)* initiative, the CAISO will also evaluate commitment cost market power.

⁴¹ Structure refers to the ownership of available supply (or capacity) in a market.

demand. Competitiveness is assessed through the dynamic competitive path assessment which includes the three pivotal supply test.⁴²

The three pivotal supplier test evaluates a local area in the market at a given constraint and determines if the constraint is competitive or uncompetitive. The three largest suppliers are removed and the local area is re-assessed to determine if there is sufficient supply to meet demand in the area. If there is enough supply to meet demand without the three largest suppliers in the area, the supplier is not pivotal and the constraint is competitive. If there is not enough supply to meet demand without the three largest suppliers, the suppliers are pivotal and the constraint is uncompetitive. Suppliers in an uncompetitive constraint may exercise market power and are subject to mitigation procedures.⁴³ For example, assume there are seven different suppliers in a locally constrained area with load of 500 MW. The three largest suppliers in the area have a total supply of 650 MW. The test would determine if the remaining suppliers have enough supply to meet the load of 500 MW. If the remaining four suppliers did not have enough supply to meet load, the constraint would be deemed uncompetitive. After the pivotal supplier test is complete, the residual supply index determines the ratio of supply from non-pivotal suppliers to demand. If the residual supply index is less than 1.0, then an uncompetitive level of supply is available.⁴⁴

After the dynamic competitive path assessment is completed, the CAISO then determines what portion of the marginal congestion component of a resource's node is from the uncompetitive transmission constraints, known as the locational marginal price decomposition method. A positive non-competitive congestion component indicates the potential of local market power. The non-competitive congestion component of each locational marginal price is calculated as the sum over all non-competitive constraints of the product of the constraint shadow price and the shift factor of the resource to the constraint. Every resource with a locational marginal price non-competitive congestion component greater than zero is subject to mitigation.

Bids for these resources are mitigated down to the higher of the resource's default energy bid, or the "competitive locational marginal price" at the resource's location.⁴⁵ The locational marginal price is equal to System Marginal Energy Cost (SMEC) + Competitive Congestion Component + Non-Competitive Congestion Component + LOSSES. The competitive locational marginal price is equal to SMEC + Competitive Congestion Components + LOSSES.

A resource's energy cost reference level (*i.e.*, default energy bid) for gas or non-gas suppliers is calculated using one of the following four options:

⁴² Determines if there is sufficient residual supply of counterflow to meet the demand for counterflow on a given constraint.

⁴³ Exercising market power may include a supplier inflating their energy prices, commitment costs, or withholding capacity.

⁴⁴ Demand Response Resources, Participating Load, and Non-Generator Resources are considered in the market power mitigation process, but are not subject to mitigation.

⁴⁵ The locational marginal price established in the locational marginal price mitigation run minus the non-competitive congestion component thereof (competitive LMP = $LMP_i - LMP_i^{NC}$).

1. Variable Cost Option (CAISO Tariff Section 39.7.1)
2. Negotiated Rate Option (CAISO Tariff Section 39.7.1.3)
3. Locational Marginal Price Option (CAISO Tariff Section 39.7.1.2)
4. *Variable Cost Option plus Bid Adder* (CAISO Tariff Section 39.7.1.4 for frequently mitigated units)⁴⁶

A supplier for each resource ranks the variable cost, negotiated, or locational marginal price options as their preferred method order for calculating their default energy offer. If a supplier does not provide a ranking preference, the above order applies as the ranking default.⁴⁷

The negotiated option requires the supplier to provide cost information to establish an approved rate formulation. Suppliers who elect to have their rate negotiated, first submit a proposed default energy bid (*i.e.*, energy reference level) along with supporting documentation. If denied, the CAISO and the supplier will enter into negotiations for sixty days. During this period, if the supplier and the CAISO agree to a rate, it will generally become effective within eleven business days.⁴⁸ The negotiated default energy offer will remain in effect until it is modified by FERC; modified by mutual agreement between the CAISO and supplier; or the negotiated rate expires, is terminated, or is modified in accordance with any FERC order.⁴⁹ The CAISO files these values in a confidential report with FERC each month.

Day-Ahead Market

The day-ahead market power mitigation process occurs prior to the integrated forward market and consists of single market run in which all modeled transmission constraints are enforced. The purpose of the day-ahead market power mitigation process is to determine which supply offers need to be mitigated before the integrated forward market runs.

Real-Time Market

The CAISO's real-time conducts a market power mitigation process in the Real-Time Unit Commitment (RTUC) run and in the 5-minute real-time dispatch run (RTD).⁵⁰

Hour-Ahead Scheduling Process

⁴⁶ Only applies to a "Frequently Mitigated Unit that is eligible for a Bid Adder may select a fourth Default Energy Bid option, which is equal to the Variable Cost Option plus the Bid Adder as described in Section 39.7.

⁴⁷ California ISO Business Practice Manual, Market Operations, Section 6.5.4 Default Energy Bids

⁴⁸ California ISO Tariff Section 39.7.1.3.1 Submission Process:

http://www.caiso.com/Documents/Section39_MarketPowerMitigationProcedures_asof_May2_2017.pdf.

⁴⁹ *Id.*

⁵⁰ Pending FERC approval of *Commitment Cost and Default Energy Bid Enhancements*, market power mitigation will occur in Short-Term Unit Commitment run (STUC).

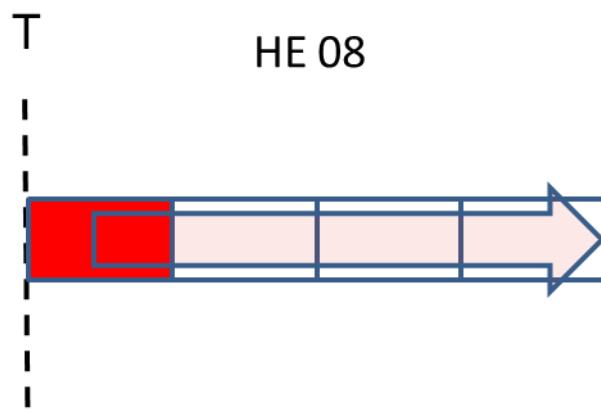
The hour-ahead scheduling mitigation process uses results from real-time unit commitment run (RTUC). The hour-ahead scheduling process uses a single mitigated supply offer for the entire trading hour is calculated using the minimum supply offer price of the four mitigated bid curves from the 15-minute levels at each supply offer.⁵¹ The purpose of the hour-ahead scheduling process is to estimate the 15-minute market results for scheduling hourly import supply offers.

15-Minute Market

The 15-minute market mitigation process uses results from real-time unit commitment run (RTUC). For the 15-minute market, mitigation begins with a resource's unmitigated supply offer for the first 15-minute interval of a trading hour.⁵² After the mitigation runs, the market receives mitigation results for each 15-minute interval of a trading hour (*i.e.*, four 15-minute intervals in an hour is equal to four separate mitigated supply offers for the hour).

If mitigation occurs to a supply offer in the first 15-minute, the remaining intervals within the trading hour are mitigated using the mitigated supply offer from the first interval as illustrated below in **Example 1**.

Example 1: Market power is determined for a resource in the first 15-minute interval of the 15-market indicated in red.

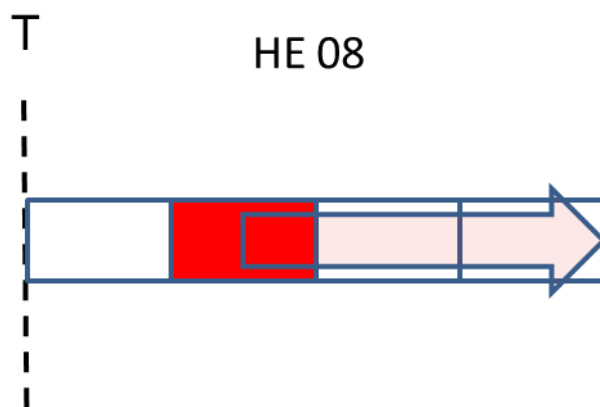


If market power is not detected in the first interval of the 15-minute market, but is detected for the second interval, a resource's supply offer will be mitigated for the second interval and all remaining intervals of the trade hour. The same logic would apply if market power was not detected for the first or second interval of the 15-market, but was detected for the third interval. Example 2 illustrates this logic below.

⁵¹ California ISO Business Practice Manual, Real-Time Market, Section 34.1.5.3 Hour-Ahead Scheduling Process MPM.

⁵² There are four (4) 15-minute intervals in an hour.

Example 2: Market power is determined for a resource in the second 15-minute interval of the 15-market indicated in red.



5-Minute Market

The 5-minute market, also known as real-time dispatch, receives mitigation results from the corresponding 15-minute interval. The 5-minute market will mitigate further using the results from the previous run where the current binding interval was the first advisory interval. Then, the market will determine if the next 5-minute interval has market power and if the supply offer should be mitigated. If market power is detected in a 5-minute market, the corresponding 15-minute interval will be mitigated.