



Commitment Cost and Default Energy Bid Enhancements (CCDEBE)

Revised Straw Proposal

August 2, 2017

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1. Introduction

The purpose of this initiative is to evaluate the CAISO's market rules relating to suppliers' bidding flexibility. Over the past decade, the CAISO has implemented several incremental changes to its market rules to increase suppliers' bidding flexibility. Even with these improvements, stakeholders maintain that the incremental changes have not resulted in the bidding flexibility they need to reflect all costs under all conditions so have been insufficient to resolve concerns. At the Board of Governors and Management direction, the CAISO is evaluating comprehensive changes to address these bidding rule concerns in this initiative.

Based on stakeholder discussions as part of this initiative, the CAISO believes its current bidding rules do not always provide suppliers the flexibility they need to reflect costs and business needs, especially in light of the expanding Energy Imbalance Market, increasing instances of constrained conditions, and growth of its fleet to include increasingly diverse supply resources. If the market overly limits supply offers, the CAISO is concerned this could undermine market efficiency and discourage participation by non-resource adequacy resources and Energy Imbalance Market resources.

Efficient resource commitment by the California ISO market relies on the ability of suppliers to submit supply offers that reflect suppliers' willingness to sell based on expectations of costs. This in turn also ensures that market participants recover these costs. The California ISO believes its market design should have sufficient bidding flexibility that the design:

- Balances allowing suppliers to submit economic prices reflecting their willingness to provide energy based on their expectation of costs and risks measured against the need to protect against structural or behavioral issues
- Ensures mitigated prices are reasonable reflections of suppliers' cost expectations

Under current rules, California ISO's supply offers include up to four components that represent the total production cost of the unit representing combined cost of the resource starting up, operating at minimum load to be available for dispatch. The California ISO allows market-based energy offers limited by an offer cap and subject to a local market power mitigation test that identifies potential for uncompetitive conditions. If uncompetitive conditions are identified, the California ISO will replace market-based energy offers with the administratively calculated default energy bid¹ (reference level for energy). For its commitment cost offers regardless of whether there is a potential for uncompetitive conditions, the California ISO applies a cost cap effectively only supporting suppliers submitting cost-based commitment cost offers subject to a validation. The validation determines if the cost offers are within a reasonable range of CAISO's expectations of unit's costs i.e. 125% of proxy costs. If suppliers submit cost-based commitment cost offers in excess of this range set by the cost cap, the commitment cost offers are adjusted down to the maximum allowable level.

The California ISO believes suppliers need more flexibility to reflect unique costs, price volatility, and other business considerations than its current market rules provide. By enhancing its bidding flexibility, the

¹ Default energy bid is determined based on one of three options based on market participant's election of variable cost, negotiated or LMP-based.

CAISO can better support integration of renewable resources through incentivizing flexible resources participation during tight fuel supply, account for costs of flexible resources (gas and non-gas) to reduce risk of insufficient cost recovery, and further encourage participation in its markets.

While the CAISO identified needs to address its bidding flexibility design for its commitment costs and mitigated energy prices, the CAISO did not initially intend to address the unlikely risk that a suppliers' cost-based energy offer would exceed \$1,000/MWh because it has not observed price volatility approaching those price levels in the West. However in November 2016, Federal Energy Regulatory Commission (Commission) released a Final Rule (Order 831) requiring the CAISO to enhance its functionality to address bidding flexibility for cost-based energy offers above \$1,000. To comply with Order 831, the CAISO must allow suppliers' verified² cost-based energy offers between \$1,000/MWh and \$2,000/MWh to be eligible to contribute to setting merit order and market prices. The CAISO is further required to support an ex post verification process where any submitted offers either above \$2,000/MWh or unverified, are eligible for an after-the-fact review and eligible for uplift recalculation if verifiable based on the after-the-fact review. The CAISO expanded the scope of this initiative to ensure sufficient bidding flexibility for cost-based energy offers above \$1,000/MWh and proposes to leverage the ex ante and ex post verification processes needed for Order 831 compliance to address existing limitations on its commitment costs and mitigated energy prices.

The purpose of this document is to propose market design enhancements to increase suppliers' bidding flexibility and to comply with Order 831.

This straw proposal will discuss:

- **Changes since previous version** – Describes changes to the proposal in response to stakeholder comments on straw proposal.
- **Summary of revised proposals**- Presents a high-level summary of proposals.
- **Energy Imbalance Market classification** - Provides proposal for Governing Body classification and a discussion of related stakeholder comments.
- **Background** - Provides helpful context relevant to the development and understanding of the issues addressed by these straw proposals and includes background on electric and natural gas markets, bidding rules, market power mitigation methods, and supply offers.
- **Principles** - Presents the design principles adopted by the CAISO for the development of the straw proposal.
- **Market Monitors' recommendation** - Presents rationale for proposal not to pursue the Department of Market Monitoring's recommendation and includes a discussion of stakeholder comments.

² Per Order 831, the standard for verification will be an ex ante verification on whether the cost-based energy offer is a reasonable reflection of cost expectations.

- **Proposal** - Presents proposal to address bidding flexibility concerns including changes to its bidding rules, reference level design, and mitigation measures.
- **Issues removed from scope** - Presents the issues from the issue discussion the ISO determined are not appropriate within scope of this initiative but instead better addressed in other efforts.
- **Appendices** - Provide technical details on the CAISO proposal from straw proposal.

2. Changes since previous version

The ISO made the following changes to the Straw Proposal published on June 30, 2017 in this version:

1. Expanded Background sections to move appendices from straw proposal providing context for proposal to this section and added background on Gas Electric Coordination challenges.
2. Refinements to Hourly Minimum Load Offers policies found in Sections 8.1.3.1 and 8.1.3.2
3. Refinements to Negotiated Commitment Cost Reference Levels and Supplier Submitted adjustments to energy and commitment cost reference levels policies found in Sections 8.2.3.1 and 8.2.3.2
4. Refinements to Market-based commitment costs subject to mitigation policy found in Section 8.3.3.2
5. Updated Appendix A: Stakeholder Engagement Plan schedule
6. Added Appendix B: Details on negotiated options
7. Added Appendix C: Guidelines for ex ante adjustment requests and verification
8. Added Appendix D: Details on commitment cost mitigation
9. Added Appendix E: Details on proposed revision for re-bidding rules

3. Summary of revised proposals

Based on stakeholder feedback as well as consideration of implementation impacts of the various design paths presented in the Issue Paper and discussed during the stakeholder workshops, the CAISO is proposing enhancements that will fall on the third from the left design path shown in the decision tree from the Issue Paper. CAISO proposes to allow market based offers for each component of the supply offer subject to mitigation and allow greater flexibility to negotiate or adjust each component.

Figure 1 below includes two decision trees. They show the trade-offs between the four identified market design paths to attempt to find the optimal path balancing allowing suppliers to submit economic prices reflecting their willingness to provide energy measured against need to protect against structural or behavioral issues and ensuring mitigated prices are reasonable reflections of suppliers' cost expectations. There are four major paths that identified that could lead to a balance. The decision tree on the left is evaluating four potential design paths for the cost level to mitigate a supplier's market based bid based on the amount of risk the market would be exposed to market power concerns. Showing the direct inverse relationship between the market and the suppliers risk exposure, the decision tree on the right shows that the same path that has the lowest risk to the market (path 4) results in exposing suppliers to the highest risk that they cannot reflect their resources cost in the market.

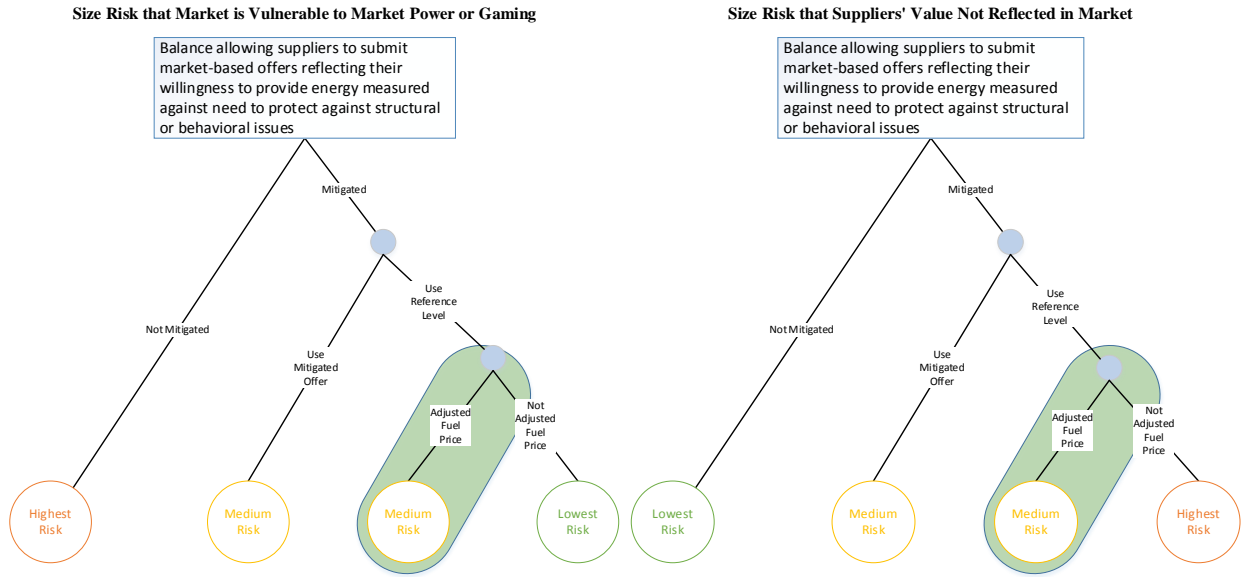


Figure 1: Potential design paths

The California ISO’s current design is the path that imposes a potentially unacceptable risk that the suppliers’ cost expectations will not be reasonably reflected in the market in order to ensure against undo exercise of market power. This is shown by the farthest right path on the second decision tree showing the likely size of the risk suppliers' valuations will not be reflected in the market. While the farthest right path is the highest risk path for the risk on suppliers it is the lowest risk path for the risk to the market since it maintains the lowest risk that the market could be exposed to opportunities to exercise market power or gaming strategies. The design choice sacrifices bidding flexibility to ensure the lowest risk to consumers of artificial pricing. This is consistent with the California ISO’s current policies.

The California ISO posits that the optimal balance would promote a market efficient solution that results in energy prices reflecting suppliers’ willingness to sell under competitive market conditions and suppliers’ cost expectations under uncompetitive market conditions. Such a path would likely fall within one of the two middle paths that have a medium-level risk to both the suppliers and the markets.

The following table, Table 1, provides a breakdown of the straw proposal discussed in remainder of the paper.

Section	Issue	Proposal	Change Type
8.1.3.1	Bidding rules may limit ability to reflect changes in minimum load costs hourly or to select hours for participating in market even when not subject to must-offer obligation	Support hourly minimum load offers	Tariff
8.1.3.2		Apply settlement rules when no minimum load cost offer present	Tariff

Section	Issue	Proposal	Change Type
8.2.3.1	Reference levels may not reasonably reflect impact of externalities or suppliers' cost expectations (Issue Paper Sections 4.4 and 4.5)	Add negotiated option for commitment cost reference levels	Tariff
8.2.3.2		Allow Supplier provided ex ante reference levels adjustments subject to verification requirements	Tariff
8.2.3.2		Allow Supplier provided ex ante reference levels adjustments subject to verification requirements	BPM
8.3.3.1	Commitment cost mitigation may be overly restrictive since ISO only supports cost-based offers that must fall within a reasonable range of reference levels (Issue Paper Section 4.2)	Support market-based commitment cost offers subject to caps	Tariff
8.3.3.2		Apply dynamic market power mitigation	Tariff
8.3.3.3		Apply results of market power mitigation on commitment costs to default assessment for exceptional dispatches	Tariff

Table 1: Summary of Proposals

4. Energy Imbalance Market classification

The CAISO proposed during its issue paper phase and March and April workshops that this initiative should involve the EIM Governing Body's advisory role to the Board of Governors (Governing Body – E2 classification).

Some stakeholders, PGE and NVE believe it appropriate for the Energy Imbalance Market Governing Body to have an approval role for this initiative since it could have a unique effect on Energy Imbalance Market (EIM) participants. The CAISO disagrees. The CAISO continues believe this initiative involves an advisory role for the EIM Governing Body as the initiative is proposing changes to generally applicable real-time market rules or rules that apply to all CAISO markets.

This initiative affects the day-ahead and real-time market rules where the real-time market rules will affect the Energy Imbalance Market entities. These rule changes to ensure consistency and support of an efficient market will need to be applied across the CAISO market, including the EIM, so that the least cost solution produced is assessing costs based on similar principles. Accordingly, the CAISO does not anticipate carving EIM specific scope items out from the overarching design making any proposed changes “generally applicable”.

5. Background

The purpose of this section is to provide context needed to understand the CAISO’s straw proposal presented in Section 8, Proposal. The CAISO will present this context by discussing the following:

- CAISO bidding and settlement
- CAISO energy and commitment cost payments
- Validating cost based commitment cost components
- Mitigating market based energy offers
- Gas-electric markets

5.1. CAISO bidding and settlement

The CAISO requires suppliers to submit supply offers (i.e., bids) into the market. These offers represent their willingness to provide energy at a given price. A supply offer is broken down into four cost components that represent the total production cost of the unit and are as follows:

1. **Startup costs** – costs associated with bringing a unit online from being shut down into a mode it can produce energy³,
2. **Transition costs** – costs associated with moving from one configuration to another for multi-stage suppliers (MSG),
3. **Minimum load costs** – operating the unit at the minimum operating level (Pmin) where a unit cannot drop below without compromising the unit’s operation including run hour costs and costs of producing energy up to Pmin, and
4. **Incremental energy costs** – costs associated with producing energy above Pmin.

When discussing a suppliers’ offer, the common phrase for startup, transition, and minimum load costs is “commitment cost offers” and incremental energy costs is “energy offer”. The CAISO currently supports suppliers to submit market-based energy offers and cost-based commitment cost offers. For purposes of validating its cost-based commitment cost offers or replacing a mitigated energy bid with a cost-based offer, the CAISO calculates reference levels to estimate a resource-specific cost-based offer.

³ These costs will vary by the amount of time the unit has been shut down generally referred to as “hot”, “intermediate”, or “cold” starts. “Cold” starts will be the most expensive of the three as it is likely to require the most fuel or auxiliary power to bring the unit from off to on.

Currently the CAISO validates its cost-based commitment cost offers by subjecting them to a cap (i.e. maximum allowable level). The cap method provides only limited bidding flexibility under the proxy cost option up to 125% of calculated costs and no flexibility under the registered cost option, which fixes commitment cost offers at a market participant registered value up to 150% of calculated commitment cost reference levels for a minimum of 30 days. For market-based energy offers, the CAISO has an offer cap of \$1,000 per MWh and subjects this offers to a dynamic local market power mitigation mechanism. When triggered, a market participant's bid will be mitigated to the selected energy cost reference level. CAISO discusses the mitigation and validation methods in more detail in following sections.

The CAISO requires suppliers to submit offers to its day-ahead market no later than 10AM Pacific the day prior to any trade day. For the real-time market, suppliers submit offers no later than 75 minutes before the beginning of each trade hour (T-75) and can vary from an offer submitted in the day-ahead market. The energy offers can vary between hours in both the day-ahead and real-time market. Energy offers can be updated in real-time constrained by real-time market close at T-75. Commitment costs are also eligible for re-bidding in real-time if the resource did not receive a day-ahead commitment either through an integrated forward market award or a binding residual unit commitment start-up instruction.

5.1.1. Survey of bid structures

In all organized markets, suppliers submit (i.e. bid) supply offers into the market that represent their willingness to provide energy at a given price and are broken into up to four cost components.

There are two different approaches across the organized markets for establishing a benchmark against which the supply offers are evaluated for mitigation purposes. On one hand, California ISO, ISO-NE, NYISO, and MISO have bidding rules where their bid-in supply offers are evaluated in reference to an administratively calculated reference level for mitigation purposes. On the other hand, PJM and SPP's bidding rules allow suppliers to submit separate price-based supply offers and cost-based offers and there supply offers are evaluated in reference to their cost-based offers for mitigation purpose. The California ISO will refer to the price-based supply offers as "supply offers", the cost-based supply offers as "cost-based offers", and the administratively calculated reference level as "reference levels".

There are two primary designs for supply offer structures, i.e. bid structures, used by organized markets. The first design has supply offers with a minimum load cost component and without a no load cost component, a minimum load structure. The second design has supply offer curves without a minimum load cost component and with a no load cost component, a no load structure.

The California ISO's supply offers have a minimum load structure. The supply offer includes up to four components that represent the total production cost of the unit:

- startup costs associated with bringing a unit online from being shut down⁴,

⁴ These costs will vary by the amount of time the unit has been shut down generally referred to as "hot", "intermediate", or "cold" starts. "Cold" starts will be the most expensive of the three as it is likely to require the most fuel or auxiliary power to bring the unit from off to on.

- transition costs associated with moving from one configuration to another for multi-stage suppliers (MSG),
- minimum load costs associated with operating the unit at the minimum operating level (Pmin) where a unit cannot drop below without compromising the unit's operation, and
- incremental energy costs associated with producing energy above Pmin.

Other markets with the minimum load cost structure have three bid components as they do not model transition costs for MSGs.

While the second design functions similarly for the startup cost and incremental energy cost components, the markets with a no load cost structure were designed to bid no load costs and an economic minimum operating level for use in the market process instead of the minimum load cost component. No load costs are largely fuel costs associated with synchronizing a unit to the grid and sustaining a net zero output from the unit. The incremental energy costs are the cost to produce energy above the economic minimum level.

For example, PJM requires suppliers to establish their minimum operating levels through submitting economic minimum operating levels and emergency minimum operating levels. The market systems are optimized using economic minimum levels and the emergency minimum is reserved for emergencies on the system.

5.1.2. Survey of bidding rules

The California ISO requires suppliers to submit supply offers to its day-ahead market no later than 10AM Pacific the day prior to its trade day. The energy offer can vary between hours in both the day-ahead while the commitment cost offer cannot vary by hour. The commitment cost offer does not vary by hour today as it was originally designed to represent an event based cost incurred when awarding a commitment.

The California ISO's survey of organized markets bidding rules showed that its energy bidding rules are very flexible. Energy offers submitted in the real-time market can be different than day-ahead market bids. Whether the unit received a day-ahead schedule or not, the supplier can adjust the units energy offer up until 75 minutes prior to the operating interval⁵ limited by the \$1,000/MWh offer cap and subject to local market power mitigation. These rules are very similar to ISO-NE, NYISO, and MISO's energy bidding rules.

In addition to the limitation to vary by hour noted above, the California ISO currently does not provide as much rebidding flexibility for commitment cost offers. It limits suppliers' commitment cost offers by applying a bid cap method for mitigation purposes. The bid cap limits commitment cost offers to no more

⁵ The ISO dispatches its real-time market in five minute intervals where those dispatches are cleared against real-time load. Advisory dispatches are sent up to four and a half hours prior to the operating interval from through the five minute market (5MM).

than 125 percent of their unit-specific reference level calculation. Further, suppliers cannot adjust these commitment cost offers in real-time.

In response to stakeholders concerns that the rules were too restrictive and that they were at risk of incurring commitment costs above CAISO's commitment cost bid cap, the California ISO analyzed the flexibility provided across the organized markets during the *Bidding Rules Enhancements* initiative. The California ISO found that NYISO, PJM, and SPP allow resources without a day-ahead schedule to rebid commitment costs in the real-time market and MISO and ISO-NE allow even greater flexibility to adjust up until 30 minutes before the operating hour.

In the case of the NYISO, NYISO chose not to allow full bidding flexibility such as MISO or ISO-NE because of reliability concerns. The concern was that there is an operational need to lock commitment costs for units that received a day-ahead schedule to support reliability. However it would not adversely impact reliability to allow rebidding flexibility for units without day-ahead schedules. NYISO notes that "for system reliability, the NYISO needs to be able to rely on the Day-Ahead commitment of Suppliers sufficient to serve expected real-time Load. Maintaining the Minimum Generation and Start-up Bids for Day-Ahead scheduled Suppliers allows the NYISO to rely on them for incremental Energy, should the need arise."⁶

On the other hand, ISO-NE found it required the greater level of flexibility because it has experienced significant reliability degradation from gas supply constraints causing suppliers to not respond to dispatch. For example, the ISO-NE found in "an examination, conducted in early 2012, of dispatch response performance following the 36 largest system contingency events over the last three years indicates that, on average, the response rate for New England's non-hydro generating resources was less than 60 percent of the amount requested during the events."⁷

After finding sufficient benefit to increasing its commitment cost bidding flexibility, the California ISO filed tariff amendments to increase flexibility in its real-time market. Pending FERC approval of the *Bidding Rules Enhancements* tariff filing⁸, the California ISO will no longer lock in the commitment cost offers used in the day-ahead but will now allow suppliers to revise these offers in real-time. A generating unit will be able to adjust these offers for (1) hours without day-ahead schedules and (2) once committed in real-time for hours after it reaches its minimum run time. If the unit is not bid into the day-ahead market, the supplier can rebid commitment costs in the real-time market at any point up until the real-time market closes for a particular hour.

These updated bidding rules are consistent with the bidding flexibility found in the other organized markets.

Under the *Bidding Rules Enhancements* initiative, the California ISO committed to perform a survey of other organized markets' bidding flexibility rules and market power mitigation methods as a tool for

⁶ NYISO, FERC docket no. ER10-1977, July 26, 2010, p. 4.

⁷ ISO-NE, FERC docket no. ER13-1877, transmittal letter, July 1, 2013, p. 3.

⁸ August 19, 2016 Tariff Amendment on Bidding Rules Enhancements, Minimum Load Costs, RE16-2445, http://www.caiso.com/Documents/Aug19_2016_TariffAmendment_BiddingRules_CommitmentCostsEnhancements_ER16-2445.pdf.

evaluating whether comparatively the California ISO’s rules are more or less restrictive to other market operators. The California ISO expands this review to include the mitigated prices to which supply offers are mitigated and flexibility provided to support appropriate cost recovery.

The intent of CAISO’s survey was to understand how the bidding rules and mitigation methodologies of other ISOs are similar or differ from each other. The California ISO is evaluating whether other design features could effectively be applied in its markets to address the concerns raised by Stakeholders in this initiative.

First, the below table, Table 2, shows the results of the survey on bidding rules.

Organized Markets	Bid structure	DA Market Close	RTM rebidding (Last time to modify)	
			Commitment Costs	Incremental Energy
CAISO⁹	Submit energy, start-up, minimum load, and transition cost offers	10:00 PT TD-1	(Pending) For hours with no day-ahead award and once committed when not under a minimum run time limitation: T-75 ¹⁰	T-75
ISO-NE¹¹	Submit energy, start-up and no load offers All cost offers may vary by hour	10:00 ET TD-1	T-30	T-30
MISO¹²	Submit energy, no load and start-up offers	11:00 CT TD-1	T-30 Eligibility for uplift payments are subject to more nuanced uplift rules so changed bid may not be guaranteed uplift.	T-30 Eligibility for uplift payments are subject to more nuanced uplift rules so changed bid may not be guaranteed uplift.

⁹ CAISO, Tariff section 30.5.1 General Bidding Rules.

¹⁰ Pending tariff filing as result of Bidding Rules Enhancements policy.

¹¹ ISO-NE Market Rule 1, Sections III.1.7.6, III.1.10.9

¹² MISO, Tariff Module C: Energy and Operating Reserve Markets, Section 39.2.5 and 40.2.5, Required Generation Offer and Demand Response Unit - Type II Offer Components.

Organized Markets	Bid structure	DA Market Close	RTM rebidding (Last time to modify)	
			Commitment Costs	Incremental Energy
NYISO¹³	Submit energy, minimum load, and start-up offers	5:00 ET TD-1	T-75 If no day-ahead schedule then no limit on price level bid but price level locked for offers with day-ahead schedules.	T-75 Eligibility for uplift payments are subject to more nuanced uplift rules so changed bid may not be guaranteed uplift.
PJM¹⁴	Submit price-based and cost-based schedules for start-up, no load, and energy offers Choice of cost-based option for start-up and no load fees or price-based option start-up and no load fees.	10:30 ET TD-1 Daily bidding under cost-based option for start-up and no load. Twice per year for price based start-up and no load.	<u>Price-based</u> 14:15 ET TD-1: May update offers for hours not committed in day-ahead May not change from self-schedule to economic bidder <u>Cost-based</u> If no day-ahead, may opt to instruct market to use its cost-based schedules for an hour by three hours prior to the operating hour If day-ahead awards, must opt to use cost-based schedules prior to 2100 ET TD-1	<u>Price-based</u> 14:15 ET TD-1: May update offers for hours not committed in day-ahead May not change from self-schedule to economic bidder <u>Cost-based</u> If no day-ahead, may opt to instruct market to use its cost-based schedules for an hour by three hours prior to the operating hour If day-ahead awards, must opt to use cost-based schedules prior to 2100 ET TD-1

¹³ NYISO, Market Services Tariff (MST), Section 4.2 and 4.4 MST.

¹⁴ PJM, Manual 11: Energy & Ancillary Services Market Operations, Section 2.3.3 Market Sellers.

Organized Markets	Bid structure	DA Market Close	RTM rebidding (Last time to modify)	
			Commitment Costs	Incremental Energy
SPP¹⁵	Submits unit offers and mitigated unit offers for start-up, no load, and energy offers Mitigated offers must be consistent with Mitigated Offer Development Guidelines	11:00 CT TD-1	<u>Unit offers:</u> T-30 <u>Mitigated offers:</u> If day-ahead award then no rebidding If no day-ahead award and not eligible for intra-day adjustments then up to 17:00 CST TD-1 If units online past DA or RUC commitment period, fuel-switching units, or a quick start unit: ¹⁶ T-30	<u>Unit offers:</u> T-30 <u>Mitigated offers:</u> If day-ahead award then no rebidding If no day-ahead award and not eligible for intra-day adjustments then up to 17:00 CST TD-1

Table 2: Survey of Organized Markets' Bidding Rules

5.2. CAISO energy and commitment cost payments

Energy prices do not directly reflect start-up costs, transition costs, or minimum load costs. These costs influence which units are committed, indirectly affecting the energy price. The energy price reflects the marginal cost of energy given commitment decisions.

The CAISO settles a resource's market award through market revenues and uplift payments. For any incremental energy produced, the supplier will receive payment at the locational marginal price LMP. If a unit has a shortfall of market revenue the supplier's over the day, the difference between the unit's supply offer and market revenues are compensated by uplift mechanisms, such as make-whole payments.

Energy prices generally only reflect the marginal cost of the next unit needed to meet demand, which is an incremental cost not a total cost. The market runs a security constrained unit commitment run which minimizes the total costs of power production given a set of physical constraints using supply offers representing the short-run total production costs at a given output level. The short-run total production

¹⁵ SPP Market Protocols Integrated Marketplace, Section 4.2.2.1.

¹⁶ SPP Market Protocols Integrated Marketplace, Section 8.2.2.

costs are modelled using the commitment cost and incremental energy cost components of the supply offer¹⁷.

After the set of units committed are determined, the market will produce prices that reflect the marginal cost of serving an additional unit of demand, which generally is set by the energy offers and does not include commitment cost offers. Energy prices are not intended to reflect the impact of start-up costs, transition costs, no load or minimum load costs. As noted above, these costs will influence which units are committed so there is an indirect impact to the energy price. Instead, the energy price is intended to reflect the marginal cost of energy given commitment decisions.

The California ISO settles a unit's market award so that they are compensated at the price submitted in their supply offer through their market revenues and uplift payments. For the incremental energy produced, the supplier will receive payment for this energy at the energy price (market revenues). To the extent a unit has a market revenue shortfall where its market revenues do not exceed its supply offer, the unit is compensated for the difference between its supply offer and its market revenues through uplift mechanisms.

Uplift mechanisms provide make-whole payments to suppliers who had a market revenue shortfall. The California ISO will generally pay this make-whole payment either through its bid cost recovery mechanism for market awards or excess cost payments for out-of-merit exceptional dispatches¹⁸ (uplift payments). The need for uplift payments tends to occur more when energy demand is lower or when the ISO dispatches a unit to operate at or near its minimum load.

Initially, electricity markets when designed envisioned that energy prices would be sufficiently high so that the need for uplift payments would be limited. As energy markets and operations shifts to reflect the impact of renewable output, the market is concerned that need for uplift payments to serve as primary source of compensation for lumpier commitment costs may be resulting from its observation of more instances of low prices and an increased need to dispatch units near minimum load. Both of these factors could result in suppliers needing uplift to make whole their supply offers.

5.3. Validating cost based commitment cost components

For the cost-based offers, the CAISO does not apply mitigation since by definition these are cost-based offers but instead applies a validation (i.e. verification) representing a reasonable range that cost offers could fall around the CAISO reference level for commitment costs. For gas-fired resources, the CAISO calculates fuel cost portion of the proxy costs; non-gas resources submit their fuel cost equivalent portion for the proxy costs. The upper bound of the range called the maximum allowable commitment cost levels is set at 125 percent of commitment cost reference level. The 25% headroom provides some flexibility to

¹⁷ Any solution within the boundaries defined by these constraints will be a valid solution but the optimal solution within the boundary will be the one that produces the lowest cost to consumers.

¹⁸ The California ISO settles the excess cost for exceptional dispatches used to mitigate or resolve congestion as a result of transmission related modeling limitations through exceptional dispatch uplift settlements (Charge Code Configuration Guide 6488). The California ISO settles the excess costs for system emergency exceptional dispatch energy types through the real-time excess cost uplift settlements (Charge Code Configuration Guide 6482). Both of these excess cost uplift settlements are made at the supplier's offer price or better.

recover costs that are not reflected in the commitment cost reference levels. Stakeholders have expressed that these commitment cost rules are too restrictive and suppliers are at risk for incurring costs above the commitment cost cap.

For estimating the commitment cost reference levels today, the CAISO supports a proxy cost option for all resources and a registered cost option only for use-limited resources. Under registered cost option, use-limited resources can register costs up to 150% of a monthly commitment cost reference level but have no daily bidding flexibility. See Appendices for additional information on the commitment cost reference levels (proxy costs).

5.4. Mitigating market based energy offers

For market-based offers for energy above minimum load, the CAISO limits the market-based energy offers to a \$1,000/MWh cap and they are subject to local market power mitigation. The \$1,000/MWh cap is a “circuit breaker” cap providing a backstop against uncertainty affecting the market power mitigation test. If an energy offer fails the market power mitigation test, the energy offer will be replaced with the applicable reference level for energy costs, called a default energy bid (DEB).

The three pivotal supplier test assesses the sufficiency of counterflow supply available to meet demand after removing capacity owned by one or more entity to identify which binding transmission constraints are competitive or un-competitive. After removing the potentially largest suppliers if there is sufficient counterflow supply to meet demand, the constraint is deemed competitive. Otherwise, it is uncompetitive.

The CAISO then determines the portion of the marginal congestion component at the resource’s node that comes from uncompetitive transmission constraints. If the non-competitive congestion component is positive, indicating the resource may have the ability to exercise market power through its ability to relieve congestion on uncompetitive constraints, the resource will be mitigated to the higher of the competitive market price with the uncompetitive portion of the marginal congestion component removed or the resource’s reference level.

For calculating the energy cost reference level (i.e., DEB) today, gas or non-gas suppliers can select one of three options:

1. Variable Cost Option (see CAISO Tariff Section 39.7.1)
2. Negotiated Rate Option (see CAISO Tariff Section 39.7.1.3)
3. LMP Option (see CAISO Tariff Section 39.7.1.2)

A supplier for each resource or load will rank the above 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.¹⁹

Currently, the negotiated option requires the supplier to provide cost information to establish an approved rate formulation with the Department of Market Monitoring (DMM). Suppliers who elect to

¹⁹ California ISO Business Practice Manual, Market Operations, Section 6.5.4 Default Energy Bids

have their rate negotiated first submit a proposed default energy bid (i.e. energy reference level) along with supporting documentation. Within ten business days, a written response will inform the whether the requested rate has been accepted or denied. If accepted, the new rate will generally become effective within eleven business days. If denied, the CAISO or DMM will enter into negotiations for sixty days. During this period, if the supplier and the CAISO or DMM agree to a rate, it will generally become effective within eleven business days.²⁰ 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.²¹ The CAISO files these values in a confidential report with FERC each month.

5.4.1. Survey of mitigation design

The organized markets generally apply one of two mitigation methods either a conduct and impact test or a three pivotal supplier test. Once failing a mitigation test, markets mitigate the supply offers to reference levels or suppliers submitted cost-based offers. In all markets that mitigate to reference levels except for California ISO, the markets provide an opportunity to request a fuel price adjustment in the reference level calculation or to provide opportunity for after-the-fact uplift payments. This more accurately reflects suppliers' cost expectations the reference levels or cost-based offers as well as ensures after-the-fact compensation for actually incurred costs that exceed these values.

ISO-NE, MISO, SPP, and NYISO apply a conduct and impact test to its supply offers, all components of its supply offers. Whereas, PJM and CAISO apply a three pivotal supplier test for mitigation. PJM applies mitigation to the entire supply offer, all components of its supply offer, and CAISO only applies mitigation to the energy component.

A three pivotal supplier test evaluates if a given constraint is competitive or un-competitive. If there is sufficient supply to meet demand, after removing the largest suppliers, the constraint is competitive. Otherwise, it is uncompetitive and provides opportunity for the exercise of market power. Suppliers whose can provide supply to uncompetitive constraints are subject to mitigation procedures. These tests are triggered by a binding constraint or another defined need for supply in a defined area. Offers would be mitigated if, without the largest suppliers, the demand could not be met. The determination that demand could not be met without the supply is made by comparing the demand at that location to the supply offered with the three largest suppliers removed. If dispatched, the supply offered would be injected on the system and depending on its distribution factor would flow a portion of that power across the applicable constraint in the counterflow direction relieving congestion in the prevailing flow direction.

CAISO found that ISO-NE, MISO, SPP and NYISO applied a different form of market power mitigation test than itself – conduct and impact test. A conduct and impact test is a two-step mitigation methodology. A unit fails the conduct test when the offer reaches a pre-determined threshold, e.g., 200 percent above the reference level or supplier submitted cost-based offer. It is then subject to the impact test. How the

²⁰ California ISO Tariff Section 39.7.1.3.1 Submission Process:

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

²¹ *Id.*

impact test is conducted in each market varies, but essentially it replaces the supply offer with the reference level or cost-based offer and compares the resulting energy prices or change in uplift payments to see if the supply offer has the ability to impact the market. An impact test on energy prices alone would not be effective at capturing market power related to inflated commitment cost offers.

While some markets only review impact to energy prices and others such as NYISO include impact to uplift payments, the California ISO believes that an impact test applied to commitment cost offers needs to include changes to the overall amount of uplift payments to reliably capture market impacts from inflated commitment cost offers.

When an organized market applies an impact test on energy prices or uplift payments, it reruns the market using the reference levels or cost-based offers to see if there is a decrease in uplift payments or energy prices in the market power test run. If the market power test shows lower energy prices or uplift payments than the run using the supply offer, the supply offer fails the impact test and the reference level or cost-based offer will be used in the final market run.

For example of an impact test on energy price changes, a unit located in a load pocket that is the marginal unit necessary to serve local load. The market operator's minimum load reference level for the unit is \$5,000 and the unit has a default energy bid of \$50/MWh. Assume the unit bids \$50,000 for minimum load and \$50/MWh for energy. The market solution would commit the unit and have an energy price of \$50/MWh at that location. Under a conduct and impact test structure, it would fail the conduct test and be subject to an impact test. The market operator replaces the supply offers with the minimum load reference level of \$5,000 and the default energy bid \$50/MWh.

Then, the market operator reruns the market and compares the energy prices or uplift payments. The energy price remains the same at \$50/MWh. If the test just looks at energy prices, since the two resulting energy prices are the same, the unit would not have its minimum load bid of \$50,000 mitigated. However in some markets, if the supplier's offer would have resulted in higher uplift costs then it could be mitigated (e.g. NYISO).

A concern with the use certain forms of a conduct and impact test is that units withholding capacity from the market to impact prices for an external benefit could be successful unless a screen for withholding is included in the design. To address this, NYISO evaluates units that were not cleared in its market process. This is done by replacing supply offers not cleared in the market process with either the reference levels or cost-based offers and then rerunning the market solution to apply the conduct and impact test. If when evaluating the new commitment decisions and energy prices, the energy prices or uplift payments with are lower than prices determined with the supply offer the supplier will fail the impact test even if not committed in market run. In NYISO, MISO and ISONE, there is one impact test that is applied to all mitigated resources, not to each portfolio.

Table 3 shows the results on market power mitigation methodologies and Table 4 provides additional detail on markets' conduct and impact tests. The mitigation results in Table 3 include description of the price levels that the bids are mitigated to if either test fails, opportunities for fuel price adjustments in advance of the market run, opportunity to seek after-the-fact cost recovery, and validation methods to ensure market is protected from submission of artificial prices.

Organized Markets	Mitigation method	Provisions for ad hoc reference level adjustments	Uplift compensation when supplier is limited in reflecting costs in supply offer	Validation Method
CAISO	<p><u>Both Methods</u></p> <p>For commitment costs: conduct test applied and mitigates to bid cap</p> <p>For dispatchable energy: Dynamic structural test (three pivotal suppliers)</p>	None	Proposed an after-the-fact cost recovery for commitment costs exceeding bid cap due to marginal fuel procurement costs through extending 205 filing right at FERC. Pending at FERC	None, ISO calculates reference level and does not adjust its reference levels prior to or after the market run.
ISO-NE²²	<p><u>Conduct and impact test applied and mitigated to reference level</u></p> <p>Pivotal supplier test and a constrained area test to determine which conduct thresholds to apply for general mitigation</p> <p>Apply conduct test only to minimum load cost, start-up and no load based on criteria</p> <p>If energy or commitment fails,</p>	<p>May request revisions to reference level calculation no later than 17:00 ET TD-2 with exceptions up until 21:30 ET TD-1;</p> <p>May seek a fuel price adjustment intra-day by submitting expected fuel price to replace bid-in price in reference level calculation when its expected price will be greater than that used in calculation.</p>	Federal Power Act Section 205 filing right at FERC to seek recovery of supply offers mitigated or above the offer cap exceed settlement payments for costs above the offer cap or for mitigated energy offers. ²³	Fuel price adjustment in reference level must reflect price at which supplier expects to procure fuel and must submit supporting documentation within 5 business days.

²² ISO-NE, Market Rule 1, Section III.A.3 and Section III.A.5.

²³ Reference to ISO-NE after-the-fact cost recovery language

Organized Markets	Mitigation method	Provisions for ad hoc reference level adjustments	Uplift compensation when supplier is limited in reflecting costs in supply offer	Validation Method
	mitigates all parameters			
MISO²⁴	<u>Conduct and impact test applied and mitigated to reference level</u> Conduct thresholds applied to reference level to trigger impact Impact test on prices or uplift payments Mitigation only applied in the presence of binding transmission constraints or reserve zone constraints.	May contact the IMM to make other arrangements including intra-day changes if the Reference Levels do not accurately reflect their costs	NONE	None the CAISO could find
NYISO²⁵	<u>Conduct and impact test applied and mitigated to reference level</u> Conduct thresholds to trigger impact test	May update fuel prices in reference levels if submitted in sufficient time prior to market close	If not able to submit timely and extraordinary circumstance, may request to revise fuel cost and recalculate reference levels, restore accepted bids that would not have	MMU screens for fuel type and fuel price information submitted for potentially inaccurate information, for updates to reference level

²⁴ MISO, Tariff Module D: Market Monitoring and Mitigation Measures, Section 63, 64 and 65.

²⁵ NYISO, NYISO Tariffs, Market Administration and Control Area Services Tariff, Attachment H: ISO Market Power Mitigation Measures, Section 23.1 and 23.3. Specifically section 23.3.1.4.6.9 for reference to start-up and minimum load costs, specifically section 23.3.1.4.6.7 for changes to the reference level for fuel, and section 23.3.1.4.6.7 for timing before real-time market close.

Organized Markets	Mitigation method	Provisions for ad hoc reference level adjustments	Uplift compensation when supplier is limited in reflecting costs in supply offer	Validation Method
			<p>failed mitigation with new reference level and settle after-the-fact.</p> <p>Also - extend 205 filing right at FERC</p>	<p>before market close expected to retain invoices and supporting documentation under data retention requirements</p>
PJM²⁶	<p><u>Pivotal Supplier Test applied and mitigated to cost-based offer</u></p> <p>Structural test (three pivotal suppliers) for active constraints</p> <p>Bid-in cost-based offers required to be consistent with unit-specific fuel policy</p>	N/A	<p><u>Cost-based adjustments</u></p> <p>May request compensation for differences between bid-in cost-based offer and actually incurred costs after-the-fact through uplift</p> <p><u>Energy costs above offer cap</u></p> <p>May seek uplift payments after-the-fact for cost based energy offers greater than \$2,000/MWh by submitting relevant supporting documentation.</p>	<p><u>Cost-adjustments</u></p> <p>MMU reviews requested adjustments after-the-fact. If unsatisfied, may request PJM review and include MMU finding in request.</p> <p><u>Energy costs above offer cap</u>, must submit by 1030 ET TD+1 documentation of the Market Seller’s calculation of the cost-based offer in accordance with cost development guidelines and applicable fuel cost policy.</p>

²⁶ PJM, Manual 15: Cost Development Guidelines, Section 1.6.1 Reason for Cost based offers: Market Power Mitigation.

Organized Markets	Mitigation method	Provisions for ad hoc reference level adjustments	Uplift compensation when supplier is limited in reflecting costs in supply offer	Validation Method
SPP	<p><u>Conduct and impact test²⁷ applied and mitigated to mitigated offers</u></p> <p>Conduct thresholds to trigger impact test</p> <p>Mitigation only applied in presence of a binding constraint or reserve zone, or unit committed to address Local Reliability Issue. Pivotal supplier test used to determine constrained areas.</p> <p>Mitigated offers consistent with Mitigated Offer Development Guidelines</p>	N/A	NONE	MMU verifies mitigated offers using fuel cost policy and cost day submitted consistent with mitigated offer development guidelines

Table 3: Various Mitigation Methods for Commitment and Energy Costs

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
ISO-NE	Energy	General	lower of 300% or \$100/MWh increase relative to reference	lower of either 200% or \$100MW/h of energy prices	III.A.5.5.

²⁷ SPP Market Protocols Integrated Marketplace, Attachment AF, Section 3.

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
			level (except if offer less than \$25/MWh)		
ISO-NE	Energy	Constrained	lower of 50% or \$25/MWh increase relative to reference level	lower of either 50% or \$25/MWh of energy prices	III.A.5.5.
MISO	Energy	Broad Constrained Area (sufficient compensation expected)	lower of 300% or \$100/MWh increase relative to reference level (except if offer less than \$25/MWh)	lower of 200% or \$100/MWh increase of energy prices or any increase in uplift payments	64.1.2
MISO	Energy	Narrow Constrained Area (insufficient compensation expected)	lower of 300% or \$100/MWh increase relative to reference level (except if offer less than \$25/MWh)	calculated threshold relative to energy prices or any increase in uplift payments	64.1.2
NYISO	Energy	General	lower of 300% or \$100/MWh increase relative to reference level (except if offer less than \$25/MWh)	lower of 200% or \$100/MWh increase of energy prices	23.3.1.2.1
NYISO	Energy	Constrained	Distribution factor greater than 0 and increase of more than calculated threshold	lower of 200% or \$100/MWh increase of energy prices or uplift payments	23.3.1.2.2
SPP	Energy	Frequently Constrained Area	17.5% increase relative to submitted mitigated	\$25/MWh increase of energy prices, uplift payments,	AF 3.2, 3.7

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
			offer (except if offer less than \$25/MWh)		
SPP	Energy	Local Reliability Issue Commitment	10% increase relative to submitted mitigated offer (except if offer less than \$25/MWh)	\$25/MWh increase of energy prices, uplift payments,	AF 3.2, 3.7
SPP	Energy	General	25% relative to submitted mitigated offer (except if offer less than \$25/MWh)	\$25/MWh increase of energy prices, uplift payments,	AF 3.2, 3.7
NYISO	Minimum Load	General	lower of 300% or \$100/MWh increase relative to reference level (except if offer less than \$25/MWh)	lower of 200% or \$100/MWh increase of energy prices	23.3.1.2.1
NYISO	Minimum Load	Constrained	Distribution factor greater than 0 and increase of more than calculated threshold	lower of 200% or \$100/MWh increase of energy prices or uplift payments	23.3.1.2.2
MISO	Minimum Load (No-Load plus Energy up to Hourly Economic Minimum) Level	Broad Constrained Area (sufficient compensation expected)	lower of 300% or \$100/MWh increase relative to reference level (except if offer less than \$25/MWh)	lower of 200% or \$100/MWh increase of energy prices or any increase in uplift payments	64.1.2
MISO	Minimum Load (No-Load plus Energy up	Narrow Constrained Area (insufficient	Distribution factor greater than 0 and increase of more	calculated threshold relative to energy	64.1.2

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
	to Hourly Economic Minimum) Level	compensation expected)	than calculated threshold	prices or any increase in uplift payments	
SPP	No-load	Local Reliability Issue Commitment	10% increase relative to submitted mitigated offer	\$25/MWh increase of energy prices, uplift payments,	AF 3.2, 3.7
SPP	No-load	General	25% relative to submitted mitigated offer (except if offer less than \$25/MWh)	\$25/MWh increase of energy prices, uplift payments,	AF 3.2, 3.7
MISO	Start-up	Broad Constrained Area (sufficient compensation expected)	200% of reference level	lower of 200% or \$100/MWh increase of energy prices or any increase in uplift payments	64.1.2
NYISO	Start-up	General	200% of reference level	lower of 200% or \$100/MWh increase of energy prices	23.3.1.2.1
NYISO	Start-up	Constrained	200% increase relative to reference level	lower of 200% or \$100/MWh increase of energy prices or uplift payments	23.3.1.2.2
SPP	Start-up	Local Reliability Issue Commitment	10% increase relative to submitted mitigated offer	\$25/MWh increase of energy prices, uplift payments,	AF 3.2, 3.7
SPP	Start-up	General	25% relative to submitted mitigated offer (except if offer less than \$25/MWh)	\$25/MWh increase of energy prices, uplift payments,	AF 3.2, 3.7

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
MISO	Start-up Offers	Narrow Constrained Area (insufficient compensation expected)	50% of reference level	calculated threshold relative to energy prices or any increase in uplift payments	64.1.2

Table 4: Conduct and Impact Thresholds

5.4.2. Survey of mitigated prices

The two main methods for determining the mitigated price to settle the mitigated supply offers are to either mitigate to the reference level or the submitted cost-based offer. In the first instance, the market operator replaces and settles the supply offers with the administratively calculated reference levels. In the second instance, the market operator replaces the supply offers with the cost-based offers when the unit tests positive for market power.

The CAISO, NYISO, ISO-NE, and MISO adopted the method based on a reference level.²⁸ Whereas, PJM and SPP adopted the second method to mitigate to the cost-based offer bid in by the supplier. Reference levels are estimates of a generating unit's incremental production cost for use in its market power mitigation mechanisms. Bid-in cost based offers are offers developed by the supplier submitted in bids along with the market based offers that follow set of development guidelines and associated policies.

Calculating reference levels (proxy costs or default energy bids)

For mitigating its energy offers, the California ISO mitigates non-gas fired units to their energy cost registered in Master File and gas-fired units to their default energy bid or competitive LMP. The default energy bid will either be based off the locational marginal price, variable cost, or negotiated option. For these gas-fired units, the supplier will rank its preference for default energy bid calculation between these three options. The variable cost option as it is (1) the administratively calculated option, (2) it largely provides the basis for the negotiated default energy bid calculation as well for units who the variable cost option does not reasonably value the unit, and (3) it serves to highlight scenarios driving suppliers need for alternatives to the variable cost estimate.

For limiting its commitment cost offers to a bid cap reflecting reasonable value of a cost based offer, the California ISO limits potential market power through an established bid cap that limits commitment cost offers to its unit-specific cap. If a supplier submits a commitment cost offer that exceeds its bid cap, the California ISO limits the commitment cost offers to the bid cap levels not to the reference levels. To set

²⁸ In all of the other ISO/RTOs sampled, the market monitoring unit either calculates or works with the ISO/RTO to calculate reference level commitment costs in conjunction with performing a market power mitigation test.

the unit-specific commitment cost bid caps, the California ISO multiplies the reference levels by 125 percent of gas-fired units' reference levels or non-gas fired units' registered commitment cost values in Master File²⁹. The bid cap is designed to provide headroom for suppliers to submit bids reflecting their expectation of the units' short-run incremental costs due to commitment decisions balanced against the need to protect against market power.

Determining Reference Levels

The California ISO determines reference levels somewhat differently for gas-fired and non-gas fired units. It developed proxy cost methodology to estimate reference levels for the largest block of price setting units, the gas-fired resources, and then decided to allow suppliers with non-gas fired units to register their expectation of those units' production costs in master file³⁰.

For gas-fired units, the California ISO calculates an estimate of the unit-specific production costs for each component of the supply offer curve using the unit's heat rate and an estimated delivered price of fuel to estimate short-run incremental costs for fixed or variable costs. Reference levels by component are:

- Proxy startup cost: reference level for startup costs associated with bringing a unit online from not operating
- Proxy transition cost: reference level for transition costs associated with moving from one configuration to another for multi-stage generator (MSG)
- Proxy minimum load costs: reference level for minimum load costs associated with operating the unit at the Pmin output level that a unit cannot operate below without compromising the operation of the unit
- Default Energy Bids (DEBs): reference level for incremental energy costs associated with producing energy above Pmin

Whether the California ISO calculates an estimate of a units' cost or the supplier registers its unit-specific cost information, the cost information should be reflective of a unit-specific expectation of cost for producing power at a given output level. The reference levels generally include estimates for fuel costs, variable operations and maintenance charges, grid management charges, greenhouse gas compliance costs, start-up energy costs, and where applicable negotiated major maintenance charges and/or default energy bid adders. The reference level for incremental energy costs associated with producing energy above Pmin includes a 110 percent scalar in its incremental energy costs reference levels to cover incidental costs outside of the prior listed cost estimates.

The foundational assumptions made to enable these mechanisms are:

- There is only one fuel type support for each generating unit.

²⁹ This is for units under the proxy cost option. There is an exception for gas-fired units that are use-limited, the California ISO allows suppliers to elect the registered cost option for these units where there is no bidding flexibility as costs are not bid-in but fixed for 30 days but it does provide a higher bid cap set to 150 percent of the calculated cost.

³⁰ The master file contains all the units' technical parameters including those impacting their variable costs.

- There is one procurement location for a fuel region.
- There is one pipeline shipping company (shipper) for a fuel region.
- Next day gas commodity prices are a reasonable proxy for expected procurement costs.

Estimating Delivered Price by Market

The California ISO estimates the fuel cost portion of its reference levels as the product of the unit's heat rate and the fuel region's estimated delivered price. To enable the California ISO to estimate this delivered price, the California ISO requires suppliers to register its units in a fuel region. The fuel region designation is selected based on the most likely procurement location and pipeline shipping company used to deliver fuel to the unit. For each fuel region, the California ISO calculates a daily estimate of delivered fuel costs (gas price index); the region's delivered price is set as a combination of procurement costs, shipping costs, and other variable fuel costs.

Depending on the market, the California ISO uses an average of next day gas commodity prices for gas flowing on either the first or second gas days³¹ to estimate the procurement cost piece of the delivered price. The average is performed using the available published next day gas commodity prices from ICE, SNL Energy/BTU daily, NGL, or Platt's Gas Daily. The formula for the estimated delivered price of gas at a unit is shown in Appendix C: Guidelines for ex ante adjustment requests and verification in *Equation 5*. It shows the different formulations by market for the gas price index used to determine the delivered price estimate.

First in the day-ahead market, the California ISO calculates reference levels using the gas commodity price that is an average of natural gas transactions done the morning two days prior and largely for flows one day prior to electric trade day (GPI_{DA} , day-ahead delivered price). The trading day two days prior is used because the next day commodity price for trading one day prior is not available at 10AM Pacific, when the day-ahead market closes. The day-ahead delivered price will reflect the gas commodity price for the morning hours of its electric day³².

Second in the real-time market, the California ISO calculates a unit's reference level using the gas commodity price that is an average of natural gas transactions. These are done the morning one day prior and largely for flows on the electric trade day (GPI_{RT} , real-time delivered price). The California ISO's real-time delivered price will reflect the next day gas commodity price for the majority of hours across the electric day.³³

³¹ California ISO Tariff, Section 30.4 and 39.7.1.1.1.3.

³² This paragraph does not include any discussion of the temporary measure approved under the *Aliso Canyon* filings to allow the gas commodity price used to determine the delivered price (GPI_{DA}) is the second gas day's volume weighted average price morning of the day-ahead market made available between 8 and 9 AM Pacific via webICE.

³³ Temporarily suspended in combination with Endnote 32 on a temporary basis due to *Aliso Canyon* filing.

The gas commodity prices used in the real-time market are more representative of expected costs for the trade day than those used in the day-ahead market. There is an exception to this – the manual price spike procedure.

In this procedure, the California ISO tracks day-over-day price trends in the gas market looking at the published next day gas commodity prices between the second and first gas days. The California ISO will trigger its manual gas price spike process when it observes that second gas day's next day gas commodity price is 125 percent of the first gas day's gas commodity price calculated the prior evening. When this happens, the manual gas price spike procedure updates the day-ahead reference levels with the second gas day's next day gas commodity price. The suppliers can take advantage of a re-offer period initiated around 11:30 AM Pacific and the market will re-run the day-ahead with the new offer stack.

Without this procedure, the market could face limitations when it uses the day-ahead delivered price instead of the real-time delivered price in the day-ahead market's reference level calculations. If market conditions are different between the two days, the gas daily indices published for each day will not be strongly correlated with each other, in other words sufficiently different as to not be appropriate proxies. When this happens, the California ISO's day-ahead reference levels would represent expectations of production costs if the power was produced on the day the California ISO runs its day-ahead market. It would not reflect suppliers' expectations of production costs for producing power during the California ISO trade day.

For a review of the formulas for the day-ahead delivered price (GPI_{DA}) and the real-time delivered price (GPI_{RT}) see Appendix C: Guidelines for ex ante adjustment requests and verification, *Equation 5*. This is one of the major inputs into the reference level calculations on which the California ISO's mitigated prices are based. In summary, the purpose of the estimated delivered price is to provide a market-based estimate of the fuel cost for power production.

Methodology for Validating Bid-in Cost Based Offers or Reference Level Adjustments

In association with suppliers having the ability to submit their cost-based offers to the market as opposed to relying on reference levels, PJM and SPP adopted validation methods to protect against the exercise of market power from submission of inflated or inaccurate cost-based offers. Both PJM and SPP validate the bid-in mitigated offers by requiring a supplier to register a fuel cost policy with them and develop the mitigated offers consistent with cost development guidelines. Suppliers are responsible for providing information needed to assess total fuel costs³⁴.

The market monitoring units screen the mitigated offers for deviations from the guidelines and fuel policy. Then also refer any deviations to FERC. For example, SPP requires cost data to be submitted consistent with the information detailed in the supplier's cost policy. SPP's market monitoring unit replicates the bid-in mitigated offers using the fuel cost policy and the supplier's cost data and evaluates the bid-in mitigated offers against their replicated bids (or reference levels). The advantage to this method is it

³⁴ See generally PJM Manual 15, Cost Development Guidelines at § 2.3

provides more flexibility for suppliers to establish its short-run variable cost methodology. SPP's Mitigated Offer Developments Guidelines, SPP states that:

“Each Market Participant will be responsible for establishing its own method of calculating delivered fossil fuel cost, limited to inventoried cost, replacement cost or a combination thereof that reflects the way fuel is purchased or scheduled for purchase.”³⁵

While SPP permits suppliers' to submit their cost-based offers to the market, SPP adopted an interesting blended design where it uses these bid-in offers but screens for potential market power using calculated reference levels. The advantage of this blended design is it balances the increased flexibility for suppliers to submit cost with a robust market monitoring regime to protect against the exercise of market power.

Regardless of the design adopted, the organized markets have become increasingly concerned that either the reference levels calculated by the ISOs or even the bid-in cost-based offers could not fully reflect the production costs of a unit. This has led to the introduction of two market design enhancements across the organized markets. The two market design enhancements are:

- Opportunities for fuel price adjustments in advance of the market run when reference level calculation is expected to insufficiently reflect expectation of unit's fuel cost estimates; and
- Opportunity to seek after-the-fact recovery when actual costs exceed offered or mitigated price. NYISO, ISO-NE, MISO allow suppliers to request fuel price adjustments in real-time for the fuel price used in the reference levels. They approve requests to revise gas commodity prices in reference levels if the default gas commodity price used does not fully reflect prevailing gas market prices or actual costs to the supplier. The CAISO does not currently have this functionality in its market.

ISO-NE allows suppliers to update the fuel price used in its reference level when the supplier has an expectation its procurement costs will exceed the fuel price used in the ISO-NE's reference level. This fuel price adjustment must be made in sufficient time prior to the market close. If this update is requested, the ISO-NE requires suppliers to perform the following:

“Within five Business Days following submittal of a fuel price, a Market Participant must provide the Internal Market Monitor with documentation or analysis to support the submitted fuel price, which may include but is not limited to (i) an invoice or purchase confirmation for the fuel utilized or (ii) a quote from a named supplier or (iii) a price from a publicly available trading platform or price reporting agency, demonstrating that the submitted fuel price reflects the cost at which the Market Participant expected to purchase fuel for the operating period covered by the Supply Offer, as of the time that the Supply Offer was submitted, under an arm's length fuel purchase transaction...The submitted fuel price must be consistent with the fuel price reflected on the submitted invoice or purchase confirmation for the fuel utilized, the

³⁵ SPP Market Protocols Integrated Marketplace Appendices.

quote from a named supplier or the price from a publicly available trading platform or price reporting agency, plus any approved adder, or the other documentation or analysis provided to support the submitted fuel price.” (III.A.3.4(b))

Even if a supplier is allowed to bid its cost-based offer, there can still be instances when a suppliers incurred costs exceeds its cost-based offer. This is why in PJM and SPP, the markets provide after-the-fact uplift payments for actual incurred costs exceeding cost-based offer. ISO-NE also provides for after-the-fact cost recovery for supply offers mitigated or above the offer cap through a Federal Power Act Section 205 filing at FERC. Pending FERC approval of its *Bidding Rules Enhancements* filing, the California ISO will also provide this after-the-fact cost recovery opportunity for actual incurred commitment costs above its commitment cost bid cap not recovered through market revenues. On a temporary basis, the measures approved under the *Aliso Canyon* emergency filings included extended this filing right to incurred costs above the incremental energy offer’s mitigated price.

5.5. Gas-electric markets

The purpose of this section is to discuss the interplay between the gas and electric markets and system operations that affect gas-fired generating units. The challenges these units face provide background knowledge for understanding why stakeholders that manage these units have raised concerns with the current market design for commitment cost bidding and the determination of mitigated prices for supply offers.

To do so the following will be discussed:

- Next Day Gas and Day-Ahead Electric Markets
- Challenges Facing Suppliers
- Challenges Facing Gas System

5.5.1. Next day gas and day-ahead electric markets

To illustrate how the gas market nomination cycles and gas commodity price publication times affect the California ISO’s market operations, Figure 2 visualizes the interplay between the gas trade day and electric trade day. Gray bars, titled “Electric Day-Ahead (TD-1)” and “Electric Trade Day (TD)”, show the electric days. Further in the diagram, one vertical strip of gray shows the day-ahead market window from 10AM-1PM Pacific.

The colored items in this diagram show the gas trade day and publication timing for the first gas day that began flows TD-1 at 7AM Pacific (Gas Day 1 ,GD1) in blue and second gas day that begins flowing on TD at 7AM Pacific (Gas Day 2, GD2) in orange.

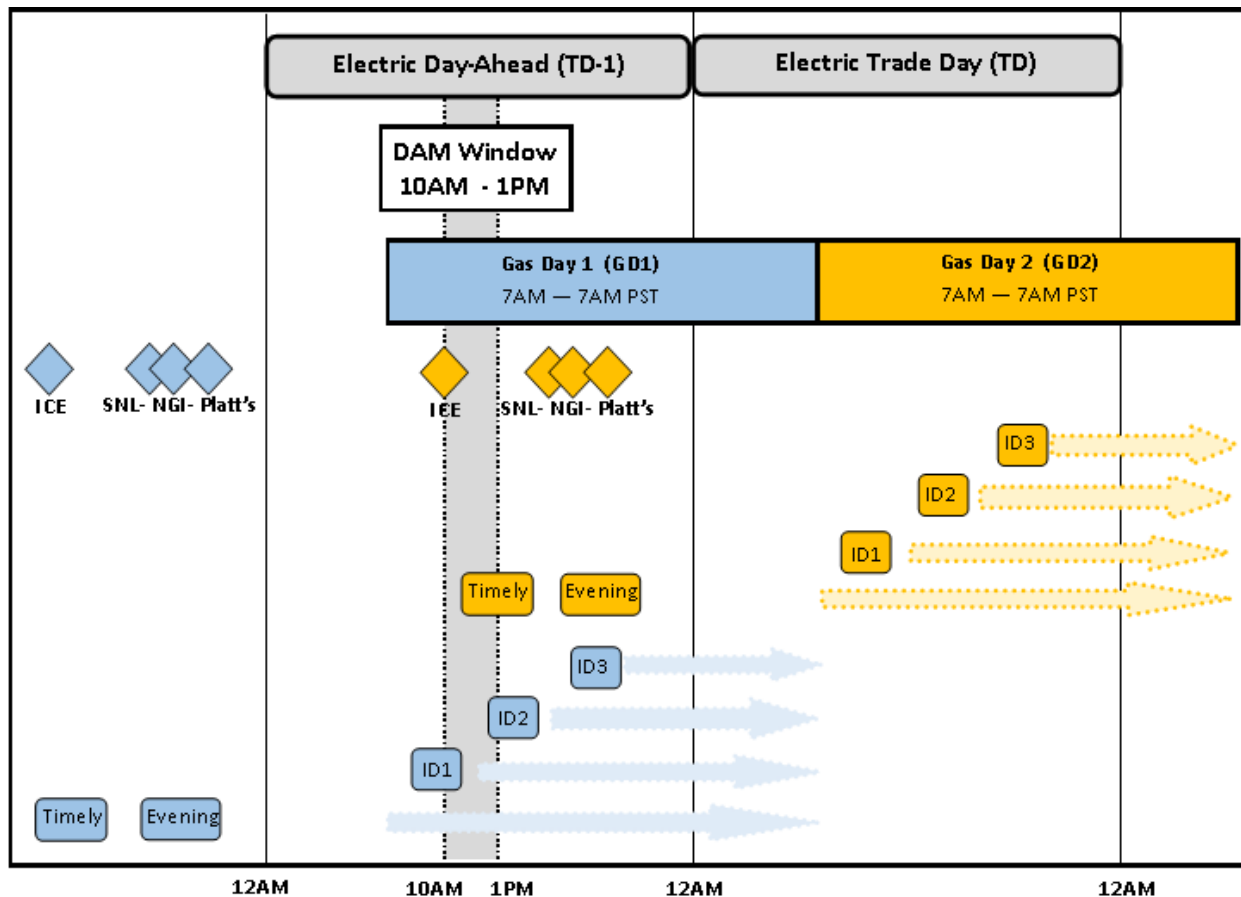


Figure 2: Gas and Electric Day Timelines effective April 1, 2016 (Order 809)

The colored blocks represent each nomination cycle during the gas day from its deadline to final notification with arrows associated with each cycle showing the effective flow hours. The publication times associated with GD1’s GPI are shown in Figure 2 as blue diamonds and the flows hours under that contract is shown by the blue box entitled “Gas Day 1”. The publication times associated with GD2’s GPI are shown in Figure 2 as orange diamonds and the flows hours for that product type is shown by the orange arrows under the orange box entitled “Gas Day 2”.

Table 5 lists the details for the five gas nomination cycles.

Nomination Cycle	Nomination Deadline (PT)	Notification of Nominate (PT)	Nomination Effective (PT)	Bumping of interruptible transportation
Timely	11:00 a.m.	3:00 p.m.	7:00 a.m. Next Day	N/A
Evening	4:00 p.m.	7:00 p.m.	7:00 a.m. Next Day	Yes
Intra-day 1	8:00 a.m.	11:00 a.m.	12:00 p.m. effective	Yes

Intra-day 2	12:30 p.m.	3:30 p.m.	4:00 p.m. effective	Yes
Intra-day 3	5:00 p.m.	8:00 p.m.	8:00 p.m. effective	No

Table 5: Gas nomination deadlines effective April 1, 2016 (PT)

5.5.2. Challenges facing suppliers

Suppliers face unique challenges for their gas procurements and nominations needed to meet California ISO commitments or dispatches due to the different timelines across the gas and electric markets. The California ISO publishes its day-ahead market at 1PM Pacific coming after the timely gas nomination cycle deadline at 11AM Pacific when the majority of gas trading has already occurred that morning. Suppliers may choose to delay procuring fuel until they receive their financially binding day-ahead schedules so they have certainty of the quantity to procure. Some stakeholders have expressed to the California ISO that if they cannot reasonably anticipate their electric day-ahead schedules in the morning before the California ISO publishes them, they might forego purchasing gas during this more liquid trading period and choose to wait to procure in less liquid periods.

The ISO understands that suppliers may do a risk assessment as to whether procuring gas with uncertainty as to the needed quantity versus procuring during illiquid periods is less risky. When the day-ahead market results are available, suppliers who determined waiting has less risk will procure and schedule gas to meet their schedules. In this scenario, the supplier will procure gas during the most illiquid trading periods since the timely cycle is already complete.

On the other hand, suppliers who receive more consistent dispatches or perform sophisticated economic modeling to predict dispatch will attempt to procure as much gas as possible to produce the amount of energy that they can anticipate. If they overestimate their needs and need to sell off gas in real-time, they could be at risk of losing money on that fuel if costs are lower during real-time than when they procured the fuel. As can be seen, suppliers engage in a complex risk assessment to evaluate what is the optimal procurement strategy and these strategies will vary by supplier.

If suppliers determine they can enter into longer term contracts either for delivery or hedging purposes, these contracts could either be transacted with market products that settle off of these monthly gas market prices (price taking for standard monthly published indices) or could even be by procuring products where the trading in that product sets the monthly gas market prices (price setting of the standard monthly published indices). The gas market prices for forward products suppliers use for hedging or price forecasting include: NYMEX futures price for Henry Hub prompt-month contract available on the third

day of bid week³⁶, first of month (FOM) prompt-month contracts³⁷, end of month contracts (gas daily average)³⁸, and next day gas contracts (i.e. gas daily).

While much of the liquidity in the natural gas markets is traded during “bidweek” trading setting the gas commodity price for the first of month gas index, which is a published index representing monthly value at the beginning of the month, the liquidity intra-month is more modest. “Bidweek” is the last five business days prior to the beginning of the delivery month, called the “prompt-month,” where physical basis or fixed price physical transactions contribute to setting the volume weighted average price across the five business days. Market participants that buy or sell prompt-month physical contracts during bidweek will contribute to the price formation of the natural gas first of month index for flows during the prompt-month. This is significant because it explains why electric suppliers confront difficulties finding liquidity in the gas spot market and non-standard products.

The California ISO understands that since suppliers would likely not have much certainty in the amount of gas needed to meet their dispatches over the next month as well as because the amount needed will vary day by day, electric suppliers would likely not begin to procure until the next day markets or later. After the next day market closes, liquidity has largely dried up. Since most liquidity traded during bidweek, liquidity begins to thin in the next day markets and after that market closes, supplies are expected to carry premiums relative to the standard published next day gas commodity price.

In next day trading, the procurement is largely for nominations made during the timely cycle. The next day gas commodity price will be set by the volume weighted average price of physical basis or fixed price physical transactions cleared during the qualifying trades window; trades cleared prior to timely nomination deadline of 11AM Pacific set gas market price. Table 6 below emphasizes the relationship between the next day gas commodity prices used for the various published next day gas commodity prices and the nomination cycles

For each publication used to determine the estimate of delivered price in the reference levels, Table 6 shows the time period that completed transactions qualify to be included in the price index calculation in the “Qualifying Trades Window” column, the earliest time made available, the latest time made available and the methodology details³⁹.

³⁶ Henry Hub NYMEX contract (HH) index prices is formed by the volume weighted average price of HH contracts transacted during a 30 minute period on the third day of bidweek (2:00 – 2:30 EST).

³⁷ IFERC, NGI, and NGX are some examples of publishers that publish the first of month contracts that are formed by the volume weighted average price of fixed price or physical basis contracts transacted around the clock during bidweek.

³⁸ End of month or gas daily average contracts are formed by the simple average of each next day gas index published during the contract month.

³⁹ The ISO averages next day gas indices published by ICE, SNL Energy/BTU daily, NGI, or Platt’s Gas Daily indices to determine its day-ahead or real-time gas price indices (GPI).

Source	Qualifying Window (PT)	Trades Available (PT)	Earliest Time Available (PT)	Latest Time Available (PT)	Details
ICE	4:00AM – 11:00 AM		11:30 AM	1:30 PM	Volume weighted average price of fixed price completed deals on ICE's trading platform.
SNL Energy/BTU Daily	That day before 3:00 PM		That day before 4:00 PM	That day before 7:00 PM	Volume weighted average price of next day contracts (typically) ⁴⁰
NGI ⁴¹	Next day trades must have been completed prior to industry [timely] nomination deadline at 11AM PT for next-day pipeline flows.		7:00 PM	2:00 AM (flow date)	Volume weighted average of reported fixed-price physical deals delivery. ⁴² Note, ICE reports cleared transactions to NGI so ICE trades automatically included and supplemented by other reported trades.
Platt's ⁴³	Next day trades must have been completed prior to industry [timely] nomination deadline at 11AM PT for next-day pipeline flows.		5:00 PM	7:00 PM	Volume weighted average of reported fixed-price physical deals delivery. ⁴⁴ Note, ICE reports cleared transactions to Platt's so ICE trades automatically included

⁴⁰ Transactions done on Friday are for flow on Saturday, Sunday and Monday and generally the prior day's index will apply to holidays.

⁴¹ NGI's Price Index Methodology Point-By-Point Index Descriptions and Code of Conduct Statement, <http://www.naturalgasintel.com/ext/units/Daily-GPI/NGIMethodology.pdf>.

⁴² Transactions done on Friday are for flow on Saturday, Sunday and Monday and generally the prior day's index will apply to holidays.

⁴³ Platt's North American Natural Gas Methodology: June 2016, http://www.platts.com/IM.Platts.Content/MethodologyReferences/MethodologySpecs/na_gas_methodology.pdf

⁴⁴ Transactions done on Friday are for flow on Saturday, Sunday and Monday and generally the prior day's index will apply to holidays.

Source	Qualifying Window (PT)	Trades	Earliest Time Available (PT)	Latest Time Available (PT)	Details
					and supplemented by other reported trades.

Table 6: Natural gas day-ahead indices publication times

All the publishers produce a gas daily index that largely contains trades completed in the morning for flows onto a pipeline the next day. The discussion that follows will refer to this gas daily index as the “next day gas commodity price.” Publishers calculate from the qualifying transactions a volume weighted average price that is then published as the next day gas commodity price. Almost all publishers cut off the eligibility for a qualifying trade at 11AM Pacific.

Compare the nomination deadline for the timely cycle in Table 5 to the cut off time used by each publisher for qualification to contribute to the index price in Table 6.⁴⁵ Both are 11AM Pacific.

It is clear that gas market trading patterns are closely tied to the nomination deadlines created by the North American Energy Standards Board for natural gas nominations. The ISO understands suppliers will try to the best of their ability to procure gas in the next day markets that close prior to the timely cycle’s nomination deadline at 11AM Pacific. Due to its higher liquidity and higher likelihood of available pipeline capacity, suppliers are more likely to be able to reserve (i.e. nominate) sufficient pipeline capacity to deliver gas to their units than during later cycles.

For both the monthly and daily gas market prices, fixed price physical contracts representing price for gas delivered at the location defined under that price index is the most active product traded on the West Coast. This is because while deliveries to the East are largely sourced from the Gulf so a basis to NYMEX Henry Hub prices is attractive, the fixed price of delivered gas into the western trading points is not generally closely correlated to Henry Hub prices making fixed price gas more active. For example, western locations indexed at next day commodity prices (i.e. gas market prices) could be much closer to the price of sourcing gas from Canada or the Rockies.

The above describes largely normal operations. Suppliers are faced with additional challenges when either the electric or gas systems are under strained conditions. When there is a gas system reliability concern the electric suppliers as customers on that system will be faced with requirements imposed on them by the gas system. These will be discussed in the context of the challenges facing the gas system.

5.5.3. Challenges facing gas system

Gas system operators need to ensure that the gas system is operating in their gas operating day in a manner that does not compromise its reliability. The gas system operator will assess after the nomination

⁴⁵ FERC released a final order on April 16, 2015 (Order 809, RM14-2) establishing new times for nomination practices used by the interstate pipelines to nominate natural gas transportation.

cycles how much capacity is available for additional nominations and whether scheduled deliveries and storage inventory can support its customer demand.

If an issue supporting customer demand or pipeline usage, too low or too high, that could compromise ability of pipeline and gas burners to continue to function, the gas system operation will issue notifications to their customers. These notifications could include operational flow orders (OFO), emergency flow orders (EFO), or curtailments.

The operational flow orders are designed to bring the nominated gas flows and gas demand closer to balance pipeline pressure. These notifications can be issued on both the high and low side. Gas customers can use their pipeline pack or storage facilities inventory to increase or decrease their gas burn to their scheduled flows depending on system needs. If time permits, the gas customers could also procure and nominate flows on or off system. These nominations depend on the type of action needed to help ensure system integrity.

Below are descriptions of low operational flow orders, high operational flow orders, and curtailments.

Low Operational Flow Order

If expected storage withdrawal capacity is higher than the withdrawal capacity allocated for balancing needs, a low operational flow order is issued in advance of the gas day. In this scenario, scheduled deliveries are expected to be lower than the gas burn in real-time. The gas operator would anticipate its customers would need to rely on storage to balance the difference between their scheduled deliveries and their gas burn. However, if the amount needed to balance this difference is greater than the system's withdrawal capacity, the system could be compromised. The gas operator needs its customers to schedule additional deliveries so balancing functions can be reliably done with the available withdrawal capacity.

Suppliers need to either nominate flows onto the gas system or decrease their gas burn to increase gas quantity on the pipeline. If the supplier does not decrease its burn levels to within a percent allowed of its scheduled deliveries (i.e. tolerance band), they will incur a noncompliance penalty.

An emergency flow order is invoked when the low operational flow order was insufficient to ensure system integrity and threatened deliveries to end-use customers. In response, suppliers need to reduce their usage to less than or equal to their scheduled deliveries by sending flows off-system or by reducing its own gas burn. If the supplier does not decrease its burn levels to below its scheduled deliveries, it will incur a noncompliance penalty.

High Operational Flow Order

A high operational flow order is issued when expected system capacity is greater than the scheduled deliveries. The expected system capacity includes expected gas demand and storage injection capacity. It is offset by the scheduled deliveries off-system. In this scenario, the gas operator is concerned with scheduled deliveries being brought onto the gas pipeline and if not used would need to be injected into its storage facilities.

Suppliers need to either nominate flows off the gas system or increase their gas burn to reduce gas quantity on pipeline. If the supplier does not burn within the tolerance band provided by the gas company, it will incur a noncompliance penalty.

When gas companies require suppliers to keep their gas consumption within a tolerance band around their nominated gas flows, the gas companies' noncompliance charges are intended to make gas users view the cost of gas differently. They would view the gas cost differently because the gas effectively costs them more if they operate outside the tolerance band.

Curtailments

Curtailments are interruptions of natural gas service to customers, also called schedule cuts. The gas operator will issue cuts to the scheduled gas based on an order of priority. Electric suppliers (suppliers) are a part of the first tier of customers curtailed because they generally use interruptible services. If the suppliers purchased firm noncore transmission service, the supplier would not be curtailed until all the interruptible services were cut. The final customer to be cut would be the core end-use customers.

Some types of curtailments include:

- System occurrences where the system cannot maintain pressure,
- Localized occurrences affected by capacity restrictions or emergencies,
- Emergency occurrences of a threatened or actual shortage undermining ability to serve end-use customers (this curtailment can deviate from the order of priority),
- Planned maintenance occurrences where cuts are needed to complete safety or maintenance work on the pipeline.

6. Principles

The purpose of this section is to present the design principles the CAISO is using for evaluating and designing enhancements to its bidding flexibility

The ISO will describe principles for the following categories:

- Competitive conditions
- Uncompetitive conditions – mitigation testing
- Uncompetitive conditions – reference level design

6.1. Competitive conditions

The CAISO believes the following market design principles are important for considering enhancements to bidding flexibility under competitive conditions:

1. Competition should discipline markets⁴⁶ since it limits market power while providing profit-maximizing incentives
2. Suppliers are incentivized to offer based on asset valuation because market based offers allow suppliers to submit prices at which they are willing to sell energy. Market based offer prices may differ from production cost estimates by including risk margins (could vary by risk tolerance levels), reflecting subsidies or contracts impacts, and reflecting other factors such as preferred use of resources.
3. Resources without must-offer-obligations should have the flexibility to select the hours in a day they participate in the market.
4. Reduce barriers to entry into the CAISO markets regardless of technology type.

Market-based offers should be subject to “circuit breaker” caps to ensure that potential uncertainty affecting the mitigation test would not result in a significant false negative causing potential adverse market impacts.

6.2. Uncompetitive conditions – mitigation testing

The CAISO believes the following market design principles related to mitigation design are important for considering enhancements to bidding flexibility under uncompetitive:

1. Market must be protected against market power by testing for insufficient supply without which the market cannot provide competitive incentives.
2. Market power mitigation three pivotal supplier test is sufficient because it is a robust design and applies a consistent methodology across the three-part offer.
3. Market should only mitigate when a mitigation test shows potential to exercise market power and balance a reasonable output of false positives/false negatives.

Any methodology should consider implementation concerns, such as the need to balance costs against potential benefits and provide sufficient transparency

6.3. Uncompetitive conditions – reference level design

The CAISO believes the following market design principles are important for considering enhancements to bidding flexibility for its reference level design:

1. Market produces efficient dispatch solution and price signals when suppliers offers are reasonable reflections of the suppliers’ cost expectations.

⁴⁶ NRG comments on *Commitment Costs and Default Energy Bid Enhancements* issue paper stated, “Competition...should discipline market participants’ offers. If, under competitive conditions, suppliers’ offers reflect unrealistic expectations for their units’ value, the generating units will not run and the supplier will lose out.” (Page 5)

2. Suppliers' offers must only be mitigated to price levels that are a reasonable reflection of suppliers' cost expectations.⁴⁷
3. Suppliers should not be able to value assets based on monetized risks, subsidies, contracts, or other factors including ability to reflect fuel availability in its offers through a risk margin or scarcity value to reflect risks of negative reliability externalities on a routine basis.
4. Suppliers should have ability to reflect fuel availability in its offers through a risk margin or scarcity value to reflect risks of negative reliability externalities as an exception so the CAISO and supplier can avoid affecting reliability.
5. Gas and non-gas units with unique cost methods should be able to negotiate both commitment cost and energy cost estimate methodologies.
6. Gas and non-gas units should be able to provide adjustments to reflect price volatility and if submitted market should validate supplier submitted cost based as reasonable reflections of suppliers' cost expectations.
7. Validation methods should screen against artificial pricing impacts, not suppliers' ability to predict actual costs. At the time of offer submission, costs should be a reflection of costs expectations; however, actual costs may differ.
8. Market should support an ex post cost recovery process when adjusted cost based offers cannot be validated prior to the market run. This ex post process will not be an avenue for recovery for offers with "wrong" cost expectations or validation thresholds (or cost caps) did not effectively capture reasonable adjustments.

7. Market Monitors' recommendation

The purpose of this section is for the CAISO to respond to stakeholder comments on the Department of Market Monitoring's proposal and explain rationale for not pursuing DMM's recommendation.

Based on its review of stakeholder comments in *Aliso Canyon Gas-electric Coordination Phase 1's* straw proposal, *Aliso Canyon Gas-electric Coordination Phase 3's* straw proposal, *Commitment Cost and Default Energy Bid Enhancements'* issue paper and workshops, the CAISO has decided not to pursue Department of Market Monitoring's proposals to:

- Make permanent the *Aliso Canyon* temporary measure that allows the CAISO to manually update the gas price index used in day-ahead market to calculate reference levels based on an

⁴⁷ CAISO disagrees with the proposed principle from EDF and NRG proposed in comments to issue paper that suppliers should be allowing the ability to recover actual fuel costs under all circumstances. CAISO wants to clarify that cost based offers should be based on cost expectations since when submitted into market there is still uncertainty as to actual costs. The market design should support suppliers' ability to submit their costs expectations and eligible for compensation if awarded as that is their offer if it is a reasonable reflection of expectation. It is not the role of the CAISO to make suppliers whole when their realized costs are different than their expected costs – this is the appropriate price risk for suppliers to assume to participate in the market. CAISO agrees with stakeholders it is inappropriate for design to limit their ability to submit cost expectations and will address it accordingly in proposal.

approximation of the next day gas price index available off webICE between 8:30 and 9:00 Pacific

- Apply a Monday premium based on statistical difference between observed trades in same-day, intra-day, or Monday only products to the next day gas index
- Create and publish a real-time gas price index
- Provide more guidelines for the after-the-fact filing right at FERC

The CAISO arrived at the determination not to pursue these recommendations because of significant regulatory concerns; lack of sufficient oversight to mitigate risk of artificial prices if implemented, and cannot be implemented by fall 2017 so would replace the long-term market solution planned implementation in fall 2018.

After reviewing stakeholder comments on the CAISO's workshops, the CAISO understands there is general support among stakeholders for DMM's proposal as long as pursuing their proposal is done as an interim or "bridge solution" to long-term enhancements. NVE, Six Cities, SCE, PG&E, PGE, NRG, and EDF all support implementing DMM's proposal with PGE, NRG, and EDF stressing it as a 'bridge solution' that would make incremental progress towards better cost reflection in the near term. NRG, EDF, and WPTF continue to stress the focus should remain on pursuit of long-term enhancements resolving the issues that FERC provided guidance to pursue in the *Commitment Cost Enhancements* order and the suggestions from DMM for the short-term should not divert resource from pursuing long-term solutions.

The CAISO understood from stakeholder comments and workshop discussions that the support for the DMM proposal based on a desire to have any solution in effect as soon as possible not because the proposal addresses the raised concerns or mitigates need for long-term solution. However, this is a misunderstanding because the CAISO has been directed to bring to the Board of Governors and file a comprehensive package. The comprehensive package may need to be phased from an implementation perspective but the guidance to pursue long-term enhancements is a clear directive. Consequently if adopted, the proposal would serve as the full solution for the raised concerns.

Given this, the CAISO believes since it understands there to be broader support for pursuing long-term market enhancements that its focus should remain on proposing a comprehensive package. CAISO understands there to be broader support for long-term enhancements since NRG, Environmental Defense Fund (EDF), Six Cities and Western Power Trading Forum (WPTF), and Department of Market Monitoring (DMM) are all generally supportive. While Six Cities and Department of Market Monitoring (DMM) appeared to support consideration of long-term changes, they also appear to prefer the CAISO consider phasing the initiative to focus on its reference level design first. At first, PG&E oppose large scale changes such as consideration of commitment cost mitigation but in its comments on the CAISO's workshops softened its stance to express concerns that any mitigation design would need to be thoroughly designed and tested.

Under this light, the CAISO believes stakeholder comments submitted under *Aliso Canyon Phase 1* for the straw proposal provide the best feedback on support for a real-time index since this was when the CAISO most recently stakeholdered a proposed option for a CAISO calculated real-time gas index. In *Aliso Canyon Phase 1*, the CAISO proposed two options to use updated fuel information in the reference level calculations either based on (1) SC submitted fuel price or (2) CAISO developed "real-time" gas price

index⁴⁸. Under that initiative, there was consensus that a CAISO calculated real-time gas price index was not supported and that pursuing flexibility for suppliers to submit requests to adjust fuel price was broadly supported.

8. Proposal

The purpose of this section is to propose to allow market based offers for each component of the supply offer subject to mitigation and allow greater flexibility to negotiate or adjust each component to support greater market efficiency. The proposal to pursue market-based commitment cost offers is contingent on the CAISO finalizing a feasibility and costs assessment for dynamic market power mitigation that would have to accompany it.

The CAISO has implemented several incremental changes through the around twelve stakeholder initiatives addressing bidding rules and mitigation over the past decade; stakeholders continue to believe additional changes are needed. In addition, Stakeholders expressed at Board of Governors meetings last year that the measures proposed did not go far enough in addressing stakeholders concerns regarding bidding flexibility and long-term structural changes such as market-based commitment cost offers subject to mitigation are necessary to address increasing concerns. At the March 2016 Board of Governors meeting, the Board committed to stakeholders that the CAISO would conduct a stakeholder initiative to comprehensively address bidding rules and reference level enhancements with the intent of implementing long-term market solutions.

EDF, NRG, and Western Power Trading Forum (WPTF)'s comments on the issue paper and workshops a reiteration of the stakeholder understanding of FERC guidance to pursue long-term enhancements. The CAISO shares the same understanding of federal guidance received to pursue diligently these long-term enhancements. Specifically, the FERC's December 2014 decision approving the filing for Commitment Cost Enhancements' proposals provided guidance to the CAISO on its efforts to improve cost recovery for gas-fired resources as expressed below:

“While we agree with CAISO that the current proposal represents an immediate improvement that can be implemented in time to provide generators a better opportunity to recover their costs during periods of natural gas price volatility that may occur during the 2014-2015 winter season, we expect CAISO to abide by its commitment to consider longer-term market design changes for commitment cost bids

⁴⁸ Neither option was adopted to resolve the identified limitation. ISO adopted DMM recommendation to apply scalars to the gas price index used to set reference levels – 125% for DEBs and 175% for commitment proxy costs. After November 30, 2017, DMM is requesting the ISO retire these scalars and replace the GPI used in real-time with an ISO real-time price index instead of the next day gas price.

in conjunction with the bidding rules enhancements stakeholder initiative commenced earlier this month. ”⁴⁹

Further, the CAISO believes the release in November 2016 of the FERC’s Final Rule on Offer Caps (Order 831) affirms FERC’s continued commitment to holding the CAISO to this guidance and provides clarity on the role of market operator to support robust design that does not overly limit suppliers to reflect cost expectations.

During Aliso Canyon Phase 3, stakeholders expressed the importance to the market of CAISO continuing to pursue long-term market enhancements to bidding flexibility in this initiative.⁵⁰ Portland General Electric (PGE) stated that, “...the importance of this initiative [*Commitment Costs and Default Energy Bid Enhancements*] should not be underestimated.⁵¹” NRG Energy (NRG), Environmental Defense Fund (EDF), and Western Power Trading Forum (WPTF) echoed this statement. WPTF stressed that, “Adequate bidding rules should be a priority for the CAISO...” CAISO also notes that EDF characterized the need for long-term changes as “a pressing need”.

The straw proposal discussed in this section will provide the long-term market solutions to comprehensively address bidding rules and reference level enhancements.

The ISO will describe the pieces of its proposal as follows:

- Hourly minimum load offers
- Negotiated commitment cost reference levels and supplier submitted adjustments to energy and commitment cost reference levels
- Market-based commitment costs subject to mitigation

8.1. Hourly minimum load offers

CAISO proposes to allow market based offers for each component of the supply offer subject to mitigation and allow greater flexibility to negotiate or adjust each component. The purpose of this section is to describe the CAISO proposal to allow greater bidding flexibility by allowing minimum load costs to vary by hour.

The CAISO will describe its proposal for hourly minimum load offers as follows:

- Issues
- Stakeholder comments
- Proposal

⁴⁹ Abridged version of quote included in WPTF comments on *Commitment Cost and Default Energy Bid Enhancements* issue paper, Page 2, http://www.caiso.com/Documents/WPTFComments_CommitmentCosts_DefaultEnergyBidEnhancementsIssuePaper.pdf.

⁵⁰ *Aliso Canyon Gas-Electric Coordination Phase 3* Draft Final Proposal, Section 2.1 Summary of stakeholder comments on gas constraints. Available at: <http://www.caiso.com/Documents/DraftFinalProposal-AlisoCanyonGas-ElectricCoordinationPhase3.pdf>

⁵¹ PGE comments on *Aliso Canyon Gas-electric Coordination Phase 3* straw proposal, http://www.caiso.com/Documents/PGEComments_AlisoCanyonGas_ElectricCoordinationPhase3StrawProposal.pdf.

8.1.1. Issues

The CAISO's current bidding rules limit suppliers' ability to reflect changes in minimum load costs hourly because minimum load bids are currently daily bids rather than hourly. If the market overly limits supply offers, the CAISO is concerned this could undermine market efficiency and discourage participation by non-resource adequacy resources and Energy Imbalance Market resources.

CAISO finds its current bidding rules can restrict suppliers from reflecting estimated costs and business needs or preferred use of resource. Stakeholders expressed concern that the current rules are overly limiting because:

- While suppliers can update the daily minimum load offers in real-time if, they were not awarded in day-ahead this would not address need to vary by hour based on changes to fuel prices
- Stakeholders request greater flexibility to select hours to participate if they do not have a must-offer obligation.

On need to reflect hourly variation, Stakeholders raised two businesses cases for treating minimum load offers as hourly values instead of daily. First, multi-stage generators (MSGs) need flexibility to reflect minimum load costs vary by hour because a higher configuration's minimum output levels may increase or decrease relative to the output level of the lower configuration. Since the lower configuration's output can be a function of ambient temperature, the maximum output of the lower configuration is at a higher output level during cooler periods, causing the minimum operating level of the higher configuration to increase. The variation of the minimum output level of higher configurations can vary significantly in desert climates with large temperature variations. Second, resources with physical minimum load rates request flexibility to re-bid costs between \$0 and revised minimum load costs with default energy bid integration⁵².

On need for non-resource adequacy resources to select hours to participate, stakeholders raised legitimate concern that non-resource adequacy resources may not want to participate during all hours of the day and should be able to select hours for their bidding. Based on implementation constraints during its market redesign and technology upgrade the ISO implemented its bid insertion rules in a manner where it only generates a 0.1 MW energy bid for non-RA to reflect it does not have a must-offer obligation and generates a MW energy bid for RA for its entire available capacity. Effectively, because the ISO treats its minimum load as a daily value, which is available to the ISO for all hours, both non-RA with minimum load bids and RA resources will be available at least up to its minimum operating level. ISO maintains this implementation is consistent with its current tariff given the treatment of minimum load as daily. This issue discussion is helpful as potential justification for need for hourly variations, a necessary condition to support this greater flexibility.

⁵² Described in detail in *Bidding Rules Enhancements* draft final proposal on minimum load costs, available at http://www.caiso.com/Documents/DraftFinalProposal_BiddingRulesEnhancements_MinimumLoadCosts.pdf.

8.1.2. Stakeholder comments

While initially there was some support by stakeholders for considering a “no load” design based on WPTF, PG&E, and NRG’s comments on the CAISO’s issue paper, the CAISO now understands from stakeholder comments after its workshops that there is limited if any support for considering a shift to a “no load structure”. Through discussions at the March and April workshops, the CAISO became aware that the value of such a shift comes from enhancements to minimum load bidding flexibility by allowing hourly changes. As a result, only PGE and NRG are now conceptually supportive of the CAISO switching to a no load structure instead of a minimum load structure but NRG acknowledged that hourly bidding would meet the same need.

Based on this understanding, the CAISO more closely evaluated stakeholder comments supporting hourly bidding for commitment cost offers. The CAISO understands from comments that there is broad support for allowing hourly minimum load cost offers. PG&E⁵³, SCE, NVE, PGE, Six Cities, NRG, WPTF, and DMM expressed in comments support for the CAISO incorporating hourly minimum load cost bidding subject to rules that lock the re-bidding to no higher than a certain level through its minimum run time. PGE emphasized suppliers’ need for flexibility to shape their dispatch to their load and ramping needs.

On both hourly minimum load bidding and commitment cost bidding, DMM, SCE, and WPTF raised concerns of market price impacts or market vulnerabilities to suppliers ‘gaming’ uplift with hourly bidding flexibility for commitment cost offers. It is our understanding that DMM qualifies their support with the condition that the CAISO carefully designs bidding rules around this.

8.1.3. Proposal

The purpose of this section is to describe the details of the proposed changes needed to support hourly minimum load offers.

The section will discuss the following portions of the proposal:

- Support hourly minimum load offers
- Apply settlement rules when no minimum load cost offer present

Support hourly minimum load offers

Based on the issues identified for need to vary minimum load costs hourly and reasonable request for greater flexibility for non-RA resources to select hours to participate, the ISO proposes to address these limitations by supporting hourly minimum load. While there was discussion of two options during its workshops based on stakeholder input, the ISO understands there is broad support for resolution and either a “no load” or hourly treatment would resolve the issues. Given the much more limited implementation involved with hourly treatment, the ISO proposes to adopt that option for its straw proposal.

⁵³ PG&E comments on *Commitment Cost and Default Energy Bid Enhancements* issue paper expressed interest albeit without this as a high priority enhancement,
http://www.caiso.com/Documents/NRGComments_CommitmentCosts_DefaultEnergyBidEnhancementsIssuePaper.pdf.

The ISO proposes to change its treatment of the minimum load component to an hourly value instead of a daily. The minimum load component will be an hourly component for which suppliers can submit different hourly prices or choose not to offer in a particular hour. Minimum load costs will continue to represent the combined costs associated with power production as well as short-term fixed costs for a run hour. (e.g., major maintenance adders). Run hour costs refer to cost items associated with operating for an hour not related to energy production whereas the fuel cost or fuel cost equivalent are for the energy production in MWh.

Necessary to implement effectively supporting hourly minimum load offers, the ISO will enhance its bidding rules to ensure that non-RA resources will be able to select hours to participate. This implementation will improve the current policy only to subject RA resources with must-offer obligations to bid insertion.

While several stakeholders indicated concern and the importance of ensuring bidding rules are effective to mitigate behavioral concerns with this enhanced flexibility after further discussion in workshops the ISO has determined its current real-time market re-bidding rules need to be modified. Current re-bidding rules allow suppliers to resubmit their minimum load offers in real-time only if they neither received an integrated forward market award or binding residual unit commitment start-up instruction for that hour. Once committed by the real-time market, the ISO has automated bidding rules to ensure the minimum load offers are locked at the last offer price level used by the market to initiate the commitment and maintained through the resource's inter-temporal constraint (e.g. minimum run time, minimum on time). These rules are currently manually enforced but will be automated in the fall 2017 release.

Figure 3 and Figure 4 illustrate the current re-bidding rules against the proposed hourly treatment. In Figure 3, the red triangles represent the hourly minimum load bids submitted and evaluated in the short-term unit commitment process for the 4 ½ hour optimization window from 3:30 to 7:00 AM. As shown, the last minimum load bid evaluated by the commitment process was around \$1,500 for hour ending 7 but at increased levels in hours ending 8 and 9 under its minimum run time. In Figure 4 the ISO would automatically apply the bidding rules and lock the bids at around \$1,500 for hours ending 8 and 9. Once able to alter the resource's commitment, hour ending 10, the ISO will allow the higher bid at \$2,250.

Revising bid-in market based offer for MLC to an hourly component would allow for the values to vary across hours as shown by hourly bids and allowing SC to select hours to participate

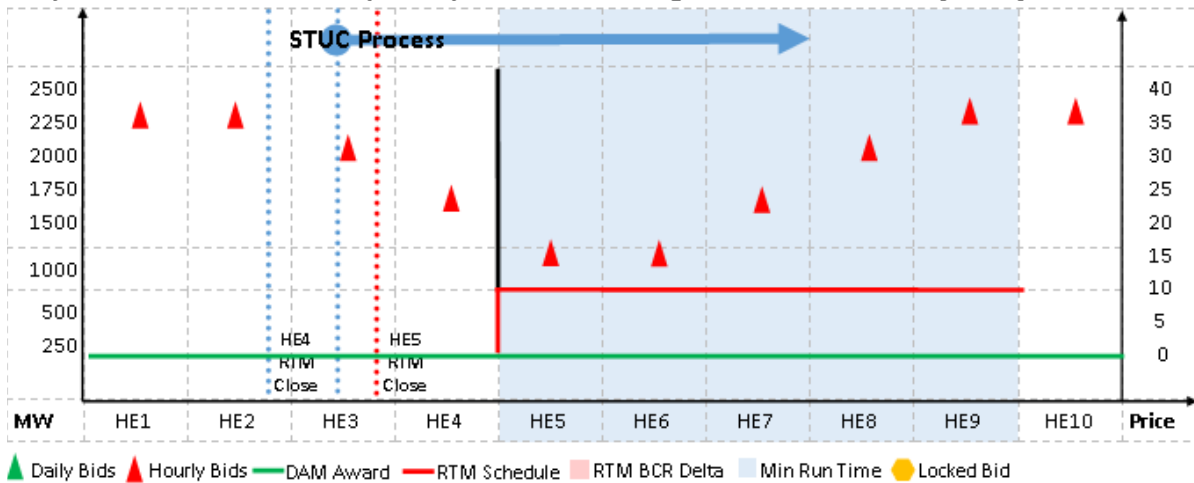


Figure 3: Illustration of proposed change for hourly minimum load

Revising bid-in market based offer for MLC to an hourly component would allow for the values to vary across hours as shown by hourly bids and allowing SC to select hours to participate

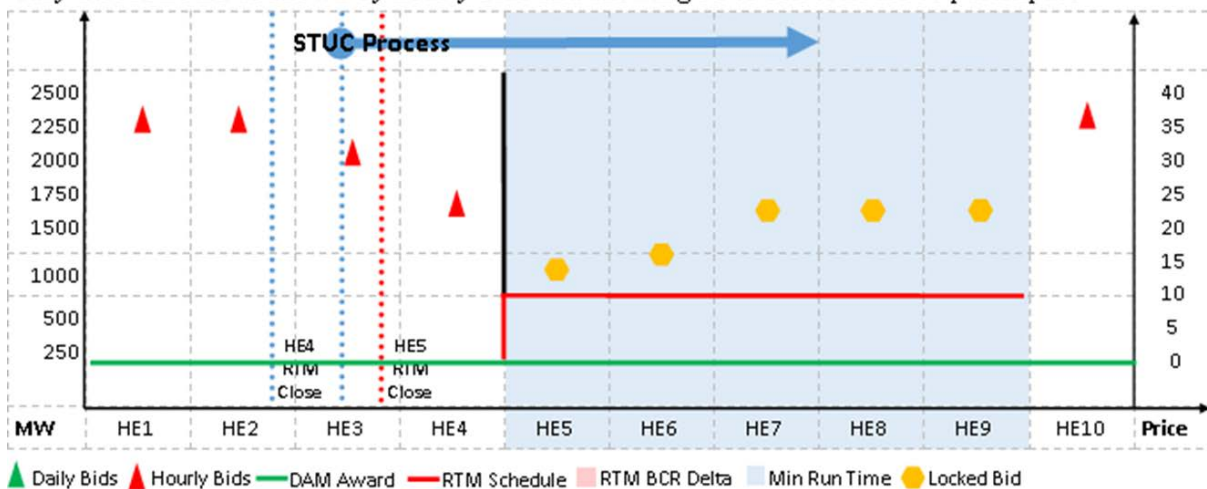


Figure 4: Illustration of rebidding rules on proposed change

CAISO proposes based on stakeholder feedback to add additional rule changes to its re-bidding rules necessary to support hourly minimum load offers. While the original proposal was to lock the bids at the exact price level of the last bid, the CAISO now proposes to use an average of the supplier’s minimum load offers used in the unit commitment decision optimization horizon. This will avoid potential gaming concerns. Further, the CAISO proposes to allow re-bidding below the locked levels that represent the maximum re-biddable levels. The following section describes a scenario necessitating revised offers to be re-bid at levels below the locked bid level.

Apply settlement rules when no minimum load cost offer present

To implement effectively the CAISO supporting hourly minimum load, the ISO needs to propose a change to its settlement treatment of minimum load offers when there is no offer available to the market but a resource must continue operating because of an inter-temporal constraint such as minimum run time.

CAISO market design respects physical constraints. CAISO needs to adopt a “no bid” process for instances without a bid is necessary to both respect physical constraints and settle resource appropriately. Figure 5 shows the scenario of concern. This resource submitted hourly minimum load bids for hours ending 1 through 6 and later for hour ending 10. The commitment process evaluating commitments from 3:30AM to 7AM validates to ensure that sufficient bids are available to meet the inter-temporal constraint within the optimization window. There is a seams issue where the commitment process cannot see that the supplier did not submit a minimum load offer for hour ending 7 – an hour needed to meet its minimum run time. The market will send a dispatch instruction to minimum load for hour ending 7 and then be able to issue a shutdown instruction beginning hour ending 8.

Revising bid-in market based offer for MLC to an hourly component would allow for the values to vary across hours as shown by hourly bids and allowing SC to select hours to participate

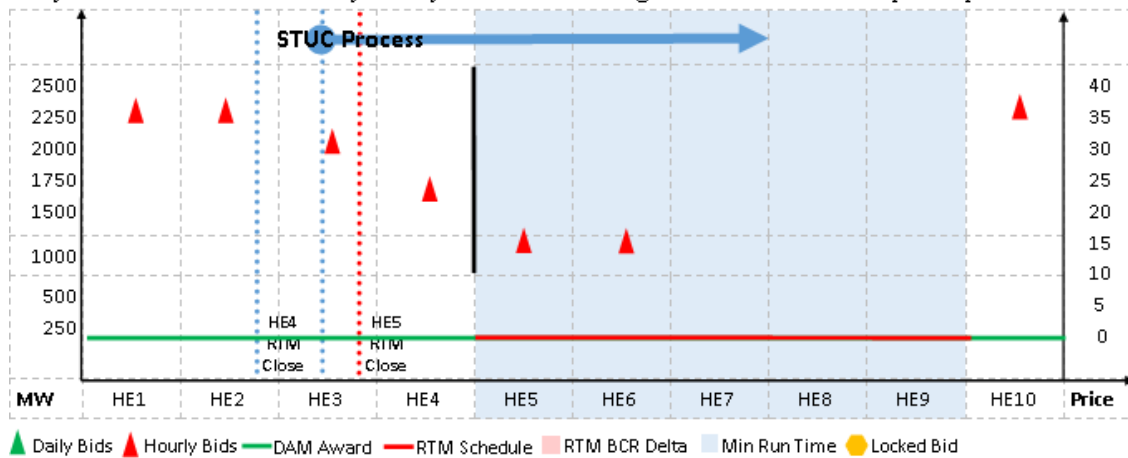


Figure 5: Illustration of need to dispatch even if no offer

The CAISO proposes to consider an interval without a minimum load offer analogous to an ISO commitment period and will insert for its minimum load cost the resource’s proxy costs, negotiated or estimated. This is for purposes of bid-cost recovery settlement. The CAISO believes this treatment is appropriate since the supplier will have flexibility to update its market-based bids for the hours that would otherwise have missing offers to reflect market-based offers. As long as the revised minimum load offer is submitted prior to receiving a binding commitment, the minimum load offer will be able to be evaluated and not be overly restricted in cost recovery by settling at the resource’s reference level.

Figure 6 shows the same scenario as Figure 5 but emphasizes that the commitment processes for hours ending 5 through 10 and hour endings 6 through 11 have yet to run. The CAISO believes there is sufficient time for the supplier to update supply offers for HE8 and HE9 after receiving the binding start up and commitment instruction. If not done, the CAISO proposes to treat as self-commitment periods. In Figure 6, the supplier does submit revised offers in its hour ending 5 bid submissions at around \$1,000.

Revising bid-in market based offer for MLC to an hourly component would allow for the values to vary across hours as shown by hourly bids and allowing SC to select hours to participate

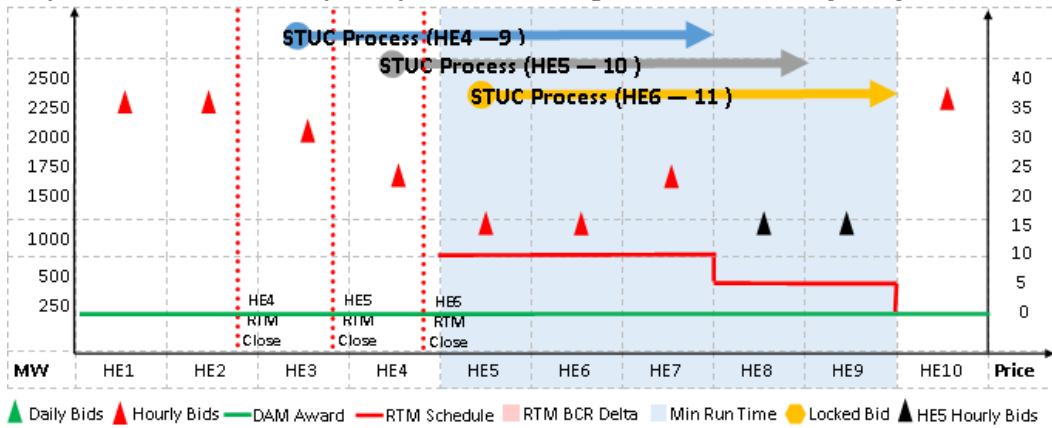


Figure 6: Revising minimum load offers to remain eligible for uplift

Note that the revised minimum load offers are below the “locked” or “maximum” bidding level at around \$1,500. This implementation maintains the integrity of the market power mitigation from the re-bidding rules while allowing suppliers to have the opportunity to resolve the need to treat hours ending 8 and 9 as a self-commitment period. The revised bids during the final hours will allow the CAISO to consider the entire minimum run time an ISO commitment eligible for bid cost recovery.

8.2. Negotiated commitment cost reference levels and supplier submitted adjustments to energy and commitment cost reference levels

CAISO proposes to allow market based offers for each component of the supply offer subject to mitigation and allow suppliers greater flexibility to negotiate or adjust reference levels for each supply offer component. The purpose of this section is to describe the CAISO proposal to allow greater flexibility to negotiate or adjust each component of supply offer reference levels.

The ISO will describe its proposal for hourly minimum load offers as follows:

- Issues
- Stakeholder comments
- Proposal

8.2.1. Issues

CAISO understands the major issues facing suppliers related to supply offer reference levels are the need to either (1) reflect on a routine basis unique cost formulations or (2) reflect price volatility due to changing market conditions.

The CAISO agrees that reference levels may not reasonably reflect impact of externalities or suppliers’ cost expectations especially for the commitment cost reference levels or suppliers that are required to submit energy reference levels for every run (See Issue Paper Sections 4.4 and 4.5).

On the subject of clarifying the role of fuel replacement costs in establishing delivered gas price estimates, the CAISO notes that the marginal cost of fuel is the market price at which supplier would expect to replace the inventory – as that is a widely accepted principle – but there is an open debate instead on “when” that replacement would or should occur. Establishing the marginal cost of fuel to an electric generator based on replacement cost of the next unit purchased is accepted widely because economics are rooted in the need to evaluate whether to burn the fuel to produce energy, maintain it in inventory, or sell fuel. A profit maximizing electricity supplier would evaluate and weigh each of those possibilities.

The CAISO understands the Department of Market Monitor to believe the replacement costs would be incurred at a time in the future when fuel prices are the lowest so as to maximize profits. However, the CAISO understands from other stakeholders they view the timing of that replacement as being tied to specific times of year or based on the prevailing market price at the time the decision is made. ISO seeks stakeholder input on the nuance in this discussion specifically what if any requirements for “when” should be considered if fuel replacement cost were to be considered in reference levels?

The existing reference level design does not reflect cost expectations when significant price volatility occurs between the next day and non-standard products especially under constrained gas conditions. Related to constrained gas conditions, many stakeholders believe they need the ability to better reflect costs in offers when those costs include risks such as non-compliance with gas pipeline instructions through no fault of the resource caused by CAISO dispatch instructions.

CAISO believes suppliers need more freedom to reflect unique costs and volatility to incentivize submission of economic offers than its current market design provides. By enhancing its bidding flexibility it can better support integration of renewable resources through incentivizing flexible resources participation during tight fuel supply, account for costs of flexible resources (gas and non-gas) to reduce risk of insufficient cost recovery, and encourage participation of non-resource adequacy and Energy Imbalance Market resources.

While the CAISO identified needs to address its bidding flexibility design for its commitment costs and mitigated energy prices, the CAISO did not initially intend to address the unlikely risk that a suppliers’ cost-based energy offer would exceed \$1,000/MWh because it has not observed price volatility approaching those price levels in the West. However in November 2016, Federal Energy Regulatory Commission (Commission) released a Final Rule (Order 831) requiring the CAISO to enhance its functionality to address bidding flexibility for cost-based energy offers above \$1,000. To comply with Order 831, the CAISO must allow suppliers’ verified⁵⁴ cost-based energy offers between \$1,000/MWh and \$2,000/MWh to be eligible to contribute to setting merit order and market prices. The CAISO is further required to support an ex post verification process where any submitted offers either above \$2,000/MWh or unverified, are eligible for an after-the-fact review and eligible for uplift recalculation if verifiable based on the after-the-fact review. The CAISO expanded the scope of this initiative to ensure sufficient bidding flexibility for cost-based energy offers above \$1,000/MWh and proposes to leverage the ex ante and ex post verification

⁵⁴ Per Order 831, the standard for verification will be an ex ante verification on whether the cost-based energy offer is a reasonable reflection of cost expectations.

processes needed for Order 831 compliance to address existing limitations on its commitment costs and mitigated energy prices.

8.2.2. Stakeholder comments

The purpose of this section is to summarize the stakeholder comments on both the issues stakeholders face where the CAISO reference level design may not allow their commitment cost offers or mitigated energy bid to be a reasonable reflection of suppliers' cost expectations and potential options to resolve these concerns.

Reference level adjustments versus bid-in cost based offers

The CAISO sought stakeholder input on two potential options for enhancing its bidding flexibility to reasonably reflect suppliers' cost expectations once mitigated or subject to commitment cost caps. These were (1) bid-in cost based offers or (2) fuel price adjustments.

On bid-in cost based offers, the CAISO understands that stakeholders are broadly supportive. NVE, PGE, NRG, WPTF, and EDF all support bid-in cost based offers⁵⁵ with EDF noting that it is the most beneficial way forward from the perspective of advancing price formation. Specifically, EDF and NRG support a solution similar to that of PJM or SPP where the CAISO, Market Monitor, and supplier agree on fuel cost policies ahead of time. NRG adds that, in the past, the use of indices as proxies for suppliers' costs has been problematic.

Specifically on the addition of bid-in cost based energy offer, the CAISO understands PGE and WPTF support the use of cost based offers for energy component of the supply offer.

CAISO understands that PG&E and DMM oppose bid-in cost based offers. However, the CAISO interpreted from their comments that this opposition is due to an assumption that considering bid-in cost based offers would preclude applying automated ex ante screens to catch anomalous offers outside 'reasonableness range' on suppliers' bid-in cost based offers. PG&E stated this assumption in their comments by pointing out that they assumed such a design would rely on ex-post reviews of cost rather than pre-market screens. PG&E adds their concern that erroneous offers will only be caught ex-post and voices their desire for a more flexible design that would include automated ex ante screens of suppliers' offers to catch inadvertent or misleading submissions before they impact the market. Further EDF expressed support for automated ex ante screening but stressed the screens are not a substitute for following rules.

The CAISO understands that stakeholders broadly support fuel price adjustments to reference level calculations. NVE, SCE, and Pacific Gas & Electric (PG&E) are supportive of fuel price adjustments. NVE expressed view it might be best to focus on exploring adjustments to reference levels as it builds off the existing framework. In the event the CAIS proposes to retain its reference level framework and not introduce bid-in cost based offers, the CAISO understands that stakeholder support for these adjustments would increase. While PGE and EDF prefer bid-in cost based offers, they do support fuel price adjustments as a backup option.

⁵⁵ CAISO understands the comments to assume if the CAISO introduced bid-in cost based offers it would do so consistently across all components of its supply offer.

PG&E and NVE expressed support of a similar functionality to that of NYISO including an automatic ex ante review through its fuel entry thresholds or a manual ex ante review where the CAISO, Market Monitor, and supplier jointly discuss the need for an adjustment to the fuel input in the reference level software. Additionally, we understand that DMM believes that either bid-in or adjusted reference levels would require the CAISO to introduce automated pre-market verification to protect against artificial price impact.

WPTF appears to hold a slight preference for enhancements to the CAISO's reference level design that would be technology agnostic. When discussing bid-in cost based energy offers, WPTF points out that the tariff currently allows non-gas resources to submit cost based energy offers, and extending this functionality to gas resources would be more equitable, especially since it would lend itself as well to gas as it does to other resource types. WPTF refers to a similar concern as a disadvantage to fuel price adjustments. WPTF appears to oppose fuel price adjustments as they would only address gas-fired resources and alternative resources are expected to increase in the future.

Including non-compliance risks in reference levels

The CAISO understands a number of stakeholders support allowing suppliers to reflect risk of non-compliance charges for violating gas pipeline instructions set to incentivize behavior supportive of gas system reliability in either their reference levels. Conceptually, stakeholders believe that the design needs to be enhanced to allow suppliers to recover unavoidable charges triggered by CAISO dispatch. They believe this recovery should be either through the market or an after-the-fact uplift settlement approved by the CAISO.

Six Cities, NRG, and EDF all support including the non-compliance risk as a new cost component to the reference levels and potentially contribute to setting electricity market prices or be considered in an after-the-fact review. Some of these stakeholders believe this inclusion is appropriate since penalties incurred often come as a result of following CAISO dispatch. NRG states that "market prices should always reflect reliability needs and must also reflect costs incurred to meet those needs."⁵⁶

We understand that Six Cities, PG&E, and NRG feel the largest risks of not capturing the true cost associated with this non-compliance risk only occurs in the real-time market and largely for dispatches after 4PM Pacific on the electric operating day (one hour prior to intraday 3 gas nomination cycle close). Six Cities requested the ability to reflect those risks for hours ending 16-24 on days where gas pipeline instructions are in effect. NRG believes the largest risk of the market undervaluing costs is when resources' bids are mitigated, especially during these hours⁵⁷.

PG&E, SCE, and DMM oppose the inclusion of such risks in the reference levels or bid-in cost based offers. We understand that PG&E does not support allowing the inclusion of such risks to impact price. Further, PG&E believes that the inclusion of the non-compliance risk in market could undermine incentivizes for

⁵⁶ NRG comments on *Commitment Costs and Default Energy Bid Enhancements* workshops, Page 2, http://www.caiso.com/Documents/NRGComments_CommitmentCosts_DefaultEnergyBidEnhancementsWorkingGroupMar30_Apr202017.pdf.

⁵⁷ NRG comments on *Commitment Costs and Default Energy Bid Enhancements* issue paper, Page 2, http://www.caiso.com/Documents/NRGComments_CommitmentCosts_DefaultEnergyBidEnhancementsIssuePaper.pdf.

suppliers to avoid non-compliance charges for violating instructions meant to preserve gas system reliability. PG&E stated in their comments, “PG&E does not believe allowing OFO penalty costs or gas system non-compliance risk adders in offers and references, and thereby assuring cost recovery of penalty charges through LMP revenues, incents behavior to avoid such penalties meant to preserve gas system reliability.”⁵⁸ SCE appears supportive of making non-compliance charges eligible for after-the-fact cost recovery.

Strongly in disagreement with the DMM and PG&E position, EDF stated in its issue paper comments how important it is for full costs of natural gas generation to be reflected,

“DMM recommends that certain cost components (e.g. gas penalties, imbalance charges) be excluded from natural gas costs used to calculate offer caps, as these do not typically represent hourly marginal costs and cannot be reasonably estimated in advance. DMM’s recommended approach conflicts with the fundamental principle outlined earlier in these comments – CAISO rules should allow market participants to recover gas costs incurred in following CAISO dispatch instructions and market awards under all circumstances.¹⁴ DMM’s recommended approach imposes an unduly high risk of under recovery of fuel costs on suppliers – an outcome that is likely to be exacerbated by the ongoing limited operability of Aliso Canyon, which has increased the likelihood of OFO situations and the imposition of penalties.”⁵⁹

The CAISO understands that there is general support from NVE, Six Cities, PG&E, and SCE for after-the-fact resettlement to help suppliers recover unavoidable gas penalties or other unknown costs at the time of bidding. NV Energy expressed in their comments that they oppose CAISO relying solely on after-the-fact resettlement mechanism by means of extending a 205 filing right to suppliers at FERC. The CAISO understands NVE to believe that the implementation of the after-the-fact resettlement should take place on a separate and accelerated path. PG&E conditions its support for resettlement of unavoidable gas penalties to only considering penalties incurred after 4PM Pacific due to a CAISO dispatch instruction.

8.2.3. Proposal

The purpose of this section is to describe the details on the CAISO proposal to allow greater flexibility to negotiate or adjust each component of supply offer reference levels.

The section will discuss the following portions of the proposal:

- Add negotiated option for commitment cost reference levels
- Allow Supplier provided ex ante reference levels adjustments subject to verification requirements

⁵⁸ PG&E comments *Commitment Costs and Default Energy Bid Enhancements* workshops, Page 3, http://www.aiso.com/Documents/PG_EComments_CommitmentCosts_DefaultEnergyBidEnhancementsWorkingGroupMar30_Apr202017.pdf.

⁵⁹ EDF comments *Commitment Costs and Default Energy Bid Enhancements* on issue paper, Page 5, http://www.aiso.com/Documents/EDFComments_CommitmentCosts_DefaultEnergyBidEnhancementsIssuePaper.pdf.

Add negotiated option for commitment cost reference levels

ISO proposes to add a negotiated option for commitment cost reference levels to address the issue facing suppliers with unique costs where they need the CAISO's administratively calculated reference levels to have the ability to capture their unique cost formulations on a routine basis. The ISO already provides this flexibility to suppliers for incremental energy offer reference levels through the negotiated DEB option described in Section 4.3, Mitigating market-based energy offers. At a minimum, the components that would be eligible for negotiation are those components in the ISO's existing proxy commitment costs estimates. If a supplier believes additional components to its calculations are necessary, the supplier will need to pursue negotiating the more complex calculation.

ISO believes expanding its reference level design to add the same concept to its commitment cost reference levels is prudent so suppliers' can reflect unique cost formulations. This proposal will provide better bidding flexibility to increase suppliers' ability to reflect complex costs when their offers are mitigated or capped. The ISO believes this proposal has the advantage that it leverages existing systems and policies for a negotiated rate for mitigation purposes while allowing similar flexibility in its commitment cost reference levels that it currently provides for its energy cost reference levels.

CAISO supports negotiated rate option for purpose of reflecting systematic differences in cost formulations where suppliers have unique circumstances not captured by generic reference level method. Design change provides consistent levels of flexibility for relevant cost inclusion for gas/non-gas and increases ability to reflect cost expectations improving efficiency of dispatch and cost recovery

Supplier seeking a negotiated commitment cost reference level would be able to seek consideration of tailoring its reference level to reflect more complex cases than a generic reference level formula could. The ISO proposes that under its reference level negotiations for commitments costs that the ISO would support with sufficient justification tailoring the formulations to reflect:

- Complex formulations of delivered fuel price especially for fuel-switching resources and resources that have opportunity to procure fuel from multiple locations or transport its fuel supplies across multiple pipelines
- Complex formulations of delivered fuel price that do not assume the next day gas index is the appropriate price benchmark for the resource.
- Additional cost components not included in the generic reference level formula

CAISO proposes that inclusion of risk margin(s) for risks of undermining gas pipeline instructions or for cash-out risk continue to not be appropriate cost components to include in reference levels whether generic or negotiated on a systematic basis. This is with the exception that the CAISO believes suppliers should be able to reflect gas system constraints and the risk of incurring gas system penalties when they would unavoidably incur penalties by following CAISO dispatch instructions. (This also allows the ISO dispatch to consider the gas constraint.) Recall the ISO's third principle under its Uncompetitive conditions – reference level design principles,

Suppliers should not be able to value assets based on monetized risks, subsidies, contracts, or other factors including ability to reflect fuel availability in its offers

through a risk margin or scarcity value to reflect risks of negative reliability externalities on a routine basis.

ISO believes that market-based offers which reflect willingness to sell energy at a given price differ from cost-based offers by supporting inclusion of information that adjusts willingness to sell but is not related to energy production costs on a routine basis. On an exceptional basis when conditions warrant, the ISO finds it appropriate for suppliers' valuation of fuel price to change to reflect fuel availability so the ISO dispatch can consider the scarcity in finding the optimal solution.

Allow Supplier provided ex ante reference levels adjustments subject to verification requirements

CAISO proposes to allow suppliers to submit ex ante, prior to the market run, an adjustment to its reference levels for commitment costs or energy costs. These adjustments to either commitment cost or energy cost reference levels will be subject to verification requirements⁶⁰ prior to the market run (ex ante verification). If the CAISO cannot verify before the applicable market run, it will not include the adjustment in the market but will include any adjusted reference level cost in uplift settlements calculations if it is verified in an ex post verification.

CAISO proposes that the adjustments on commitment cost reference levels should not be subject to any backstop or "circuit breaker" caps while the adjustments on energy cost reference levels will be subject to a \$2,000/MWh cap for purpose of setting market prices. The circuit breaker caps on commitment cost reference levels adjustments because they are subject to ex ante and ex post screening.

CAISO proposes that the adjustments to energy cost reference levels will be accepted at any price level with nuances to its use. For determining market prices, CAISO will only use an adjusted energy bid price reference level that it can verify, prior to the market run, as a reasonable reflection of cost expectation and that is no more than \$2,000/MWh (energy adjustment cap)⁶¹. If above \$2,000/MWh, the ISO will use the relative levels of any adjustments submitted above \$2,000/MWh to determine merit order dispatch at that price level. If unverifiable ex ante or greater than \$2,000/MWh, the CAISO will review after the market run (ex post verification) whether it can verify the adjustment is a reasonable reflection of supplier's cost expectation at the time the adjustment was submitted by supplier and if verifiable is eligible for uplift re-calculation. The verification will be based on documentation the supplier provides verifying its cost expectation at the time it submitted the energy bids.

CAISO proposes reference level adjustments so that when conditions arise that drive the suppliers' cost expectations away from the administratively calculated cost estimates – negotiated or estimated – the supplier can request an adjustment to deviate from the estimates, which are only designed to serve under largely stable conditions. This proposal for adjustments to energy cost reference levels is the vehicle for submitting cost-based energy offers above \$1,000 subject to verification requirements required under FERC Order 831.

⁶⁰ Verification requirements proposed were developed to comply with Order 831.

⁶¹ Order 831 compliance requires applying cap to adjusted references levels used to set market prices.

This additional feature is necessary to address the identified needs that arise on an exceptional basis that do not routinely impact a resource's cost expectations. As reiterated in prior section, the ISO is adopting design principles that do not support inclusion of risk margins on a routine basis. The fourth design principle adopted by the CAISO in its development of this proposal is that:

*Suppliers should have ability to reflect fuel availability in its offers through a risk margin or scarcity value to reflect risks of negative reliability externalities **as an exception so the CAISO and supplier can avoid affecting reliability.***

Adding the negotiated option alone does not fully accommodate the appropriate level of supply offer flexibility since significant changes in price volatility as result of limited fuel availability is largely observed in broker markets or between counterparties trading off the Intercontinental Exchange's electronic trading platform. The CAISO's reference levels on a routine basis should only reflect published index prices as price setting trading for those indices are appropriately monitored.

The CAISO proposes to establish guidelines to apply to the following new processes:

- How suppliers would develop the cost-based offer that the supplier is requesting an adjustment to from its reference level,
- How CAISO would apply an ex ante reasonableness validation for purpose of accepting adjustments for use in determining market prices or uplift payments, and
- How CAISO would provide ex post verification to those failing ex ante verification or capped at energy adjustment cap.

Details on guidelines that the CAISO proposes gas and non-gas units should follow in submitting reference level adjustments and guidelines for reviewing requests is moved into Appendix C: Guidelines for ex ante adjustment requests and verification.

The following describes the CAISO's proposal for verification as follows (1) establishing guidelines, (2) ex ante and ex post verification, (3) after-the-fact filing right at FERC, and (4) authority to monitor and audit excepted adjustments for clawback if artificial prices are detected.

Establishing guidelines

The CAISO proposes to allow reference level adjustments rather than adjustments to only the fuel price component. The CAISO arrived at this decision after reflecting on comments from WPTF advising against pursuing market enhancements addressing need that is only applicable to gas-fired units given increasingly diverse resources in the CAISO market in light of the broad support for allowing fuel price adjustments to reference levels. The CAISO believes allowing adjustments on the reference level instead of an input will provide flexibility that was supported in comments on the fuel price adjustments but in a manner that is technology agnostic.

The reference level adjustment will allow suppliers to submit requests to update up to four components of the supply offer where the submitted adjustment for that component would replace the routinely calculated reference level. In its Business Practice Manuals, the CAISO will clarify that the technology agnostic definition of its supply offer components should be revised accordingly:

- **Startup costs** – costs associated with bringing a unit online from being shut down *or a state not capable of producing energy into a mode it can produce energy*⁶²,
- **Transition costs** – costs associated with moving from one configuration to another for multi-stage generators (MSG),
- **Minimum load costs**- operating the unit at the minimum operating level (Pmin) where a unit cannot drop below without compromising the unit’s operation including costs of producing energy up to Pmin as well as *run hour costs unrelated to any energy production possible even for resources with 0 MWh minimum operating level*, and
- **Incremental energy costs** – costs associated with producing energy above Pmin expressed as a \$/MWh value *where participating demand response resources costs should be at least at net benefits test value.*

There appears to be confusion over how these terms apply to non-gas units and the language italicized is intended to resolve that confusion and clarify that the CAISO systems will support minimum load costs even for resources without minimum load energy that incur run hour costs. CAISO seeks stakeholder feedback as to whether this meets the need for greater clarity expressed and on what further guidelines should be developed for how the CAISO would expect the cost-based offer to be developed.

The CAISO proposes that the guidelines should not provide specific conditions that would warrant suppliers’ requesting adjustments but should provide the following scenarios and guidelines for approving adjustments for:

- Day-ahead supply offers where prevailing prices in next day gas products are trading more than 110% of the index price published the day prior to the CAISO day-ahead market run (GD1)⁶³
- Real-time supply offers where prevailing prices in non-standard products are trading more than 110% above the index price published the morning of the CAISO day-ahead market run (GD2)
- Real-time supply offers reflecting risk margin or scarcity value needed to support reliability on upstream fuel systems only eligible for adjustments in hours after 4PM Pacific under scenarios where gas pipeline instruction has been released and/or gas system capacity levels are insufficient to deliver fuel supply to avoid violating a gas pipeline instructions
- Fundamental drivers affecting non-gas units “fuel” or “prime mover” equivalent that will require documentation supporting exogenous factor is impacting ability to produce energy changing non-gas fuel equivalent costs from those registered in Master File

Supporting documentation will be required to support sufficient justification for submitting adjustments and determining reasonable expectation of costs based on the changes in fundamental drivers. Details on how CAISO proposes gas and non-gas units should develop reference level adjustments is moved into Appendix C: Guidelines for ex ante adjustment requests and verification.

⁶² These costs will vary be the amount of time the unit has been shut down generally referred to as “hot”, “intermediate”, or “cold” starts. “Cold” starts will be the most expensive of the three as it is likely to require the most fuel or auxiliary power to bring the unit from off to on.

⁶³ Consequently both the manual gas price spike procedure and the manual update of day-ahead gas price index to include an approximation of next day gas index will not be supported.

CAISO sought stakeholder feedback on what other conditions the CAISO should specifically describe – especially if any are non-gas related – in the guidelines for conditions warranting adjustments and sufficient supporting documentation in its straw proposal. No specific conditions were identified by stakeholders in their comments outside of these.

CAISO proposes not to define specific guidelines or conditions for reference level adjustment requests by a non-gas resource. The CAISO will not provide those guidelines since there is no existing detailed criteria for how to calculate these non-gas fuel equivalent costs under the CAISO’s Tariff. CAISO proposes the ex ante submitted reference level adjustments by a non-gas resource should meet the Tariff requirements for establishing non-gas fuel equivalent costs. Reference level adjustments for non-gas resources will allow these resources to more dynamically update their cost expectations if a change in fundamentals arises. Appendix C: Guidelines for ex ante adjustment requests and verification includes a discussion of the specific tariff language that can be leveraged to clarify cost development guidelines for non-gas resources. In the future, if specific cost estimate calculations are defined for non-gas resources, the CAISO will define at that time the principles for developing the adjustment requests. Details on guidelines that the CAISO proposes non-gas units should follow in submitting reference level adjustments is moved into Appendix C: Guidelines for ex ante adjustment requests and verification.

Ex ante and ex post verification processes

CAISO proposes to require subjecting adjustments on either commitment cost or energy cost reference levels to verification requirements⁶⁴ prior to the market run (ex ante verification) and if unable to verify in time will verify afterward (ex post verification). CAISO proposes that the adjustments on commitment cost reference level adjustments should not be subject to any backstop or “circuit breaker” caps, because they are subject to ex ante screening, while the adjustments to energy cost reference levels will be subject to \$2,000/MWh for purpose of setting market prices.

Figure 7 provides a conceptual flow chart of the process for identifying the appropriate price to reflect a supplier’s offers at in the market based on whether there is competitive or uncompetitive conditions, if uncompetitive whether an adjustment request has been submitted for the reference levels, if an adjustment request passes the reasonableness validation in its ex ante screen, and if unverifiable the proposal to send the original submitted adjustment to an ex post verification process.

⁶⁴ Verification requirements proposed were developed to also comply with Order 831.

Competitive Conditions



Uncompetitive Conditions without DEB or proxy cost adjustment



Uncompetitive Conditions with DEB or proxy cost adjustment

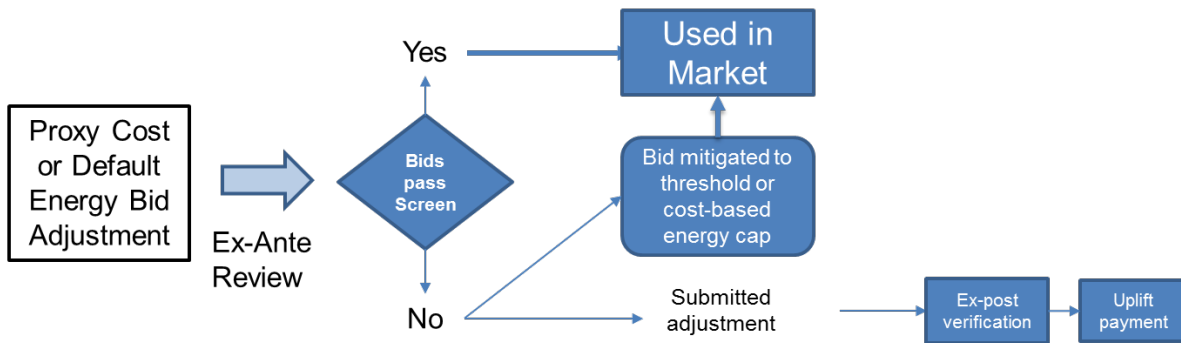


Figure 7: Illustration of adjustment request and verification process

To be included in the market, the CAISO will require the requested adjustment to be verified prior to the market run (i.e., ex ante verification). This ex ante verification will be performed through evaluating the reference level adjustment through an automated screen comparing the adjusted value against a reasonableness threshold. If the adjustment falls below the reasonableness threshold, the CAISO will accept the reference level adjustment automatically. If the adjustment is higher than lower of the reasonableness threshold or cost-based cap if applicable⁶⁵, the CAISO will adjust the reference level adjustment to the reasonableness threshold – capping the adjustment at a reasonable rate and sending the original adjustment request to the ex post verification process. Details on how CAISO to verify ex ante including the approach for developing the reasonableness threshold is moved into Appendix C: Guidelines for ex ante adjustment requests and verification.

The ex post verification processes will be used for adjustments to reference levels that either failed the ex ante automated screening or in the case of adjustments to energy cost reference levels that exceed \$2,000/MWh cap and that had reasonableness thresholds above \$2,000/MWh as well. If successfully verified, CAISO proposes to re-calculate its uplift settlement with verified cost-based adjustment to the

⁶⁵CAISO proposing to only apply cost-based cap to the adjustments to energy cost reference levels so for the purpose of evaluating adjustments to commitment cost reference levels will only be evaluated against the threshold.

reference level(s) and if market revenues are insufficient to cover their costs (i.e., revenue shortfall) will be eligible for uplift.

CAISO proposes to seek authority to initiate an audit process if suppliers' behavioral issues are identified. CAISO proposes to render ineligible temporarily and to impose penalties on any Scheduling Coordinator who submits inaccurate fuel price or fuel type that was biased in the favor of the Market Participant (i.e. artificially priced). If CAISO is not able to substantiate the suppliers' compliance in following the established guidelines, CAISO will penalize supplier by clawingback the market revenues or uplift payments. Further, the CAISO proposes to render the supplier ineligible to submit reference level adjustments until a defined amount of time has elapsed. This authority is essential as an additional measure to protect against artificial price impacts.

The CAISO will adopt language similar to the following:

"If (i) the ISO determines, following consultation with the [Market Participant] and review by the [ISO or Market Monitoring Unit], that the [Market Participant] or its representative has, over a time period of at least one week, submitted inaccurate fuel type or fuel price information that was biased in the [Market Participant]'s favor, or (ii) if a [Market Participant] is subject to a penalty or sanction of these Mitigation Measures for submitting inaccurate fuel price or fuel type information, then the ISO shall cease using the fuel type and fuel price information submitted to the ISO's Market Information System along with the Generator's Bid(s) to develop reference levels for the affected Generator(s) in the relevant (Day-Ahead or real-time) market for the duration(s) set forth below.

The first time the ISO ceases using the fuel type and fuel price information submitted to the ISO's Market Information System along with the Bid(s) for a Generator to develop Day-Ahead or real-time reference levels for that Generator, it shall do so for 60 days. The 60 day period shall start two business days after the date that the ISO provides written notice of its determination that the application of mitigation is required.

Any subsequent time the ISO ceases using the fuel type and fuel price information submitted to the ISO's Market Information System along with the Bid(s) for a Generator to develop Day-Ahead or real-time reference levels for that Generator, it shall do so for 180 days. The 180 day period shall start two business days after the date that the ISO provides written notice of its determination that the application of mitigation is required."⁶⁶

Make permanent after-the-fact filing right at FERC for energy costs

Given the proposal that the CAISO ex post verification will be limited to verifying that the conditions warranting review have been met and sufficient supporting documentation has been submitted, the

⁶⁶ New York Independent System Operator Tariff Market Administration and Control Area Services Sections 23.3.1.4.6.8 - 23.3.1.4.6.8.2

CAISO proposes to provide the tariff authority to file at FERC for costs that are incurred but out outside of the conditions and verification rules that the CAISO will administer in either ex ante or ex post review. This will provide supplies with the ability to recover extraordinary costs under extraordinary conditions and circumstances.

Consequently, CAISO proposes to make permanent extending the 205 filing right at FERC actual energy costs exceeding the energy adjustment cap or the mitigated price at its energy cost reference level that were unrecovered through market revenues. This policy was initially proposed and stakeholdered under *Aliso Canyon Phase 1*. The revised draft final proposal in *Aliso Canyon Phase 1* proposed “cost recovery filing opportunity for incurred marginal procurement costs associated with providing incremental energy.”

While this is currently effective in the CAISO tariff, the provision is currently temporary. CAISO proposes to make permanent this opportunity to complement the already permanent tariff language for this cost recovery filing opportunity for incurred commitment costs above commitment cost caps unrecovered through market revenues.

8.3. Market-based commitment costs subject to mitigation

CAISO proposes to allow market based offers for each component of the supply offer subject to mitigation so that market participants have greater flexibility to submit offers that support their cost expectations and business needs. The purpose of this section is to describe the CAISO proposal to allow market based offers for each component of the supply offer subject to mitigation.

The CAISO will describe its proposal for hourly minimum load offers as follows:

- **Error! Reference source not found.**
- Stakeholder comments
- Proposal

8.3.1. Issues

The CAISO is the only ISO/RTO that does not support market based commitment costs offers subject to mitigation. Only mitigating commitment cost offers when a resource has market power increases the ability for suppliers to their reflect cost expectations and business needs.

The current design limits suppliers’ ability to submit prices based on their willingness to sell regardless of whether the supplier could adversely impact the market based on an assumption that reasonable range of costs should be constrained within 25 percent of reference levels. This assumption is empirically supported by analysis performed by the Department of Market Monitoring. Under most scenarios, the 25 percent appears to provide a sufficient margin of error to allow the suppliers’ cost expectations to be reflected in their commitment cost offers.

However, this disregards that under competitive conditions it is within the market design to allow supply offers that reflect a suppliers’ willingness to sell power based in part on their own expectations of costs

and risks. As discussed in the Background section, this is appropriate because the competitive market forces exist to provide incentives that limit adverse market impacts from market power.

8.3.2. Stakeholder comments

CAISO understood from stakeholder comments that there is general support that the CAISO should propose enhancements to the CAISO bidding flexibility so that the design provides a better balance between suppliers' ability to reflect willingness to provide energy at a given price under competitive conditions and the market operator's need to protect against market power under uncompetitive conditions. CAISO understands that Portland General Electric (PGE), NV Energy (NVE), NRG, Western Power Trading Forum (WPTF), Environmental Defense Fund (EDF), and the Department of Market Monitoring (DMM) all support introducing market-based commitment cost offers.

Generally, stakeholders expressed that introducing market based offers would be necessary for suppliers to accurately reflect their willingness to provide energy in the market. Overall, these changes would benefit market efficiency and competition leading to an increase in market participation. NVE specifically points out that this feature would increase market participation in their comments because it would allow suppliers to better quantify the value of their resources to the market. These views were tempered by several stakeholders conditioning their support on successful development of dynamic mitigation.

In absence of introducing market-based offers, DMM, EDF and WPTF oppose simply increasing the headroom provided on top of the proxy commitment cost. They point out that simply raising the cap on cost based offers would not suffice as this effectively just increases the mark up under which suppliers could exercise market power if under uncompetitive conditions.

8.3.3. Proposal

The purpose of this section is to describe the details on the CAISO proposal to allow market based offers for each component of the supply offer subject to mitigation.

The section will discuss the following portions of the proposal:

- Support market-based commitment cost offers subject to caps
- Apply dynamic market power mitigation
- Apply results of market power mitigation on commitment costs to default assessment for exceptional dispatches

Support market-based commitment cost offers subject to caps

Based on the CAISO's understanding of virtually full consensus that it should support market-based commitment cost offers subject to caps as long as a sufficiently robust market power mitigation is applied, the CAISO proposes to pursue this enhancement. From a policy and market design perspective, the CAISO had held the goal to support market-based commitment cost offer when feasible to implement the mitigation test since 2007.

CAISO wants to make clear that this straw proposal to pursue these enhancements is contingent upon completion of its evaluation of the feasibility and capital costs associated with enhancements relative to

the benefits. CAISO will finalize this assessment and provide information in its draft final proposal. If cost benefit analysis indicates feasibility and stakeholder comments continue to support this direction, the CAISO would consider phasing the implementation of this initiative so that the mitigation enhancements are implemented either simultaneously with the planned *Real-time Market Enhancements* initiative or shortly after. This initiative will make changes to the functionality associated with each of the various market runs comprising the real-time market so it would not be efficient to introduce commitment cost market power mitigation into the real-time market until the CAISO makes those changes.

With an introduction of market-based commitment cost offers, the CAISO proposes it will apply “circuit breaker” hard caps on the commitment cost components of the market-based supply offers as well. Recall the fifth of the CAISO’s adopted principles under competitive conditions stated,

Market-based offers should be subject to “circuit breaker” caps to ensure that potential uncertainty impacting the mitigation test would not result in a significant false negative resulting in potential adverse market impacts.

Today, CAISO enforces a hard cap on its market-based energy offers at \$1,000/MWh consistent with this principle. Similarly, the CAISO proposes hard caps on market-based commitment cost offers. These hard caps are used as backstop mitigation accounting for imperfect information in mitigation methods. CAISO proposes to establish a conservative cap initially and then as needed increase over time similar to the manner it phased in the higher energy offer caps over several years.

CAISO proposes under this initiative to establish the new market-based commitment cost component caps at 300 percent above the commitment cost reference levels for start-up, transition, and minimum load components. The commitment cost reference levels, proxy costs, today are calculated without any scalar since cost-based commitment cost offers are not subject to mitigation but instead validated against a maximum allowable level. Under the proposed policy, the commitment cost reference levels will be enhanced to include the 110% scalar representing incidental costs above the fuel cost proxy.

Apply dynamic market power mitigation

CAISO recognizes and strongly agrees with stakeholder views that an effective market power mitigation test is necessary to allow the introduction of market-based commitment cost components.

CAISO proposes to revise its dynamic commitment cost mitigation design to not make a distinction between net buyers and net sellers. Net buyers of energy only incur allocations of bid cost recovery based on their ratio share of system load. If they were exempt from commitment cost mitigation, there could be an incentive for net buyers to inflate their commitment costs bids because they would recover all of their commitment costs but only be allocated a share of the resulting bid cost recovery costs. This is different from incremental energy and its market power mitigation design that exempts net buyers. There is no incentive for a net buyer to inflate energy costs because it would be exposed to higher costs for its load than it receives for its generation if it inflated energy costs through high supply bids.

CAISO proposes to introduce commitment cost market power mitigation in all unit commitment processes to the extent possible where the dynamic competitive path assessment would determine non-

competitive congestion components⁶⁷ separately for (1) binding constraints and (2) critical constraints. Binding constraints are constraints where power flows are at a 100% versus critical transmission constraints which are constraints where power flows are at 85% or greater of the line limit in the prevailing flow direction. This would require adding a market power mitigation process to the short-term unit commitment run and adding producing a second non-competitive congestion component for potential to relieve critical constraints for identifying resources with potential to exercise market power with its minimum load offers.

As discussed in its issue paper Section 5.2.2, Evaluating Pivotal Supplier Test Design for Unit Commitment, the CAISO is concerned that there might be some instances where market power would not be detected as result of unit commitment under a pivotal supplier test if only evaluating binding constraints. For example, if market power is exercised through commitments with inflated offers that result in fully relieving a binding constraint, then a pivotal supplier test based on binding constraints would not capture the adverse market impact. Commitment can result in fully relieving a binding constraint because commitment is “lumpy,” and the minimum load of a unit is more than enough to fully relieve a binding constraint such that it cannot be observed in the final market solution.

After reviewing stakeholder comments and working with subject matter experts, the CAISO believes that to feasibly implement a test that could capture the effect of “lumpy” minimum load energy levels on relieving constraints that a wider selection of constraints need to be evaluated. As CAISO explained in its issue paper, expanding its mitigation to evaluate the critical constraints would likely result in over-mitigation since it would view constraints as binding that were not binding in the final solution. Resources that are effective in relieving congestion on an uncompetitive constraint in any iteration would be subject to mitigation. Even with the possibility that the constraint would never bind, the unit would not have the ability to exercise market power.

While the CAISO understands that this could potentially be seen as a step backward from adopting mitigation methodologies balancing mitigation to levels that do not over or under mitigate at unacceptable levels, the CAISO does not share this view. Effectively by only supporting cost-based commitment cost offers the CAISO design assumes uncompetitive conditions for every run which provides certainty that over-mitigation is occurring regularly. CAISO views this enhancement as the necessary compromise to provide more flexibility balanced against need to protect against potential for supplier to have market power on its unit commitments. CAISO also notes based on limited testing that while it would mitigate “more” than the binding approach there appears to be demonstrable benefits in reducing the current over-mitigation. Further, this approach relying largely on post-processing changes to existing processes and adding a short-term unit commitment process is a feasible implementation approach given market performance considerations.

⁶⁷ CAISO clarifies its approach to establishing a basis for mitigating commitment costs at a resource level through adding an analogous approach to the non-competitive congestion components to the second RSI calculation that estimates the net effect of commitment on congestion system-wide. See Appendix D: Details on commitment cost mitigation, D.7 LMPM mitigation criteria for the detailed explanation.

To enhance the dynamic competitive path assessment to determine and apply mitigation based on non-competitive congestion components separately for (1) binding constraints and (2) critical constraints, the CAISO proposes the following changes to its local market power mitigation design.

First, for the non-competitive congestion component from binding uncompetitive constraints, CAISO is proposing that if any resource fails based on a non-competitive congestion component greater than \$0/MWh that the entire supply offer would be mitigated to the commitment cost and energy cost reference levels. This test is used for mitigating market-based energy offers today. The CAISO is not proposing any changes to the calculation of these non-competitive congestion components' calculations.

Second, for the non-competitive congestion component from critical uncompetitive constraints, CAISO is proposing that if any resource fails based on a non-competitive congestion component greater than \$0/MWh that only the market-based commitment cost offers would be mitigated to the commitment cost reference level for each component. To develop a non-competitive congestion component from critical competitive constraints, the CAISO will need to enhance its post-processing in the dynamic competitive path assessment to perform a second residual supply index calculation on all critical constraints. The contribution to the marginal congestion component (MCC) from the critical constraints with insufficient supply for relieving the constraint would be separated from the MCC and the summation of the effective contribution to that resource is the second non-competitive congestion component at each resource's node.

CAISO notes that current policy is to **exempt** demand response, participating load, non-generator resources and virtual supply from mitigation. CAISO will not be proposing any changes to this policy.

Table 7 presents the proposed characteristics for the proposed commitment cost mitigation that differ from the mitigation applied to the entire supply offer. CAISO seeks stakeholder feedback on these characteristics.

Mitigation Design Feature	IFM	STUC	HASP	RTM Pre-Dispatch/FMM
Requires new process	N	Y	N	N
Type of constraint tested	Critical (85% Flow)	Critical (85% Flow)	Critical (85% Flow)	Critical (85% Flow)
RSI calculation – allows commitment/de-commitments	Y	Y ⁶⁸	Y	Y

⁶⁸ RSI calculation for energy mitigation does not allow commitments or de-commitments in the real-time market power mitigation processes.

Mitigation Design Feature	IFM	STUC	HASP	RTM Pre-Dispatch/FMM
RSI calculation – basis for maximum capacity that could be withheld from pivotal suppliers	maximum effective available capacity	maximum effective available capacity ⁶⁹ (ramping constrained)	maximum effective available capacity (ramping constrained)	maximum effective available capacity (ramping constrained)
Apply mitigation	Revised logic for applying mitigation has been made based on continued developments on proposal. Details provided in Appendix D: Details on commitment cost mitigation, D.8 Applying mitigation.			

Table 7: Proposed characteristics of commitment cost mitigation

Detailed explanations for the proposal for the commitment cost mitigation post-processing methodology is provided in Appendix D: Details on commitment cost mitigation.

Apply results of market power mitigation on commitment costs to default assessment for exceptional dispatches

To implement effectively the enhancements to support market-based commitment cost offers balanced against need to protect against market power concerns, the CAISO proposes to ensure it enhances the default competitive path assessment for purposes of mitigating commitment cost offers associated with exceptional dispatches using the new residual supply index on all critical constraints as well.

As explained in the *Exceptional dispatch Mitigation in Real-time* initiative approved by FERC in 2013,

“While this feature [dynamic market power mitigation] will greatly improve the accuracy of local market power mitigation within the market dispatch, it does introduce a gap in identifying and mitigating for Exceptional Dispatch that have local market power. This proposal addresses that gap through a separate set of path designations that are based on the dynamic designations and will be used in applying mitigation to Exceptional Dispatch. The proposal also extends the methodology to providing a set of default path designations that will be used as “back-up” in the event that the dynamic competitive path assessment within the market software fails to produce a valid set of path designations.”⁷⁰

To ensure that with these enhancements the CAISO maintains this existing policy to ensure the default competitive path assessment which would now need to receive two residual supply index calculations and

⁶⁹ RSI calculation for energy mitigation assesses maximum ramp range within unloaded capacity in the real-time market power mitigation processes.

⁷⁰ *Exceptional Dispatch Mitigation in Real-time* draft final proposal, <http://www.aiso.com/Documents/DraftFinalProposal-ExceptionalDispatchMitigationRealTime.pdf>.

create two lists of historical designations. The first list is the current one maintained today, which determines path designations for purposes of applying mitigation to Exceptional Dispatch is:

- A constraint that passes the following two thresholds will be deemed competitive for purposes of applying mitigation to Exceptional Dispatch:
 - Congestion Threshold: Congested in 10 hours or more in the RTUC run where the dynamic competitive path assessment is calculated, and
 - Competitive Threshold: Deemed competitive 75 percent or more of the instances where the constraint was binding and tested.
- Data for the test statistics will reflect the most recent 60 days of trade dates available at the time of testing to focus application on more seasonal conditions.
- This set of designations will be updated not less frequently than every seven days to reflect changes in system and market conditions.

CAISO proposes that the default competitive path assessment will also be enhanced to support two sets of default path designations: (1) for purposes of mitigating incremental energy portion of the exceptional dispatch (default energy designations) and (2) for purposes of mitigation of commitment costs associated with an exceptional dispatch (default commitment designations).

The only change to current use of the default energy designations proposed is that the mitigation would only apply to the incremental energy portion. The methodology approved by FERC in 2013 would continue to use for determining historical designations for energy mitigation of exceptional dispatches.

Under this proposal, the CAISO would propose that a second historical designation for commitment cost is performed leveraging the existing design with the following changes:

- A constraint that passes the following two thresholds will be deemed competitive for purposes of applying mitigation to commitment cost portion of the Exceptional Dispatch:
 - Congestion Threshold: Critical flow in 10 hours or more in the RTUC run where the dynamic competitive path assessment is calculated, and
 - Competitive Threshold: Deemed competitive 75 percent or more of the instances where the constraint was critical and tested.

The CAISO believes with these proposed changes to the default competitive path assessment that there should be sufficient market power mitigation protections proposed to support increasing flexibility to support market-based commitment cost offers.

9. Issues removed from scope

The purpose of this section is to explain the rationale behind the CAISO decision to remove consideration of certain issues described in its issue paper because of stakeholder feedback and other practical considerations.

CAISO proposes to remove the issue that Exceptional Dispatch Mitigation May Not Be Restrictive Enough discussed in detail in its issue paper section 4.3.

The CAISO came to this decision for the following reasons:

- Limited to no stakeholder support or prioritization of issue
- Issues are better addressed in other stakeholder efforts

First, the CAISO identified little support. In both stakeholder comments responding to its issue paper and to the workshops, the CAISO found little stakeholder support for continuing to consider potential changes to its exceptional dispatch mitigation design. In response to its issue paper posing if its exceptional dispatch mitigation design is under restrictive only PG&E saw value in changing the mitigation design⁷¹.

Additionally, the CAISO identified these issues are better addressed in other stakeholder efforts.

For example, the CAISO already moved and addressed in a separate initiative, *Aliso Canyon Gas-electric Coordination Phase 3*, one of the sub-issues. Where both SCE and DMM submitted supportive comments for need to ensure the CAISO mitigates incremental exceptional dispatches issued to address natural gas constraints based on uncompetitive transmission constraints based on counterflow supply when constraint is enforced.

The CAISO after further discussion realized that the Department of Market Monitoring was not aware that the CAISO had previously determined the authority to deem select transmission constraints uncompetitive should apply to the mitigation of incremental exceptional dispatches under its existing exceptional dispatch policy which says the dynamic competitive path assessment results (including overrides is implied) is used to determine . Consequently, the CAISO included the detailed language in both its straw and draft final proposal for *Aliso Canyon* that the override applies to both the dynamic and default assessments. The CAISO uses the default assessment for exceptional dispatch mitigation. The CAISO believes there has not been a “gap” on incremental exceptional dispatch since the authority has been in effect. Further, in its most recent draft final proposal for phase 3 of *Aliso Canyon* the CAISO has proposed to automate the dynamic competitive path assessment to include gas constraint. The CAISO has determined any enhancements to its incremental exceptional dispatch mitigation is outside the scope of this project.

As to the issue for the need to evaluate and address decremental exceptional dispatch mitigation, the CAISO has determined enhancements to introduce a decremental exceptional dispatch mitigation design are not a pressing need at this time and serve to delay serious consideration on the higher value items. Concerns of market power potentially being exercised through decremental exceptional dispatches requires a specific scenario in which market prices are sufficiently negative that a negative offer price would fail to clear through the market and inform possibility of need to dispatch down and be paid additional revenues for that decremental movement. This is an unlikely scenario outside of Overgeneration conditions. Consequently, the CAISO believes it can better address this policy discussion in a stakeholder process focused more on impacts of overgeneration on market dynamics.

⁷¹ PG&E comments on *Commitment Cost and Default Energy Bid Enhancements* issue paper, http://www.aiso.com/Documents/PG_EComments_CommitmentCosts_DefaultEnergyBidEnhancementsIssuePaper.pdf.

Appendix A: Stakeholder Engagement Plan

The California ISO will discuss this revised straw proposal with stakeholders during a meeting on August 3, 2017. After the stakeholder meeting, the California ISO will issue a stakeholder comments template with the questions posed throughout this document. Stakeholders are asked to submit their written comments to initiativecomments@caiso.com by close of business on August 10, 2017.

The target completion for both phases and presentation of the draft final proposal to the EIM Governing Body and CAISO Board of Governors is November 2017. Current schedule for this initiative is shown in Table 8.

Milestone	Date
Issue paper posted	November 18, 2016
Stakeholder call	November 22, 2016
Stakeholder written comments due	December 9, 2016
Straw Proposal Posted	June 30, 2017
Stakeholder meeting	July 6, 2017
Stakeholder written comments due	July 20, 2017
Revised straw proposal	August 1, 2017
Stakeholder technical workshop	August 3, 2017
Stakeholder written comments due	August 10, 2017
Draft final proposal posted	August 18, 2017
Stakeholder call	August 30, 2017
Stakeholder written comments due	September 11, 2017
EIM governing body meeting	October 10, 2017
Board of Governors meeting	November 1-2, 2017

Table 8: Initiative Schedule

Appendix B: Details on negotiated options

The current provisions for negotiated default energy bids is found in the California ISO Tariff Section 39.7.1.3.1. The ISO plans to mirror the existing process for negotiating proxy costs.

The CAISO proposes to incorporate negotiations for proxy costs similar to the following, which is adapted from the current provisions for negotiated default energy bids:

“Scheduling Coordinators that elect the Negotiated Rate Option for the [Negotiated Proxy Cost] shall submit a proposed [Negotiated Proxy Cost] along with supporting information and documentation as described in a BPM. Within ten (10) Business Days of receipt, the CAISO or an Independent Entity selected by the CAISO will provide a written response. If the CAISO or Independent Entity accepts the proposed [Negotiated Proxy Cost], it will generally become effective within eleven (11) Business Days from the date of acceptance by the CAISO and remain in effect until: (1) the [Negotiated Proxy Cost] is modified by FERC; (2) the [Negotiated Proxy Cost] is modified by mutual agreement of the CAISO and the Scheduling Coordinator; or (3) the [Negotiated Proxy Cost] expires, is terminated or is modified pursuant to any agreed upon term or condition or pertinent FERC order.

If the CAISO or Independent Entity selected by the CAISO does not accept the proposed [Negotiated Proxy Cost], the CAISO or Independent Entity selected by the CAISO and the Scheduling Coordinator shall enter a period of good faith negotiations that terminates sixty (60) days following the date of submission of a proposed [Negotiated Proxy Cost] by a Scheduling Coordinator. If at any time during this period, the CAISO or Independent Entity selected by the CAISO and the Scheduling Coordinator agree upon the [Negotiated Proxy Cost], it will generally be become effective within eleven (11) Business Days of the date of agreement and remain in effect until: (1) the [Negotiated Proxy Cost] is modified by FERC; (2) the [Negotiated Proxy Cost] is modified by mutual agreement of the CAISO and the Scheduling Coordinator; or (3) the [Negotiated Proxy Cost] expires, is terminated or is modified pursuant to any agreed upon term or condition or pertinent FERC order.

If by the end of the sixty (60)-day period the CAISO or Independent Entity selected by the CAISO and the Scheduling Coordinator fail to agree on the [Negotiated Proxy Cost] to be used under the Negotiated Rate Option, the Scheduling Coordinator has the right to file a proposed [Negotiated Proxy Cost] with FERC pursuant to Section 205 of the Federal Power Act.

During the sixty (60)-day period following the submission of a proposed negotiated [Proxy Cost] by a Scheduling Coordinator, and pending FERC’s acceptance in cases where the CAISO or Independent Entity selected by the CAISO fail to agree on the [Negotiated Proxy Cost] for use under the Negotiated Rate Option and the Scheduling

Coordinator filed a proposed [Negotiated Proxy Cost] with FERC pursuant to Section 205 of the Federal Power Act, the Scheduling Coordinator will be valued using the estimated proxy cost option.”

The Department of Market Monitoring sought clarification on the process and to identify what cost components would be eligible for negotiation. CAISO can clarify that at a minimum, the negotiation would include the cost components included in the CAISO’s existing proxy commitment cost estimates. The CAISO supported calculations and associated components are described in Business Practice Manual for Market Instruments and summarized in Appendix C: Guidelines for ex ante adjustment requests and verification.

Appendix C: Guidelines for ex ante adjustment requests and verification

This appendix provides the details for the proposed guidelines for the CAISO proposal to support supplier submitted ex ante reference level adjustments. The CAISO proposes to establish guidelines to apply to the following new processes:

- How suppliers would develop the cost-based offer that the supplier is requesting an adjustment to from its reference level (development guidelines for reference level adjustment),
- How CAISO would apply an ex ante reasonableness validation for purpose of accepting adjustments for use in determining market prices or uplift payments, and
- How CAISO would provide ex post verification to those failing ex ante verification or capped at energy adjustment cap.

CAISO is still evaluating feasibility of whether CAISO can automate the inclusion of an approximation of the next day gas index in its day-ahead market on a routine basis. Currently, the guidelines incorporate the need to address the lagged next day gas index. If it determines automation is feasible, CAISO will revise appendix to remove reference to next day gas index published the morning of its day-ahead market.

The reference level adjustment will allow suppliers to submit requests to update up to four components of the supply offer where the submitted adjustment for that component would replace the routinely calculated reference level. CAISO proposes that the guidelines for suppliers to submit adjustment request values should be restricted to re-calculation of cost-based estimates by the supplier with the more appropriate value for the inputs unable to be captured by the CAISO's reference level calculations.

The CAISO proposes that the guidelines for when a reference level adjustment can be submitted should not provide specific conditions that would warrant submission but should provide the following scenarios and guidelines for approving adjustments for either (1) fuel market price conditions, (2) fuel market or transport availability conditions or (3) fundamental drivers necessitating update to non-gas resources cost estimates maintained in Master File.

C.1 Required formulations for calculating reference levels for adjustments

The following formulations should be used for adjustments. A supplier may request an adjustment to the fuel cost or fuel cost equivalent component that are described in each of the following sections. CAISO will expect the supplier to submit the total value including the variable operations & maintenance, grid management charge adder, greenhouse gas compliance costs (if appropriate), frequently mitigated adders (if appropriate), negotiated major maintenance adders (if appropriate), and opportunity cost adders (if appropriate) but that those values will be static and consistent with CAISO's existing calculations. Further, the resource characteristics that feed into these equations will be required to be consistent with Master File registered values or as revised through outage management system.

C.1.1 Energy Cost Calculations (Variable Cost Option)

Variable energy costs are the \$/MWh costs associated with power production at a given MW output level. These costs are variable and vary with the dispatch level of the resource (i.e. quantity produced).

Default Energy Bid Cost

$$= \begin{cases} (\text{Segment's Fuel Cost} + \text{VOM} + \text{GMC Adder}) * \text{Scalar}, \\ \quad \text{GHG}_{Flag} = 'N' \text{ and } \text{DEBA} = 0 \text{ and } \text{OC} = 0 \\ (\text{Segment's Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost}) * \text{Scalar}, \\ \quad \text{GHG}_{Flag} = 'Y' \text{ and } \text{DEBA} = 0 \text{ and } \text{OC} = 0 \\ (\text{Segment's Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost} + \text{DEBA}) * \text{Scalar}, \\ \quad \text{GHG}_{Flag} = 'Y' \text{ and } \text{DEBA} \neq 0 \text{ and } \text{OC} = 0 \\ (\text{Segment's Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost} + \text{DEBA}) * \text{Scalar} + \text{OC Adder}, \\ \quad \text{GHG}_{Flag} = 'Y' \text{ and } \text{DEBA} \neq 0 \text{ and } \text{OC} \neq 0 \end{cases}$$

Where:

If gas resource, then:

Segment's Fuel Cost = $\text{Unit Conversion} * \text{Incremental Heat Rate} * \text{GPI}$,
 where
 $\text{Incremental Heat Rate} = (\text{HEAT_RATE}_{i+1} * \text{MW}_{i+1} - \text{HEAT_RATE}_i * \text{MW}_i) / (\text{MW}_{i+1} - \text{MW}_i)$ ⁷²

else if non-gas, then:

Segment's Fuel Cost = $\text{Incremental Cost Curve}$, where
 $\text{Incremental Cost Curve} = (\text{AvgCost}_{i+1} * \text{MW}_{i+1} - \text{AvgCost}_i * \text{MW}_i) / (\text{MW}_{i+1} - \text{MW}_i)$ ⁷³

VOM=variable operating and maintenance adder (VOM)

GHG Cost = $\text{Unit Conversion} * \text{Heat_Rate} * \text{Emissions Rate} * \text{GHG Allowance Rate}$

Unit conversion = 0.001

DEBA = ISO determined default energy bid adder

Scalar = 1.1

OC Adder = ISO determined opportunity cost adder for resources with eligible output limitations calculated or negotiated

Equation 1: Default Energy Bid Variable Cost Calculation

⁷² Suppliers register average heat rates in Master File that are later converted to incremental heat rate. There is additional logic to the formulation of the incremental heat rate in tariff.

⁷³ Suppliers register average cost curves in Master File that are later converted to incremental cost curves. There is additional logic to the formulation of the incremental cost curve in tariff (analogous to that for incremental heat rates).

C.1.2 Maximum Allowable Minimum Load Costs

Minimum load costs are costs incurred per hour to maintain the resource at the minimum operating point as specified by the Pmin value in the ISO Master File. These costs do not require having a minimum operating point above zero since it could include short-term fixed costs incurred for a run hour and/or variable costs for power production at Pmin. See Tariff Section 30.4.1.1.2.

Minimum Load Cost

$$= \begin{cases} (\text{Minimum Load Fuel Cost} + \text{VOM} + \text{GMC Adder}) * \text{Scalar}, & \text{GHG}_{Flag} = 'N' \text{ and } MMA = 0 \text{ and } OC = 0 \\ (\text{Minimum Load Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost}) * \text{Scalar}, & \text{GHG}_{Flag} = 'Y' \text{ and } MMA = 0 \text{ and } OC = 0 \\ (\text{Minimum Load Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost} + MMA) * \text{Scalar}, & \text{GHG}_{Flag} = 'Y' \text{ and } MMA \neq 0 \text{ and } OC = 0 \\ (\text{Minimum Load Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost} + MMA) * \text{Scalar} + \text{OC Adder}, & \text{GHG}_{Flag} = 'Y' \text{ and } MMA \neq 0 \text{ and } OC \neq 0 \end{cases}$$

Where:

If gas resource, then:

Minimum Load Fuel Cost = $Unit\ Conversion * Heat_Rate * Pmin * GPI_{DA,RT}$, where Heat_Rate and Pmin are registered fields in Master File

else if non-gas, then:

Minimum Load Fuel Cost = $(Unit\ Conversion * HEAT_{AVG_COST\ POINT1, PMIN} * Pmin + MIN_LOAD_COST)$, where HEAT_AVG_COST, Pmin, and MIN_LOAD_COST are registered fields in Master File

VOM = $VOM * Pmin$
 GMC Adder = $Pmin * GMC$

GHG Cost = $Unit\ Conversion * Heat_Rate * Pmin * Emissions\ Rate * GHG\ Allowance\ Rate$

Unit conversion = 0.001

MMA = ISO determined major maintenance adder

Scalar=1.25

OC Adder = ISO determined opportunity cost adder for resources with eligible run hour limitations calculated or negotiated

Equation 2: Proxy Minimum Load Costs

While the majority of this section is addressing how the supplier would determine its adjustment request, supporting minimum load costs associated with run hours not energy production for non-gas resources' without minimum operating levels will be made in the CAISO's proxy cost calculations.

As stated in Section 8.2.3.2, CAISO proposes to enhance its systems to support minimum load costs associated with run hour costs for non-gas resources without a conventional minimum operating level. As result, the minimum load cost field in Master File needs to clarify that if on proxy cost and a non-gas unit, the minimum load cost field is for cost associating with run hours and the first segment of the average cost curve is for costs associated with producing energy up to that minimum level.

C.1.3 Maximum Allowable Start-up Costs

Start-up (or shutdown) cost is a cost incurred per event of the resource that is the cost of bringing the resource into a mode by which it can operate hourly and to a given dispatch level. The cost does not vary with hours the resource is called on and/or the dispatch level of the resource. See Tariff Section 30.4.1.1.2.

Start-up Cost Reference Level Calculation

$$= \begin{cases} (\text{Start-up Cost} + \text{Start-up Energy Cost} + \text{GMC Adder}) * \text{Scalar}, \\ \quad \text{GHG}_{Flag} = 'N' \text{ and } MMA = 0 \\ (\text{Start-up Cost} + \text{Start-up Energy Cost} + \text{GMC Adder} + \text{GHG Cost}) * \text{Scalar}, \\ \quad \text{GHG}_{Flag} = 'Y' \text{ and } MMA = 0 \\ (\text{Start-up Cost} + \text{Start-up Energy Cost} + \text{GMC Adder} + \text{GHG Cost} + \text{MMA}) * \text{Scalar}, \\ \quad \text{GHG}_{Flag} = 'Y' \text{ and } MMA \neq 0 \\ (\text{Start-up Cost} + \text{Start-up Energy Cost} + \text{GMC Adder} + \text{GHG Cost} + \text{MMA}) * \text{Scalar} + \text{OC Adder}, \\ \quad \text{GHG}_{Flag} = 'Y' \text{ and } MMA \neq 0 \text{ and } OC \neq 0 \end{cases}$$

Where:

If gas resource, then:

Start-up Fuel Cost = $STRT_{STARTUP_FUEL} * GPI_{DA,RT}$, where $STRT_{STARTUP_FUEL}$ is registered field in Master File

else if non-gas, then:

Start-up Fuel Cost = $STRT_{STARTUP_COST}$, where $STRT_{STARTUP_COST}$ is registered field in Master File

Start-up Energy Cost = $STRT_{STARTUP_AUX} * EPI$, where $STRT_{STARTUP_AUX}$ is registered field in Master File

GMC Adder = $P_{min} * (STARTUP_RAMP_TIME / 60min) * \frac{GMC}{2}$, where $STARTUP_RAMP_TIME$ is registered field in Master File

GHG Cost = $STRT_STARTUP_FUEL$ * Emissions Rate * GHG Allowance Rate where
 $STRT_STARTUP_FUEL$ is registered field in Master File

MMA = ISO determined major maintenance adder

Scalar=1.25

OC Adder = ISO determined opportunity cost adder for resources with eligible start limitations
 calculated or negotiated

Equation 3: Proxy Start-Up Costs

C.1.4 Maximum Allowable Transition Costs

Transition cost is a cost incurred per event of the resource that is the cost of moving from one state of operation (“From Configuration”) to another state of operation (“To Configuration”). The cost does not vary with the hours the resource is called and/or the dispatch level of the resource. CAISO views these costs as similar to starting up a higher configuration and is the difference in start-up costs between the two configurations. See Tariff section 30.4.1.1.5.

Transition Cost

$$= \begin{cases} (Proxy\ Start\ Up\ Costs_{ToConfig} - Proxy\ Start\ Up\ Costs_{FromConfig}) * Scalar, & OC = 0 \\ (Proxy\ Start\ Up\ Costs_{ToConfig} - Proxy\ Start\ Up\ Costs_{FromConfig}) * Scalar + OC\ Adder, & OC \neq 0 \end{cases}$$

Where:

$Proxy\ Start\ Up\ Costs_{ToConfig}$
 = Calculated proxy start up costs of the “To Configuration” the resource is transitioning to

$Proxy\ Start\ Up\ Costs_{FromConfig}$
 = Calculated proxy start up costs of the “From Configuration” the resource is transitioning

Scalar=1.25

OC Adder = ISO determined opportunity cost adder for resources with eligible start limitations
 calculated or negotiated

Equation 4: Proxy Transition Costs

C.2 Guidelines for developing adjustment value for non-natural gas units

For non-natural gas units, the CAISO proposes to require non-natural gas suppliers to develop the cost expectation for the fuel equivalent costs in the adjustment request based on the following proposed revisions to existing tariff language for non-gas resources.

For adjustments to non-gas resources' default energy bids regardless of option selected, CAISO proposes the following tariff language from Section 39.7.1.1.1.2 should be leveraged to clarify cost development guidelines for adjustment requests as follows:

“Resource owners for non-natural gas-fueled units shall submit to the CAISO [for ex ante adjustments to the incremental] fuel [equivalent] costs (\$/MW) measured for at least two (2) and up to eleven (11) generating operating points (MW), where the first and last operating points refer to the minimum and maximum operating levels (i.e., PMin and PMax), respectively... Cost curves will include: (i) greenhouse gas allowance costs for each non-natural gas-fired resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling Coordinator for the resource; and (ii) a volumetric Grid Management Charge adder that consists of: (i) the Market Services Charge; (ii) the System Operations Charge; and (iii) the Bid Segment Fee divided by the MW in the Bid segment. Cost curves shall be stored, updated, and validated in the Master File.”

For adjustments to non-gas resources' start-up and minimum load proxy costs, CAISO proposes the following tariff language from Section 30.4.1.1.2(b) should be leveraged to clarify cost development guidelines for adjustment requests as follows:

“Start-Up Cost and Minimum Load Cost [adjustment] values under the Proxy Cost methodology, [negotiated or estimated], shall be based on...The relevant cost information of the particular resource, including fuel or fuel equivalent input costs, which will be provided to the CAISO by the Scheduling Coordinator [in its adjustment request]

Start-Up Costs will also include: (i) greenhouse gas allowance costs for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling Coordinator; (ii) the rates for the Market Services Charge and System Operations Charge multiplied by the shortest Start-Up Time listed for the resource in the Master File, multiplied by the PMin of the resource as registered in the Master File, multiplied by 0.5; and (iii) a resource-specific adder, if applicable, for major maintenance expenses (\$ per Start-Up) determined by the CAISO or Independent Entity selected by the CAISO to determine such major maintenance expenses.

Minimum Load Costs also include: (i) operation and maintenance costs as provided in Section 39.7.1.1.2; (ii) greenhouse gas allowance costs for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling Coordinator; (iii) the rates for the Market Services Charge and System Operations Charge multiplied by the PMin of the resource as registered in the Master File; (iv) the Bid Segment Fee; and (v) a

resource-specific adder, if applicable, for major maintenance expenses (\$ per operating hour) determined by the CAISO or an Independent Entity selected by the CAISO.

For each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, the information provided to the CAISO by the Scheduling Coordinator must be consistent with information submitted to the California Air Resources Board. Adders for major maintenance expenses will be determined pursuant to Section 30.4.1.1.4.”

C.3 Guidelines for developing adjustment value for natural gas units

For natural gas resources, the fuel cost portion of the energy cost, minimum load cost, and start-up cost calculations are based on a delivered gas price estimate. If adjustments to the delivered gas price estimate used to determine resources’ cost expectations, the reference level adjustments should be calculated consistent with the following formulas with the adjusted delivered gas price estimate.

Select conditions warranting a request may impact the delivered gas price estimate shown in the following equation, *Equation 5*, shows the formulation for the gas price indices used in the CAISO’s proxy costs and default energy bid (variable cost) calculations.

Gas Price Index

$$GPI_{DA} = \text{Commodity Price}_{DA} + \text{Transportation Rate} + \text{Shrinkage Allowance}_{DA} + \text{Cap \& Trade Credit} + \text{Miscellaneous}$$

$$GPI_{RT} = \text{Commodity Price}_{RT} + \text{Transportation Rate} + \text{Shrinkage Allowance}_{RT} + \text{Cap \& Trade Credit} + \text{Miscellaneous}$$

Where:

*Commodity Price*_{DA} = ICE_{GD2,8-9AM} (ICE calculated midpoint made available prior to official index publication)

*Commodity Price*_{RT} = average(SNL_{GD2}, Platts_{GD2}, ICE_{GD2}, NGI_{GD2})⁷⁴

$$\text{Shrinkage Allowance}_{DA} = \text{Commodity Price}_{GD2} * \frac{\text{Fuel Reimbursement Rate}}{1 - \text{Fuel Reimbursement Rate}}$$

$$\text{Shrinkage Allowance}_{RT} = \text{Commodity Price}_{GD2} * \frac{\text{Fuel Reimbursement Rate}}{1 - \text{Fuel Reimbursement Rate}}$$

⁷⁴ SCE1, SCE2, SDG1, SDG2 fuel regions have calculated commodity price in RT that include a scalar on the average of the published indices (175% for purpose of calculating maximum allowable commitment costs 125% for purpose of calculating default energy bids).

Transportation Rate and Cap & Trade Credit (neg. value) are the approved gas pipeline shipping company rates on the company's electric supplier rate for that region.

Miscellaneous costs will be defined specific to the fuel region.

Equation 5: Gas Price Index for Delivered Gas Price Estimate⁷⁵

C.4 Guidelines for determining when adjustment is warranted

Suppliers must be able to support sufficient justification for need to request a reference level adjustment. Supporting documentation will be required to support there is justification for adjusting suppliers' reference levels. The supporting documentation should indicate a fundamental driver is driving cost expectations to depart from CAISO's estimates. The supporting documentation should be used to:

- Support need for departure from CAISO's cost estimates
- Support which component of costs are impacted by the changes in fundamental drivers or operational needs
- Support monetary amount included in adjustment

Currently, the CAISO is only aware of the need for these adjustments to the delivered gas price estimates for either changes to fuel market price conditions or fuel market or transport availability conditions.

To support adjustment requests to proxy costs and default energy bids, negotiated or estimated, CAISO proposes the following list as appropriate supporting documentation:

- Under fuel market price conditions:
 - Index publisher information (consummated low-mid-high)
 - Electronic platform information (bid-ask spreads)
 - Off-ICE quotes if meets a liquidity/counterparty requirement of 5-10 price quotes where the quotes cannot be from an affiliate.
- Under fuel market or transport availability conditions⁷⁶:
 - Current line pack levels or other pipeline capacity reports
 - Notice of fuel transport flow orders (e.g. OFO/EFO)
 - Fuel scarcity conditions (e.g. "can't find counterparty")

⁷⁵ Formula will be effective when *Bidding Rules Enhancements* is implemented to add the shrinkage allowance, cap-and-trade credits, and miscellaneous costs.

⁷⁶ While fuel market or transport availability conditions may impact market prices triggering need for the "fuel market price conditions" request categories, this second category is for instances when the market price – on and off ICE – does not reflect the fuel constraint. Documentation required for any cost based components priced based on fundamentals outside of market price information.

CAISO expects suppliers to evaluate whether the following conditions have occurred prior to submitting an ex ante request. If any are identified, CAISO proposes it should trigger supplier submitting requests to adjust the delivered gas price estimate:

- Under fuel market price conditions:
 - Day-ahead supply offers where prevailing prices in next day gas products are trading more than 110% of the index price published the day prior to the CAISO day-ahead market run (GD1)⁷⁷
 - Real-time supply offers where prevailing prices in non-standard products are trading more than 110% above the index price published the morning of the CAISO day-ahead market run (GD2)
- Under fuel market or transport availability conditions:
 - Real-time supply offers reflecting risk margin or scarcity value needed to support reliability on upstream fuel systems only eligible for adjustments in hours after 4PM Pacific under scenarios where gas pipeline instruction has been released and/or gas system capacity levels are insufficient to deliver fuel supply to avoid violating a gas pipeline instructions

For the purpose of determining the appropriate monetary amount to request for a reference level adjustment, CAISO proposes the following for the two categories of drivers impacting delivered gas price estimates.

First, fuel market price conditions should result in suppliers re-calculating cost-based supply offers should using the CAISO's formulations for cost estimates with a revised delivered gas price estimate that reflects prevailing prices at the time the adjustment request is submitted. CAISO proposes to support adjustments from its reference levels up to a reasonable range for a delivered gas price estimate set by the high of the prevailing market prices excluding lower bound outliers. CAISO proposes the metric it will use to evaluate ex post is that the delivered gas price estimate is less than the lower outlier fence across an aggregate distribution of:

- Day-ahead supply offers:
 - Establish distribution of market prices aggregating multiple gas products to determine prevailing market price for flows beginning 7AM PT TD by overlaying offers scraped from:
 - Next day gas trading,
 - Custom products traded on an electronic exchange,
 - Off-ICE quotes if meets a liquidity/counterparty requirement of 5-10 price quotes where the quotes cannot be from an affiliate⁷⁸.

⁷⁷ Consequently both the manual gas price spike procedure and the manual update of day-ahead gas price index to include an approximation of next day gas index will not be supported. If able to automate the inclusion of approximation of next day gas index, CAISO will revise.

⁷⁸ CAISO will screen for affiliate using the same logic employed in the LMPM process to determine affiliates for the purpose of calculating Withheld Capacity.

- Establish the high side of the aggregated market price distribution by setting the high after excluding outliers by finding the lower bound fence for outliers as 3rd Quartile + 1.5*Interquartile Range (IQR) where IQR is 3rd Quartile – 1st Quartile.
- Set the high for prevailing market prices at the lower of the highest offer across aggregated market prices or the lower fence for outliers.
- If supplier is basing delivered gas price off of procurement locations other than standard procurement location or based on additional costs likely to be incurred due to deliverability or capacity limitation on the fuel system, CAISO will support inclusion of other procurement locations or additional fees for items such as backhauling fees. This support is contingent on supporting the constraint by submitting current line pack levels or other pipeline capacity reports.
- Real-time supply offers:
 - Establish distribution of market prices aggregating multiple gas products to determine prevailing market price for flows beginning 12AM PT TD (ID1), 4PM (ID2), or 8PM (ID3) by overlaying offers scraped from:
 - Custom products traded on an electronic exchange,
 - Off-ICE quotes if meets a liquidity/counterparty requirement of 5-10 price quotes where the quotes cannot be from an affiliate⁷⁹.
 - Establish the high side of the aggregated market price distribution by setting the high after excluding outliers by finding the lower bound fence for outliers as 3rd Quartile + 1.5*Interquartile Range (IQR) where IQR is 3rd Quartile – 1st Quartile.
 - Set the high for prevailing market prices at the lower of the highest offer across aggregated market prices or the lower fence for outliers.
 - If supplier is basing delivered gas price off of procurement locations other than standard procurement location or based on additional costs likely to be incurred due to deliverability or capacity limitation on the fuel system, CAISO will support inclusion of other procurement locations or additional fees for items such as backhauling fees. This support is contingent on supporting the constraint by submitting current line pack levels or other pipeline capacity reports.

In addition to fuel market or transport availability conditions necessitating a more complex calculation of the aggregated market price distribution, CAISO proposes it would be appropriate for suppliers to recalculate their cost-based supply offers using the CAISO's formulations for cost estimates with a revised delivered gas price estimate that reflects risk of non-compliance with a fuel transport flow orders at the time the adjustment request is submitted.

CAISO proposes to support supplier submitted ex ante adjustments from its reference levels up to a reasonable range for a delivered gas price estimate that includes a risk margin to reflect this non-compliance risk based on a probability of violating order due to CAISO instructions beginning HE17.

⁷⁹ CAISO will screen for affiliate using the same logic employed in the LMPM process to determine affiliates for the purpose of calculating Withheld Capacity.

Real-time supply offers beginning TD HE17 under fuel transport flow orders:

- Must provide documents showing notice of fuel transport flow orders (e.g. OFO/EFO)
- If based on notice of fuel transport flow orders, CAISO proposes a reasonable monetary adjustment would be to adjust the delivered gas price estimate from the next day index used in the cost estimate up by adding the non-compliance charge associated with the specific level of flow order associated with hours between TD HE17 and TD HE24.

While CAISO proposes suppliers will need to submit ex ante these reference level adjustments even for non-compliance risks for HE 17-24, CAISO emphasizes these will likely not be verifiable through its ex ante verification screen. Instead, CAISO anticipates that when these conditions arise that the adjustments will exceed the reasonableness thresholds resulting in limiting the request to that level for purpose of market solution and providing more time to verify ex post under a rigorous review.

CAISO will verify these guidelines were followed in submitting ex ante adjustments and did not provide artificial price information through the ex ante (using automated screen), ex post, and perform an audit on frequently submitted and ex ante approved adjustments

C.5 Guidelines for establishing reasonableness threshold

To be included in the market, the CAISO will require the requested adjustment to be verified prior to the market run (i.e., ex ante verification). This ex ante verification will be performed through evaluating the reference level adjustment through an automated screen comparing the adjusted value against a reasonableness threshold. If the adjustment falls below the reasonableness threshold, the CAISO will accept the reference level adjustment automatically. If the adjustment is higher than lower of the reasonableness threshold or cost-based cap if applicable⁸⁰, the CAISO will adjust the reference level adjustment to the reasonableness threshold – capping the adjustment at a reasonable rate and sending the original adjustment request to the ex post verification process.

CAISO proposes the reasonableness threshold should be a threshold calculated to represent a statistically reasonable delta of observed consummated deals relative to the next day indices used to set its reference level calculations that factors in a feedback loop that is resource-specific.

As an initial step - the CAISO will produce four thresholds associated with resources: day-ahead threshold, day-ahead Monday threshold, real-time threshold, and real-time Monday threshold. Thresholds will be calculated seasonally to represent the difference between observed consummated deals compared to the fuel regions' next day gas indices. Thresholds will be based on historical data for the same season over the past three years accounting for the removal of outliers. For non-natural gas units, these thresholds will be calculated for the 'CISO' fuel region and used as benchmark for ex ante verification of non-natural gas requests. For natural gas units, these thresholds will be applied largely based on their fuel regions registered in Master File.

As a final step – the CAISO will incorporate a term capturing a feedback loop from the ex post verification processes. If CAISO successfully verifies supplier ex post and through that process learns that the supplier

⁸⁰CAISO proposing to only apply cost-based cap to the adjustments to energy cost reference levels so for the purpose of evaluating adjustments to commitment cost reference levels will only be evaluated against the threshold.

bears burden of risk of higher costs relative to the thresholds that can be determined based on delta between ICE same-day, intra-day, Monday-only deals and the published indices, CAISO will include an error term that will allow CAISO to tune a fuel-region level threshold to each resource by biasing the threshold.

The remainder of this discussion will provide greater details on the first step of establishing these reasonableness thresholds.

For day-ahead threshold, the CAISO will calculate seasonally a statistical expectation of the delta between the highest same-day or intra-day consummated deal observed on Intercontinental Exchange versus the next day gas index used in its day-ahead market processes (i.e. gas day with flows beginning morning of its day-ahead market run).⁸¹

For day-ahead Monday threshold, the CAISO will calculate seasonally a statistical expectation of the delta between the highest same-day, intra-day, or Monday-only consummated deal observed on Intercontinental Exchange versus the next day gas index used in its day-ahead market processes (i.e. gas day with flows beginning morning of its day-ahead market run).

For real-time threshold, the CAISO will calculate seasonally a statistical expectation of the delta between the highest same-day or intra-day consummated deal observed on Intercontinental Exchange versus the next day gas index used in its real-time market processes (i.e. gas day with flows beginning morning of its trade day).

For day-ahead Monday threshold, the CAISO will calculate seasonally a statistical expectation of the delta between the highest same-day, intra-day, or Monday-only consummated deal observed on Intercontinental Exchange versus the next day gas index used in its day-ahead market processes (i.e. gas day with flows beginning morning of its trade day).

⁸¹ Note – CAISO continuing to evaluating feasibility of automating use of approximation of next day gas index.

Appendix D: Details on commitment cost mitigation

Purpose of this appendix is to provide the details on the proposed changes to commitment cost bidding rules and mitigation design under *Commitment Cost and Default Energy Bid Enhancements*.

Proposal will apply two post-processing steps in both the DCPA and LMPM for purposes of mitigating energy and commitment cost bids. All units will go through both processes.

D.1 Overview

CAISO proposes to allow market based offers for each component of the supply offer subject to mitigation where minimum load cost component is treated hourly and start-up and transition costs remain event-based costs at daily values. CAISO proposes to revise its mitigation design to not make a distinction between net buyers and net sellers. CAISO proposes to apply real-time market commitment cost re-bidding rules as previously stakeholdered with minor revision to allow re-bidding of commitment costs below the locked bid values used in the unit commitment decision process.

The LMPM will:

- Include net buyers and sellers of energy
- Run once with all constraints (AC run)
- DCPA will identify uncompetitive constraints for purpose of mitigating energy and commitment cost bids separately by calculating two separate residual supply indices on two different sets of constraints where:
 - For energy mitigation: test all binding constraints to determine residual supply index (RSI_k) for constraints K
 - For commitment cost mitigation: test all critical constraints to determine residual supply index (RSI_l) for constraints L (including binding) L,
- Evaluate mitigation need:
 - For energy mitigation: using the non-competitive congestion component of the LMP at the resource location (energy mitigation criterion)
 - For commitment cost mitigation: using the net effect of commitments calculation (commitment mitigation criterion)
- Mitigate bids at what value:
 - For energy mitigation: at above the competitive locational marginal price (mitigation price floor) at the resource location to not exceed the corresponding default energy bid
 - For commitment cost mitigation: at corresponding proxy commitment costs (called mitigated proxy costs).

Following sections will describe the new RSI and mitigation criterion for mitigating commitment cost components. CAISO denotes changes to the formulas by adding a superscript CCM where the input is altered to support a test suitable for commitment cost mitigation.

D.2 Data inputs to the LMPM and DCPA

Variable	Market Run	Formulation	Description
$ENGYMIN_i^{CCM}$	INPUT	<p>If $(RD_i \neq 0$ or $RU_i \neq 0)$ and $DOP_{i,t-1} - RR_i * 15 \leq$ $ENGYMIN_i$</p> <p>then</p> $ENGYMIN_i^{CCM} = 0$ <p>else</p> $ENGYMIN_i^{CCM} = MINCAP_i + RD_i$	<p>Minimum operating level for resource i can be dispatched to on energy bids respecting regulation down awards during test interval and accounting for ability to de-commit or shutdown a resource i if its downward ramping capability would allow the resource to at least reach its minimum operating level. Where $MINCAP_i$ is the lower operating limit.</p>
$ENGYMIN_i$	INPUT	$\max[(MINCAP_i + RD_i), self - scheduled\ energy]$	<p>Minimum operating level for resource i can be dispatched to on energy bids respecting regulation down awards during test interval (i.e. lower operating limit plus regulation down award). Where $MINCAP_i$ is the lower operating limit.</p>
$ENGYMAX_i$	INPUT	$\min((MAXCAP_i - OR_i - RU_i), (MAXECON_i - OR_i))$	<p>Maximum operating level for resource i that it can be dispatched to on energy bids given outages and derates and respecting operating reserves and regulation up during test interval (i.e. upper operating limit minus operating reserves or regulation up awards)</p>
$SF_{l,i}$	INPUT	INPUT	<p>Shift factor from resource location r to constraint l where constraint set L includes all critical constraints. Note that for MSG Plants the SF is given per plant aggregate connectivity node.</p>
$MAXCAP_i$	INPUT	$\min(Pmax_i - Derate_i, maxED)$	<p>Maximum operating level of resource r where $Pmax_i$ is regulation $Pmax$ if on regulation otherwise operational $Pmax$. Note – for MSG plants these are plant level maximums and derates.</p>

Variable	Market Run	Formulation	Description
$MAXECON_i$	INPUT	$\min \left(\begin{array}{c} Pmax_i - Derate_i, \\ \max ED, \\ \max econ\ bid\ MW \end{array} \right)$	Maximum operating level of resource r where Pmax _i is regulation Pmax if on regulation otherwise operational Pmax
$MINCAP_i$	INPUT	$\max(Pmin_i + Pmin\ Rerate_i, \min ED)$	Minimum operating level of resource r where Pmin _i is regulation Pmin if on regulation otherwise operational Pmin.
$DERATE_i$	INPUT	INPUT	Reduction in potential output from maximum operating level ($MAXCAP_i$) from unit outages or derates during test interval
OR_i	INPUT	INPUT	Operating reserve awards for resource i in test interval. For HASP, OR _i is (HASP qualified self-scheduled spinning including transferred DA spin capacity)+ (HASP qualified self-scheduled non-spinning including transferred DA non-spinning capacity). For RTUC, OR _i is awarded spinning capacity + awarded non-spinning capacity.
RD_i	INPUT	INPUT	Regulation down award for resource i in the test interval. For real-time, HASP qualified self-scheduled regulation down including transferred DA regulation down capacity.
RU_i	INPUT	INPUT	Regulation up award for resource i in the test interval. For real-time, HASP qualified self-scheduled regulation up including transferred DA regulation up capacity.
RR_i	INPUT	INPUT	Effective ramp rate at DOP _i in case of dynamic ramp rate.
DOP_i	INPUT	INPUT	Dispatch operating point for physical or virtual supply resource i for the all

Variable	Market Run	Formulation	Description
			constraints run results for the test interval ⁸²
$DOP_{i,t-1}$	INPUT	INPUT	Dispatch operating point for resources I from prior interval
RR_i	INPUT	INPUT	Resource i ramp rate in MW/minute

Table 9: Revised data inputs for commitment cost mitigation

D.3 Constraints tested

Test critical constraints (L) in all unit commitment processes (IFM, STUC, HASP, and RTPD) for commitment cost mitigation. Binding constraints are constraints where power flows are at a 100% versus critical transmission constraints, which are constraints where power flows at a given percentage as determined by the CAISO to identify “critical” constraints. Currently the critical constraint limit is set at 85% or greater of the line limit in the prevailing flow direction. Proposed enhancement would test all critical constraints – regardless of the parameter value.

D.4 Suppliers’ portfolio tested

D CPA identifies potentially pivotal suppliers versus fringe competitive suppliers based on total withheld capacity (WC) by supplier on a portfolio basis. D CPA assigns resources I to suppliers based on the Scheduling Coordinator ID adjusted for registered tolling agreements, identified in equations with subscript B. All resources made available to the day-ahead or real-time market that can be started to respond to dispatch in binding period tested will be evaluated whether committed in all constraints run or not.

LMPM evaluates total withheld capacity at an affiliate level by assigning resources to a supplier’s portfolio based on the Scheduling Coordinator who owns the SCID assigned to the resource unless a different Scheduling Coordinator, or an Affiliate of a different Scheduling Coordinator, controls the resource. Evaluation of withheld capacity for purpose of determining potential pivotal suppliers will not factor into its evaluation whether supplier is a net seller or buyer⁸³. Both net buyers and sellers can be included in either potentially pivotal supplier or fringe competitive supplier sets.

D.5 All constraints run

The first step in the LMPM method is to run the all constraints (AC) run. Given the mitigation reference bus used in the AC run, the analysis finds for the test interval t the optimal dispatch operating points for each physical and virtual supply resource r, binding constraints, shift factors, and locational marginal prices (LMPs).

⁸² Technically referred to as Dispatch Operating Target (DOT); DOP(P) is the expected dispatch trajectory through the DOTs.

⁸³ CAISO method for allocating bid cost recovery on a ratio share of system load r

The AC run outputs are used as basis for dynamic competitive path assessment and LMP decomposition used to flag resources for energy and commitment cost mitigation and set the mitigation price floor for energy mitigation.

The following market run types include a market power mitigation procedure testing for energy bid mitigation:

- Integrated forward market (energy and commitment cost mitigation)
- Short-term unit commitment (commitment cost mitigation only)
- Hour-ahead scheduling process (energy and commitment cost mitigation)
- Fifteen minute market (real-time pre-dispatch) (energy and commitment cost mitigation)
- Five minute market (real-time dispatch) (energy and commitment cost mitigation)

D.6 Dynamic Competitive Path Assessment (DCPA)

The dynamic competitive path assessment deems binding transmission constraints either competitive or uncompetitive based on a residual supply indices. The residual supply index based on the current DCPA design will flag energy bid mitigation based on the value of the RSI_t . The residual supply index for commitment cost mitigation (RSI_t^{CCM}) will flag commitment cost mitigation based on the value of the second set of RSI_t^{CCM} for each critical constraint.

D.6.1 Subscripts

The following table, Table 10, contains the subscripts used in the equations for the mitigation process. These subscripts are based on those used in the Business Practice Manual sections on mitigation.

Subscript	Subscript Name	Subscript Description
j	SC	The SCID(s) adjusted for tolling agreements (establishes affiliate level for test)
d	Trading Day	Trading Day
i	Resource ID	Resource ID or node index
I	Set of resource IDs	All resource IDs
k	Binding constraint	Binding constraint from the all constraints run where power flows are 100% of line limit in direction of the reference bus
K	Set of binding constraints	All binding constraints
l	Critical constraint	Critical constraints from the all constraints run where power flows are 85% of line limit in direction of the reference bus (will include binding constraints)
L	Set of critical constraints	All critical constraints
t	Interval	Interval within the optimization time horizon

Subscript	Subscript Name	Subscript Description
T	Optimization time horizon	Set of all intervals that fall within the optimization time horizon

Table 10: Subscript notation

D.6.2 Timing

The following indicate when the dynamic competitive path assessment will be run:

- Integrated forward market: after all constraints run prior to running the integrated forward market
- Short-term unit commitment process: after all constraints run prior to running the short-term unit commitment process. Note – requires enhancing LMPM design to perform market power mitigation procedure in this process adding this AC run.
- Hour-ahead scheduling process: after all constraints run prior to running hour-ahead scheduling process
- Fifteen minute market (real-time pre-dispatch): After the last real-time pre-dispatch run that procures ancillary services from internal resources just prior to the real-time dispatch runs for the same trade interval
- Five minute market (real-time dispatch): After the all constraints run after real-time pre-dispatch and prior to real-time dispatch run

D.6.3 Potentially pivotal or fringe competitive supplier

Identification of the top three potentially pivotal suppliers in the day-ahead market will be based on the available effective supply that can be withheld by each supplier. In the day-ahead this is the total effective counterflow supply versus in real-time which is the most ramp-constrained capacity including the minimum load energy a supplier could withhold. In real-time, the lowest output level for a resource i will account for the ability to de-commit or shutdown the resource by setting a revised minimum operating level ($ENGYMIN_i^{CCM}$) to 0 otherwise the downward dispatchable range will reflect ramp-constrained movement. For each critical constraint l , suppliers are ranked on $WC_{l,j}^{CCM}$ from highest to lowest and the top three suppliers are identified as within the set of potentially pivotal suppliers for that constraint and the remainder are identified as fringe competitive suppliers.

This withheld capacity (WC) from supplier J to critical constraint l is the sum across B 's resources, which is expressed as follows where it is calculated for resources i in potentially pivotal supplier portfolio J with $SF_{l,i} < 0$:

IFM Formulation:

$$WC_{l,j}^{CCM} = \sum_{i=1}^n (SF_{l,r} * ENGYMAX_i + SVCF_{l,j,i})$$

RTUC formulation:

$$WC_{i,j}^{CCM} = \sum_{i=1}^n [SF_{l,i} * (\min(DOP_{i,t-1} + RR_i * 15, ENGYMAX_i) - \max(DOP_{i,t-1} - RR_i * 15, ENGYMIN_i^{CCM}))]$$

$ENGYMIN_i^{CCM}$ is determined by the following conditional logic:

If $DOP_{i,t-1} - RR_i * 15 \leq ENGYMIN_i$ then $ENGYMIN_i^{CCM} = 0$ else $ENGYMIN_i^{CCM} = ENGYMIN_i$

In HASP, for a unit that is offline in the previous interval and has a startup time of 60 minutes or less, then WC = Pmin. For RTUC, the startup time to be used will be reduced to 15 minutes or less. Note - Withheld Capacity (WC) shall not consider pump storage resources, pseudo generators associated with PDR/ RDRP/Dispatched Pump resources, NGR LESR and NGR DDR and any external resources are excluded (consistent logic to existing MPM).

Additional inputs defined in Section titled, Data inputs to the LMPM and DCPA.

D.6.4 Effective available counterflow supply

Effective supply of counterflow is comprised of two parts: the highest possible output from the fringe competitive suppliers that do not withhold any capacity and the lowest possible output from the three potentially pivotal suppliers which reflects the capacity they could withhold.

In the case of the day-ahead application, the entire output of physical resources belonging to the potentially pivotal suppliers can be withheld because the supplier could not bid making the entire amount unavailable as well as the flexibility provided by the multi-period optimization. Accordingly, ramp rate constraints are ignored since the multi-period optimization can adjust dispatch in an earlier hour to achieve the dispatch it needs in the current hour if that was economic or necessary.

This is not the case in the real-time. The dynamic competitive path assessment accounts for ramping constraints in the real time application. The effective counterflow supply in real-time is the ramp-constrained capacity that potentially pivotal suppliers could withhold including the minimum load energy. In real-time, the lowest output level for a resource i will account for the ability to de-commit or shutdown the resource by setting a revised minimum operating level ($ENGYMIN_i^{CCM}$) to 0 otherwise the downward dispatchable range will reflect ramp-constrained movement.

The energy supply from pump storage and NGR LESR resources shall be included in the counterflow calculation. The demand side of pump storage and NGR LESR resources shall be excluded from the flow calculation. The NGR DDR, pseudo generators associated with PDR/ RDRP/Dispatched Pump resources and NGR DDR shall be excluded from the flow calculation (consistent with existing LMPM logic).

D.6.5 Counterflow supply from potentially pivotal suppliers

For use in commitment cost mitigation (CCM) calculation, effective supply of counterflow to constraint I from a physical resource i belonging to **potentially pivotal supplier** is the lowest output this supplier can achieve given the dispatch operating point in prior interval, resource ramp rates in MW/min, and minimum output limits. In the day-ahead, this is the total effective supply without ramp constraints versus real-time which is ramp-constrained supply including minimum load energy.

The effective counterflow supply from potentially pivotal suppliers on constraint I (SCF_l^{PPSCCM}) are expressed in the equations and input definitions described below and are calculated for resources I in potentially pivotal supplier portfolio J with $SF_{l,i} < 0$:

$$SCF_l^{PPSCCM} = \sum_{j=1}^n \sum_{i=1}^n SPCF_{l,j,i}^{PPSCCM}$$

IFM formulation:

$$SPCF_{l,j,i}^{PPSCCM} = 0$$

RTUC formulation:

$$SPCF_{l,j,i}^{PPSCCM} = SF_{l,i} * \max(DOP_{i,t-1} - RR_i * 15, ENGYMIN_i^{CCM})$$

$ENGYMIN_i^{CCM}$ is determined by the following conditional logic:

If $DOP_{i,t-1} - RR_i * 15 \leq ENGYMIN_i$ then $ENGYMIN_i^{CCM} = 0$ else $ENGYMIN_i^{CCM} = ENGYMIN_i$

D.6.6 Counterflow supply from fringe competitive suppliers

Effective supply of physical counterflow (SPCF) to constraint I from a physical resource i belonging to **fringe competitive supplier** (FCS) is the highest possible output from the fringe competitive suppliers. Fringe competitive suppliers do not withhold any capacity. In the day-ahead, this is the total effective supply without ramp constraints versus real-time which is ramp-constrained supply.

The effective counterflow supply from fringe competitive suppliers on constraint I (SCF_l^{FCSCCM}) are expressed in the equations and input definitions described below and are calculated for resources I in potentially pivotal supplier portfolio J with $SF_{l,i} < 0$:

$$SCF_l^{FCSCCM} = \sum_{j=1}^n \sum_{i=1}^n SPCF_{l,j,i}^{FCSCCM} + \sum_{j=1}^n \sum_{i=1}^n SVCF_{l,j,i}$$

IFM formulation:

$$SPCF_{l,j,i}^{FCSCCM} = SF_{l,i} * ENGYMAX_i$$

$$SVCF_{l,j,i} = SF_{l,i} * DOP_i$$

RTUC formulation:

$$SPCF_{l,j,i}^{FCSCCM} = SF_{l,i} * \min(DOP_{i,t-1} + RR_i * 15, ENGYMAX_i)$$

$$SVCF_{l,j,i} = 0 \text{ (virtual bids liquidated prior to real-time)}$$

Additional inputs defined in Section titled, Data inputs to the LMPM and DCPA.

D.6.7 Demand for counterflow

The demand for counterflow to critical constraint I is the sum of all dispatched energy that will flow on I in the counterflow direction. Dispatched energy from both physical and virtual supply resources

included as eligible resources. The set of resources summed will not include virtual supply in real-time since virtuals are liquidated prior to the real-time market runs.

The demand for counterflow to constraint I where constraint was critical in all constraints run (DCF_l^{CCM}) is expressed as follows and calculated for physical resources and virtual supply resources I with $SF_{l,i} < 0$ and constraints I contained within the critical constraint list:

$$DCF_l^{CCM} = \sum_{i=1}^n SF_{l,i} * DOP_i$$

The supply from pump storage and NGR LESR resources shall be included in the counter flow calculation. The demand side of pump storage and NGR LESR resources shall be excluded from the flow calculation. The NGR DDR, pseudo generators associated with PDR/ RDRP/Dispatched Pump resources and NGR DDR shall be excluded from the flow calculation. The external resources will be excluded from the flow calculation.

Additional inputs defined in Section titled, Data inputs to the LMPM and DCPA.

D.6.8 Residual supply index

Residual supply index is the test metric for whether a constraint I contained within the critical constraint list L is considered competitive or uncompetitive used in net effect of commitments assessment.

The test metric for this residual supply index for critical constraint I is expressed as

$$RSI_l^{CCM} = \frac{SCF_l^{PPSCCM} + SCF_l^{FCSCCM}}{DCF_l^{CCM}}$$

Where:

RSI_l^{CCM} = residual supply index for the ability of effective supply to relieve congestion on critical constraint I after the removal of effective supply from three largest potentially pivotal suppliers

SCF_l^{PPSCCM} = effective supply of counterflow to critical constraint I from all **potentially pivotal suppliers** that is not withheld including physical and cleared virtual supply

SCF_l^{FCSCCM} = effective supply of counterflow to critical constraint I from all **fringe competitive fringe suppliers** (those not identified as potentially pivotal suppliers) including physical and cleared virtual supply

DCF_l^{CCM} = Demand for counterflow on critical constraint I

If $RSI_i^{CCM} \geq 1$ then the critical constraint l is deemed competitive else $RSI_i^{CCM} < 1$ and deemed uncompetitive.

D.7 LMPM mitigation criteria

For each interval within the optimization horizon, system will assess if the mitigation criterion is met. The mitigation criterion for purpose of mitigating all components of the supply offer (energy mitigation criterion) is a positive non-competitive congestion component at the resource's LMP. The CAISO will calculate a second criterion for mitigating only the commitment cost components, which is a positive net effect of commitments on congestion system-wide.

Given the mitigation reference bus, the analysis finds the critical constraints in AC run, and for every pricing node location i identifies what is the net effective impact to relieving congestion on uncompetitive constraints the resource i could contribute to the system (NEC_i).

LMPM will determine a mitigation criterion for the purpose of mitigating commitment cost components of the market-based supply offer by calculated the net effect of injections at the resource location i to relieve congestion market-wide without considering the order of magnitude of the shadow price. In other words, the magnitude of impact to LMP from ability to withhold counterflow supply is not considered as apart of net effect to relieve congestion due to commitments.

The net effect of commitments at resource location i (NEC_i) is used for flagging commitment cost mitigation by determining if resource has locational advantage with the incentive to withhold counterflow supply. The net effect of commitments is calculated by summing the aggregate effect of resource i 's shift factor to each critical constraint deemed uncompetitive based on a $RSI_i^{CCM} < 1$.

Every unit with $NEC_i > 0$ will be mitigated - a zero tolerance criterion where NEC_i is calculated as follows:

$$NEC_i = \sum_{l=1}^n SF_{l,i} * -1$$

Where a negative constant integer of 1 replaces the shadow price of binding constraints and establish a negative constant integer for non-binding critical constraints. The negative constant integer of 1 represents the key assumption that if all constraints are considered "binding" for purposes of commitments that there would be a cost savings to the objective function of relaxing the constraint by one unit.

D.8 Applying mitigation

Resources that are identified as having local market power in an hour as a result of the dynamic competitive path assessment and local market power decomposition tests on net effect of commitments are run ($NEC_i > 0$) will have their bids mitigated. Minimum load bids will be mitigated to their mitigated minimum load proxy cost, start-up bids to their mitigated start-up proxy costs, and transition costs to their mitigated transition proxy costs. Note - demand response, participating load, non-generator resources and virtual supply are included in power balance constraint but are exempt from mitigation.

Since commitment costs do not set a market value for commitment costs no mitigation price floor needs to be established. Mitigated proxy costs regardless of which commitment cost component can be one of two options selected either an estimated or negotiated proxy cost.,

LMPM applies mitigation to the minimum load components as follows by unit commitment process:

- Integrated Forward Market - bids mitigated for the hour the resource failed
- Short-term unit commitment process – bids mitigated for the hour if any of the 15-minute intervals associated with that hour failed
- Hour-ahead scheduling process - bids mitigated for the hour if any of the four 15 minute intervals tested within the HASP window fail
- Fifteen minute market - bids mitigated in applicable 15-minute interval of real-time pre-dispatch run through balance of hour
- Five minute market – mitigated bids from fifteen minute market carried through to the real-time dispatch run and allows for additional mitigation applied in five minute market through the balance of hour⁸⁴

Once mitigation flag for a test interval t is determined, LMPM applies mitigation to the start-up and transition cost components as follows by unit commitment process:

- Integrated Forward Market – bids mitigated for the set of intervals of the optimization window T if any hour the resource failed
- Short-term unit commitment process – bids mitigated for the set of intervals of the optimization window T if any of the 15-minute intervals associated with that hour failed
- Hour-ahead scheduling process - bids mitigated for the set of intervals of the real-time unit commitment process optimization window T if any of the four 15 minute intervals tested within the HASP window fail
- Fifteen minute market – mitigated bids from hour-ahead scheduling process carried through to the fifteen-minute market and allows for additional mitigation applied in applicable 15-minute interval of real-time pre-dispatch run through balance of associated unit commitment process
- Five minute market – mitigated bids from fifteen minute market carried through to the real-time dispatch run and allows for additional mitigation applied in five minute market through the balance of associated unit commitment process

Appendix E: Details on proposed revision for re-bidding rules

CAISO proposes to change its treatment of the minimum load component to an hourly value instead of a daily value. The minimum load component will be an hourly component for which suppliers can submit different hourly prices or have their proxy cost used for hours they do not want to be committed. In light of hourly bidding of minimum load and mitigation of commitment cost components, CAISO proposes minor revisions to pending SIBR rules for real-time market re-bidding (*Bidding Rules Enhancements and*

⁸⁴ Application as approved in the *Local Market Power Mitigation Enhancements 2015*, available at <http://www.caiso.com/informed/Pages/StakeholderProcesses/CompletedClosedStakeholderInitiatives/LocalMarketPowerMitigationEnhancements2015.aspx>.

Aliso Canyon Phase 1). The real-time rebidding rules reflected in SIBR rules for locking minimum load, start-up, or transition costs will apply consistently to all components. To support hourly bidding, the proposed change will allow re-bidding during the window “locked” to levels below the maximum allowable re-biddable level associated with the prior commitment decision.

The purpose of this section is to explain the logic for inserting bids into bid stack, illustrate the commitment logic used in each unit commitment process given an assumption that resource does not provide commitment cost bids for every hour, and describe the process for locking bids once subject to re-bidding rules.

First, the logic for inserting bids into the bid stack sent to market applications includes:

- Submission of daily start-up or transition cost bids would not result in system inserting bids into market application for resource,
- Submission of minimum load cost bid for a given hour where system does not identify an energy bid submission will result in system inserting a 0.1MW energy bid estimated at default energy bid value at that 0.1MW set point, and finally
- For resources with a resource adequacy must-offer obligation (RA MOO) in day-ahead or real-time or for resources with integrated forward market (IFM) awards for ancillary services: system will insert generated bids or generated proxy costs
- For resources without a RA MOO or IFM ancillary service awards: if no minimum load hourly bid is submitted then the system will not insert any bids for that resource to its market application.

Second, the unit commitment logic used in each unit commitment process given hourly bids. The unit commitment process will allow commitments if:

- Integrated forward market:
 - Solution results in a feasible start-up instruction i.e. start-up time (SUT) < minutes to awarded interval
 - No minimum up time logic i.e. can extend beyond optimization window
- Short-term unit commitment process (real-time unit commitment process RTUC#2)
 - Solution results in feasible start-up or transition instruction i.e. start-up time (SUT) ≤ minutes to awarded interval
 - Solution results in dispatch only if start-up time and minimum run time of resource can be evaluated by unit commitment process i.e. start-up time (SUT) + minimum up time (MUT) ≤ 270
 - Solution will maintain resource at or above minimum load until resource completes its MUT
 - Minimum up time cannot extend beyond the optimization window
- Hour-ahead scheduling process (real-time unit commitment process RTUC#1)
 - Solution results in feasible start-up or transition instruction i.e. start-up time (SUT) ≤ 105

- Solution results in dispatch only if start-up time and minimum run time of resource can be evaluated by unit commitment process i.e. start-up time (SUT) + minimum up time (MUT) ≤ 270 i.e. STUC logic
- Solution does not constrain dispatch to resources with $SUT+MUT \leq 105$ Solution will maintain resource at or above minimum load until resource completes its MUT
- No minimum up time logic i.e. can extend beyond optimization window
- Real-time unit commitment process RTUC#3
 - Solution results in feasible start-up or transition instruction i.e. start-up time (SUT) ≤ 75
 - Solution results in dispatch only if start-up time and minimum run time of resource can be evaluated by unit commitment process i.e. start-up time (SUT) + minimum up time (MUT) ≤ 270 i.e. STUC logic
 - Solution does not constrain dispatch to resources with $SUT+MUT \leq 75$
 - Solution will maintain resource at or above minimum load until resource completes its MUT
 - No minimum up time logic i.e. can extend beyond optimization window
- Real-time unit commitment process RTUC#4
 - Solution results in feasible start-up or transition instruction i.e. start-up time (SUT) ≤ 60
 - Solution results in dispatch only if start-up time and minimum run time of resource can be evaluated by unit commitment process i.e. start-up time (SUT) + minimum up time (MUT) ≤ 270 i.e. STUC logic
 - Solution does not constrain dispatch to resources with $SUT+MUT \leq 60$
 - Solution will maintain resource at minimum load until resource completes its MUT
 - No minimum up time logic i.e. can extend beyond optimization window.

Finally, the integrated forward market and residual unit commitment run will use the bid set inclusive of mitigated or non-mitigated bids for each component from the market power mitigation run. If resource receives an integrated forward market award or binding RUC start-up instruction, the CAISO will allow these resources to revise their commitment cost bids up to a maximum re-biddable level (i.e. locked bids) and will lock the bids at these maximum levels for each hour.

In real-time, the market will lock the maximum value of the commitment cost bids to the values used in the market run to produce those market outcomes. The maximum re-biddable levels must be no higher than:

- Start-up/transition costs: daily value for transition costs or start-ups – either mitigated or non-mitigated – used in market run
- Minimum load costs: hourly values for minimum load bids – either mitigated or non-mitigated – used in market run

In real-time, SIBR will allow resources without integrated forward market award or binding RUC start-up instruction to re-bid commitment cost components. Once there is a real-time market binding start-up or transition instruction, SIBR will lock the re-bidding of start-up or transition cost bids to no higher than the maximum re-biddable level. Further, minimum load, start-up, or transition costs re-bidding will be locked

to no higher than the maximum re-biddable level based on the bid prices used in the commitment decision through its minimum run time (also called minimum up time). The maximum re-biddable level for purposes of locking the bids will be the last bid for start-ups or transition costs (event-based values) and the average of the minimum load bids used in the binding commitment decision.

Rules largely already designed and pending implementation fall 2017. Only change will adjust rule to accept bids during locked window if less than maximum allowable levels either daily value for start-ups and transitions or hourly values for minimum load costs that led to the binding commitment decision.