



California ISO

Local Market Power Mitigation Enhancements

Revised Straw Proposal

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1 Changes from the Issue Paper/Straw Proposal

The CAISO appreciates the written stakeholder comments received in response to the issue paper/straw proposal and the October 10, 2018 stakeholder working group meeting. In response to this input, the CAISO has made the following proposal modifications:

- 1. Prevention of Economic Displacement between Mitigated Balancing Authority Areas:** The CAISO proposes to limit transfers between balancing authority areas in the event of market power mitigation to an amount that considers the exporting balancing authority area's obligation to support EIM diversity benefits. This proposed rule would be optional, based on the preference of the exporting EIM balancing authority area.
- 2. Hydro Default Energy Bid:** The updated proposed default energy bid would be limited to hydro resources with storage (excludes run-of-river) and available to all qualifying resources in the CAISO and the EIM balancing authority areas. Additionally, this hydro default energy bid would incorporate a gas floor price, a day-ahead electricity index, a balance of the month electricity index, and a monthly electricity index.
- 3. Reference level adjustment process for gas resources and default energy bid option for use-limited resources:** The updated process for gas resources will include a review of same-day gas prices made available by the Intercontinental Exchange (ICE) between 8:00 and 9:00 am. A greater than 10% change in same-day gas prices will result in the CAISO automatically updating a resource's reasonableness threshold, based on its corresponding fuel region. Consequently, the CAISO has removed its previously proposed static gas resource reasonableness threshold for the real-time market for Monday of 25% relative to the index. 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 is no longer proposing a reference level adjustment process for hydro resources with a hydro default energy bid option.

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 use-limited 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 balancing authority area, have raised concerns related to recent real-time gas price volatility.

This paper presents the CAISO's revised straw 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 the following enhancements:

- **Mitigation process modifications:** 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 balancing authority area or group of balancing authority areas are import-constrained in a market interval, triggering mitigation in subsequent intervals, which results in a balancing authority area shifting to export at mitigated prices. This situation can result in mitigating bids for resources' serving as the source of exported power does not involve market power. The CAISO proposes to address this issue by modifying the calculation of the competitive locational marginal price used in the market power mitigation process and no longer extending mitigation beyond the interval being tested. These modifications will 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 balancing authority areas 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 balancing authority area to another, relative to its market power mitigation run, because they become more economic when a resource's bids are mitigated. Although market power mitigation should protect against market power within the combined balancing authority area "bubble," it does not seem appropriate to dispatch greater quantities at the mitigated price than was originally scheduled in the market power mitigation run.

The CAISO proposes to address this issue by limiting transfers between EIM balancing authority areas in a manner that recognizes the flexibility benefits created from participation in EIM. Accordingly, the revised proposal will limit transfers between all balancing authority areas to the greater of: (1) the flexible ramping upward requirement of the exporting balancing authority area; or (2) pre-mitigation (MPM) export quantity. This proposed rule would be available for all balancing authority areas in the EIM that elect to use it. When combined with the

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

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

proposed default energy bid option outlined below, this approach would address nearly all cases of economic displacement.

- **Hydro default energy bid:** CAISO's existing methodologies for calculating default energy bids can inaccurately reflect the actual costs for hydro resources with storage. Although the mitigation process enhancements described above will address situations when the market dispatches resources in quantities greater than what is needed to resolve market power, there will still be cases when default energy bids are applied to resolve market power. To address stakeholder concerns, the CAISO proposes an additional default energy bid option for hydro resources with storage. This option would be available to qualifying hydro resources located in EIM and the CAISO balancing authority areas.
- **Reference level adjustment process:** The CAISO proposes changes to the reference level adjustment.³ The CAISO proposes to proactively update reasonableness thresholds for all resources located in a given fuel region used for the CAISO's real-time market based on same-day gas trading the CAISO observes on Intercontinental Exchange (ICE). Consequently, the CAISO has removed its previously proposed static gas resource reasonableness threshold for the real-time market for Monday of 25% relative to the index. 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 is no longer proposing to allow hydro resources with the hydro default energy bid option to request reference level adjustments.
- **Gas price indices:** The CAISO proposes consolidating the published gas-price indices the real-time market uses to calculate gas-fired resources' reference levels.

3 EIM Decisional Classification

This initiative includes four elements. The first element involves enhancements to two of CAISO's existing bid mitigation processes. The second introduces a new default energy bid option. The third element modifies the reference level adjustment process for gas resources, while the fourth updates the CAISO tariff to reflect current gas publications for the real-time market. The categorization of this initiative is complicated in that one of the proposed elements falls within the EIM Governing Body's primary authority, while the remaining three fall within its advisory role. These two groups of changes are severable for decision purposes. Accordingly, the CAISO would present

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.

them separately to the EIM Governing Body, one for approval and the remaining three for advisory input.

First, this proposal would modify the calculation of the competitive locational marginal price used in market power mitigation. This change affects rules that apply uniformly in both the CAISO and EIM balancing authority areas. Consequently, this component falls within the EIM Governing Board's advisory to the Board.

The first element of this proposal would also introduce a second modification to the mitigation framework that would impose transfer limitations between mitigated regions of EIM balancing authority areas to the greater of: (1) the flexible ramping upward requirement of the exporting balancing authority area; or (2) the pre-mitigation transfer quantity. This optional enhancement would apply exclusively to EIM balancing authority areas and therefore falls within the EIM Governing Body's primary authority.

Second, this proposal would create a new default energy bid designed to approximate the opportunity costs for hydro resources. This enhancement would apply uniformly to hydro resources in both the CAISO and EIM. Consequently, this component falls within the EIM Governing Board's advisory to the Board.

Third, this proposal 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 balancing authority areas. Consequently, these components fall within the EIM Governing Board's advisory to the Board.

The fourth element introduces updates to the CAISO tariff to reflect current gas publications for the real-time market. This proposed change falls within the EIM Governing Board's advisory to the Board.

This initiative is not classified as hybrid for approval purposes because each of these four parts is severable from the others for decisional purposes. As currently proposed, the CAISO would present the first, third and fourth parts to the EIM Governing Body for advice, and the second part for approval. Assuming the second part is approved by the EIM Governing Body, it would then be placed on the Board of Governors consent agenda at their next meeting. In addition, the CAISO would seek the Board of Governor's approval for the remaining elements.

Stakeholders are encouraged to submit 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 issue paper / straw proposal on September 13, 2018, the CAISO held a working group meeting on October 10, 2018 to review and further discuss all the relevant elements of the initiative. Stakeholders submitted comments for the issue paper / straw proposal, as well as supplemental comments in response to the working group meeting. Both sets of stakeholder comments are summarized below, based on the different elements of this initiative.

4.1 Mitigation Process Enhancements Comments

General Comments

Several stakeholders question whether it is appropriate to mitigate EIM balancing authority area's energy bids given the voluntary nature of EIM. The CAISO disagrees with stakeholders that it is inappropriate to mitigate a resource's supply offers because the EIM is voluntary.

As the CAISO explained in its EIM tariff FERC filing in 2014, there may be balancing authority area-wide market power in an EIM entity's balancing authority area when all or most of the generation in the balancing authority area is owned by one entity. CAISO believes that such structural market power is mitigated effectively by extending local market power mitigation procedures to the EIM entity balancing authority area when congestion is projected to occur on a transmission intertie into an EIM entity balancing authority area due to an EIM transfer limit on the intertie.⁴ FERC agreed with the CAISO and granted the CAISO authority to apply its local market power mitigation rules and procedures to the EIM footprint (*i.e.*, to participating resources in the EIM balancing authority areas and EIM transfers).⁵

As Powerex notes in their comments, some EIM entities "have amended their open access transmission tariffs such that EIM prices are used to financially settle the energy and load imbalances of their transmission customers." A mitigation design must protect against market participants who may exert market power on other balancing authority areas and cause financial harm to load and generation.

Idaho Power Company claims that it is inappropriate to mitigate an EIM balancing authority area when that balancing authority area is in a competitive bubble with three or four of its neighboring EIM balancing authority areas and transmission is constrained between the constrained region and CAISO, or other EIM balancing authority areas. However, within the bubble, transmission is not constrained. As the CAISO explained in the technical workshop, the current EIM design does not perform a pivotal supply test across EIM balancing authority areas. It is assumed that if one or more EIM balancing authority areas jointly separate from the CAISO, the pivotal supplier test would fail

⁴ See *California Indep. Sys. Operator Corp.*, 147 FERC ¶ 61,231 (2014).

⁵ *Id.* at P 216.

because by removing the three largest suppliers, there would be insufficient supply to meet the area's load under competitive conditions (i.e. more supply available than load). Under these conditions, even a supplier that is not one of the three largest suppliers could exert market power within its balancing authority area and on the other balancing authority areas in the import-constrained region.

Market power mitigation for an EIM balancing authority area is triggered when EIM balancing authority area's power balance constraint has a positive shadow price above the CAISO power balance constraint shadow price. The positive shadow price of the EIM balancing authority area power balance constraint occurs when there is import congestion from the CAISO to the individual EIM balancing authority area or if the EIM balancing authority area is in a bubble of multiple EIM balancing authority areas that become import constrained from the CAISO. As a result, changes to the existing pivotal supplier test would be necessary to account for scheduling limits between EIM balancing authority areas. Additional analysis is needed to support such changes based upon the magnitude of over-mitigation. The CAISO proposal to address economic displacement by limiting the exports to the greater of the transfers in the market power mitigation run, or the flexible ramping up requirement for the exporting balancing authority area, was proposed to address cases of economic displacement, while ensuring mitigation is still appropriately applied throughout the EIM.

Prevention of Flow Reversal

NV Energy and Puget Sound Energy (PSE) request additional background on the competitive locational marginal price as a market construct, as well as justification and rationale for the existing mitigation process, which does not reexamine the competitive locational marginal price for each interval and extends mitigation for the balance of the hour. 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. Since the implementation of the original policy, the CAISO market software has been enhanced and the mitigation performance has been improved making these provisions not needed.

Chelan Public Utility District (Chelan PUD), Idaho Power, Public Generating Pool (PGP), Bonneville Power Administration (Bonneville), and Powerex support the CAISO's proposed mitigation process modifications to address flow reversal, as introduced by the CAISO in the straw proposal for this initiative.⁶ The Department of Market Monitoring suggests that the complicated modifications to the market power mitigation software (such as dynamic mitigation) be part of a separate second phase in order avoid further delay in addressing the key issue of gas prices used to calculate bid caps for the real-time market.

⁶ <http://www.aiso.com/Documents/IssuePaperandStrawProposal-LocalMarketPowerMitigationEnhancements.pdf>

NV Energy does not support this approach, noting concerns about the proposed nominal price adder, while Southern California Edison (SCE), the Western Power Trading Forum (WPTF), and Seattle City and Light (SCL) requests additional analysis to examine potential locational marginal price impacts. SCE also questioned the potential for a market revenue surplus or shortage (*i.e.*, uplift).

The CAISO acknowledges the requests from SCE, WPTF, and SCL for further analysis on the frequency of flow reversal and the believes adequate analysis has been performed by the Department of Market Monitoring (DMM), which highlights that flow reversal has the potential to occur “up to 2% of all 15-minute intervals” and “.4% of all 5-minute intervals.”⁷ 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.

Several stakeholders, including SCL and WPTF, express concerns regarding the proposed nominal price adder and the potential to impact or otherwise distort price signals. The CAISO disagrees with this comment, as the purpose of the nominal price adder is to ensure that mitigated resources are not incrementally dispatched because there is insufficient bid separation between competitive and noncompetitive areas. For example, assume local congestion where the competitive locational marginal price is \$70. If resources inside the constrained area offers are reduced to a competitive locational marginal price of \$70, it is possible for the resource to be incrementally dispatched relative to the market power mitigation run. This has the effect of eliminating the congestion, which triggered mitigation. The small adder ensures that the final market solution is consistent with market power mitigation schedules. This further ensures accurate pricing in both the competitive and noncompetitive areas because prices in the competitive area cannot be lowered by using additional supply from the congested area. This occurs when there is both local and system level congestion. In addition, the proposed price adder to create separation from the competitive locational marginal price would be minimal (e.g., \$0.001).

DMM proposed during the October working group meeting that the Energy Transfer System Resource cost (applicable to all EIM balancing authority areas) would serve as a sufficient mechanism to create price separation. The CAISO believes an additional price adder is needed, since the Energy Transfer System Resource cost is not significant enough (ranging between \$0.0001-0.0005) to have the intended impacts needed to create price separation. Energy Transfer System Resource cost are also intended to differentiate the power balance constraint shadow price between balancing authority areas that import energy from outside a constrained region. Specifically, the Energy Transfer System Resource cost was designed for the specific purpose of differentiating parallel transmission paths between balancing authority areas to establish

⁷ 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>

a robust solution. Using this feature to accomplish a different objective could create unnecessary dependencies that may affect future software maintenance. Finally, from both a policy and implementation perspective, Energy Transfer System Resource cost are only applicable to EIM balancing authority area's transfers. This is problematic, since the nominal price adder should be applied for all mitigation cases, including resources within the CAISO when exporting leads to uncompetitive binding constraints.

Prevention of Economic Displacement between Mitigated Balancing Authority Areas

SCL, PGP, and Powerex support the CAISO's proposal to address this issue by limiting exports to pre-mitigation quantities, claiming the approach would substantially reduce the application of bid mitigation to voluntary supply offers, and hence would help avoid discouraging the participation of additional voluntary supply in the EIM. Chelan PUD supports exploring the concept of limiting the volume of offers subject to mitigation for each EIM balancing authority area to the quantity that is relied upon to serve imbalance needs.

The WPTF raise concerns that creating congestion on the scheduling limit will ultimately result in price separation between two balancing authority areas, directly impacting market transparency.

PSE recommends that the CAISO consider limiting transfers to the quantity in the previous interval (similar to the concept utilized for the flexible ramping test), or the original transfer limit. PSE further requested clarification on the direction in which transfers would be limited.

DMM raises concerns that the proposed export limitation may constitute a change that may impact assumptions used in studies related to market-based rate authority.

Idaho Power emphasizes that mitigation should not apply for transfers between balancing authority areas within a constrained region, as long as there are not constraints within the region. Additionally, the proposed transfer limitations will require further analysis and study, as well as clarification on impacts to market-based rate authority.

PacifiCorp did not provide comments directly related to the CAISO's proposed approach to address economic displacement by limiting exports.

The CAISO believes that participation in the EIM is voluntary in that the CAISO does not specify the amount of transmission made available for EIM transfers or the level of EIM participating resources that have a must offer obligation in a given operating hour. In order to benefit for economic trade within the EIM, EIM balancing authority areas are required to pass a resource sufficiency evaluation. The purpose of the resource sufficiency evaluation is to ensure that each EIM balancing authority area can adequately balance their own balancing authority's supply and demand independently

recognizing lower flexibility is needed given the diversity benefit of the flexible ramping product. The resource sufficiency evaluation ensures that balancing authority areas do not inappropriately lean on the capacity, flexibility and transmission of other balancing authority areas in the EIM footprint.

The CAISO further believes that not allowing an increase in the transfers when an EIM balancing authority area when mitigation trigger is an appropriate approach for addressing economic displacement. However, in this revised straw proposal the CAISO proposes further modifying the process to limit the transfer to the greater of the pre-mitigation quantity, or the flexible ramping up requirement of the exporting balancing authority area. This modification will reduce economic displacement using mitigated bids, maintaining the voluntary nature of the EIM. But, the rule recognizes that flexible resources necessary to pass the hourly resource sufficiency evaluation can be used to meet other balancing authority area's imbalances, which is consistent with the shared benefits of a central dispatch across the EIM footprint.

The CAISO discusses potential scenarios that can occur in real-time dispatch where additional EIM transfers out of an EIM balancing authority area would have been economic even using unmitigated bids. These scenarios occur because in real-time dispatch the transfer constraint limiting additional EIM transfers out will be determined using the advisory dispatch from the previous market run. As a result, the CAISO proposes to allow each balancing authority area the ability to elect to either enable or disable limitation of transfers. This will allow each Balancing Authority Area the option to elect to implement this rule, depending on the individual resource mix, transfer capability, and corresponding OATT parameters.

The CAISO believes that the concern regarding the proposed rule conflicting with the analysis used to support EIM balancing authority areas receiving market based rate authority to participate in the EIM is not valid. First, the proposal does not reduce the amount of transmission EIM balancing authority areas make available to the EIM. All transmission offered is available in the market power mitigation run for each interval. In fact, it can be argued that this proposal offers additional protection, which will incentivize additional transmission to be made available beyond what is needed to receive the flexible ramping product diversity benefit and pass the hourly resource sufficiency evaluation. Second, even if the transfer capacity that is limited in the market run under the CAISO's proposal to limit transfers in the event of mitigation, this reduced transfer capacity should not be considered in competitiveness assessments because these transfers are based on mitigated bids and market power cannot be exercised in these intervals in which mitigation occurs.

Conduct and Impact Test

Multiple stakeholders raise issue of the conduct and impact tests utilized by other ISOs. PGP specifically encourage the CAISO to include a "conduct exemption" in this initiative

that will allow offer prices to exceed their default energy bid by a defined amount without triggering application of price mitigation. Bonneville further requested the CAISO to explore the merits and potential market impacts of conduct and impact tests. Powerex suggests that the development of an “offer price threshold” would have many of the same properties as the conduct test employed by several eastern RTOs. Powerex believes an offer price threshold can be readily applied as a condition for whether or not a resource’s offer is subject to mitigation, negating the need for a complete conduct-and-impact test. Seattle City Light also encourages the CAISO to consider incorporating a conduct threshold with a more flexible scaler in its default energy bid formula.

The CAISO believes the proposed changes to the current mitigation process, combined with the introduction of a default energy bid for hydro resources, will serve as a more effective and targeted approach for the identified concerns. The CAISO does not believe a conduct threshold is appropriate market due to the frequency in which the dynamic competitive path assessment is performed. The conduct exemption used in eastern markets is a static number used in areas that are historically congested. The CAISO’s market power mitigation test is more dynamic because the test determines if a resource has the potential to exert market power in every interval of the real-time market. Further, the CAISO has proposed the inclusion of a price floor for the proposed default energy bid within this initiative, which diminishes the need for a conduct exemption.

4.2 EIM Use-Limited Default Energy Bid Comments

WPTF recommended the CAISO further consider Powerex’s recommendation to bucket energy-limited resources based on the limitation horizon (e.g., daily, intra-month) and set the scaler accordingly. The WPTF further recommends the CAISO conduct additional analysis to expand upon what was presented by Powerex.

The WPTF, Chelan PUD, and SCL generally support the default energy bid approach, but requested additional analysis, as well as clarification from the CAISO on how to define “storage.” PSE agrees that default energy bids should reflect a seller’s opportunity costs, which may include foregone sales at locations where a seller may have been able to sell power. However, PSE requested clarification on several details related to the default energy bid, including: 1) how to determine whether an entity has the ability to sell at a particular geographic location; 2) how to determine the depth of each market location, and 3) whether or not an EIM entity would have the ability to schedule transmission rights close to operation.

Powerex believes it is not workable or credible for any external entity to calculate the effective forward-looking storage horizon of a use-limited EIM participating resource at any point in time. However, the potential range of minimum and maximum storage horizons can be verified, even though the specific value within that range at any point in

time cannot. Powerex further proposes that a use-limited EIM resources may be characterized by demonstrated maximum storage horizons and recommends that the CAISO provide further details related to the process to be used to register an EIM resource as a use-limited resource and determine eligibility for the new use-limited default energy bid option.

PG&E generally supports an EIM hydro resource category that would be based on a storage horizon for default energy bid purposes. PG&E, Powerex, PGP, and Chelan PUD both support the use of a fixed \$/MWh floor price. PGP requests that CAISO include the balance of the week and balance of the month price indices into the default energy bid equation for within-month resources. Idaho Power advocates for consideration of multiple indices and a higher multiplier in the equation.

Chelan PUD, Powerex, PSE, and PGP, PG&E all support a default energy bid that would reflect opportunity costs of potential sales outside the EIM at multiple geographic locations. SCE does not support the inclusion of price indices from illiquid markets or based on illiquid locations or from a time period of very low liquidity. Instead, only reliable and liquid price indices should be used. SCE further emphasizes the importance of basing the accuracy of a default energy bid on the resource's specific characteristics, such as MWh limitation. This seems to suggest that the negotiated default energy bid should be considered as one viable option. SCE further cautions about over-reliance on a formulaic approach, which could lead to an inflated default energy bid.

The CAISO has made substantial modifications to the proposed default energy bid option in this revised straw proposal that addresses the majority of the stakeholder feedback described above. Changes include consideration for storage capability, the introduction of a price floor, the inclusion on the balance of the month price indices, and consideration of multiple geographic location (by including consideration for multiple price hubs).

4.3 Reference Level Adjustments Comments

NRG Energy, Inc. (NRG) strongly supports the CAISO's proposal to allow for manual consultations to allow suppliers to adjust generating units' reference levels, as needed under volatile gas market conditions. However, NRG urges the CAISO to consider the mechanics and timing of the consultation process for establishing the reference level prior to the market run. NRG also requests that the CAISO clarify whether the CAISO intends to allow market participants to consult with the CAISO regarding reference level adjustments to be used for the day-ahead market. The CAISO has made substantial revisions to its proposal to address these concerns.

NRG further encourages the CAISO to reconsider the need for *ex ante* verification. NRG maintains that if the CAISO (or FERC) were to identify cases of market participants adjusting reference levels based on false or misleading information, that

market participant would be subject to severe sanctions, especially if that market participant's bid sets the market clearing price; this threat of sanction should dissuade rational actors from seeking to use an unsupportable reference price adjustment. NRG maintains that without any certainty regarding timely *ex ante* verification, merely providing for after-the-fact cost recovery will ensure that the CAISO's market clearing prices will fail to reflect actual gas supply conditions, to the detriment of the market. The CAISO believes *ex ante* verification is important to protect the integrity of each market run but has made revisions to its proposal.

Regarding the proposed use-limited default energy bid in the straw proposal / issue paper, Seattle City Light (SCL) raised concerns that reference level may be unworkable for EIM entities to constantly be requesting one-time reference level adjustments to reflect real-time prices that are higher than day-ahead or monthly forward prices. SCL suggested addressing this issue through the use of a scaler in the default energy bid formula that is targeted to the storage horizon of the resource. The CAISO has revised its proposal to address this concern and is no longer proposing a reference level adjustment process for resources with a hydro default energy bid.

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 balancing authority area, supply should not be forced to sell energy at a mitigated price beyond the greater of: (1) the exporting balancing authority area's the flexible ramping upward requirement;⁸ or (2) the pre-mitigation (MPM) export quantity. 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 use-limited resources should include opportunity costs for future market sales.

⁸ This test assumes sharing of resources because it includes diversity benefit.

- 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

In this section, the CAISO proposes changes to its local market power mitigation process, a default energy bid option for hydro resources, changes to its reference level adjustment process, and changes to the gas price index used in the real-time market.

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 balancing authority area. 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 balancing authority area or group of balancing authority areas are import-constrained during a prior market interval, which triggers mitigation for the balance of the hour in the 15-minute granularity real-time pre-dispatch (RTPD) market run (or balance of the 15-minute interval in the real-time dispatch). This can result in a balancing authority area exporting at mitigated bid prices for the remainder of the hour.⁹ As a result, a resource within the mitigated balancing authority area 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 fifteen-minute market run, the mitigated bid price will be applied for the remainder of the hour in both fifteen-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.

⁹ 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 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 RTPD (or balance of 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 balancing authority area 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, 2018.¹⁰ 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 RTPD (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.

Mitigated Price Adder

As discussed at the August 3, 2018 Market Surveillance Committee meeting,¹¹ 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 balancing authority area or region to create price separation from the external competitive locational marginal price.

¹⁰ <http://www.caiso.com/Documents/DMMComments-LocalMarketPowerMitigationEnhancements-IssuePaper-StrawProposal.pdf>

¹¹ The presentation is available at: http://www.caiso.com/Documents/Presentation-EIMMarketPowerMitigationDiscussion-FTI-Consulting-Aug7_2018.pdf

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

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

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.

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

Example A: Mitigation Occurs in the First Fifteen-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 fifteen-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	Yes	\$63	No	No
4	\$60	\$59	\$25	No	\$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 detected in interval three; therefore, the mitigated price is \$63 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.

Example B: Mitigation Occurs in the Third Fifteen-Minute Market FMM 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 fifteen-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	DEB	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 DEB 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.

6.1.2 Economic Displacement between mitigated balancing authority areas

As described above, the changes to the balance of the hour (or 15-minute interval) mitigation rules will address flow reversal when a single balancing authority area 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 balancing authority areas become import-constrained from the CAISO, which triggers mitigation.

As observed in previous examples, market power mitigation can result in a different dispatch within balancing authority areas 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 balancing authority areas 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.

The CAISO proposes a market rule that would prevent economic displacement by not allowing transfers between two EIM balancing authority areas 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 exporting balancing authority area to the greater of: (1) the pre-mitigation transfer quantity or (2) the exporting balancing authority area's upward flexible ramping requirement adjusted by its imbalance energy need.¹²

This rule uses the maximum of the transfer scheduled in the market power mitigation run or the sending balancing authority area's flexible ramping for the following reasons. It is appropriate to use the transfer scheduled in the market power mitigation run if it is the maximum of the two amounts because using a lower amount would undo the market results and potentially result in a solution in which the transfer was limited such that the receiving balancing authority area was unable to meet its imbalance energy requirement. It is appropriate to use the sending balancing authority area's flexible ramping requirement if it is the maximum of the two amounts because the EIM design assumes sharing of flexible ramping capacity between balancing authority areas. That is the reason each balancing authority area's flexible ramping requirement used in the resource sufficiency tests is reduced by a diversity benefit.

In the event the transfer constraint is binding in the pricing run, the congestion rents will accrue to the source EIM balancing authority area. This is consistent with the current EIM treatment for congestion rents, in which congestions rents accrue to the balancing authority area where the constraint is located. The transfer constraint is specific to the source balancing authority area.

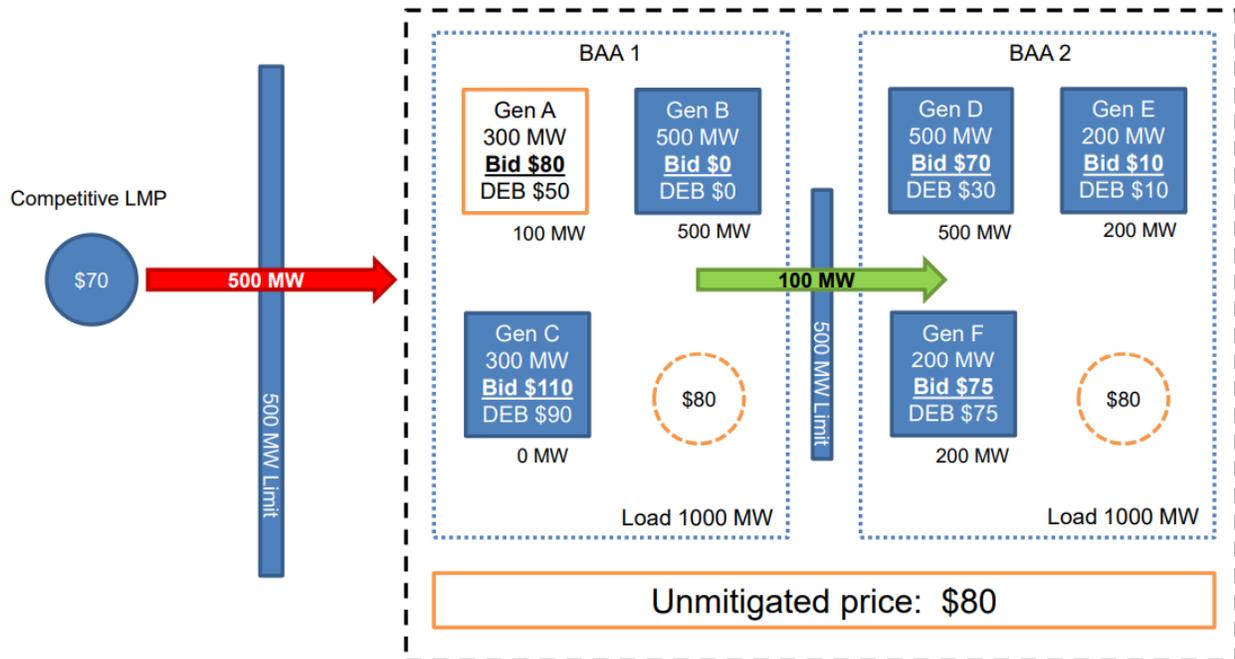
The CAISO proposes that use of this rule be optional to address EIM participant concerns that this rule could reduce transfers between EIM balancing authority areas and consequently limit EIM benefits. Each EIM balancing authority area would have the option whether to implement this rule in the market for transfers out of its balancing authority area. This would be a relatively static designation made in the CAISO's master file.

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

¹² This would be implemented by using the flexible ramping product award quantity and would also consider transfers attributable to base schedules.

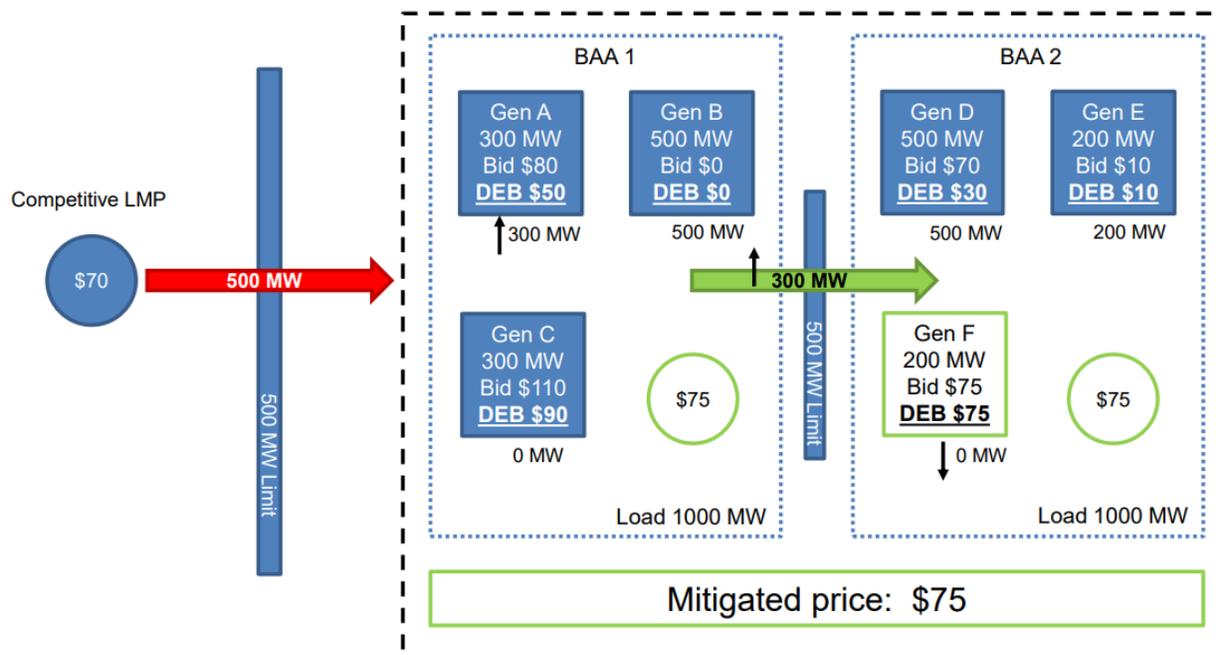
Example C

1. Market Power Mitigation Run



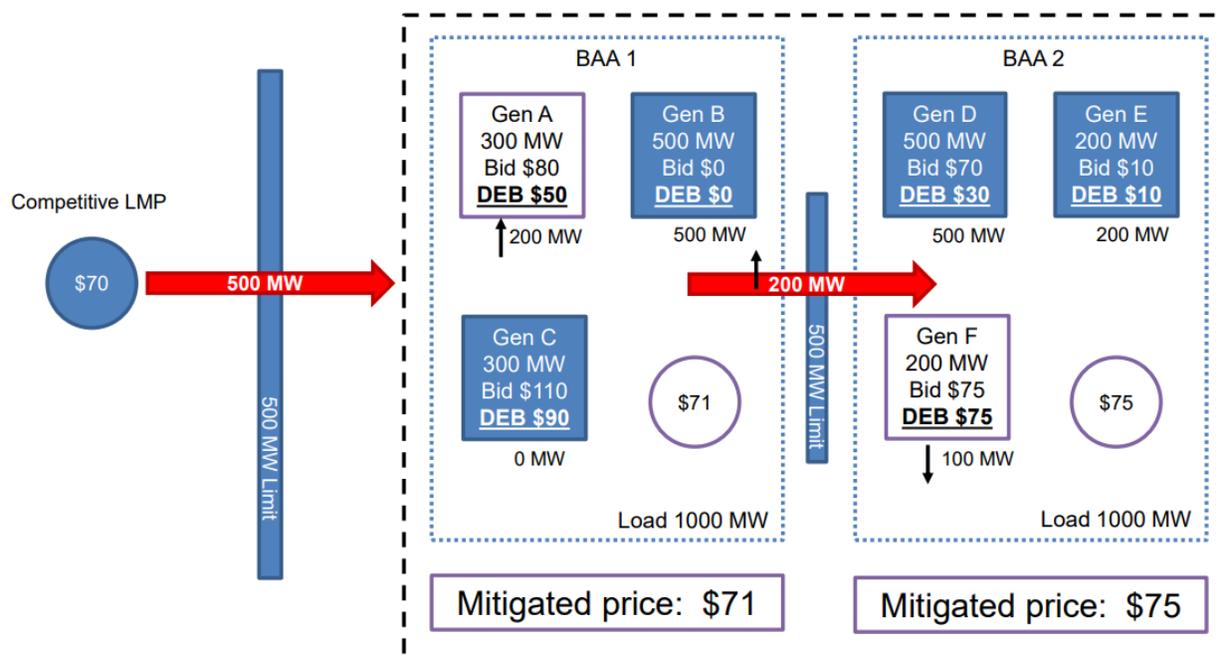
- BAA 1 and BAA 2 are in a constrained region, with a competitive locational marginal price of \$70. Imports into the region are binding at 500 MW.
- BAA 1 is exporting 100 MW to BAA 2. The bids result in a price of \$80 for both balancing authority areas.

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 balancing authority areas (assuming BAA 2 could reduce imports to BAA 1).

Market Run with Proposed Rule



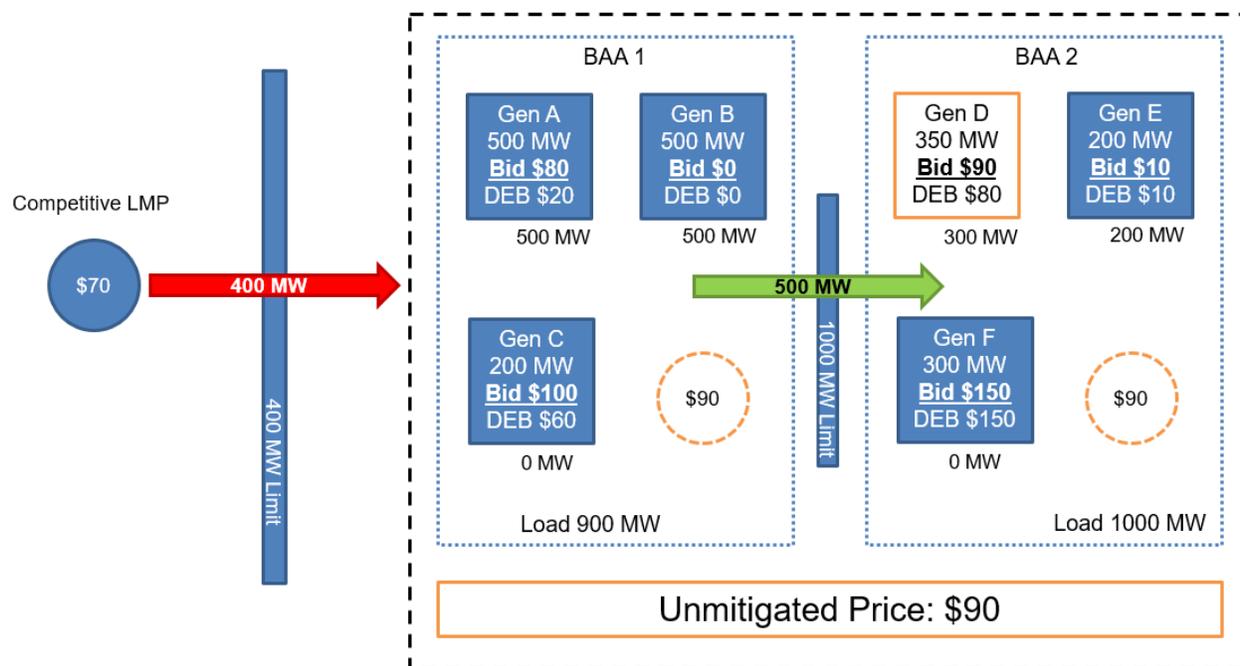
- By introducing a rule that would limit exports from any EIM balancing authority area to the greater of: (1) the flexible ramping upward requirement for the exporting BAA; or (2) pre-mitigation (MPM) export quantity.
- In this example, it is assumed that the flexible ramping upward requirement for BAA 1 was 200 MW. Accordingly, exports would increase from 100 MW in the market power mitigation run to 200 MW.

The rule does have shortcoming in the real-time dispatch because the market power mitigation run and the pricing run do not occur in the same time interval. The transfer constraint level would be determined using the advisory interval from the previous market run. Therefore changes in system conditions can result in a transfer that would have been different had the binding interval market inputs been used. The CAISO highlights two scenarios below:

Example D

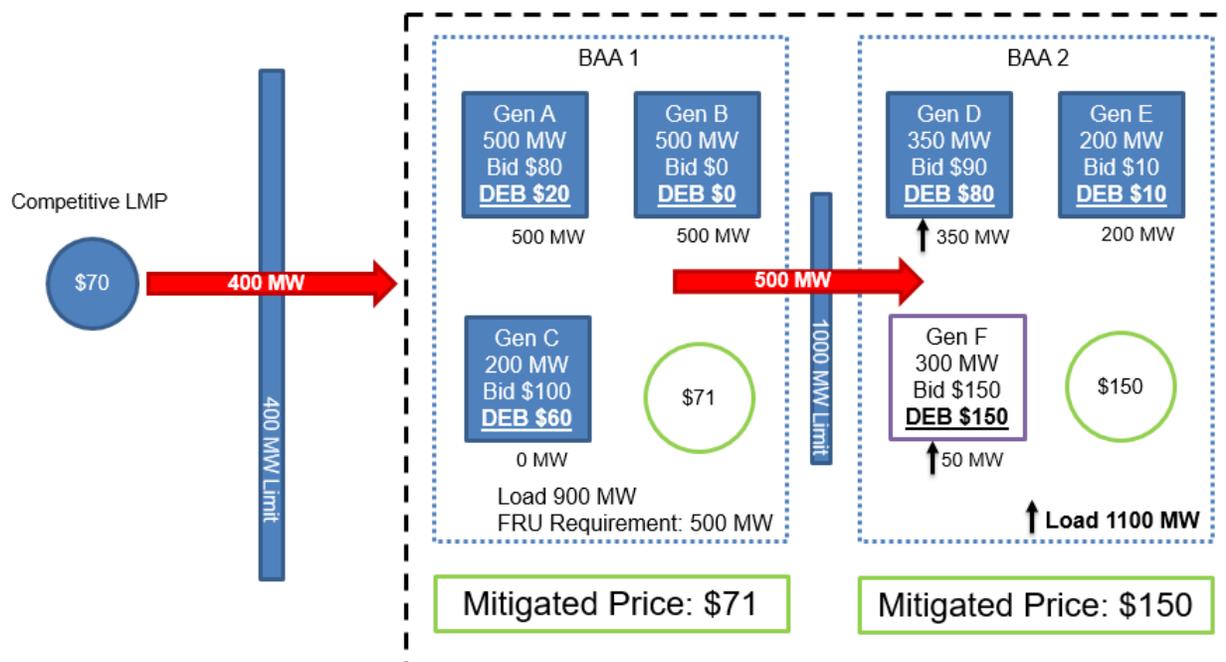
In this example, the advisory interval load forecast is lower than the actual load forecast in the binding interval. Since the transfer limit for BAA 1 is established based upon the lower load forecast this results in lower transfers than would have been scheduled had a the actual load forecast been 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 and the BAA 1 Flexible Ramping Requirement is 50 MW. Accordingly, the 500 MW of net exports to BAA 2 in the unmitigated dispatch exceeds the 50 MW flexible ramping requirement.
- Assume then Generator D has a capacity of 350 MW and that Gen F has an offer price and DEB 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 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 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. This would also result in congestion rents in this example, raising the question of which BAA would be responsible to pay these rents, as well as the incentives created.

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 balancing authority area to meet load in real-time dispatch, these impacts will be relatively small. Furthermore, the importing balancing authority area can rely on internal resources, including those set aside as available balancing capacity to meet their load.

6.2 Hydro Resource Default Energy Bid

Default Energy Bid Calculation

In response to stakeholder's comments 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 captures opportunity costs for hydro resources to sell energy in markets outside of the CAISO and at various points in the future depending on available storage. This proposed default energy bid is also constructed to consider and respect short-term limitations for these resources. This default energy bid would be available to any hydro resource with storage.

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 too low, it can cause a resource with limited availability to run earlier than at optimal times.

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 for use-limited resource 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 limitations that even hydro resources with longer-term storage typically encounter.

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 outside of the CAISO or EIM
- Opportunity cost of generation substituting local resources
- Short-term limitations

This default energy bid would be available for any hydro resource in the CAISO or EIM areas that has available storage. 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 other locations outside of the EIM. It would do this by showing it has long-term transmission rights to specified bilateral trading hubs. The hydro resource default energy bid will be calculated using the following equations:

Proposed short-term default energy bid for a resource with 1-3 months of storage:

$$ST\ DEB = MAX(Gas\ Floor, DA\ Index, BOM\ Index, M\ Index_{+1}, M\ Index_{+2}, M\ Index_{+3}) * 1.35$$

Proposed long-term default energy bid for a resource with 4 or more months of storage:

$$LT\ DEB = MAX(ST\ DEB, MAX(M\ Index_{+4}, M\ Index_{+5} \dots M\ Index_{+12}) * 1.1)$$

And:

$$Gas\ Floor = Gas\ Heat\ Rate * GPI$$

Where, the *M Index* terms in both the short and long term DEB calculations would be limited to the number of months the resource has for available storage,¹³ and

- *DA Index* – Day-ahead (DA) peak price at the local trading hub
- *BOM Index* – Balance-of-month (BOM) futures price for the current month at the local trading hub
- *M Index_{+1, +2 and +3}* – Monthly index futures price at the local trading hub for the successive months 1, 2 and 3, respectively, after the current month
- *M Index_{+4 or more}* – Monthly index futures price at a specific trading hub for successive months after the current month
- *Gas Heat Rate* – Average heat rate for a typical gas resource¹⁴
- *GPI* – The specific gas price index for the resource

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 represents the opportunity costs of generating based on the factors listed above. For example, a hydro resource that has a three month storage horizon may have a proposed default energy bid that assumes the resource would be able to sell energy immediately in the market, or save that energy for future months. This results in an opportunity cost of generating energy today at the highest price that energy could be sold for in those future months. This mechanism uses future energy trading hubs as a proxy for the potential value of future sales, and a scalar to account for volatility in real-time prices versus static day-ahead and monthly indices. Further, this mechanism considers the opportunity to sell energy at different bilateral hubs further in the future.

The short-term term component of the proposed default energy bid includes values that are correlated with real-time prices at the resource's location. These include the cost of average gas generation at the resource's location as well as day-ahead and monthly

¹³ Any resource with one month of storage or less will receive a default energy bid that includes the gas floor, day-ahead peak price, balance of month price, and month-ahead price in the calculation. A resource with storage duration longer than 12 months will receive a default energy bid that includes these terms and each month-ahead future prices up to 12.

¹⁴ The heat rate used throughout examples in this paper is 7,812 Btu/kWh. This heat rate is cited by the Energy Information Agency as an average heat rate for natural gas resources in 2017: https://www.eia.gov/electricity/annual/html/epa_08_01.html.

futures prices at a bilateral hub close to the resource's location. These values can be used to estimate real-time EIM prices and, with the applied scalar, may be used to determine a value that real-time prices, with volatility, will only exceed during a target number of intervals. This target number of intervals may result in dispatch when local market power mitigation is triggered and the resource would be required to run. If a resource truly has this availability to run the calculated value from the proposed default energy bid matches the actual opportunity cost for the resource.

Resources with long-term storage capabilities also can face short-term constraints, and therefore CAISO includes the same set of considerations in their default energy bids. These constraints include operational, environmental, recreation, and fish habitat requirements. Similar to short-term resources, resources with long-term storage capabilities would also prefer to run during the highest priced hours, and would lose potential revenue if forced to run during periods when real-time prices are lower than the optimal set of intervals. Additionally, resources with long-term storage capabilities have the opportunity to sell energy in future months. Monthly futures prices are included to capture this opportunity and long-term resources also have the ability to specify that these bilateral hubs may also be at locations accessible with firm transmission rights.

Customizable Inputs

This default energy bid formula has two inputs that may be customized for each resource receiving the 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, or put another way, the opportunity cost of a sale at one point in time which could be substituted for a future sale.

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, may 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 runs 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 proposes to offer four different bilateral energy-trading hubs for resources with four or more months of storage, which can be included in the long-term component of the default energy bid. These include Mid-Columbia, Palo Verde, north-of-path 15, and south-of-path 15.¹⁵ Hydro resources with storage within particular EIM areas or areas of CAISO will be eligible for a default bilateral energy hub, indicated in the table below. The ISO will identify some default hubs that will be included in the short-term component of the default energy bid calculation and will be the default for the long-term component. **Table 1** below shows a potential mapping that may be used.

Table 1: Default bilateral energy trading hubs

Resource Area	Default Bilateral Hub
Idaho, PacifiCorp West, Portland, Powerex, Puget	Mid-Columbia
Arizona, 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, a resource owner will also have the opportunity to select a different bilateral hub, or weighted average of hubs, for use in the long-term component of the default energy bid calculation. To do this, the market participant would show the CAISO firm transmission from the resource to a different bilateral hub.¹⁶

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. These parameters may be justified to the CAISO initially when requesting this default energy bid, but would not need to be reexamined later.¹⁷ However, because transmission contracts can change over time, resources electing this default energy bid would be required to resubmit

¹⁵ Additional areas bilateral hubs were considered, but to maintain ease of calculation CAISO has elected to offer these four hubs.

¹⁶ Resources with transmission to multiple locations have a default energy bid calculated based on the weighted average price of each hub. 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.

¹⁷ 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.

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.

Analysis

The CAISO performed detailed analysis for the proposed default energy bids using actual EIM prices for the PacifiCorp West (PACW) balancing authority area, bilateral hub prices at the Mid-Columbia trading hub, and gas price indices from October 2017 through September 2018 to determine potential appropriate adders for the short-term 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 were calculated first with Mid-Columbia bilateral hub prices for both a 1 month storage horizon and a 3 month storage horizon. The Sumas fuel region was used to calculate the floor for each DEB.
2. Compare the daily default energy bid to real-time prices in the EIM market.¹⁸
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 scalars applied to the default energy bid formula to determine how frequently resources with different storage horizons would be dispatched in the market. This analysis focuses on a resource with a particular amount of storage being dispatched less than that amount during 95% of intervals, or that a resource with a particular amount of storage is dispatched at its available storage amount or less.

If a hypothetical resource had one month or less of available storage, only had generation capability of 4.75 hours (20% of all hours) per day, and it was permissible to dispatch that resource too frequently 1 in 20 days (5% of the time), then

Table 2 below shows that such a resource bidding in at their default energy bid would have a sufficiently high default energy bid if the scalar applied was 1.30. Similarly, resources, resources with greater amounts of generating capability per day would require a lower scalar, and resources with longer durations of availability (than daily) would also require a lower scalar. However, a resource with less energy viability would

¹⁸ 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.

require a greater default energy bid to achieve the same percentage of periods dispatched less than the total availability.

Similarly, **Table 3** below shows, for a resource that has 3 months of storage capability. That table shows that for a resource with 3 months of storage capability and the availability to generate 16.75 hours per week (10% of hours) an adder of 1.31 would be sufficient to create default energy bids that, would allow the resource to be dispatched less than their availability during 95 percent of intervals.

Hydroelectric resources are highly complex and have conditions that vary with seasonal and daily conditions. Although this analysis is presented for a hypothetical resource, conditions at an actual resource may reflect these assumptions on a handful of days, but may not for most other days. This analysis is designed to inform potential bounds on an adder for the default energy bid that will create bids that are reasonable for some units, but may not be applicable or practical for all hydro resources with storage capability. All hydro resources with storage will have the ability to select this as a default energy bid in addition to the ability to select the existing default energy bid options, including the negotiated default energy and the opportunity cost adder.

This analysis shows that if a hydro resource had a 1.35 scalar applied to the short-term component of the default energy bid, this would result in a value higher than real-time prices during 95 percent of intervals for specific representative resources. This resource could have 1 month of storage that could deliver 4.75 hours of energy per day (20% of intervals) or three months of storage that could deliver energy during 16.75 hours per week (10% percent of intervals). As discussed above, if this default energy bid was in place, true opportunity costs were as constant as outlined, and the resource was always mitigated, then historic EIM price data indicates that the default energy bid would be sufficiently high for a resource to potentially be dispatched efficiently 95 percent of the time or more.

It follows that 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 scalar 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 scalar 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 safety net for any feasible 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.

Table 2: Percent a 1-month storage resource is dispatched less than potential daily availability:

Scalar	Energy Availability (Hours/Day; Appx percent of intervals)				
	2.3 Hrs. (10%)	3.5 Hrs. (15%)	4.8 Hrs. (20%)	6 Hrs. (25%)	8 Hrs. (33.3%)
116%	65%	78%	85%	91%	95%
122%	72%	83%	89%	95%	98%
130%	81%	89%	95%	97%	99%
143%	88%	95%	98%	99%	100%
165%	95%	99%	100%	100%	100%

Table 3: Percent a 3-month storage resource is dispatched less than potential weekly availability:

Scalar	Energy Availability (Hours/Week)				
	16.8 Hrs. (10%)	25 Hrs. (15%)	33.5 Hrs. (20%)	42 Hrs. (25%)	50.3 Hrs. (30%)
101%	55%	72%	83%	91%	94%
105%	62%	83%	91%	96%	96%
110%	75%	87%	94%	96%	98%
115%	81%	94%	100%	100%	100%
131%	96%	100%	100%	100%	100%

Based on the analysis above, the CAISO proposes the following:

- Allow for 2 components in the default energy bid. One for all hydro resources with storage capability and an additional component for resources with storage capability greater than 3 months.
- Include the cost to generate at a typical local gas resource in addition to peak futures bilateral trading hub prices.

The cost of generation at an average gas resource serves as a floor for hydro resources. This value represents the cost to generate substitute energy for a hydro resource the same location.

- Include a 1.35 scalar for the component of the default energy bid with less than three months of storage capability.

This scalar, in the short term component of the default energy bid, is meant to allow local resources to overcome real-time market price variability compared to day-ahead or month-ahead indices.

- Allow for resources with storage durations longer than 3 months to include additional hubs, as well as local hubs where transmission has already been purchased.
- Apply a 1.10 scalar to futures prices at these hubs for hydro resources with more than 3 months of storage capability.

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 Adjustments - Reasonableness Thresholds

The CAISO's recent *Commitment Costs and Default Energy Bid Enhancements (CCDEBE)* policy initiative established a process in which suppliers 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).¹⁹ 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 supplier to request an adjustment to a resource's reference level, 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.²⁰

The CAISO would screen these reference level adjustment requests using an automated process based on "reasonableness thresholds." The CAISO would

¹⁹ 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

²⁰ 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

automatically approve any request to adjust a reference level up to a resource's reasonableness threshold.

The CAISO would 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 and a modification to the gas index used for the day-ahead market, as described in this section.

6.3.1 Gas Resources

The CAISO proposes to amend the reasonableness threshold rules for gas resources developed in CCDEBE to better account for gas price volatility.²¹ 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. The CAISO now proposes to proactively update each morning the reasonableness thresholds used for the CAISO's real-time market on same-day gas trading the CAISO observes on ICE. The CAISO would update the reasonableness thresholds for all resources located in a given fuel region.

Currently, the CAISO uses separate gas prices in the day-ahead and real-time markets. For the real-time market, the CAISO calculates a gas price by averaging at least two published gas prices.²² The CAISO calculates the gas price each day between 7:00 and 10:00 pm using natural gas prices published earlier on the same day based on next-day gas trading. These gas prices are used in a daily fuel region calculation, which are then included in calculating each resources' bid cost reference levels. These reference levels are then used in the next day's real-time market.²³ As the gas prices are one day old when the real-time market, and reflect next-day rather than same-day gas trading, they may be different than actual same-day gas prices on the day of the real-time market.

²¹ Commitment Cost and Default Energy Bid Enhancements Second Revised Draft Final Proposal, Section 5.4
<http://www.caiso.com/Documents/SecondRevisedDraftFinalProposal-CommitmentCosts-DefaultEnergyBidEnhancements.pdf>

²² Natural Gas Intelligence, SNL Energy/BTU's Daily Gas Wire, Platt's Gas Daily, and the Intercontinental Exchange.

²³ California ISO Business Practice Manual, Market Instruments, Appendix C, Fuel Region Gas Price Calculations Rules

For the day ahead market, the CAISO 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 reverence levels for the day-ahead market run that day for the following day.

Regarding the gas-price used for the real-time market, the following example illustrates the timeline for calculating reasonableness thresholds as proposed in the CCDEBE initiative:

Day/Time	Gas Hub	Gas Price	Trade Date	Current
11/1 10:00 pm	SoCal Citygate	\$3	11/2	\$3 used in fuel region calculation to calculate reference levels

In this LMPME initiative, the CAISO previously proposed to modify the CCDEBE rules that calculated reasonableness thresholds based on simply increasing gas prices used in the calculation by 10% or 25%. This modification consisted of a proposal for a largely manual process to adjust individual resource’s reference levels for a day triggered by a request from the supplier. In response to numerous stakeholder requests to identify a process timeline to approve these manual requests, the CAISO further considered options for a more streamlined process. The CAISO determined that the benefit of approving adjustment requests separately did not justify the added workload and additional time required in time for adjustments to be reflected in the market.

Consequently, the CAISO has revised its proposal to proactively update reasonableness thresholds for all resources located in a given fuel region. This approach will be applied to the CAISO’s real-time market according to same-day gas trading the CAISO observes on ICE. The CAISO proposes to modify the current real-time market practice of using gas prices from the day prior to the day of the real-time market. Instead, the CAISO proposes to review same-day gas prices on ICE between 8:00 and 9:00 am each morning. If same-day gas prices are greater than 10% compared to the gas price index, the CAISO will automatically recalculate all resources’ reasonableness thresholds in the applicable gas fuel region’s gas price.²⁴ Otherwise, the reasonableness thresholds will remain based on adding 10% to the gas price index. A resource’s updated reasonableness threshold will apply throughout the real-time trade date. The CAISO will update gas price indices and recalculate reasonableness thresholds between 9:00 and 10:00 am.

The following example illustrates the proposed process for updating reasonableness thresholds used for the real-time market:

²⁴ Both energy and commitment cost reasonableness thresholds would be recalculated.

Day/Time	Gas Hub	Gas Price	Trade Date	Proposal
11/1 10:00 pm	SoCal Citygate	\$3	11/2	Current
11/2 8:00 am	SoCal Citygate	\$4	11/2	\$4 > 10% = Recalculate/update reasonableness thresholds
11/2 8:00 am	SoCal Citygate	\$3.2	11/2	\$3 < 10% = No recalculation/update

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 gas index costs in its day-ahead market for Mondays by including ICE’s Monday-only index.

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%.

6.3.2 Hydro Resource Default Energy Bid

The CAISO previously proposed a reference level adjustment process in this LMPME initiative for resources using the hydro resource default energy bid. This was intended to account for differences between bilateral electricity prices on a particular day and the day-ahead published hub price indices used in the hydro resource default energy bid. After further consideration, the CAISO no longer proposes a reference level adjustment process for the hydro resource default energy bid. This is because the proposed hydro resource default energy bid includes a scaler that already accounts for these differences.

6.4 Gas Prices Indices

The CAISO proposes to remove references 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.

7 Stakeholder Engagement

Table 4 outlines the proposed schedule to complete policy for the EIM Identified Market Power Mitigation Enhancements.

Table 4

Date	Milestone
November 16, 2018	Revised Straw Proposal Posted
November 28, 2018	Stakeholder Call
December 7, 2018	Stakeholder Written Comments Due
January 14, 2019	Draft Final Proposal Posted
January 21, 2019	Stakeholder Call
January 28, 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 revised straw proposal with stakeholders during a teleconference on November 28, 2018. Stakeholders should submit their written comments to initiativecomments@caiso.com by close of business on December 7, 2018.

Appendix A

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 workshops²⁵

7.2 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 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.²⁶ Suppliers are prohibited from utilizing reference level adjustments for strategically placing bids to inflate market revenues or create uplift.

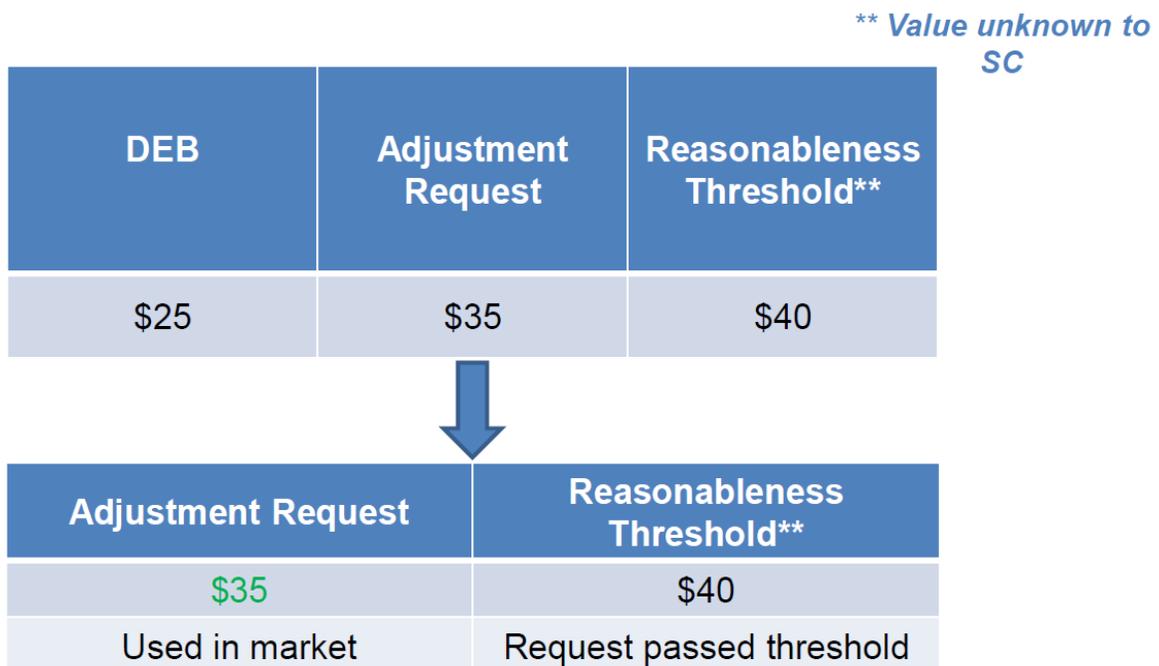
²⁵ For details regarding the *EIM Offer Rules* stakeholder workshop, see:

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

²⁶ Suppliers will not be required to submit this documentation to the CAISO for every adjustment request; however, it must be available upon request.

After a supplier submits a reference level adjustment request, the CAISO will verify the requested amount before a market run.²⁷ To verify an adjustment request, the CAISO 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%.²⁸ For non-gas resources, the reasonableness threshold is 110%.²⁹

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 to request an adjustment to their default energy bid. Their default energy bid is \$25 and they believe their costs are now

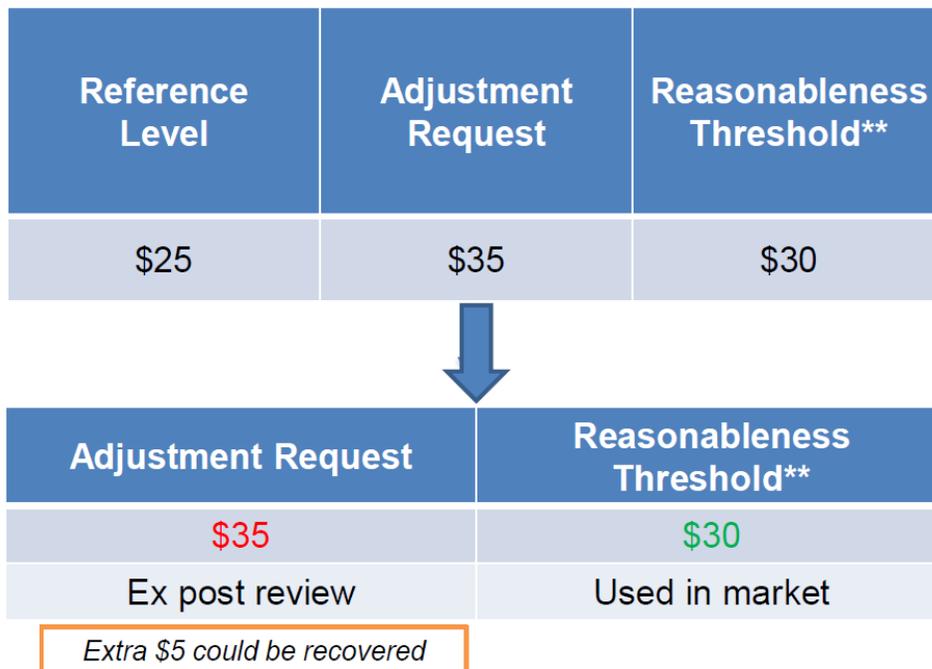
²⁷ If the CAISO is unable to verify an adjustment before the market run, the CAISO will determine whether costs were actual costs incurred above the adjusted reference level through the after-market verification process.

²⁸ 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%.

²⁹ The scaled fuel equivalent costs are calculated by applying a volatility scalar to Master File registered fuel equivalent cost values.

\$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 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.³⁰

7.3 California ISO’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.

³⁰ May not include any adders above cost such as a risk related adder or unrecovered costs through market revenues.

The CAISO evaluates market power through a market structure assessing two quantitative measures for energy.³¹ The CAISO's market power mitigation test is most commonly referred as a three pivotal supplier test.³² To assess transmission competitiveness, the CAISO must first determine if there is sufficient supply to meet demand. Competitiveness is assessed through the dynamic competitive path assessment which includes the three pivotal supply test.³³

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.³⁴ 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.³⁵

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.³⁶ The locational marginal price is equal to System Marginal Energy Cost (SMEC) +

³¹ 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.

³² Structure refers to the ownership of available supply (or capacity) in a market.

³³ Determines if there is sufficient residual supply of counterflow to meet the demand for counterflow on a given constraint.

³⁴ Exercising market power may include a supplier inflating their energy prices, commitment costs, or withholding capacity.

³⁵ Demand Response Resources, Participating Load, and Non-Generator Resources are considered in the market power mitigation process, but are not subject to mitigation.

³⁶ The locational marginal price established in the locational marginal price mitigation run minus the non-competitive congestion component thereof (competitive LMP = $LMP_i - LMP_i^{NC}$).

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 three options:

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)³⁷

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.³⁸

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.³⁹ 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.⁴⁰ The CAISO files these values in a confidential report with FERC each month.

7.3.1 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.

³⁷ 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.

³⁸ California ISO Business Practice Manual, Market Operations, Section 6.5.4 Default Energy Bids

³⁹ California ISO Tariff Section 39.7.1.3.1 Submission Process:

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

⁴⁰ *Id.*

7.3.2 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 five-minute real-time dispatch run (RTD).⁴¹

7.3.2.1 Hour-Ahead Scheduling Process

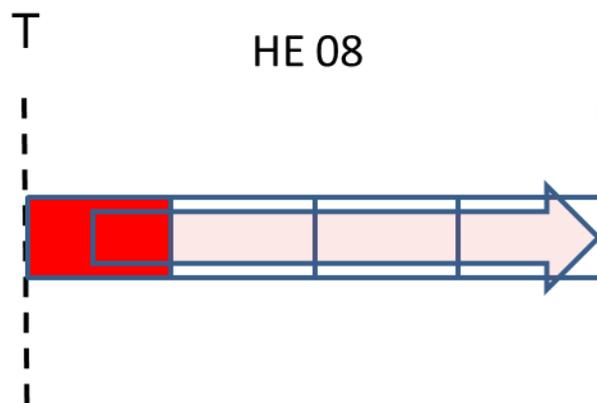
The hour-ahead scheduling mitigation process uses results from real-time unit commitment run (RTUC). The hour-ahead scheduling process uses a single mitigated supply offer for the entire trading hour is calculated using the minimum supply offer price of the four mitigated bid curves from the fifteen-minute levels at each supply offer.⁴² The purpose of the hour-ahead scheduling process is to estimate the fifteen-minute market results for scheduling hourly import supply offers.

7.3.2.2 Fifteen-Minute Market

The fifteen-minute market mitigation process uses results from real-time unit commitment run (RTUC). For the fifteen-minute market, mitigation begins with a resource's unmitigated supply offer for the first fifteen-minute interval of a trading hour.⁴³ After the mitigation runs, the market receives mitigation results for each fifteen-minute interval of a trading hour (*i.e.*, four fifteen-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 fifteen-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 fifteen-minute interval of the fifteen-market indicated in red.



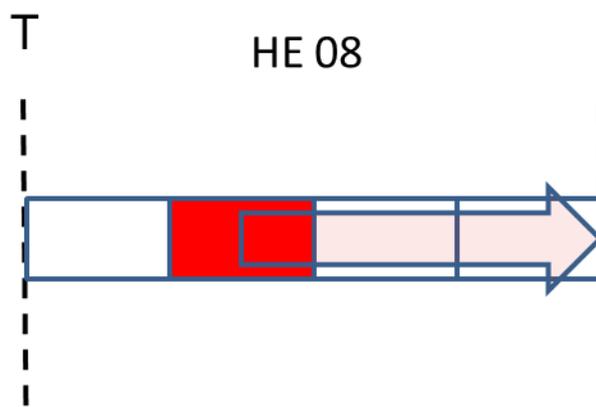
⁴¹ Pending FERC approval of *Commitment Cost and Default Energy Bid Enhancements*, market power mitigation will occur in Short-Term Unit Commitment run (STUC).

⁴² California ISO Business Practice Manual, Real-Time Market, Section 34.1.5.3 Hour-Ahead Scheduling Process MPM.

⁴³ There are four (4) fifteen-minute intervals in an hour.

If market power is not detected in the first interval of the fifteen-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 fifteen-market, but was detected for the third interval. Example 2 illustrates this logic below.

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



7.3.2.3 Five-Minute Market

The five-minute market, also known as real-time dispatch, receives mitigation results from the corresponding fifteen-minute interval. The five-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 five-minute interval has market power and if the supply offer should be mitigated. If market power is detected in a five-minute market, the corresponding fifteen-minute interval will be mitigated.