Commitment Costs and Default Energy Bid Enhancements

Straw Proposal

June 30, 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 bid[1] (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,

[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.

the 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' verified[2] 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:

- **Summary of 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 -** Describes context relevant to the development of the straw proposal.
- **Principles** - Presents the design principles adopted by the CAISO for the development of the straw proposal.
- **Market Monitor's recommendation -** Presents rationale for proposal not to pursue the Department of Market Monitoring's recommendation and includes a discussion of stakeholder comments.
- **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 -** 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

[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.

markets, bidding rules, market power mitigation methods, reference level calculations, and supply offers settlements, and cost based framework descriptions and formulas.

2. Summary of 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. 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 exposes 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 the cannot reflect their resources cost in the market.

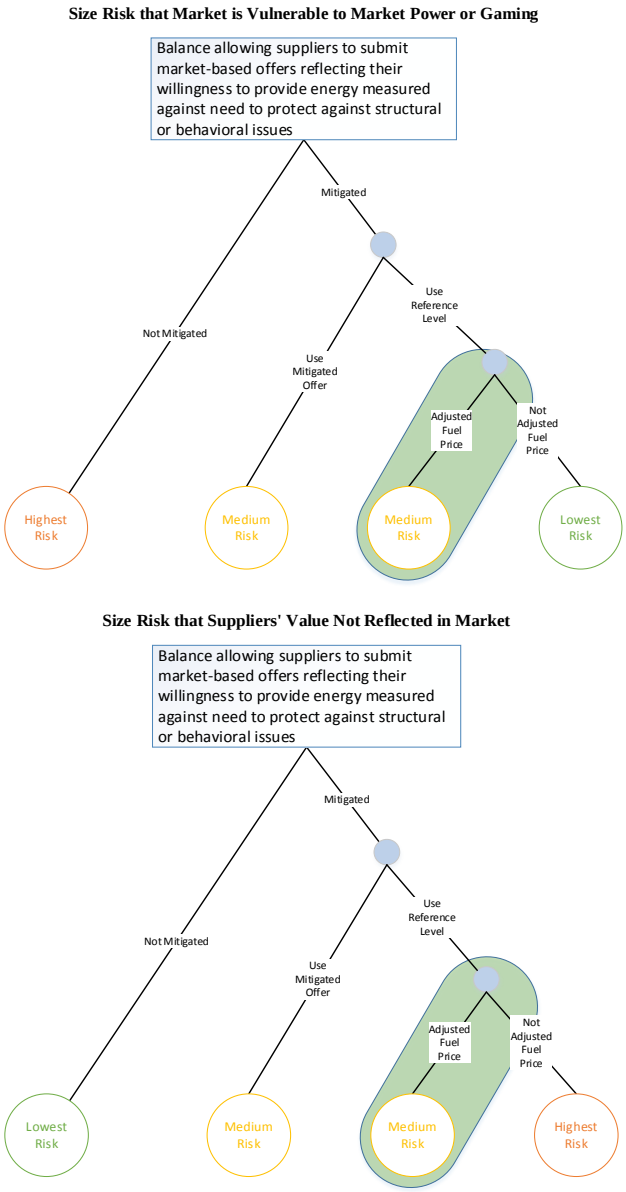

Figure 1: Potential design paths

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

Section	Issue	Proposal	Change Type
7.1.3.1	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
7.1.3.2		Apply settlement rules when no minimum load cost offer present	Tariff

Section	Issue	Proposal	Change Type
7.2.3.1	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
7.2.3.2		Allow Supplier provided ex ante reference levels adjustments subject to verification requirements	Tariff
7.2.3.2		Re-calibrate penalty price parameters to support possibility of energy offers at $2,000/MWh	BPM
7.3.3.1	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
7.3.3.2		Apply dynamic market power mitigation	Tariff
7.3.3.3		Apply results of market power mitigation on commitment costs to default assessment for exceptional dispatches	Tariff

Table 1: Summary of Proposals

3. 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".

4. Background

The purpose of this section is to provide context needed to understand the CAISO's straw proposal presented in Section 7, Proposal. The CAISO will present this context by discussing the following:

- CAISO bidding and settlement
- Validating cost-based commitment cost offers
- Mitigating market-based energy offers

4.1. 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 energy[3],
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.

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.

[3] 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.

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.

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 model of short-run total production costs use the commitment cost and incremental energy cost components of the supply offer.[4]

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.

The CAISO will generally reward make-whole payment through a bid cost recovery mechanism for market awards or excess cost payments for out-of-merit exceptional dispatches (uplift payments). The need for uplift payments tends to occur more when energy demand is lower or when the CAISO dispatches a unit to operate at or near its minimum load.

4.2. Validating cost-based commitment cost offers

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 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).

[4] 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.

4.3. 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 CACAISO Tariff Section 39.7.1)
2. Negotiated Rate Option (see CACAISO Tariff Section 39.7.1.3)
3. LMP Option (see CACAISO 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.[5]

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 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. [6] 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.[7] The CAISO files these values in a confidential report with FERC each month.

[5] California ISO Business Practice Manual, Market Operations, Section 6.5.4 Default Energy Bids
[6] California ISO Tariff Section 39.7.1.3.1 Submission Process: http://www.caiso.com/Documents/Section39_MarketPowerMitigationProcedures_asof_May2_2017.pdf
[7] *Id.*

5. 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

5.1 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 markets[8] 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.
5. 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.

5.2 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.

[8] 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)

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

5.3 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.
2. Suppliers' offers must only be mitigated to price levels that are a reasonable reflection of suppliers' cost expectations.[9]
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.

6. Market Monitor's 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.

[9] 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.

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 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 index[10]. 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.

7. 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**11**. 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 CACAISO to abide by its commitment to consider longer-term market design changes for commitment cost bids in conjunction*

[10] 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.

[11] For more information regarding uplift payments, see Appendix.

with the bidding rules enhancements stakeholder initiative commenced earlier this month. " [12]

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.[13] Portland General Electric (PGE) stated that, "…the importance of this initiative [*Commitment Costs and Default Energy Bid* Enhancements] should not be underestimated.[14]" 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

7.1. 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

[12] 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.

[13] *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

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

7.1.1. 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 rerates request flexibility to re-bid costs between $0 and revised minimum load costs with default energy bid integration[15].

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.

7.1.2. 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

[15] 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.

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&E[16], 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 WTPF 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.

7.1.3. 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

7.1.3.1. 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.

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

[16] 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.

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 are effective. 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 2 and Figure 3 illustrate the current re-bidding rules against the proposed hourly treatment. In Figure 2, 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 3, 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.

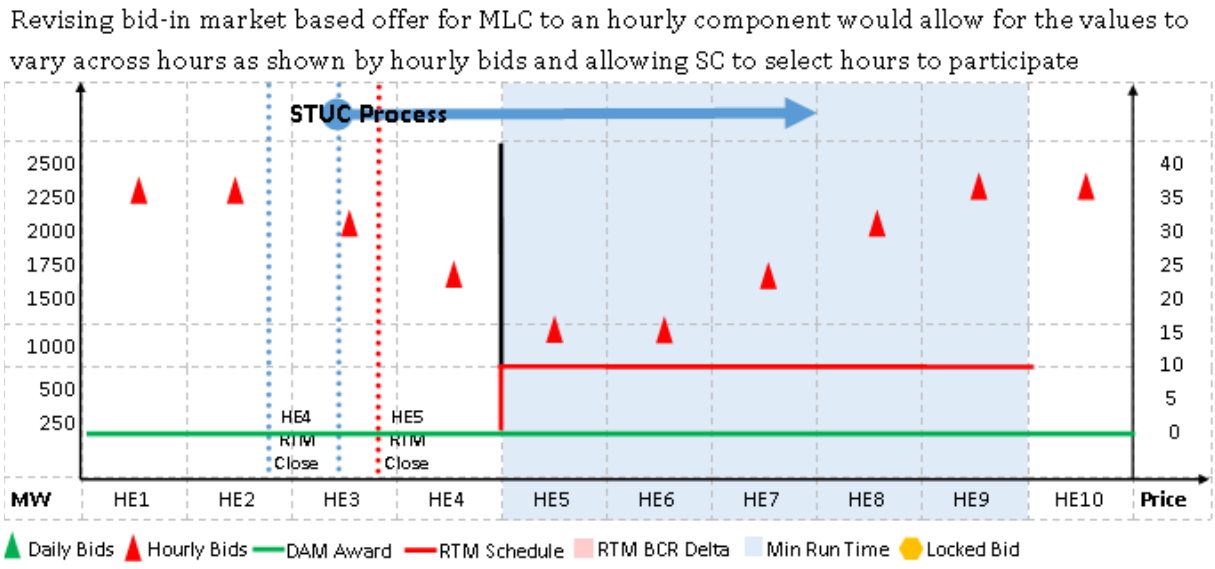

Figure 2: Illustration of proposed change for hourly minimum load

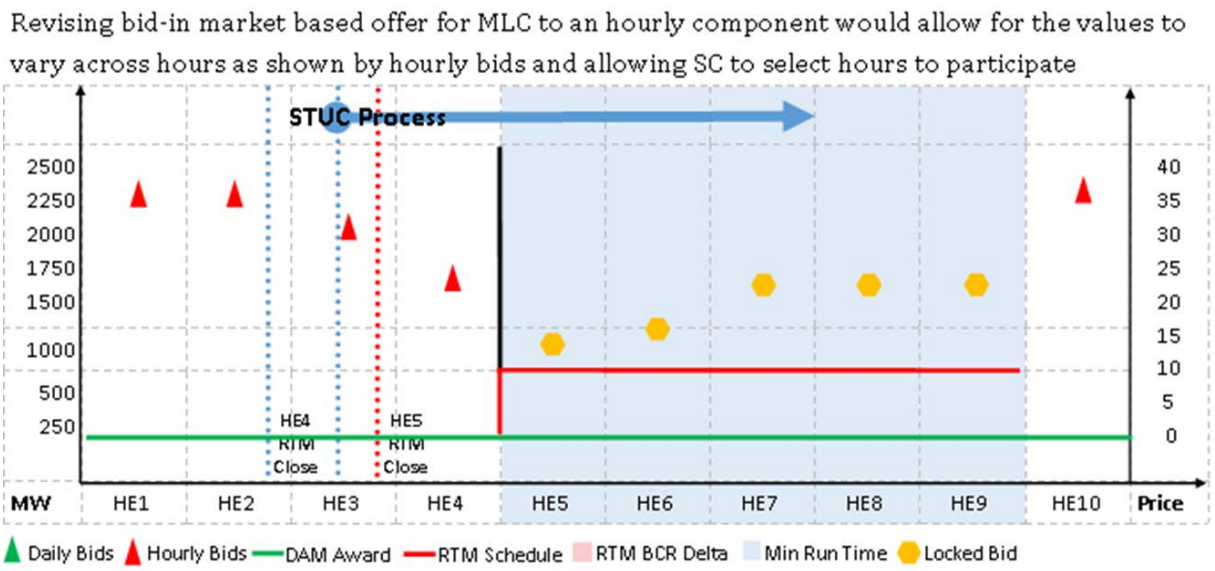

Figure 3: Illustration of rebidding rules on proposed change

CAISO proposes one additional rule change 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 has identified flexibility to allow revised minimum load offers submitted up to the last bid is necessary. The following section describes a scenario necessitating revised offers to be re-bid at levels below the last bid's price.

7.1.3.2. 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 4 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 shut down instruction beginning hour ending 8.

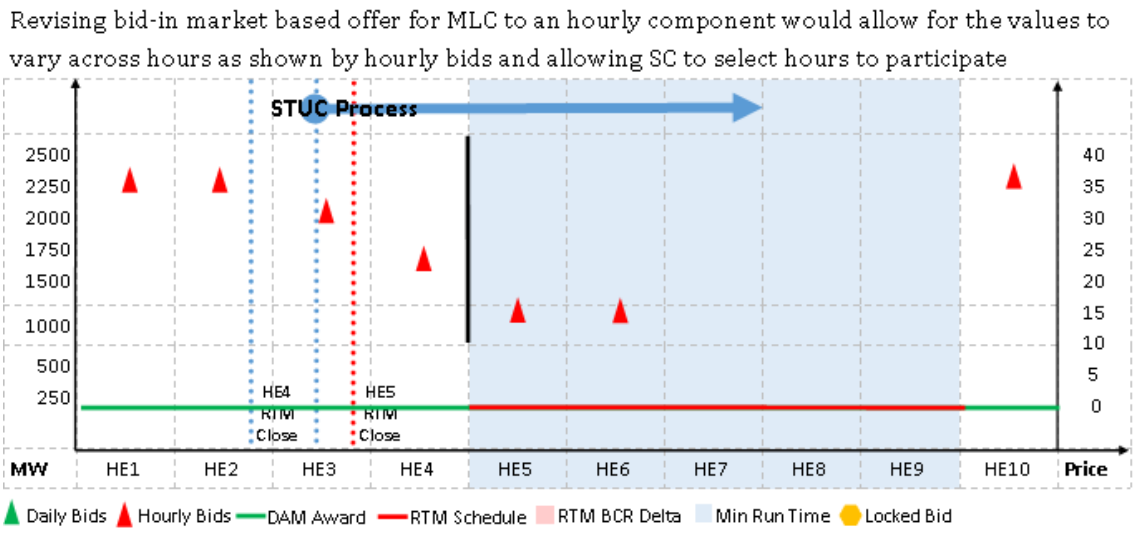

Figure 4: Illustration of need to dispatch even if no offer

The CAISO proposes to consider interval without a minimum load offer analogous to a self-commitment period and will not consider minimum load costs in these hours in its uplift mechanisms. The CAISO believes this treatment is fair since the supplier will have flexibility to submit minimum load offers for the hours that would otherwise have missing 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 considered for uplift settlement.

Figure 5 shows the same scenario as Figure 4 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 5, the supplier does submit revised offers in its hour ending 5 bid submissions at around $1,000.

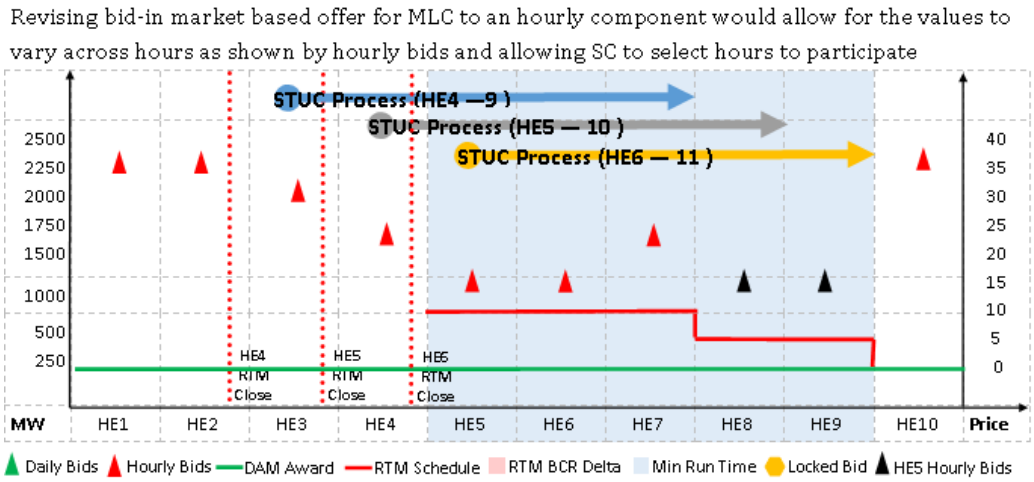

Figure 5: Revising minimum load offers to remain eligible for uplift

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.

7.2. 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

7.2.1. 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' verified[17] 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.

7.2.2. 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 offers[18] 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

[17] 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.

[18] 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.

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.

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.[19]"

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 hours[20].

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 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."[21] 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."*[22]

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

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

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

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

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.

7.2.3. 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

7.2.3.1. 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.

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.

7.2.3.2. 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 requirements[23] 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)[24]. 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

[23] Verification requirements proposed were developed to comply with Order 831.
[24] Order 831 compliance requires applying cap to adjusted references levels used to set market prices.

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.

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.

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 potential clawback if artificial prices are detected.

Establishing guidelines

The CAISO proposes to introduce 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*[25],
- **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)[26]
- 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

Supporting documentation will be required. Among other potential documents, the CAISO proposes the following list as appropriate supporting documentation:

- Fuel market price information:
  - Index publisher information (consummated low-mid-high)

[25] 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.

[26] 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.

  - Electronic platform information (bid-ask spreads)
  - Off-ICE quotes if meets a liquidity/counterparty requirement of 5-10 price quotes from at least 2 different counterparties

- Fuel market or transport availability conditions required documentation for any cost based components priced based on fundamentals outside of market price information above:
  - 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")

CAISO seeks 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.

Ex ante and ex post verification processes

CAISO proposes to require subjecting adjustments on either commitment cost or energy cost reference levels to verification requirements[27] 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 6 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.

[27] Verification requirements proposed were developed to also comply with Order 831.

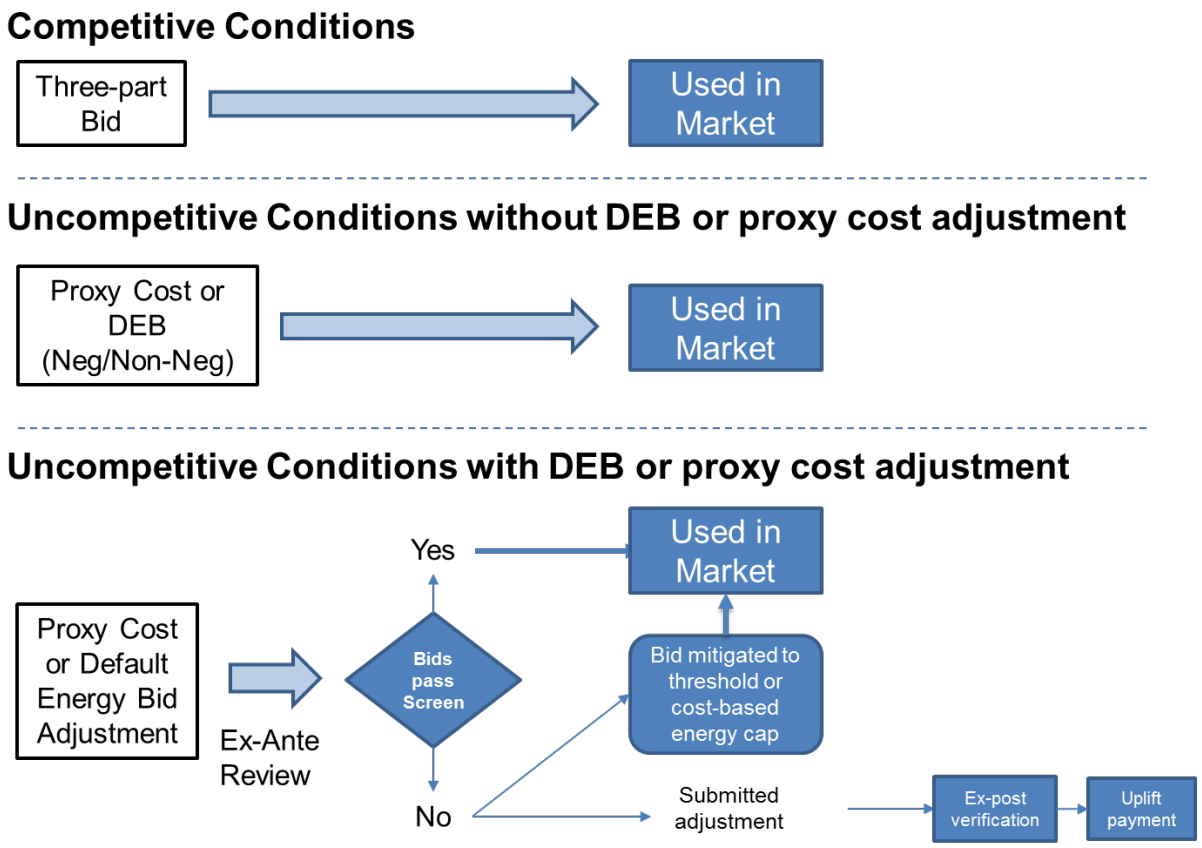

Figure 6: Illustration of adjustment request and verification process

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 applicable[28], 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 is considering whether it should seek authority to initiate an audit process if suppliers' behavioral issues are identified. If CAISO is not able to substantiate the suppliers' compliance in following the established guidelines, CAISO will clawback the market revenues or uplift payments. CAISO is seeking stakeholder comments on whether it should seek authority to clawback these artificial payments.

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

[28]CAISO 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.

verified, CAISO proposes to re-calculate its uplift settlement with verified cost-based adjustment to the reference level(s) and if market revenues are insufficient to cover their costs (i.e., revenue shortfall) will be eligible for uplift.

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 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.

7.3. 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:

- Issue
- Stakeholder Comments
- Proposal

7.3.1. Issue

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.

7.3.2. 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.

7.3.3. 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

7.3.3.1. 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.

7.3.3.2. 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 introduce a 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 components 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.

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 2 presents the proposed characteristics for the proposed commitment cost mitigation. 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[29]	Y	Y
RSI calculation – basis for maximum capacity that could be withheld from pivotal suppliers	maximum effective available capacity	maximum effective available capacity[30]	maximum effective available capacity	maximum effective available capacity
Apply mitigation	If hour failed test	If failed test in any of the 15-minute intervals associated with an hour	If failed test in any of four 15-minute HASP intervals for that hour for HASP up to RTPD/RTD	If failed test in applicable 15-minute interval of RTPD run through balance of hour

Table 2: Proposed characteristics of commitment cost mitigation

7.3.3.3. 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

[29] RSI calculation for energy mitigation does not allow commitments or de-commitments in the real-time market power mitigation processes.
[30] RSI calculation for energy mitigation assesses maximum ramp range within unloaded capacity in the real-time market power mitigation processes.

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."[31]

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 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:

[31] *Exceptional Dispatch Mitigation in Real-time* draft final proposal, http://www.caiso.com/Documents/DraftFinalProposal-ExceptionalDispatchMitigationRealTime.pdf.

- 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.

8. 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 design[32].

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

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

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.

9. Appendix A: Stakeholder Engagement Plan

The California ISO will discuss this straw proposal with stakeholders during a meeting on July 6, 2017 After the stakeholder call, 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 July 20, 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 July 2017. Current schedule for this initiative is shown in Table 3.

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
Draft final proposal posted	August 25, 2017
Stakeholder meeting	September 1, 2017
Stakeholder written comments due	September 11, 2017
EIM governing body meeting	October 10, 2017
Board of Governors meeting	November 1-2, 2017

Table 3: Initiative Schedule

10. Appendix B: Stakeholder Engagement Plan

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 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, Table 3 shows the results of the survey on bidding rules, directly following Table 4 shows the results on market power mitigation methodologies, and the last table, Table 5, provides additional detail on markets' conduct and impact tests. The mitigation results in Table 4 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.

Table 3: Survey of Organized Markets' Bidding Rules

Organized Markets		**Bid structure**	**DA Market Close**	**RTM rebidding (Last time to modify)**	
				Commitment Costs	**Incremental Energy**
CAISO[1]		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[2]	T-75
ISO-NE[3]		Submit energy, start-up and no load offers All cost offers may vary by hour	10:00 ET TD-1	T-30	T-30
MISO[4]		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.

Organized Markets		Bid structure	DA Market Close	RTM rebidding (Last time to modify)	
				Commitment Costs	Incremental Energy
NYISO[5]		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.
PJM[6]		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. .	Price-based 14:15 ET TD-1: May update offers for hours not committed in day-ahead May not change from self-schedule to economic bidder Cost-based 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	Price-based 14:15 ET TD-1: May update offers for hours not committed in day-ahead May not change from self-schedule to economic bidder Cost-based 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

Organized Markets		Bid structure	DA Market Close	RTM rebidding (Last time to modify)	
				Commitment Costs	Incremental Energy
SPP[7]		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	Unit offers: T-30 Mitigated offers: 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:[8] T-30	Unit offers: T-30 Mitigated offers: 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 4: Various Mitigation Methods for Commitment and Energy Costs

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	Both Methods For commitment costs: conduct test applied and mitigates to bid cap For dispatchable energy: Dynamic structural	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.

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
	test (three pivotal suppliers)			
ISO-NE[9]	Conduct and impact test applied and mitigated to reference level Pivotal supplier test and a constrained area test to determine which conduct thresholds to apply for general mitigation Apply conduct test only to minimum load cost, start-up and no load based on criteria If energy or commitment fails, mitigates all parameters	May request revisions to reference level calculation no later than 17:00 ET TD-2 with exceptions up until 21:30 ET TD-1; 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.	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.[10]	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.
MISO[11]	Conduct and impact test applied and mitigated to reference level 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

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
NYISO[12]	Conduct and impact test applied and mitigated to reference level 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 failed mitigation with new reference level and settle after-the-fact. Also - extend 205 filing right at FERC	MMU screens for fuel type and fuel price information submitted for potentially inaccurate information, for updates to reference level before market close expected to retain invoices and supporting documentation under data retention requirements
PJM[13]	Pivotal Supplier Test applied and mitigated to cost-based offer Structural test (three pivotal suppliers) for active constraints Bid-in cost-based offers required to be consistent with unit-specific fuel policy	N/A	Cost-based adjustments May request compensation for differences between bid-in cost-based offer and actually incurred costs after-the-fact through uplift Energy costs above offer cap May seek uplift payments after-the-fact for cost based energy offers greater than $2,000/MWh by submitting relevant supporting documentation.	Cost-adjustments MMU reviews requested adjustments after-the-fact. If unsatisfied, may request PJM review and include MMU finding in request. Energy costs above offer cap, 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.
SPP	Conduct and impact test[14] applied and mitigated to mitigated offers Conduct thresholds to trigger impact test	N/A	NONE	MMU verifies mitigated offers using fuel cost policy and cost day submitted consistent with mitigated offer development guidelines

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
	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. Mitigated offers consistent with Mitigated Offer Development Guidelines			

Table 5: Conduct and Impact Thresholds

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
ISO-NE	Energy	General	lower of 300% or $100/MWh increase relative to reference level (except if offer less than $25/MWh)	lower of either 200% or $100MW/h of energy prices	III.A.5.5.
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	lower of 300% or $100/MWh increase relative to reference	calculated threshold relative to energy	64.1.2

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
		(insufficient compensation expected)	level (except if offer less than $25/MWh)	prices or any increase in uplift payments	
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 offer (except if offer less than $25/MWh)	$25/MWh increase of energy prices, uplift payments,	AF 3.2, 3.7
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	lower of 200% or $100/MWh increase of energy prices or uplift payments	23.3.1.2.2

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
			than calculated threshold		
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 to Hourly Economic Minimum) Level	Narrow Constrained Area (insufficient compensation expected)	Distribution factor greater than 0 and increase of more than calculated threshold	calculated threshold relative to energy prices or any increase in uplift payments	64.1.2
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

Economic Withholding			Conduct Threshold	Impact Threshold	Tariff Section
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
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

11. Appendix C: Stakeholder Engagement Plan

This appendix provides the formulations for the day-ahead delivered price estimate (GPI_{DA}), real-time delivered price estimate (GPI_{RT}), and reference levels used in the California ISO markets. Note that while mitigated energy offers are settled at the price level at the default energy bid the commitment costs are settled at the maximum allowable price level at 125 percent of the calculations shown.

Equation 1: Gas Price Index for Delivered Price Estimate[15]

Gas Price Index

$$GPI_{DA} = Commodity\ Price_{GD1} + Transportation\ Rate + \text{Shrinkage Allowance}_{GD1} + Cap\ \&\ Trade\ Credit + Miscellaneous$$

$$GPI_{RT} = Commodity\ Price_{GD2} + Transportation\ Rate + \text{Shrinkage Allowance}_{GD2} + Cap\ \&\ Trade\ Credit + Miscellaneous$$

Where

$$Commodity\ Price_{GD1} = average(SNL_{GD1}, Platts_{GD1}, ICE_{GD1}, NGI_{GD1})$$

$$\text{Shrinkage Allowance}_{GD1} = Commodity\ Price_{GD1} * \frac{Fuel\ Reimbursement\ Rate}{1\ -Fuel\ Reimbursement\ Rate}$$

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

Transportation Rate, Cap & Trade Credit 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 2: Default Energy Bid Cost

Default Energy Bid Cost

$$= \begin{cases} (\text{Segment's Fuel Cost} + \text{VOM} + \text{GMC Adder}) * Scalar, GHG_{COMPLIANCE} =' N' and\ DE \\ (\text{Segment's Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost}) * Scalar, GHG_{COMPLIANCE} =' Y' a \\ (\text{Segment's Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost} + DEBA) * Scalar, GHG_{COMPLIANCE} =' \end{cases}$$

Where:

$\text{Segment's Fuel Cost} = Unit\ Conversion * \text{Heat\_Rate} * GPI$

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

$\text{Scalar} = 1.1$

$\text{Unit conversion} = 0.001$

Equation 3: Proxy Start-Up Costs

Start-up Cost

$$= \begin{cases} \text{Start-up Fuel Cost} + \text{Start-up Energy Cost} + \text{GMC Adder}, GHG_{COMPLIANCE} =' N' and \\ \text{Start-up Fuel Cost} + \text{Start-up Energy Cost} + \text{GMC Adder} + \text{GHG Cost}, GHG_{COMPLIANCE} =' Y \\ \text{Start-up Fuel Cost} + \text{Start-up Energy Cost} + \text{GMC Adder} + \text{GHG Cost} + MMA, GHG_{COMPLIANCE} \end{cases}$$

Where:

$\text{Start-up Fuel Cost} = STRT_{STARTUP_{FUEL}} * GPI_{DA,RT}$

$\text{Start-up Energy Cost} = STRT\_STARTUP\_AUX * EPI$

$$\text{GMC Adder} = Pmin * (STARTUP\_RAMP\_TIME/60min) * \frac{GMC}{2}$$

$\text{GHG Cost} = STRT\_STARTUP\_FUEL * \text{Emissions Rate} * \text{GHG Allowance Rate}$

Equation 4: Proxy Minimum Load Costs

Minimum Load Cost

$$= \begin{cases} \text{Minimum Load Fuel Cost} + \text{VOM} + \text{GMC Adder}, GHG_{COMPLIANCE} =' N' and\ MMA = \\ \text{Minimum Load Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost}, GHG_{COMPLIANCE} =' Y' and\ MM \\ \text{Minimum Load Fuel Cost} + \text{VOM} + \text{GMC Adder} + \text{GHG Cost} + MMA, GHG_{COMPLIANCE} =' Y' and \end{cases}$$

Where:

$$\text{Minimum Load Fuel Cost} = Unit\ Conversion * \text{Heat\_Rate} * Pmin * GPI_{DA,RT}$$

$$\text{VOM} = \text{VOM} * \text{Pmin}$$

$$\text{GMC Adder} = Pmin * GMC$$

$$\text{GHG Cost} = Unit\ Conversion * \text{Heat\_Rate} * Pmin * \text{Emissions Rate} * \text{GHG Allowance Rate}$$

$$\text{Unit conversion} = 0.001$$

Notes

[1] A market clearing price is the price at which the profit maximizing buyers and sellers are the same for a given quantity demanded.
[1] 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).
[1] 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.
[1] 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.
[1] 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).
[1] Market Instruments BPM at 191.
[1] Transactions done on Friday are for flow on Saturday, Sunday and Monday and generally the prior day's index will apply to holidays.
[1] 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.
[1] Transactions done on Friday are for flow on Saturday, Sunday and Monday and generally the prior day's index will apply to holidays.
[1] Platt's North American Natural Gas Methodology: June 2016, http://www.platts.com/IM.Platts.Content/MethodologyReferences/MethodologySpecs/na_gas_methodology.pdf
[1] Transactions done on Friday are for flow on Saturday, Sunday and Monday and generally the prior day's index will apply to holidays.
[1] 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.[1]
[1] 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.
[1] 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).
[1] NYISO, FERC docket no. ER10-1977, July 26, 2010, p. 4.
[1] ISO-NE, FERC docket no. ER13-1877, transmittal letter, July 1, 2013, p. 3.
[1] 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 .
[1] 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.
[1] 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.
[1] Distribution factor or shift factor is the percentage of an injection or withdrawal at a given node flows across the constraint in the direction of the reference bus to determine whether the injection or withdrawal exacerbates or relieves congestion. There is a shift factor for each constraint, node combination so that the power transfer across the constraint can be modelled. Injections at location with positive shift factors will exacerbate the congestion where withdrawals at that location will relieve congestion. Conversely, injections at location with negative shift factor will relieve congestion where withdrawals will exacerbate congestion.
[1] 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.
[1] 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.
[1] The master file contains all the units' technical parameters including those impacting their variable costs.
[1] California ISO Tariff, Section 30.4 and 39.7.1.1.1.3.
[1] 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.
[1] Temporarily suspended in combination with Endnote 26 on a temporary basis due to *Aliso Canyon* filing.
[1] See generally PJM Manual 15, Cost Development Guidelines at § 2.3
[1] SPP Market Protocols Integrated Marketplace Appendices.
[1] A market clearing price is the price at which the profit maximizing buyers and sellers are the same for a given quantity demanded.
[1] One caveat to this is that next day trading will be transacted at prices that are the expectation of costs for delivery based on expected market fundamentals. If the expected fundamentals are aligned with the real fundamentals, the next day and intra-day prices will be correlated.
[1] Id to Endnote 21.
[1] CAISO, Tariff section 30.5.1 General Bidding Rules.
[1] Pending tariff filing as result of Bidding Rules Enhancements policy.
[1] ISO-NE Market Rule 1, Sections III.1.7.6, III.1.10.9
[1] 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.
[1] NYISO, Market Services Tariff (MST), Section 4.2 and 4.4 MST.
[1] PJM, Manual 11: Energy & Ancillary Services Market Operations, Section 2.3.3 Market Sellers.
[1] SPP Market Protocols Integrated Marketplace, Section 4.2.2.1.
[1] SPP Market Protocols Integrated Marketplace, Section 8.2.2.
[1] ISO-NE, Market Rule 1, Section III.A.3 and Section III.A.5.
[1] Reference to ISO-NE after-the-fact cost recovery language
[1] MISO, Tariff Module D: Market Monitoring and Mitigation Measures, Section 63, 64 and 65.
[1] 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 23.3.1.4.7 for changes to the reference level for fuel, and section 23.3.1.4.6.7 for timing before real-time market close.
[1] PJM, Manual 15: Cost Development Guidelines, Section 1.6.1 Reason for Cost based offers: Market Power Mitigation.
[1] SPP Market Protocols Integrated Marketplace, Attachment AF, Section 3.
[1] Formula will be effective when *Bidding Rules Enhancements* is implemented to add the shrinkage allowance, cap-and-trade credits, and miscellaneous costs.

[1] CAISO, Tariff section 30.5.1 General Bidding Rules.
[2] Pending tariff filing as result of Bidding Rules Enhancements policy.
[3] ISO-NE Market Rule 1, Sections III.1.7.6, III.1.10.9
[4] 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.
[5] NYISO, Market Services Tariff (MST), Section 4.2 and 4.4 MST.
[6] PJM, Manual 11: Energy & Ancillary Services Market Operations, Section 2.3.3 Market Sellers.
[7] SPP Market Protocols Integrated Marketplace, Section 4.2.2.1.
[8] SPP Market Protocols Integrated Marketplace, Section 8.2.2.
[9] ISO-NE, Market Rule 1, Section III.A.3 and Section III.A.5.
[10] Reference to ISO-NE after-the-fact cost recovery language
[11] MISO, Tariff Module D: Market Monitoring and Mitigation Measures, Section 63, 64 and 65.
[12] 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 23.3.1.4.7 for changes to the reference level for fuel, and section 23.3.1.4.6.7 for timing before real-time market close.
[13] PJM, Manual 15: Cost Development Guidelines, Section 1.6.1 Reason for Cost based offers: Market Power Mitigation.
[14] SPP Market Protocols Integrated Marketplace, Attachment AF, Section 3.
[15] Formula will be effective when *Bidding Rules Enhancements* is implemented to add the shrinkage allowance, cap-and-trade credits, and miscellaneous costs.